

Trends and Subgroup Differences in Tobacco Use among High School Students in the United States, 1991–1997

Sherry A. Everett, Charles W. Warren

INTRODUCTION Tobacco use is the single leading cause of death in the United States (McGinnis and Foege, 1993). National trends in adolescent tobacco use and characteristics of adolescents who use tobacco are essential data for planning and evaluating tobacco prevention efforts (Everett *et al.*, 1998b).

This analysis used national Youth Risk Behavior Survey (YRBS) data to examine changes in cigarette smoking that occurred among high school students in the United States from 1991 to 1997. This analysis also examined the relationship between demographic characteristics and tobacco use behavior among these students.

METHODS The YRBS is a component of the Centers for Disease Control and Prevention's (CDC) Youth Risk Behavior Surveillance System and measures the prevalence of health risk behaviors among adolescents through representative national, state, and local surveys conducted biennially. The 1991, 1993, 1995, and 1997 national surveys used independent, three-stage cluster samples to obtain representative cross-sectional samples of students in grades 9 through 12 in each of the 50 states and the District of Columbia. In 1991, 1993, 1995, and 1997, the respective sample sizes were 12,272, 16,296, 10,904, and 16,262; the respective school response rates were 75, 78, 70, and 79 percent; the respective student response rates were 90, 90, 86, and 87 percent; and the respective overall response rates were 68, 70, 60, and 69 percent.

For each of the four cross-sectional surveys, students completed a self-administered questionnaire that included questions about cigarette smoking, smokeless tobacco use, and cigar smoking. The following tobacco use behaviors were examined:

- 1) lifetime cigarette smoking
(ever smoked cigarettes, even one or two puffs);
- 2) ever daily smoking
(ever smoked at least 1 cigarette every day for 30 days);
- 3) current cigarette smoking
(smoked cigarettes on 1 or more of the 30 days preceding the survey);
- 4) frequent cigarette smoking
(smoked on 20 or more of the 30 days preceding the survey);

- 5) smoking a whole cigarette before age 13;
- 6) current smokeless tobacco use
(used chewing tobacco or snuff on 1 or more of the 30 days preceding the survey);
- 7) smoking cigarettes on school property
(on 1 or more of the 30 days preceding the survey);
- 8) using smokeless tobacco on school property
(on 1 or more of the 30 days preceding the survey); and
- 9) current cigar use
(smoked cigars, cigarillos, or little cigars on 1 or more of the 30 days preceding the survey).

To compare trends of current cigarette smoking with those of other drug use, data about students' current use of alcohol, marijuana, and cocaine were also used. Students were identified as current users of alcohol, marijuana, or cocaine if they reported having used these substances on 1 or more of the 30 days preceding the survey.

Demographic characteristics used in this study included sex, race/ethnicity, grade in school, and school location. In addition, as a proxy measure for socioeconomic status, students were asked to identify the highest educational level of their mothers and fathers (not included in the 1991 survey). "Parent education" was defined as the highest level of education of either parent and was categorized into one of four levels: did not finish high school, graduated from high school, some education after high school, or graduated from college. Students who reported that they were not sure of either parent's educational level were excluded from analyses using this variable ($n = 4,084$ for 1993, 1995, and 1997 combined). School location (not included in the 1991 survey) was identified as urban, suburban, or rural based on the National Center for Health Statistics categories that use population and Metropolitan Statistical Area data and U.S. Bureau of the Census definitions (Quality Education Data, Inc., 1991). School locations were not identified for a total of 471 students in 1993, 1995, and 1997; thus, these students were excluded from analyses using school location. Data are presented only for non-Hispanic Black, non-Hispanic White, and Hispanic students because the numbers of students from other racial/ethnic groups were too small for meaningful analysis.

Data were weighted to provide national estimates, and SUDAAN software was used for all data analysis. Secular trends were analyzed using logistic regression—controlling for sex, grade in school, and race/ethnicity—and simultaneously assessing linear and higher order time effects. Significant linear and quadratic trends were presented. These secular trends were also examined for each of the following subgroups: sex, race/ethnicity, school location, and parent education. Linear trends suggest a significant increase or decrease in data over time. Quadratic trends suggest a significant but nonlinear trend in data over time. When the trend includes significant linear and quadratic components, the data demonstrate some nonlinear variation (*e.g.*, leveling off or change in direction) in addition to a linear effect.

Because data on school location and parent education were not available for 1991, trend analyses were only conducted between 1993 and 1997 when using these variables. Trend analyses were not conducted for current smokeless tobacco use, smokeless tobacco use on school property, or cigar use because data for 3 or more years were not available.

RESULTS

Trends and Subgroup Differences

Lifetime Cigarette Smoking

Overall, the proportion of all high school students who reported that they had ever tried cigarette smoking remained stable from 1991 to 1997; 70.2 percent reported this behavior in 1997 (Table 3-1). The pattern was consistent across sex, race/ethnicity, and school location. Lifetime smoking remained stable in each parent education subgroup except among students whose parents had some education after high school. Among these students, lifetime smoking showed a significant linear increase.

In 1997, lifetime smoking did not significantly differ by sex or school location, but was significantly more likely among Hispanic students than among White ($t = 2.5, p < 0.05$) and Black ($t = 2.3, p < 0.05$) students (Table 3-2). Lifetime smoking was also significantly more likely among students whose parents had not finished high school ($t = 5.3, p < 0.001$), had graduated from high school ($t = 4.3, p < 0.001$), or had some education after high school ($t = 3.9, p < 0.001$) than among students whose parents had graduated from college. Students whose parents had not finished high school ($t = 2.3, p < 0.05$) were significantly more likely to report lifetime smoking than were students whose parents had some education after high school.

Ever Daily Cigarette Smoking

Overall, ever daily smoking showed a significant linear increase from 1991 to 1997; 24.8 percent reported this behavior in 1997 (Table 3-3). Males, White students, Black students, and Black males showed significant linear increases from 1991 to 1997, and students in rural schools showed a significant linear increase from 1993 to 1997. Ever daily smoking was stable among females, Hispanic students, urban and suburban school locations, and all levels of parent education.

In 1997, ever daily smoking did not significantly differ by sex, but was significantly more likely among White students than among Black ($t = 12.3, p < 0.001$) and Hispanic ($t = 7.2, p < 0.001$) students. Ever daily smoking also was significantly more likely among Hispanic students than among Black students ($t = 4.0, p < 0.001$) (Table 3-2). Students in suburban ($t = 2.2, p < 0.05$) and rural ($t = 2.4, p < 0.05$) schools were significantly more likely than students in urban schools to report this behavior. Similarly, students whose parents had not finished high school ($t = 2.8, p < 0.01$) and students whose parents had graduated from high school ($t = 2.7, p < 0.01$) were significantly more likely to report ever daily smoking than were students whose parents had graduated from college.

Table 3-1

Percentage of High School Students who Reported Lifetime Cigarette Smoking, by Sex, Race/Ethnicity, School Location, and Parent Education—Youth Risk Behavior Survey, 1991–1997

	Survey Year			
	1991	1993	1995	1997
Total	70.1 (±2.2)*	69.5 (±1.4)	71.3 (±1.7)	70.2 (±1.9)
Sex				
Female	69.5 (±2.9)	68.7 (±1.8)	70.4 (±3.2)	69.3 (±2.6)
Male	70.7 (±2.0)	70.1 (±1.5)	72.1 (±2.0)	70.9 (±1.9)
Race/Ethnicity				
White	70.4 (±2.7)	70.2 (±1.5)	71.1 (±1.9)	70.4 (±2.3)
Female	69.4 (±3.9)	70.0 (±2.1)	71.1 (±3.2)	70.3 (±3.3)
Male	71.4 (±2.3)	70.4 (±1.7)	71.1 (±2.4)	70.4 (±2.4)
Black	67.2 (±3.3)	67.1 (±2.6)	66.0 (±3.7)	68.4 (±4.4)
Female	69.3 (±3.5)	66.7 (±3.7)	62.8 (±6.2)	66.8 (±5.2)
Male	64.8 (±5.3)	67.6 (±3.2)	70.6 (±4.8)	70.1 (±4.7)
Hispanic	75.3 (±1.6)	71.8 (±2.2)	76.3 (±4.8)	75.0 (±2.7)
Female	75.0 (±4.1)	68.2 (±3.6)	74.8 (±5.1)	72.7 (±3.9)
Male	75.7 (±4.7)	75.1 (±3.6)	77.8 (±7.2)	76.9 (±3.6)
School Location				
Urban	—	68.8 (±2.3)	70.6 (±2.9)	69.4 (±3.3)
Suburban	—	70.2 (±2.0)	71.6 (±2.9)	69.5 (±2.9)
Rural	—	67.0 (±2.8)	71.5 (±4.0)	74.6 (±6.1)
Parental Education†				
Did not finish high school	—	77.8 (±4.4)	73.4 (±8.0)	79.1 (±4.0)
Graduated high school	—	76.1 (±3.1)	76.2 (±2.6)	75.2 (±2.6)
Some education after HS	—	67.7 (±2.5)	73.2 (±2.9)	72.9 (±3.4) §
Graduated college	—	67.3 (±2.1)	68.0 (±2.8)	66.2 (±2.6)

* Numbers in parentheses are 95% confidence intervals.

† Highest level of education of either parent.

§ Significant linear effect ($p < 0.05$).

Note: Trend analyses were conducted using a logistic regression model controlling for sex, grade in school, race/ethnicity, and higher order time effects.

Table 3-2

Percentage of High School Students who Reported Tobacco Use in 1997, by Sex, Race/Ethnicity, School Location, and Parent Education—Youth Risk Behavior Survey*

	Lifetime Smoking	Ever Daily Smoking	Current Smoking	Frequent Smoking	Smoked Before Age 13	Smoked on School Property	Current Smokeless Tobacco Use	Smokeless Tobacco on School Property	Current Cigar Use
Total	70.2 (±1.9) [†]	24.8 (±2.1)	36.4 (±2.3)	16.7 (±1.9)	24.8 (±2.3)	14.6 (±1.5)	9.3 (±2.2)	5.1 (±1.4)	22.0 (±2.1)
Sex									
Female	69.3 (±2.6)	25.4 (±3.1)	34.7 (±2.8)	15.7 (±2.1)	20.9 (±2.4)	13.0 (±2.2)	1.5 (±0.7)	0.4 (±0.2)	10.8 (±2.4)
Male	70.9 (±1.9)	24.3 (±2.2)	37.7 (±2.7)	17.6 (±2.7)	28.0 (±3.3)	15.9 (±1.7)	15.8 (±3.7)	9.0 (±2.5)	31.2 (±2.3)
Race/Ethnicity									
White	70.4 (±2.3)	29.2 (±1.7)	39.7 (±2.4)	19.9 (±2.2)	25.6 (±3.0)	15.8 (±1.8)	12.2 (±2.5)	6.5 (±1.7)	22.5 (±2.6)
Female	70.3 (±3.3)	31.0 (±3.3)	39.9 (±3.2)	20.1 (±3.2)	22.0 (±3.4)	14.9 (±3.2)	1.6 (±0.9)	0.4 (±0.3)	9.6 (±2.6)
Male	70.4 (±2.4)	27.7 (±2.4)	39.6 (±3.8)	19.8 (±3.3)	28.5 (±3.8)	16.5 (±2.4)	20.6 (±4.0)	11.3 (±2.9)	32.5 (±2.1)
Black	68.4 (±4.4)	9.9 (±2.1)	22.7 (±3.8)	7.1 (±1.8)	17.4 (±2.4)	8.8 (±2.0)	2.2 (±1.1)	1.4 (±0.9)	19.4 (±3.2)
Female	66.8 (±5.2)	7.4 (±2.6)	17.4 (±3.9)	4.3 (±1.8)	15.3 (±3.5)	5.5 (±2.0)	1.3 (±1.2)	0.4 (±0.7)	11.0 (±2.9)
Male	70.1 (±4.7)	12.6 (±2.9)	28.2 (±5.5)	10.1 (±3.1)	19.5 (±4.0)	12.4 (±3.1)	3.2 (±1.7)	2.5 (±1.6)	28.1 (±5.3)
Hispanic	75.0 (±2.7)	18.0 (±2.9)	34.0 (±2.7)	10.9 (±2.6)	24.9 (±3.2)	11.9 (±2.5)	5.1 (±2.3)	3.3 (±1.6)	20.3 (±4.4)
Female	72.7 (±3.9)	18.0 (±3.4)	32.3 (±3.7)	8.1 (±2.7)	20.3 (±4.2)	7.7 (±1.8)	1.2 (±1.0)	0.3 (±0.2)	13.0 (±2.8)
Male	76.9 (±3.6)	17.9 (±4.0)	35.5 (±3.6)	13.2 (±3.7)	28.6 (±5.6)	15.3 (±3.7)	8.3 (±3.3)	5.8 (±2.6)	26.3 (±7.0)
School Location									
Urban	69.4 (±3.3)	21.0 (±3.7)	32.8 (±2.4)	13.4 (±1.7)	20.9 (±2.0)	13.0 (±2.1)	7.5 (±3.3)	3.6 (±1.8)	22.7 (±5.2)
Suburban	69.5 (±2.9)	26.1 (±2.9)	37.2 (±2.8)	17.1 (±2.7)	25.7 (±2.9)	15.1 (±2.1)	8.6 (±2.5)	5.0 (±2.0)	21.6 (±1.8)
Rural	74.6 (±6.1)	29.6 (±5.6)	42.2 (±6.6)	23.8 (±5.9)	30.7 (±5.6)	16.8 (±4.9)	14.1 (±4.3)	8.0 (±3.0)	20.4 (±6.2)
Parental Education[§]									
Did not finish HS	79.1 (±4.0)	27.7 (±3.9)	39.3 (±4.6)	18.4 (±3.1)	35.4 (±3.7)	18.3 (±4.6)	8.1 (±3.0)	6.8 (±2.8)	18.7 (±4.4)
Graduated HS	75.2 (±2.6)	28.3 (±4.1)	40.2 (±3.8)	19.5 (±3.6)	30.3 (±2.6)	15.4 (±2.7)	8.7 (±3.0)	4.4 (±2.1)	21.4 (±3.4)
Some educ. after HS	72.9 (±3.4)	26.1 (±2.7)	37.7 (±3.0)	16.3 (±2.9)	25.3 (±3.5)	13.4 (±2.0)	8.9 (±2.3)	4.7 (±1.9)	20.5 (±3.4)
Graduated college	66.2 (±2.6)	22.9 (±2.7)	34.3 (±2.5)	15.5 (±2.3)	21.5 (±2.7)	14.4 (±1.9)	9.9 (±2.9)	5.1 (±1.7)	23.7 (±3.1)

* Lifetime smoking = ever smoked cigarettes, even one or two puffs; ever daily smoking = ever smoked at least one cigarette every day for 30 days; current cigarette smoking = smoked cigarettes on 1 or more of the 30 days preceding the survey; frequent cigarette smoking = smoked on 20 or more of the 30 days preceding the survey; smoked before age 13 years = age when first smoked a whole cigarette; current smokeless tobacco use = used chewing tobacco or snuff on 1 or more of the 30 days preceding the survey; smoked cigarettes on school property = on 1 or more of the 30 days preceding the survey; used smokeless tobacco on school property = on 1 or more of the 30 days preceding the survey; and current cigar use = smoked cigars, cigarillos, or little cigars on 1 or more of the 30 days preceding the survey.

[†] Numbers in parentheses are 95% confidence intervals.

[§] Highest level of education of either parent; HS = high school.

Table 3-3

Percentage of High School Students who Reported Ever Smoking Daily, by Sex, Race/Ethnicity, School Location, and Parent Education—Youth Risk Behavior Survey, 1991–1997

	Survey Year			
	1991	1993	1995	1997
Total	21.3 (±2.2)*	24.7 (±2.0)	23.6 (±2.9)	24.8 (±2.1) §
Sex				
Female	22.2 (±3.0)	24.5 (±2.5)	23.5 (±3.4)	25.4 (±3.1)
Male	20.4 (±1.9)	24.9 (±2.2)	23.7 (±3.2)	24.3 (±2.2) §
Race/Ethnicity				
White	25.0 (±2.8)	28.4 (±2.6)	27.6 (±3.7)	29.2 (±1.7) §
Female	27.2 (±4.0)	28.6 (±3.4)	28.9 (±3.9)	31.0 (±3.3)
Male	23.0 (±2.5)	28.2 (±2.9)	26.5 (±4.4)	27.7 (±2.4)
Black	7.1 (±1.7)	9.3 (±1.8)	9.1 (±2.4)	9.9 (±2.1) §
Female	5.6 (±1.8)	9.1 (±2.1)	5.6 (±3.2)	7.4 (±2.6)
Male	8.9 (±2.8)	9.4 (±3.2)	13.4 (±5.6)	12.6 (±2.9) §
Hispanic	16.1 (±2.5)	18.6 (±2.7)	17.0 (±3.8)	18.0 (±2.9)
Female	16.5 (±3.1)	18.3 (±4.0)	15.8 (±3.7)	18.0 (±3.4)
Male	15.7 (±3.2)	19.0 (±3.4)	18.3 (±5.8)	17.9 (±4.0)
School Location				
Urban	—	21.0 (±4.4)	19.2 (±2.8)	21.0 (±3.7)
Suburban	—	27.3 (±2.8)	24.5 (±4.7)	26.1 (±2.9)
Rural	—	19.1 (±2.9)	29.8 (±4.3)	29.6 (±5.6) §
Parental Education†				
Did not finish high school	—	30.5 (±4.3)	22.5 (±6.1)	27.7 (±3.9)
Graduated high school	—	27.7 (±4.1)	26.5 (±3.5)	28.3 (±4.1)
Some education after high school	—	24.0 (±2.2)	24.7 (±4.3)	26.1 (±2.7)
Graduated college	—	23.5 (±2.7)	22.1 (±3.6)	22.9 (±2.7)

* Numbers in parentheses are 95% confidence intervals.

† Highest level of education of either parent.

§ Significant linear effect ($p < 0.5$).

Note: Trend analyses were conducted using a logistic regression model controlling for sex, grade in school, race/ethnicity, and higher order time effects.

Current Cigarette Smoking Current smoking showed a significant linear increase from 1991 to 1997; 36.4 percent of high school students reported this behavior in 1997 (Table 3-4). This significant linear increase was consistent across sex, race/ethnicity, school location, and parent education, except among students whose parents had not finished high school. Among these students, current cigarette smoking was stable from 1993 to 1997.

In 1997, current smoking did not significantly differ by sex, but was significantly more likely among White students than among Black ($t = 7.7$, $p < 0.001$) and Hispanic ($t = 3.5$, $p < 0.001$) students. Current smoking was also significantly more likely among Hispanic students than among Black students ($t = 4.9$, $p < 0.001$) (Table 3-2). Students in suburban ($t = 2.4$, $p < 0.05$) and rural ($t = 2.7$, $p < 0.05$) schools were significantly more likely to report this behavior than were students in urban schools. Similarly, students whose parents had not finished high school ($t = 2.3$, $p < 0.05$), had

Table 3-4

Percentage of High School Students who Reported Current Cigarette Smoking,* by Sex, Race/Ethnicity, School Location, and Parent Education—Youth Risk Behavior Survey, 1991–1997

	Survey Year			
	1991	1993	1995	1997
Total	27.5 (±2.7) [†]	30.5 (±1.9)	34.8 (±2.2)	36.4 (±2.3) [§]
Sex				
Female	27.3 (±3.4)	31.2 (±2.1)	34.3 (±3.2)	34.7 (±2.8) [§]
Male	27.6 (±3.1)	29.8 (±2.3)	35.4 (±2.4)	37.7 (±2.7) [§]
Race/Ethnicity				
White	30.9 (±3.3)	33.7 (±2.2)	38.3 (±2.7)	39.7 (±2.4) [§]
Female	31.7 (±4.6)	35.3 (±2.6)	39.8 (±3.5)	39.9 (±3.2) [§]
Male	30.2 (±3.8)	32.2 (±2.7)	37.0 (±3.3)	39.6 (±3.8) [§]
Black	12.6 (±2.5)	15.4 (±2.5)	19.2 (±3.2)	22.7 (±3.8) [§]
Female	11.3 (±2.3)	14.4 (±2.7)	12.2 (±3.1)	17.4 (±3.9) [§]
Male	14.1 (±4.5)	16.3 (±4.2)	27.8 (±5.5)	28.2 (±5.5) [§]
Hispanic	25.3 (±2.8)	28.7 (±2.9)	34.0 (±5.3)	34.0 (±2.7) [§]
Female	22.9 (±3.8)	27.3 (±3.9)	32.9 (±5.6)	32.2 (±3.7) [§]
Male	27.9 (±3.6)	30.2 (±3.4)	34.9 (±8.7)	35.5 (±3.6) [§]
School Location				
Urban	—	26.6 (±3.6)	31.1 (±3.3)	32.8 (±2.4) [§]
Suburban	—	32.6 (±2.7)	35.7 (±3.8)	37.2 (±2.8) [§]
Rural	—	27.9 (±3.3)	39.6 (±1.9)	42.2 (±6.6) [§]
Parental Education[‡]				
Did not finish high school	—	36.8 (±4.4)	33.1 (±4.5)	39.3 (±4.6)
Graduated high school	—	32.8 (±3.5)	37.6 (±3.9)	40.2 (±3.8) [§]
Some education after high school	—	28.9 (±2.5)	36.3 (±3.7)	37.7 (±3.0) [§]
Graduated college	—	29.7 (±2.5)	33.6 (±2.7)	34.3 (±2.5) [§]

* Smoked Cigarettes on 1 or more of the 30 days preceding the survey.

[†] Numbers in parentheses are 95% confidence intervals.

[‡] Highest level of education of either parent.

[§] Significant linear effect ($p < 0.05$).

Note: Trend analyses were conducted using a logistic regression model controlling for sex, grade in school, race/ethnicity, and higher order time effects.

graduated from high school ($t = 2.9$, $p < 0.01$), or had some education after high school ($t = 2.1$, $p < 0.05$) were significantly more likely to report current smoking than students whose parents had graduated from college.

Frequent Cigarette Smoking Frequent smoking showed a significant linear increase from 1991 to 1997; 16.7 percent of students reported this behavior in 1997 (Table 3-5). This pattern was consistent among males, females, White, Black, and Hispanic students overall as well as White females, White males, Black males, and Hispanic males. Among students in rural schools, frequent cigarette smoking showed both significant linear and quadratic time effects; frequent smoking more than doubled between 1993 and 1995, then leveled off between 1995 and 1997. Frequent smoking remained stable among students in both urban and suburban schools. Among students whose parents had some education after high school and among students whose parents had graduated from college, frequent cigarette smoking significantly

Table 3-5

Percentage of High School Students who Reported Frequent Cigarette Smoking,* by Sex, Race/Ethnicity, School Location, and Parent Education—Youth Risk Behavior Survey, 1991–1997

	Survey Year			
	1991	1993	1995	1997
Total	12.7 (±2.2) †	13.8 (±1.7)	16.1 (±2.6)	16.7 (±1.9) §
Sex				
Female	12.4 (±2.9)	13.5 (±2.1)	15.9 (±3.0)	15.7 (±2.1) §
Male	13.0 (±1.9)	14.0 (±1.7)	16.3 (±2.9)	17.6 (±2.7) §
Race/Ethnicity				
White	15.4 (±2.8)	16.1 (±2.1)	19.5 (±3.6)	19.9 (±2.2) §
Female	15.8 (±3.9)	16.1 (±2.8)	20.8 (±4.1)	20.1 (±3.2) §
Male	15.0 (±2.1)	16.0 (±2.2)	18.4 (±3.8)	19.8 (±3.3) §
Black	3.1 (±1.1)	4.6 (±1.6)	4.5 (±1.8)	7.2 (±1.8) §
Female	1.9 (±1.0)	4.3 (±1.8)	1.3 (±0.8)	4.3 (±1.8)
Male	4.5 (±2.1)	4.9 (±2.5)	8.5 (±3.4)	10.1 (±3.1) §
Hispanic	6.8 (±1.5)	7.7 (±2.0)	10.0 (±3.3)	10.9 (±2.6) §
Female	5.7 (±2.3)	6.9 (±3.2)	9.3 (±3.8)	8.1 (±2.7)
Male	8.0 (±1.6)	8.5 (±2.3)	10.7 (±4.5)	13.2 (±3.7) §
School Location				
Urban	—	11.7 (±3.4)	13.0 (±2.4)	13.4 (±1.7) §
Suburban	—	15.3 (±2.4)	16.3 (±4.3)	17.1 (±2.7)
Rural	—	9.9 (±1.7)	22.2 (±3.5)	23.8 (±5.9) §,§§
Parental Education†				
Did not finish high school	—	19.0 (±4.5)	15.4 (±3.7)	18.4 (±3.1)
Graduated high school	—	16.1 (±3.0)	18.8 (±3.5)	19.5 (±3.6)
Some education after high school	—	13.1 (±2.3)	18.2 (±4.0)	16.3 (±2.9) §
Graduated college	—	12.6 (±1.7)	14.0 (±3.0)	15.5 (±2.3) §

* Smoked Cigarettes on 20 or more of the 30 days preceding the survey.

† Numbers in parentheses are 95% confidence intervals.

‡ Highest level of education of either parent.

§ Significant linear effect ($p < 0.05$).

§§ Significant quadratic effect ($p < 0.05$).

Note: Trend analyses were conducted using a logistic regression model controlling for sex, grade in school, race/ethnicity, and higher order time effects.

increased; however, frequent smoking remained stable among students whose parents had not finished high school or had graduated from high school.

In 1997, frequent smoking did not significantly differ by sex, but was significantly more likely among White students than among Black ($t = 7.9$, $p < 0.001$) and Hispanic ($t = 5.6$, $p < 0.001$) students. Frequent smoking also was significantly more likely among Hispanic students than among Black students ($t = 2.2$, $p < 0.05$). Frequent smoking among students in suburban ($t = 2.4$, $p < 0.05$) and rural schools ($t = 3.2$, $p < 0.05$) was significantly more likely than among students in urban schools. It was also significantly more likely among students in rural schools ($t = 2.0$, $p < 0.05$) than among students in suburban schools.

Smoked Cigarettes Before Age 13 Overall, the proportion of high school students who reported that they had smoked their first whole cigarette before age 13 years remained stable from 1991 to 1997; 24.8 percent of students reported this behavior in 1997 (Table 3-6). Similarly, there were no significant linear effects among males, females, White, Black, and Hispanic students overall, among students in suburban and rural schools, and across parent education. Students in urban schools showed a significant linear decrease in smoking before age 13. Hispanic males showed significant linear and quadratic effects with increases between 1991 and 1995 and then a decrease from 1995 to 1997. Among Hispanic students overall, there was a significant quadratic trend with smoking before age 13 years peaking in 1993. Among students whose parents had not finished high school, there was a significant quadratic trend with the lowest prevalence occurring in 1995.

In 1997, males were significantly more likely than females to smoke before age 13 ($t = 4.3, p < 0.001$) (Table 3-2). This behavior also was significantly more likely among White students than among Black students ($t = 4.6, p < 0.001$) and significantly more likely among Hispanic students than among Black students ($t = 3.6, p < 0.001$). Students in suburban ($t = 2.5, p < 0.05$) and rural ($t = 3.1, p < 0.01$) schools were significantly more likely than students in urban schools to smoke before age 13. Similarly, students whose parents had not finished high school ($t = 7.5, p < 0.001$), had graduated from high school ($t = 4.9, p < 0.001$), or had some education after high school ($t = 2.3, p < 0.05$) were significantly more likely to report smoking before age 13 than were students whose parents had graduated from college. Students whose parents had not finished high school were significantly more likely to report smoking before age 13 than students whose parents had graduated from high school ($t = 2.6, p < 0.05$) or whose parents had some education after high school ($t = 3.9, p < 0.001$).

Smoked Cigarettes on School Property Smoking on school property remained stable from 1991 to 1997; 14.6 percent of students reported this behavior in 1997 (Table 3-7). This pattern was consistent among females, males, White female and male students, Black females, and among students whose parents had not graduated high school, had graduated high school, and students whose parents had graduated from college. Smoking on school property showed a significant linear increase among Black students overall, Black males, Hispanic males, and students in rural schools, and showed a significant linear decrease among Hispanic females. Among Hispanic females and students in rural schools, there were also significant quadratic trends with peaking in smoking on school property in 1995 and declines from 1995 to 1997. Among Hispanic females, after the decline from 1995 to 1997, the prevalence in 1997 was lower than in 1993, whereas, among students in rural schools, smoking on school property remained higher in 1997 than in 1993 even with these declines. Among students whose parents had some education after high school, there was only a quadratic trend with smoking on school property peaking in 1995.

In 1997, males were significantly more likely than females to report smoking on school property ($t = 2.5, p < 0.05$; Table 3-2). White students were significantly more likely than Black ($t = 4.9, p < 0.001$) and

Table 3-6

Percentage of High School Students who Reported Smoking Their First Whole Cigarette before Age 13 Years, by Sex, Race/Ethnicity, School Location, and Parent Education—Youth Risk Behavior Survey, 1991–1997

	Survey Year			
	1991	1993	1995	1997
Total	23.8 (±1.5)*	26.9 (±1.4)	24.9 (±2.7)	24.8 (±2.3)
Sex				
Female	22.1 (±1.9)	23.3 (±2.1)	21.8 (±3.7)	20.9 (±2.4)
Male	25.4 (±2.2)	30.1 (±1.7)	27.8 (±2.8)	28.0 (±3.3)
Race/Ethnicity				
White	25.1 (±2.1)	28.5 (±1.9)	25.9 (±2.9)	25.7 (±3.0)
Female	23.1 (±2.7)	24.6 (±2.7)	23.7 (±4.3)	22.1 (±3.4)
Male	26.9 (±3.1)	31.9 (±2.3)	27.9 (±3.4)	28.5 (±3.8)
Black	18.0 (±2.2)	18.9 (±1.8)	17.2 (±3.1)	17.4 (±2.4)
Female	18.5 (±3.2)	17.4 (±2.5)	14.8 (±4.2)	15.3 (±3.5)
Male	17.4 (±2.7)	20.5 (±2.3)	20.1 (±3.1)	19.5 (±4.0)
Hispanic	22.0 (±2.6)	27.3 (±2.0)	26.6 (±3.2)	24.9 (±3.2) §§
Female	22.9 (±3.8)	23.5 (±3.6)	20.2 (±5.4)	20.3 (±4.2)
Male	20.9 (±3.0)	31.0 (±4.2)	33.0 (±5.5)	28.6 (±5.6) §§§
School Location				
Urban	—	26.1 (±3.1)	22.8 (±2.3)	20.9 (±2.0) §
Suburban	—	27.5 (±2.0)	25.4 (±3.7)	25.7 (±2.9)
Rural	—	25.0 (±4.0)	27.5 (±4.6)	30.7 (±5.6)
Parental Education†				
Did not finish high school	—	36.3 (±5.3)	29.1 (±5.6)	35.4 (±3.7) §§
Graduated high school	—	30.1 (±3.3)	26.0 (±4.9)	30.3 (±2.6)
Some education after HS	—	25.4 (±1.7)	26.3 (±2.7)	25.3 (±3.5)
Graduated college	—	25.1 (±2.5)	22.6 (±2.8)	21.5 (±2.7)

* Numbers in parentheses are 95% confidence intervals.

† Highest level of education of either parent.

§ Significant linear effect ($p < 0.05$).

§§ Significant quadratic effect ($p < 0.05$).

Note: Trend analyses were conducted using a logistic regression model controlling for sex, grade in school, race/ethnicity, and higher order time effects.

Table 3-7
Percentage of High School Students who Reported Smoking on School Property,* by Sex, Race/Ethnicity, School Location, and Parent Education—Youth Risk Behavior Survey, 1993–1997

	Survey Year			
	1991	1993	1995	1997
Total	—	13.2 (±1.8)†	16.0 (±2.1)	14.6 (±1.5)
Sex				
Female	—	12.9 (±1.8)	15.1 (±2.4)	13.0 (±2.2)
Male	—	13.5 (±2.1)	16.8 (±2.6)	15.9 (±1.7)
Race/Ethnicity				
White	—	14.6 (±2.4)	17.6 (±3.0)	15.8 (±1.8)
Female	—	14.5 (±2.3)	17.7 (±3.3)	14.9 (±3.2)
Male	—	14.7 (±2.8)	17.5 (±3.2)	16.5 (±2.4)
Black	—	5.9 (±1.6)	7.6 (±2.2)	8.8 (±2.0) §
Female	—	4.5 (±1.7)	4.5 (±2.4)	5.5 (±2.0)
Male	—	7.3 (±2.8)	11.6 (±2.3)	12.4 (±3.1) §
Hispanic	—	11.1 (±2.5)	14.9 (±3.3)	11.9 (±2.5)
Female	—	11.6 (±3.1)	13.6 (±3.9)	7.7 (±1.8) §, §§
Male	—	10.6 (±2.7)	16.2 (±3.9)	15.3 (±3.7) §
School Location				
Urban	—	11.8 (±2.4)	14.3 (±1.7)	13.0 (±2.1)
Suburban	—	14.8 (±2.1)	16.4 (±3.9)	15.1 (±2.1)
Rural	—	6.8 (±3.2)	18.3 (±2.1)	16.8 (±4.9) §, §§
Parent Education†				
Did not finish high school	—	16.3 (±4.1)	16.9 (±3.5)	18.3 (±4.6)
Graduated high school	—	14.3 (±3.4)	17.8 (±2.5)	15.4 (±2.7)
Some education after HS	—	12.7 (±2.0)	17.1 (±4.0)	13.4 (±2.0) §§
Graduated college	—	12.7 (±1.9)	14.3 (±2.6)	14.4 (±1.9)

* Smoked on school property on 1 or more of the 30 days preceding the survey (question not asked in 1991).

† Numbers in parentheses are 95% confidence intervals.

‡ Highest level of education of either parent.

§ Significant linear effect ($p < 0.05$).

§§ Significant quadratic effect ($p < 0.05$).

Note: Trend analyses were conducted using a logistic regression model controlling for sex, grade in school, race/ethnicity, and higher order time effects.

Hispanic ($t = 2.4, p < 0.05$) students to report this behavior. Students whose parents had not finished high school were significantly more likely to have smoked on school property than were students whose parents had some education after high school ($t = 2.4, p < 0.05$).

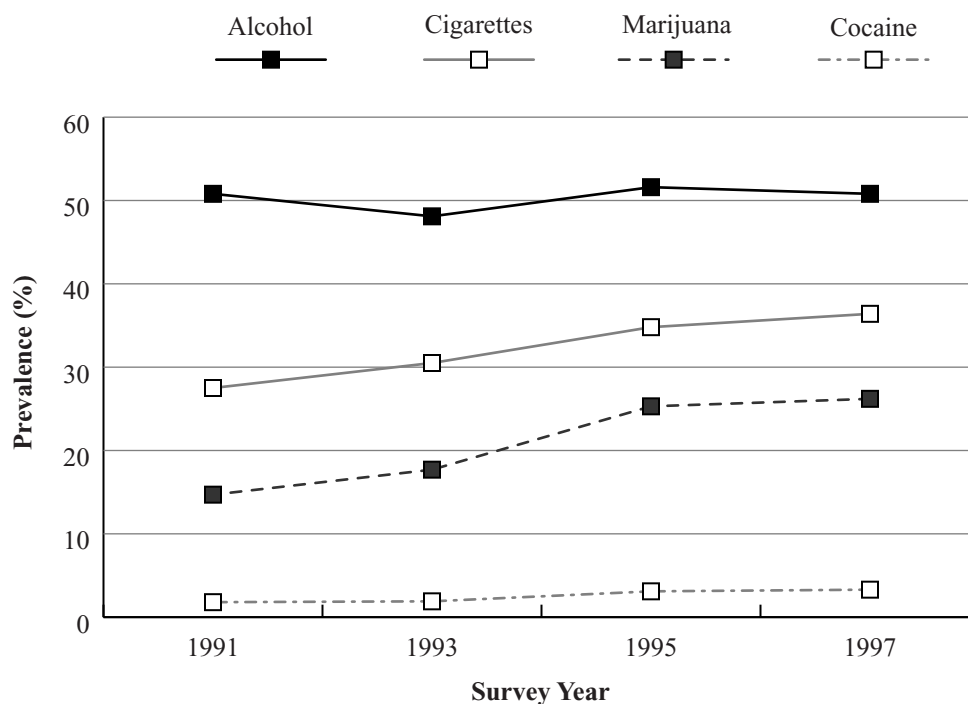
Current Smokeless Tobacco Use and Smokeless Tobacco Use on School Property In 1997, 9.3 percent of students reported current use of smokeless tobacco and 5.1 percent reported using smokeless tobacco on school property (Table 3-2).

Males were significantly more likely than females to report current smokeless tobacco use ($t = 7.9, p < 0.001$) and smokeless tobacco use on school property ($t = 6.9, p < 0.001$). White students were significantly more likely than Black ($t = 9.4, p < 0.001$) and Hispanic ($t = 5.8, p < 0.001$) students, and Hispanic students were significantly more likely than Black students ($t = 2.3, p < 0.05$), to report current smokeless tobacco use. Similarly, White students were significantly more likely than Black ($t = 6.5, p < 0.001$) and Hispanic ($t = 3.5, p < 0.001$) students, and Hispanic students were significantly more likely than Black students ($t = 2.0, p < 0.05$), to report smokeless tobacco use on school property. Students in rural schools were significantly more likely than students in suburban ($t = 2.0, p < 0.05$) and urban ($t = 2.8, p < 0.01$) schools to report current smokeless tobacco use. In addition, students in rural schools were significantly more likely than students in urban schools ($t = 2.4, p < 0.05$) to report smokeless tobacco use on school property. Parental educational level was not associated with current smokeless tobacco use; however, smokeless tobacco use on school property was significantly more likely among students whose parents had not finished high school than among students whose parents had graduated from high school ($t = 2.0, p < 0.05$).

Current Cigar Use In 1997, 22.0 percent of students reported current cigar use. Overall, males were significantly more likely than females ($t = 15.1, p < 0.001$) to report this behavior and these differences held across the racial/ethnic subgroups. Current cigar use did not vary significantly by race/ethnicity overall, by school location, or by parental education.

Trends in Current Smoking Compared with Other Drug Use Overall, current alcohol use remained stable from 1991 to 1997 (50.8 ± 2.8 percent in 1997); however, significant linear increases were seen for both current marijuana use (from 14.7 ± 2.2 percent in 1991 to 26.2 ± 2.2 percent in 1997, $p < 0.001$) and current cocaine use (from 1.8 ± 0.5 percent in 1991 to 3.3 ± 0.5 percent in 1997, $p < 0.001$). These increases were consistent with the significant linear increases in current cigarette smoking from 1991 to 1997 (Figure 3-1). This pattern was consistent among males and females, as well as among White and Hispanic students. Among Black students, however, cocaine use remained stable from 1991 to 1997.

Figure 3-1
Current Smoking and Other Drug Use* among High-School Students, 1991-1997



* Used alcohol, smoked cigarettes, used marijuana, or used cocaine on 1 or more of the 30 days preceding the survey.

Source: Youth Risk Behavior Survey, 1991-1997.

DISCUSSION This study found that lifetime cigarette smoking remained stable among high school students from 1991 to 1997; 70 percent of students reported this behavior in 1997. However, both current and frequent cigarette smoking significantly increased from 1991 to 1997. With the current patterns of tobacco use among youths, an estimated 5 million persons aged 0 to 17 years in 1995 will die prematurely from a smoking-related illness (CDC, 1996).

Approximately 80 percent of tobacco use occurs for the first time among youths aged less than 18 years (U.S. DHHS, 1994). Schools are ideal settings to influence tobacco use patterns among young people because educators can reach almost all school-aged youths and can provide prevention education when children are at the highest risk of experimenting with tobacco. To be most effective, school-based programs must target young persons before they initiate tobacco use or drop out of school (CDC, 1994). For this prevention to occur, programs must begin to reach youths at an early age. This study found that, from 1991 to 1997, the proportion of students who reported smoking their first whole cigarette before age 13 was stable—one in four students reported this behavior in 1997.

To assist schools in providing the most effective tobacco-use prevention programs, the CDC (1994) developed Guidelines for School Health Programs to Prevent Tobacco Use and Addiction. These guidelines recommend that schools provide tobacco-use prevention education from kindergarten through 12th grade, with especially intensive instruction in junior high or middle school. However, this level of instruction is not occurring as recommended. Slightly more than one-half (55 percent) of middle and junior-high school teachers and fewer than half (47 percent) of senior high school teachers taught tobacco-use prevention as a major topic in their courses in 1994 (Crossett *et al.*, in press). Only 21 percent of teachers who included tobacco-use prevention as a major topic spent six or more class periods on the topic. Few teachers are dedicating the instructional time that research trials indicate is needed to effectively prevent tobacco use (NCI, 1990; Dusenbury *et al.*, 1997; Botvin *et al.*, 1995).

This study revealed that, overall, cigarette smoking on school property remained stable from 1993 to 1997, but increased significantly among Black students overall, Black males, Hispanic males, and students in rural schools. In 1997, 14.6 percent of students reported smoking cigarettes on school property and 5.1 percent (11.3 percent of White males) used smokeless tobacco on school property. The CDC guidelines recommend that school buildings, school property, school vehicles, and school-sponsored functions be tobacco-free. In addition, the Pro-Children Act of 1994 (1994) requires smoke-free environments in all schools supported by federal funds. Most schools have smoke-free building policies in place, but lack more comprehensive prohibitions (Crossett *et al.*, in press) that, if enforced, might reduce smoking on school property.

School-based tobacco-use prevention programs are most effective when supported by community-wide programs involving families, peers, and community organizations (CDC, 1994). Other critical components of a comprehensive tobacco control program include reducing youth access (*e.g.*, by implementing and adequately enforcing restrictions on minors' access) (U.S. DHHS, 1994), reducing the appeal of tobacco products (U.S. DHHS, 1994), conducting youth-oriented mass media campaigns (U.S. DHHS, 1994; FDA, 1996), and increasing excise taxes on tobacco products (U.S. DHHS, 1994; Hamilton *et al.*, 1997; Ohsfeldt *et al.*, 1997).

Rates of cigar smoking, although significantly higher among males than females, did not significantly vary across any other subgroups. However, as in other investigations (Najem *et al.*, 1997; Nelson *et al.*, 1995), differences emerged in other tobacco-use patterns among students of different racial/ethnic backgrounds. In this study, White students were significantly more likely than Hispanic students and Hispanic students were more likely than Black students to report ever daily smoking, current smoking, frequent smoking, current smokeless tobacco use, and smokeless tobacco use on school property. Further, White students and Hispanic students were significantly more likely than Black students to report smoking before age 13, and White students were significantly more likely than Black and Hispanic students to have smoked on school property.

Parental education and school location were also associated with tobacco use. As parents' education increased, students' current cigarette smoking decreased, although frequent smoking and current smokeless tobacco use were consistent across parental education subgroups. Students in urban schools were generally less likely to use tobacco than students in rural schools. These differences partly reflect differences in the racial/ethnic distributions found across school locations. For example, urban schools in 1997 were comprised of 45 percent of White students, 23 percent of Black students, and 15 percent of Hispanic students. However, in suburban schools, 67 percent of students were White, 9 percent were Black, and 8 percent were Hispanic. In rural schools, 84 percent of students were White, 4 percent were Black, and 5 percent were Hispanic. Urban schools have a higher proportion of Black and Hispanic students than other school locations and these students are generally less likely than White students to report cigarette use.

Increasing trends in current cigarette smoking were consistent with significant increases in current marijuana and cocaine use from 1991 to 1997. This was expected given the strong association between cigarette smoking and other drug use found in other investigations (Everett *et al.*, 1998a; Escobedo *et al.*, 1997; Parra-Medina *et al.*, 1995). Programs designed to prevent tobacco use should consider other substance use because rarely is one substance used in isolation (CDC, 1994; Everett *et al.*, 1998a).

The findings in this report are subject to at least two limitations. First, these data apply only to adolescents who attend high school. However, in 1996, only 5 percent of persons aged 14 to 17 were not enrolled in school (Snyder, 1997). Second, the extent of underreporting or overreporting cannot be determined, although the survey questions demonstrate good test-retest reliability (Brener *et al.*, 1995).

CONCLUSIONS Despite national efforts to reduce tobacco use among American youths, cigarette smoking increased among high school students nationwide from 1991 to 1997. In addition, smokeless tobacco use and cigar use were high in 1997. Continued efforts are needed to reduce all forms of tobacco use among youths.

REFERENCES

- Botvin, G.J., Baker, E., Dusenbury, L., Botvin, E.M., Diaz, T. Long-term follow-up results of a randomized drug abuse prevention trial in a white middle-class population. *Journal of the American Medical Association* 273(14):1106-1112, 1995.
- Brener, N.D., Collins, J.L., Kann, L., Warren, C.W., Williams, B.I. Reliability of the Youth Risk Behavior Survey Questionnaire. *American Journal of Epidemiology* 141(6):575-580, 1995.
- Centers for Disease Control and Prevention. Guidelines for school health programs to prevent tobacco use and addiction. *Morbidity and Mortality Weekly Report* 43(RR-2):1-18, 1994.
- Centers for Disease Control and Prevention. Projected smoking-related deaths among youth—United States. *Morbidity and Mortality Weekly Report* 45(44):971-974, 1996.
- Crossett, L.S., Everett, S.A., Brener, N.D., Fishman, J.A., Pechacek, T.F. Adherence to the CDC Guidelines for School Health Programs to Prevent Tobacco Use and Addiction. *Journal of Health Education* (in press).
- Dusenbury, L., Falco, M., Lake, A. A review of the evaluation of 47 drug abuse prevention curricula available nationally. *Journal of School Health* 67(4):127-132, 1997.

- Escobedo, L.G., Reddy, M., DuRant, R.H. Relationship between cigarette smoking and health risk and problem behaviors among US adolescents. *Archives of Pediatric and Adolescent Medicine* 151(1):66-71, 1997.
- Everett, S.A., Giovino, G.A., Warren, C.W., Crossett, L., Kann, L. Other substance use among high school students who use tobacco. *Journal of Adolescent Health* 23(5):289-296 1998a.
- Everett, S.A., Husten, C.G., Warren, C.W., Crossett, L., Sharp, D. Trends in tobacco use among high school students in the United States, 1991-1995. *Journal of School Health* 68(4):137-140, 1998b.
- Food and Drug Administration. Regulations restricting the sale and distribution of cigarettes and smokeless tobacco to children and adolescents; final rule. *Federal Register* 61:44395-44618, 1996.
- Hamilton, V.H., Levinton, C., St-Pierre, Y., Grimard, F. The effect of tobacco tax cuts on cigarette smoking in Canada. *Canadian Medical Association Journal* 156(2):187-191, 1997.
- McGinnis, J.M., Foege, W.H. Actual causes of death in the United States. *Journal of the American Medical Association* 270(18):2207-2212, 1993.
- Najem, G.R., Batuman, F., Smith, A.M., Feuerman, M. Patterns of smoking among inner-city teenagers: smoking has a pediatric age of onset. *Journal of Adolescent Health* 20(3):226-231, 1997.
- National Cancer Institute. *School Programs to Prevent Smoking: The National Cancer Institute Guide to Strategies that Succeed*. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute. DHHS Publication No. (NIH) 90-500, 1990.
- Nelson, D.E., Giovino, G.A., Shopland, D.R., Mowery, P.D., Mills, S.L., Eriksen, M.P. Trends in cigarette smoking among US adolescents, 1974-1991. *American Journal of Public Health* 85(1):34-40, 1995.
- Ohsfeldt, R.L., Boyle, R.G., Capilouto, E. Effects of tobacco excise taxes on the use of smokeless tobacco products in the USA. *Health Economics* 6(5):525-531, 1997.
- Parra-Medina, D.M., Talavera, G., Elder, J.P., Woodruff, S.I. Role of cigarette smoking as a gateway drug to alcohol use in Hispanic junior high school students. *Journal of the National Cancer Institute* 18:83-86, 1995.
- Pro-Children Act of 1994. Public Law No. 103-227 Title X § C, 1044, 108 Stat. 274. 1994.
- Quality Education Data, Inc. (WED) *Data User Guide* (version 2.7). Denver, CO: Quality Education Data, Inc., 1991.
- Snyder, T.D. *Digest of Education Statistics, 1997*. Washington, D.C.: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics, 1997.
- U.S. Department of Health and Human Services. *Preventing Tobacco Use Among Young People: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 1994.