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Examining the High Rate of Cigarette Smoking among Adults with a GED

Charlotte A. Schoenborn, MPH^{a,*}, Manfred Stommel, Ph.D.^b, and Jacqueline W. Lucas, MPH^c

^aNational Center for Health Statistics, Centers for Disease Control and Prevention, Hyattsville, MD

^bMichigan State University, College of Nursing, East Lansing, MI

^cNational Center for Health Statistics, Centers for Disease Control and Prevention, Hyattsville, MD

Abstract

Objectives—We seek to identify characteristics of GED holders that explain their very high smoking rates compared with high school (HS) graduates.

Methods—We pooled data from the 2006–2014 National Health Interview Surveys (NHIS) for adults aged 25 and older (n=235,031) to describe cigarette smoking behaviors and smoking history for adults in six education categories, with a focus on comparing GED holders to HS graduates. Logistic regression was used to predict the odds of current cigarette smoking and successful quitting, accounting for demographic, employment, family/sociocultural, mental health, and other potential confounders.

Results—The smoking rate among adults with a GED (44.1%) was more than five times the rate for those with a college degree (8.3%) and almost twice the rate of adults whose highest level of education was a high school diploma (23.6%). GED holders were also more likely to have started smoking before the age of 15 (32.2%) compared with HS graduates (12.2%) (p<0.001). Even after controlling for 23 socio-demographic and health characteristics, GED holders retained significantly higher odds of current smoking compared to HS graduates (OR=1.73; 95% CI: 1.56, 1.93) and significantly lower odds of successful quitting (OR=0.83, 95% CI: 0.73, 0.94).

Conclusions—GED holders had greater odds of being a current cigarette smoker, regardless of other characteristics that usually explain smoking. Earlier smoking initiation among GED holders, in combination with lower odds of quitting, contributed to their higher current smoking rate.

Keywords

smoking; education; GED; tobacco

*Corresponding author: Charlotte A. Schoenborn, MPH, National Center for Health Statistics, CDC, 3311 Toledo Rd. Cubicle 5223, Hyattsville, MD 20782, Telephone: 301 458-4485, Fax: 301 458-4901, cas6@cdc.gov.

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Introduction

Despite progress in tobacco control, smoking education and prevention in the past 50 years, smoking remains the leading cause of preventable sickness and death in the United States.¹ Smoking rates for U.S. adults have declined over these 50 years---from 42% in 1965 to 17% in 2014.^{2, 3} Despite overall progress, smoking rates for some groups remain high. Educational attainment has long been identified as one of the strongest predictors of cigarette smoking.⁴⁻⁹ In particular, one educational group, adults whose highest level of education was the General Equivalency Diploma (GED), had a smoking rate in 2014 that was about the same as that of the general US adult population in 1965.^{2, 3}

Since its earliest days as a test battery developed for military personnel to assess high-school level academic skills, the GED has evolved into the primary alternative to a regular high school diploma.¹⁰ The annual number of GED holders has increased from 227,000 in 1971 to nearly 541,000 in 2013.¹¹ Census data indicate that in 2015 3.0% of the US population age 25 and older completed high school by earning a GED or equivalent credential.¹² Nearly two-thirds of GED test takers do so to gain access to further education and roughly half of GED test takers do so for immediate employment reasons.¹³

Most surveys combine GED holders and high school graduates into a single category, either because the two are considered comparable or because the numbers of persons with GEDs in typical medical/health-related study samples are too small to be analyzed separately unless targeted for oversampling.¹⁴ The combining of these two groups has masked important differences between them, including much higher smoking rates for the GED holders.¹⁵ While there is evidence that GED holders are comparable to high school graduates in terms of cognitive skills, they often lag behind high school graduates in earnings and health outcomes and differ in terms of their health risk behaviors.¹⁶⁻¹⁹

The National Health Interview Survey (NHIS) began identifying GED holders separately from high school graduates in 1997. Since then, higher smoking rates based on NHIS data have been found consistently among GED holders, when compared to both individuals without a high school diploma and high school graduates.⁴⁻⁹ Several recent studies have also identified differences in smoking rates of GED holders compared to adults at other levels of educational attainment.¹⁹⁻²² However, smoking behaviors were not their primary focus but rather part of a larger emphasis on health and health behaviors related to educational attainment.

Although studies of the relationship between educational attainment and health are beginning to explore differences between GED holders and adults who have followed other educational paths, much work remains to be done in terms of understanding why smoking rates are so high in this group. So far, no studies have examined smoking as the primary outcome of interest among a representative sample of U.S. adults; nor has there been much of an exploration of the contextual factors that may contribute to the high smoking rates among GED holders. Our study extends research to date by exploring a wide range of factors among a nationally representative sample of US adults. The goal is to explain why

more than 4 in 10 GED holders smoke cigarettes in spite of fifty years of progress in tobacco prevention and control that has helped to prevent people from starting to smoke and assisted people to quit.

Methods

Study Population

The NHIS is a multipurpose, in-person, health survey of the civilian, noninstitutionalized U.S. population of the United States, conducted continuously since 1957 and released annually. NHIS uses a multistage probability sample design, sampling households throughout the 50 states and the District of Columbia. The NHIS sample is designed and weighted to be representative of the U.S. population.

The basic annual survey consists of (1) family and household components, with health and demographic information on all family members; (2) a sample adult component, administered to one randomly selected adult aged 18 and over from each family; and (3) a child component (not used here). Data from the 2006–2014 NHIS Sample Adult Core questionnaires were merged in order to have sufficient sample size to examine factors that might explain the high smoking rates among GED holders, who constitute less than 4% of US adults. The analysis is based on 235,031 completed interviews with adults aged 25 and over whose cigarette smoking status is known. Since the NHIS classifies respondents based on the highest level of education completed at the time of the interview, younger adults (aged <25) were excluded to increase the likelihood that the educational attainment was complete. Final annual (unconditional) response rates over this 9-year period varied between 73.8% and 91.8% for sample households; between 73.1% and 90.3% for the family component (taking into account household nonresponse) and between 58.9% and 80.4% for the Sample Adult component (taking into account household and family nonresponse).²³

Measures

Cigarette smoking status was determined by asking sample adults “Have you smoked at least 100 cigarettes in your entire life?” and “Do you now smoke cigarettes every day, some days or not at all?” Adults who currently smoked every day or some days were classified as current smokers. Adults who had smoked at least 100 cigarettes in their lifetime, but now smoked “not at all,” were classified as former smokers. Age of smoking initiation was based on the question: “How old were you when you first started to smoke fairly regularly?” with a threshold for early onset defined as < 15 years.

Educational attainment was the primary independent variable of interest with years of education reported in single years completed or highest degree earned. Detailed levels were collapsed into six categories: 0–8 years, 9–12 years (high school dropouts), General Equivalency Diploma (GED), high school diploma (reference group), some college, and college graduate or higher.

Covariates (other predictors of smoking and smoking cessation)

Based on existing literature about predictors of smoking behaviors, six domains were identified as potential contributors to the high smoking rates among GED-holders compared to high school graduates: (1) demographic characteristics; (2) environmental factors; (3) sociocultural factors; (4) economic status; (5) health care access; and (6) mental health.^{1, 24–27} These covariates represent contextual factors in the lives of NHIS respondents at the time of the interview that were expected to contribute to explaining current smoking behavior.

Statistical Analysis

In addition to bivariate cross tabulations of educational attainment levels with smoking behaviors and covariates, logistic regression models were used to examine the association between educational attainment and (a) current cigarette smoking status and (b) successful quitting among adults who had ever smoked. Each of the variables in the six domains was introduced one at a time and in a domain-specific set. Then all variables from the six domains were included in the full model, and backwards, stepwise elimination was used to eliminate those variables that did not contribute independently to explaining the higher GED smoking rates. Interaction terms between sex and race/ethnicity and acculturation were tested but were not significant. Several interaction terms between educational attainment levels and age groups were significant leading us to examine age-stratified models. Successful quitting was examined separately to identify factors that contribute to lower quit rates (and hence higher smoking rates) among GED holders compared with high school graduates.

Analyses were conducted using Stata, version 14.0, and employing the “svy” command to provide correct variance estimates that account for the complex NHIS sample design.^{28, 29} The weighting variable for the sample adult was divided by 9 to adjust for the 9-year collated study sample. The comparison of interest was between GED holders and high school graduates (reference group) in an effort to identify why, when they have theoretically equivalent educational attainment, their smoking rates are so different. However, six levels of education were retained for the analysis and highlight the strength of the education-smoking relationship.

Results

Education differentials in smoking behavior

During the period of 2006–2014, on average, 19.0% of U.S. adults aged 25 and older were current cigarette smokers and 24.1% were former smokers, with prevalence varying markedly by level of education (Table 1). On average over the 9-year period, the smoking rate among adults with a GED (44.1%) was more than five times the rate for those with a college degree (8.3%) and almost twice the rate of adults whose highest level of education was a high school diploma (23.6%) (Table 1). About 30.6 % of GED holders who smoke started smoking before age 15 compared with 17.5% of high school graduates who smoke. Overall smoking prevalence for adults aged 25 and over declined during the study period from 20.4% in 2006 to 16.8% in 2014. Significant declines in smoking were observed in

every education group except the GED group; In 2014 smoking prevalence among adults with a GED (43.0%) was more than 2.5 times the national average (16.8%) (Figure 1).

Characteristics of GED holders compared with other education groups

Table 2 highlights selected population characteristics of GED holders compared to persons with different levels of educational attainment. To a larger extent than other educational attainment groups, GED holders are male (52.1%), single, divorced, or separated (32.2%), and have served in the military (13.7%). They are more likely than high school graduates to be Hispanic (15.5% vs 12.1%), to work in occupations (47.5% vs 39.9%) and industries (37.0% vs 32.2%) with high smoking rates, live in a transient or mobile home (12.9% vs 7.1%), have incomes below the federal poverty level (19.7% vs 10.4%) or just above (26% vs 18.1%), receive some type of government income subsidy (31.3% vs 15.9%) or food stamps (22.2% vs 9.5%), are looking for work (9.4% vs 5.6%), have a family member who is looking for work (14.0% vs 9.0%), lack health insurance (26.8% vs 17.3%), lack a usual place to go for medical care (21.8% vs 16.0%), lack transportation for medical care (4.1% vs 1.7%), and are unable to afford needed medications (18.2% vs 8.9%). GED holders also have the highest rates of limitations due to an emotional problem (6.6% vs 2.2%) or a mental disorder (0.4% vs 0.1 %).

GED holders also differed from other educational groups in terms of several other social and health characteristics not measured annually in the NHIS... During the years 2006–2010 (years the questions were asked), more than 1 in 5 (21.7%) GED holders had ever spent 24 hours or more in jail, on the streets, or in a shelter---more than three times the rate of high school graduates (5.8%) and almost twice the rate of people without a high school diploma or a GED (11.6%). GED holders were more than twice as likely as high school graduates to report emotional problems (6.6% vs 2.5%) and more likely to have engaged in episodic heavy drinking---- that is, had 5 or more drinks in a single day--- 22.4 days (on average) in the preceding year, compared with 15.5 days for high school graduates.

Comparing the unadjusted odds of being a current smoker (vs. all current non-smokers including quitters) between GED holders and high school graduates yielded an odds ratio (OR) of 2.55 (95% CI: 2.39, 2.73). Adjusting for demographic characteristics alone (age, sex, race/ethnicity and marital status) resulted in an attenuated adjusted odds ratio (AOR) of 2.29 (95% CI: 2.13–2.46.). GED holders have higher smoking rates than any other educational attainment group, even compared to high school dropouts (unadjusted OR=1.36, 95% CI: 1.26–1.47).

Predictors of cigarette smoking

Table 3 shows the full final model with 23 predictor variables divided into six domains. The covariates in all six domains significantly predicted the odds of being a current smoker, and most of these variables were moderately correlated with educational attainment; yet, controlling for all of these confounders attenuated, but did not fully account for, the differences in smoking rates between GED holders and high school graduates (AOR=1.73, 95% CI: 1.56, 1.93).

Domain-specific models

Each of the domain-specific models showed small attenuations in odds ratios for GED holders (Table 4). Even compared with high school drop-outs, the group with the second-highest smoking rates, GED holders exhibited higher rates of current cigarette smoking (OR=1.19, 95% CI: 1.06, 1.33). While statistically significant, the covariates made only modest contributions to predicting current smoking behavior, with adjusted odds ratios generally ranging between 0.67 and 1.50.

Age stratification of the full model revealed an age-education interaction. GED holders aged 25–44 had nearly twice the odds of being a current smoker relative to high school graduates with an AOR= 1.85 (95% CI: 1.57, 2.17) compared with an AOR=1.64 (95% CI: 1.41, 1.91) for GED holders aged 45–64 and an AOR=1.48 (95% CI: 1.11, 1.98) for GED holders aged 65 and over. Although the odds ratios were lower in the oldest age group, they remained significant.

Early smoking initiation and unsuccessful cessation

Table 5 shows the association between education level and successful quitting among adults who had ever smoked cigarettes in their entire life. This model controls for all 23 covariates shown in table 3, plus age at which the current or former smoker started smoking. The age of starting smoking was included because GED holders were found to have the highest proportion of early smokers (Table 1) and early smoking is associated with failure to quit.³⁰ Table 5 shows that, compared with high school graduates, the odds of successful quitting are lowest among GED holders (AOR=0.83, 95% CI: 0.73,0.94) and high-school drop-outs (AOR=0.82, 95% CI:0.76,0.90) and highest among persons with a college degree (AOR=1.77; 95% CI: 1.63,1.92). The odds of successful quitting were highest among adults who started to smoke at age 17 or 18 (AOR=1.11; 95% CI: 1.03, 1.21) compared with adults who started smoking before age 13.

Discussion

In this paper, we sought to provide contextual information to better understand the high smoking rates of GED holders. Different from the decades-long general trend of declining smoking rates among adults and high school students,³¹ GED holders' smoking rates have remained stubbornly high. We identified six domains and within these, a total of 23 characteristics measured in the NHIS annually which we predicted would contribute to high smoking rates among GED holders. Indeed, each of these 23 characteristics was associated, at least to some extent, with being a current cigarette smoker. However, none of them, individually or combined, fully explained the high smoking rates among GED holders.

As noted earlier, GED holders and high school graduates are often combined when reporting survey results.¹⁴ Our results demonstrate that the two groups are distinct in both smoking behavior and demographic characteristics and combining them masks important differences. GED holders have higher rates of economic disadvantage (less likely to have health insurance coverage, more likely to receive food stamps and other income assistance, and more likely to have incomes below the poverty threshold) compared with high school

graduates. Similarly, A Census Bureau report on earnings by educational attainment, showed that mean earnings of GED holders amounted only to 67% of the mean earnings of high school graduates.³² GED holders also generally have higher rates of emotional and mental problems, which they share with other high school dropouts.³³ In fact, as far as our data allowed us to address such issues, GED holders seem to exhibit many adverse outcomes, manifested in lower average starting age for smoking, greater propensity of having had jail time, and higher divorce rates. While controlling for these factors was not sufficient to fully explain the high smoking rates, each contributed to an overall reduction in the odds ratio that is seen between the unadjusted model (OR=2.55) to the fully adjusted model (AOR=1.73). Interestingly, the results also indicate that combining GED holders with high school dropout would not be appropriate when reporting survey results. Controlling for demographic differences between the two groups did not account for much of the higher smoking rates among the GEDs.

Limitations

The NHIS, with its large annual sample and design that permits combining data years, is uniquely suited to study small population subgroups such as GED holders. Still, adults whose highest level of educational attainment is a GED represent only 2.8% of U.S. adults aged 25 and over (n=6,882) which is a limitation for complex modeling. A second limitation is that uptake of smoking, in most cases, predated obtaining the GED, which generally is not obtained before age 18. About 7 in 10 GED holders began smoking before age 18.³⁴ Third, the NHIS measures current health and demographic characteristics and has no information about the psychological factors, family or environmental conditions that existed years earlier in respondents' lives that might have led GED holders to take up smoking at an early age. Finally, no information was available about the circumstances that lead the respondent to obtain a GED, the age at which it was obtained, or the context within which it was earned (e.g. alternative high school, prison, military)---all of which could shed light on understanding the relationship between GED attainment and smoking behavior.

With cross sectional NHIS data, it is not possible to determine causality. While it is clear that a large majority of GED holders started smoking before they became eligible for the GED exam, we cannot establish whether or not it is the same or similar factors that induce people to smoke and then to earn a GED later. The GED may have an indirect effect on smoking behavior at the time of the NHIS interview. For example, educational achievement in general, and having a GED as the highest educational credential in particular, may affect the likelihood that someone will work at a job and in an industry with high smoking rates, which, in turn, can affect the likelihood that they will be able to quit successfully. The finding that high school dropouts, who do not go on to earn a GED, have lower smoking rates than GED holders does seem to suggest that GED holders face a unique set of risk factors that predispose them to become and remain smokers.

Our finding that high smoking rates among adults with a GED cannot be fully explained by contemporary factors in their lives is consistent with findings that educational differences in cigarette smoking rates are preceded by differences in rates of smoking initiation early in life.³⁵ These differences occur long before the completion of education. Educational

differences in adult smoking prevalence are much less the result of quitting behavior in adulthood.³⁵ Consistent with this finding, Grunbaum et al. and Sussman et al. have suggested that drop-out prevention and recovery programs provide opportunities for health promotion and substance use prevention programs targeting at-risk youth, including future GED holders.^{36, 37}

Conclusions

GED holders had greater odds of being a current cigarette smoker, regardless of other characteristics that usually explain smoking. Earlier smoking initiation among GED holders, in combination with lower odds of quitting, contributed to their higher current smoking rate. Each of the economic and sociocultural factors studied were associated with smoking rates and with successful quitting in the expected direction, but including them in the models did not eliminate the higher odds of smoking nor the lower odds of quitting of GED holders compared with high school graduates.

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Highlights

- In 2014 smoking prevalence among adults with a GED (43.0%) was more than 2.5 times the national average (16.8%).
- Over the 9-year study period, the unadjusted odds of being a current smoker, comparing GED holders and high school graduates, yielded an odds ratio of 2.55. Controlling for 23 potential confounders from 6 domains resulted in an adjusted odds ratio of 1.73.
- GED holders and high school graduates are distinct in both smoking behavior and demographic characteristics and combining them, as is often done, masks important differences.
- Earlier smoking initiation among GED holders, in combination with lower odds of quitting, contributed to their higher current smoking rate.

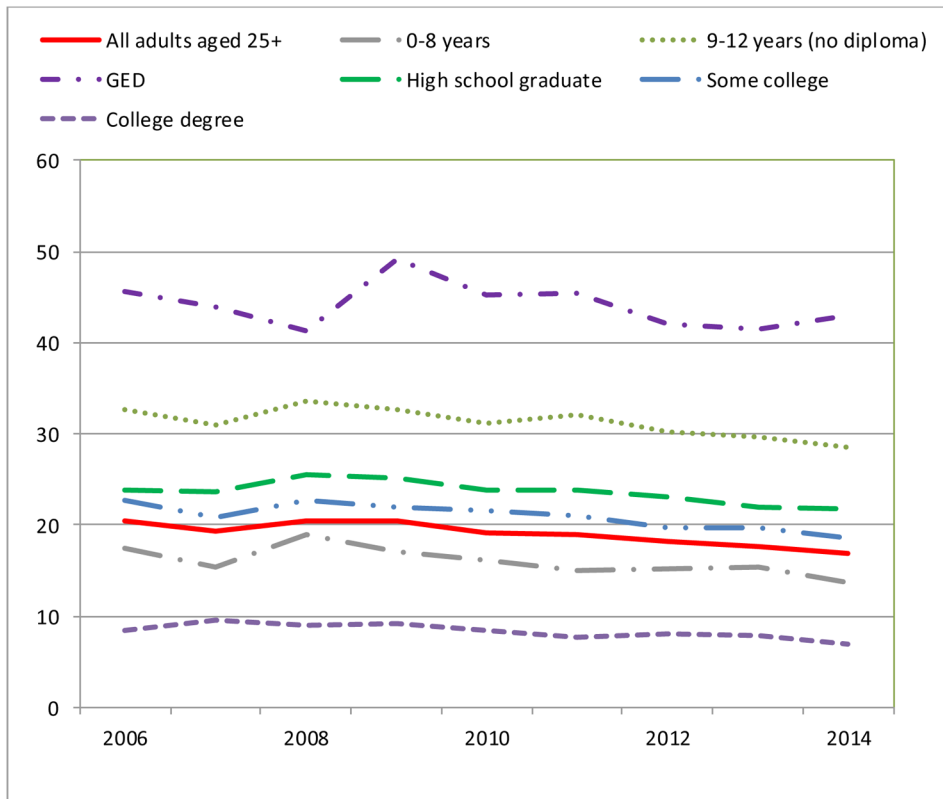


Figure 1. Trends in current cigarette smoking by education among adults aged 25 and over: National Health Interview Survey, 2006–2014

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Table 1

Number of respondents, population estimates, percent distribution (95% CI) of adults aged 25 and over by education, and percent distribution (95% CI) of smoking status by education: 2006–2014, annualized estimates.

Education level	No. of NHIS respondents	Population estimates (1,000s)	Column percent	Lifetime Cigarette Smoking Status:			Started smoking <age 15
				Current	Former	Never	
All adults aged 25+	235,031	198,845	100.0	19.0 (18.7, 19.4)	24.1 (23.8, 24.4)	56.9 (56.5, 57.3)	18.2 (17.8, 18.5)
0–8 years	16,348	11,205	5.6 (5.4, 5.8)	16.1 (15.3, 16.9)	22.2 (21.3, 23.2)	61.7 (60.5, 62.8)	32.5 (30.9, 34.1)
9–12 years (no diploma)	23,017	17,355	8.7 (8.5, 8.9)	31.3 (30.5, 32.1)	23.6 (22.9, 24.4)	45.1 (44.1, 46.0)	25.8 (24.7, 26.8)
GED	6,882	5,636	2.8 (2.7, 2.9)	44.1 (42.5, 45.8)	25.2 (24.0, 26.5)	30.6 (29.1, 32.2)	32.2 (30.5, 34.0)
High school diploma	54,784	47,415	23.9 (23.5, 24.2)	23.6 (23.1, 24.1)	24.9 (24.4, 25.3)	51.5 (50.9, 52.1)	17.5 (16.9, 18.1)
Some college	66,274	56,066	28.2 (27.9, 28.5)	20.9 (20.5, 21.4)	26.0 (25.6, 26.5)	53.0 (52.5, 53.6)	16.4 (16.0, 17.0)
College degree or higher	66,306	59,869	30.1 (29.5, 30.7)	8.3 (8.0, 8.6)	22.2 (21.8, 22.7)	69.4 (68.9, 70.0)	10.6 (10.0, 11.1)
No information	1,420	1,299	0.7 (0.6, 0.7)	16.3 (13.8, 19.2)	15.5 (13.3, 18.0)	68.2 (64.7, 71.5)	26.5 (21.3, 32.5)

Source: National Health Interview Survey, 2006–2014

Table 2

Characteristics of U.S. adults aged 25 and older by educational attainment

Characteristic	All adults aged 25+	0–8 years	9–12 years (no diploma)	GED	High school diploma	Some college	College degree or higher
Demographic							
1. Age (mean)	50.1 (49.9,50.2)	56.0 (55.4,56.5)	51.6 (51.2,51.9)	47.4 (46.9,47.9)	52.3 (52.0,52.5)	48.7 (48.4,48.9)	48.0 (47.8,48.3)
	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Age							
25–44	40.7 (40.2,41.1)	31.6 (30.4,33.0)	38.9 (37.9,39.9)	46.6 (44.9,48.2)	34.7 (34.1,35.4)	42.9 (42.2,43.5)	45.0 (44.3,45.8)
45–64	39.6 (39.3,40.0)	32.9 (31.9,33.9)	35.2 (34.3,36.1)	38.5 (36.9,40.1)	41.0 (40.4,41.6)	40.9 (40.4,41.5)	40.0 (39.4,40.6)
65+	19.7 (19.4,20.1)	35.5 (34.2,36.8)	25.9 (25.1,26.8)	15.0 (14.0,16.0)	24.2 (23.7,24.8)	16.2 (15.8,16.7)	15.0 (14.5,15.4)
2. Sex							
Male	47.9 (47.7,48.2)	50.7 (49.7, 51.7)	48.2 (47.4, 49.1)	52.1 (50.6, 53.7)	47.9 (47.3, 48.5)	45.3 (44.8, 45.8)	49.5 (49.0, 49.9)
Female	52.1 (51.8,52.3)	49.3 (48.3,50.3)	51.8 (50.9,52.6)	47.9 (46.3,49.4)	52.1 (51.5,52.7)	54.7 (54.2,55.2)	50.5 (50.1,51.0)
4. Race/Ethnicity							
Hispanic	13.4 (13.0,13.9)	53.3 (51.5,55.0)	24.5 (23.4,25.5)	15.5 (14.3,16.8)	12.1 (11.6,12.6)	10.4 (10.0, 10.7)	6.1 (5.9,6.4)
NH White	69.4 (68.8,70.0)	33.1 (31.6,34.7)	54.9 (53.7, 56.1)	68.4 (66.6, 70.1)	71.1 (70.3,71.9)	72.6 (71.9, 73.2)	76.6 (76.0,77.3)
NH African-American	11.4 (11.0,11.8)	8.1 (7.3,8.8)	17.0 (16.1, 17.9)	12.9 (11.8, 14.2)	12.6 (12.1,13.2)	12.8 (12.3,13.3)	7.9 (7.5,8.3)
NH Asian	5.0 (4.8,5.2)	4.8 (4.2,5.5)	2.6 (2.3,3.0)	1.5 (1.1,2.0)	3.2 (3.0,3.5)	3.3 (3.1, 3.6)	8.9 (8.5,9.4)
Other NH	0.8 (0.7,1.0)	0.8 (0.5,1.2)	1.0 (0.8, 1.1)	1.7 (1.3, 2.3)	0.9 (0.7,1.1)	1.0 (0.8,1.1)	0.4 (0.4,0.5)
5. Marital Status							
Married	60.5 (60.0,61.0)	55.7 (54.6,56.7)	50.7 (49.8,51.7)	50.9 (49.3,52.5)	59.4 (58.8,60.1)	58.6 (57.9,59.3)	67.9 (67.1,68.6)
Widowed	6.9 (6.7, 7.1)	16.1 (15.3,16.9)	11.3 (10.8,11.8)	6.5 (5.9,7.1)	8.8 (8.5,9.1)	5.7 (5.5,6.0)	3.4 (3.2,3.5)
Divorced/separated/single	26.1 (25.7,26.4)	22.6 (21.8,23.4)	28.8 (28.2,29.3)	32.2 (30.8,33.5)	24.8 (24.3,25.4)	28.8 (28.2,29.3)	23.5 (22.9,24.1)
Living with partner	6.4 (6.2,6.6)	5.5 (5.0,6.0)	6.7 (6.5,7.0)	10.4 (9.5,11.4)	6.7 (6.4,7.0)	6.7 (6.5,7.0)	5.1 (4.8,5.3)
Environmental factors:							
6. U.S. Region (Northeast)							
Midwest	17.8 (17.2,18.4)	14.6 (13.3,16.0)	15.6 (14.9,16.3)	13.7 (12.4, 15.2)	19.7 (18.9,20.6)	15.0 (14.4,15.6)	20.4 (18.5,21.4)
South	23.2 (22.5,23.9)	25.8 (24.9,26.7)	20.5 (19.4,21.7)	24.5 (22.7,26.5)	25.8 (24.9, 26.7)	24.8 (23.8,25.7)	22.0 (20.9,23.2)
West	36.5 (35.7,37.3)	36.3 (35.2,37.4)	42.4 (41.0,43.7)	43.9 (41.7,46.0)	36.3 (35.2,37.4)	35.8 (34.9,36.8)	33.9 (32.7,35.2)
7. Occupation Group (ages 25–64)							
Occupations with <25% smokers	68.2 (67.8,68.7)	34.2 (32.7,35.8)	38.1 (27.1,39.0)	47.3 (45.7,48.9)	53.6 (52.9,54.3)	71.4 (70.9,71.9)	90.7 (90.4,91.1)

Characteristic	All adults aged 25+	0–8 years	9–12 years (no diploma)	GED	High school diploma	Some college	College degree or higher
Occupations with 25% smokers	26.0 (25.6,26.4)	48.0 (46.5,49.5)	50.9 (50.0,51.9)	47.5 (45.9,49.2)	39.9 (36.3,40.6)	25.1 (24.7,25.6)	5.5 (5.2,5.7)
Unknown	5.8 (5.6,5.9)	17.8 (16.8,18.8)	11.0 (11.4,11.7)	5.2 (4.5,6.0)	6.4 (6.1,6.8)	3.5 (3.3,3.7)	3.8 (3.6,4.0)
8. Industry Group (ages 25–64)							
Industries with <25% smokers	71.3 (70.9,71.7)	47.7 (46.1,49.3)	49.4 (48.3,50.5)	57.9 (56.3,59.5)	61.4 (60.7,62.0)	73.2 (72.7,73.7)	87.2 (86.8,87.6)
Industries with 25% smokers	23.0 (22.7,23.4)	34.7 (33.3,36.2)	39.6 (38.5,40.7)	37.0 (35.4,38.6)	32.2 (31.5,32.8)	23.4 (22.9,23.9)	9.1 (8.7,9.4)
Unknown	5.7 (5.5,5.9)	17.6 (16.6,18.6)	11.0 (10.4,11.7)	5.3 (4.6,6.0)	6.5 (6.1,6.8)	3.4 (3.2,3.6)	3.7 (3.5,4.0)
9. Living Quarters							
Permanent home	94.7 (94.2,95.1)	89.6 (88.4, 90.7)	88.6 (87.6,89.4)	87.1 (85.6,88.5)	92.9 (92.2,93.5)	95.5 (95.0,95.9)	98.8 (98.6,98.9)
Transient or mobile home	5.3 (4.9,5.8)	10.4 (9.3,11.6)	11.4 (10.5,12.4)	12.9 (11.5,14.4)	7.1 (6.5,7.8)	4.5 (4.1,5.0)	1.2 (1.0,1.3)
10. Military service							
No service	88.9 (87.6,91.8)	95.0 (94.6,95.5)	92.7 (92.3,93.2)	86.2 (85.0,87.3)	88.5 (88.1,88.8)	86.2 (85.9,86.6)	89.8 (89.5,90.1)
Served	11.0 (10.8,11.2)	4.9 (4.5,5.4)	7.2 (6.8,7.7)	13.7 (12.6,14.9)	11.5 (11.1,11.8)	13.7 (13.4,14.1)	10.1 (9.8,10.5)
Socio-cultural factors:							
11. Acculturation							
U.S. born/English interview	81.9 (81.5,82.4)	40.6 (39.0,42.2)	76.4 (75.5,77.3)	89.2 (88.2,90.1)	85.4 (84.9,85.9)	88.1 (87.8,88.5)	82.5 (82.0,83.1)
Foreign born/English interview	12.1 (11.8,12.4)	17.9 (16.9,18.8)	10.5 (10.0,11.1)	6.0 (5.3,6.7)	9.9 (9.5,10.4)	9.6 (9.3,10.0)	15.9 (15.4,16.4)
U.S. born/Foreign language interview	0.4 (0.4,0.5)	1.2 (1.0,1.4)	0.8 (0.7,1.0)	0.8 (0.5,1.1)	0.5 (0.4,0.6)	0.3 (0.3,0.4)	0.2 (0.2,0.3)
Foreign born/non-English interview	5.5 (5.2,5.8)	40.3 (38.6,42.0)	12.2 (11.5,12.9)	4.0 (3.5,4.6)	4.2 (4.0,4.5)	1.9 (1.7,2.0)	1.3 (1.2,1.5)
12. Highest educational achievement in family							
Grade school or less	2.6 (2.5,2.8)	46.4 (45.2,47.5)	0.0	0.0	0.0	0.0	0.0
Some high school	5.8 (5.6,5.9)	14.5 (13.8,15.1)	56.1 (55.1,57.0)	0.0	0.0	0.0	0.0
GED	2.0 (1.9,2.0)	2.9 (2.6,3.4)	3.8 (3.5,4.2)	51.2 (49.6,52.8)	0.0	0.0	0.0
High school diploma	19.3 (18.9,19.6)	17.4 (16.7,18.3)	19.9 (19.2,20.7)	22.3 (21.0,23.7)	66.3 (65.6,66.9)	0.0	0.0
Some college	26.6 (26.2,26.9)	12.4 (11.6,13.2)	14.5 (13.8,15.2)	18.5 (17.2,19.9)	19.7 (19.2,20.2)	68.3 (67.8,68.9)	0.0
College graduate or more	43.5 (42.9,44.2)	6.4 (5.9,7.0)	5.7 (5.2,6.2)	7.9 (7.0,8.9)	14.0 (13.6,20.2)	31.7 (31.1,32.2)	100.0
Economic status indicators:							
13. Family income							
<100% FPL	10.0 (9.8,20.3)	29.9 (28.8,30.9)	24.6 (23.7,25.4)	19.7 (18.6, 20.9)	10.4 (10.0,10.7)	7.9 (7.6,8.2)	2.9 (2.7,3.1)
100%<200% FPL	15.0 (14.7, 5.3)	30.5 (29.6,31.4)	27.2 (26.4,28.0)	26.0 (24.7,27.2)	18.1 (17.7,18.6)	14.4 (14.0,14.8)	5.6 (5.4,5.9)
200%<400% FPL	26.2 (25.9,26.5)	18.9 (18.0,19.8)	24.0 (23.2, 24.8)	29.3 (27.9,30.8)	31.3 (30.7,31.9)	30.8 (30.3,31.2)	19.9 (19.4,20.4)
400%+ FPL	35.8 (35.2,36.5)	5.8 (5.3,6.3)	10.0 (9.5, 10.6)	13.5 (12.5,14.7)	24.7 (24.1,25.4)	34.9 (34.3,35.6)	61.3 (60.6,62.0)

Characteristic	All adults aged 25+	0–8 years	9–12 years (no diploma)	GED	High school diploma	Some college	College degree or higher
Unknown	12.9 (12.6,13.2)	14.2 (13.6,14.9)	14.2 (13.6,14.9)	11.5 (10.5,12.5)	15.5 (15.0,16.0)	12.0 (11.6,12.4)	10.3 (9.9,10.7)
14. Income assistance							
No income assistance	85.2 (84.9,85.5)	69.9 (68.9,71.0)	68.9 (67.9,69.8)	68.7 (67.1,70.2)	84.1 (83.7,84.6)	85.4 (84.9,85.8)	95.2 (95.0,95.4)
Receives income assistance	14.8 (14.5,15.1)	30.1 (29.0,31.1)	31.1 (30.2,32.1)	31.3 (29.8,32.9)	15.9 (15.4,16.3)	14.6 (14.2,15.1)	4.8 (4.6,5.0)
15. Food stamps							
No food stamps	90.8 (90.5,91.0)	79.9 (79.1,80.8)	77.4 (76.6,78.2)	77.4 (76.1,78.6)	90.3 (89.9,90.7)	91.3 (91.0,91.6)	98.0 (97.8,98.1)
Receives food stamps	9.1 (8.8,9.3)	19.9 (19.1,20.7)	22.5 (21.7,23.3)	22.5 (21.2,23.8)	9.5 (9.1,9.8)	8.6 (8.3,8.9)	1.9 (1.8,2.1)
16. Work status (ages 25–64)							
Working	73.5 (73.1,73.9)	57.1 (55.7,58.4)	56.0 (54.8,57.1)	60.4 (58.6,62.2)	70.5 (69.8,71.2)	74.2 (73.7,74.7)	83.1 (82.6,83.6)
Looking for work	5.1 (5.0,5.3)	6.0 (5.3,6.7)	8.0 (7.5,8.6)	9.4 (8.5,10.4)	5.6 (5.3,5.9)	5.6 (5.3,5.8)	3.1 (3.0,3.3)
Not working	21.3 (21.0,21.7)	36.9 (35.6,38.3)	36.0 (34.9,37.1)	30.2 (28.6,31.9)	23.8 (23.2,24.4)	20.2 (19.7,20.7)	13.7 (13.3,14.2)
17. Family work							
No family member looking for work	91.7 (91.5,91.8)	90.1 (89.4,90.7)	88.0 (87.4,88.5)	86.0 (84.8,87.1)	91.0 (90.7,91.4)	91.2 (90.9,91.5)	94.5 (94.2,94.7)
One or more family members looking for work	8.3 (8.2,8.5)	9.9 (9.3,10.6)	12.0 (11.5,12.6)	14.0 (12.9,15.2)	9.0 (8.6,9.3)	8.8 (8.5,9.1)	5.5 (5.3,5.8)
Access to health care indicators:							
18. Health insurance							
Insured all past 12 months	74.1 (73.7,74.6)	44.7 (43.6,45.9)	51.9 (51.0,52.9)	53.2 (51.6,54.8)	71.8 (71.2,72.4)	75.7 (75.2,76.2)	88.9 (88.6,89.3)
Insured < 12 months last year	2.9 (2.8,3.0)	1.6 (1.4,1.9)	2.4 (2.2,2.7)	3.8 (3.3,4.5)	2.5 (2.3,2.7)	3.7 (3.5,3.9)	2.9 (2.7,3.1)
On Medicaid	7.5 (7.2,7.7)	20.9 (19.9,21.9)	18.0 (17.2,18.8)	15.8 (14.7,17.1)	8.0 (7.7,8.4)	6.0 (5.8,6.3)	1.8 (1.6,1.9)
No insurance	15.2 (14.9,15.5)	32.5 (31.2,33.8)	27.3 (26.5,28.2)	26.8 (25.4,28.2)	17.3 (16.9,17.8)	14.4 (14.0,14.8)	6.2 (6.0,6.5)
19. Place of usual care							
Doctor's office	65.5 (65.0,66.0)	45.7 (44.4,47.1)	52.6 (51.6,53.6)	52.6 (50.9,54.3)	65.0 (64.2,65.7)	66.4 (65.7,67.1)	74.0 (73.3,74.7)
Preferred clinic	16.8 (16.3,17.2)	26.2 (25.1,27.5)	21.2 (20.4,22.1)	21.0 (19.7,22.5)	16.4 (15.8,17.0)	17.1 (16.5,17.6)	13.3 (12.7,13.9)
Hospital	2.0 (2.0,2.1)	3.2 (2.9,3.7)	4.0 (3.7,4.3)	4.2 (3.6,4.8)	2.1 (2.0,2.3)	2.0 (1.9,2.1)	1.0 (0.9,1.1)
No definite place	15.2 (14.9,15.5)	24.4 (23.3,25.5)	21.7 (20.9,22.5)	21.8 (20.3,23.3)	16.0 (15.5,16.5)	14.2 (13.8,14.6)	11.2 (10.9,11.6)
20. Transportation to medical care							
Has transportation	97.7 (97.6,97.8)	95.2 (94.8,95.6)	95.2 (94.8,95.5)	95.4 (94.7,95.9)	97.6 (97.5,97.8)	97.9 (97.8,98.1)	98.9 (98.9,99.0)
No transportation	1.8 (1.7,1.8)	4.2 (3.8,4.6)	4.2 (3.9,4.6)	4.1 (3.6,4.7)	1.7 (1.6,1.9)	1.6 (1.5,1.7)	0.6 (0.5,0.6)
21. Medication affordability							
Can afford medication	90.6 (90.4,90.8)	86.9 (86.3,87.6)	85.2 (84.6,85.8)	81.2 (79.9,82.5)	90.4 (90.1,90.8)	89.1 (88.8,89.5)	95.4 (95.2,95.6)

Characteristic	All adults aged 25+	0–8 years	9–12 years (no diploma)	GED	High school diploma	Some college	College degree or higher
Cannot afford	8.8 (8.6,9.0)	12.5 (11.9,13.1)	14.3 (13.7,14.8)	18.2 (17.0,19.5)	8.9 (8.6,9.3)	10.4 (10.1,10.7)	4.1 (3.9,4.3)
Mental health indicators:							
22. Emotional health							
No limitation due to emotional problem	97.0 (96.8,97.1)	96.3 (95.9,96.7)	95.3 (95.0,95.7)	93.1 (92.3,93.9)	96.9 (96.7,97.1)	96.6 (96.4,96.8)	98.3 (98.2,98.4)
Limited due to emotional problem	2.6 (2.5,2.7)	3.1 (2.8,3.5)	4.1 (3.8,4.5)	6.6 (5.8,7.4)	2.5 (2.4,2.7)	3.0 (2.8,3.2)	1.3 (1.2,1.4)
23. Mental disorder							
No limitation due to ADD, schizophrenia or bipolar	99.4 (99.4,99.5)	99.3 (99.0,99.4)	99.2 (99.0,99.4)	99.3 (99.0,99.4)	99.3 (99.0,99.5)	99.5 (99.4,99.6)	99.5 (99.4,99.5)
Limited due to ADD, schizophrenia, or bipolar	0.1 (0.1,0.1)	0.2 (0.2,0.3)	0.2 (0.2,0.3)	0.4 (0.2,0.5)	0.1 (0.1,0.2)	0.1 (0.1,0.1)	0.1 (0.1,0.1)
Unknown	0.5 (0.4,0.5)	0.6 (0.4,0.8)	0.6 (0.4,0.7)	0.3 (0.2,0.5)	0.5 (0.5,0.6)	0.4 (0.3,0.5)	0.4 (0.4,0.5)

Number of observations = 235,031; Population size estimate = 198,845,096;

Source: National Health Interview Survey, 2006–2014.

Table 3

Adjusted odds ratios predicting current cigarette smoking among U.S. adults aged 25 and older using 23 covariates in six domains (reference categories shown in parentheses)

	AOR	95% CI	p-value
Demographic characteristics:			
1. Educational achievement (HS diploma)	ref		
0–8 years	1.11	1.00 – 1.22	<0.047
9–12 years (no diploma)	1.46	1.36 – 1.56	<0.001
GED	1.73	1.56 – 1.93	<0.001
Some college	0.85	0.80 – 0.90	<0.001
College degree or higher	0.46	0.43 – 0.49	<0.001
2. Age	1.11	1.10 – 1.11	<0.001
Age (squared)	0.999	0.999–0.999	<0.001
3. Sex (male)	ref		
Female	0.83	0.80 – 0.86	<0.001
4. Race/ethnicity (NH white)	ref		
Hispanic	0.48	0.45 – 0.52	<0.001
NH African-American	0.60	0.58 – 0.63	<0.001
NH Asian	0.83	0.76 – 0.90	<0.001
Other NH	1.04	0.86 – 1.27	0.666
5. Marital Status (married)	ref		
Widowed	1.54	1.45 – 1.63	<0.001
Divorced/separated/single	1.57	1.51 – 1.62	<0.001
Living with partner	2.13	2.01 – 2.26	<0.001
Environmental factors:			
6. U.S. region (Northeast)	ref		
Midwest	1.04	0.99 – 1.09	0.140
South	1.00	0.95 – 1.05	0.944
West	0.82	0.78 – 0.88	<0.001
7. Occupation group (occupations with <25% smokers)	ref		
Occupations with ≥25% smokers	1.21	1.17 – 1.25	<0.001
8. Industry group (industries with <25% smokers)	ref		
Industries with ≥25% smokers	1.29	1.24 – 1.34	<0.001
9. Living quarters (permanent home)	ref		
Transient or mobile home	1.34	1.26 – 1.42	<0.001
10. Military service (none)	ref		
Served	1.32	1.25 – 1.39	<0.001
Socio-cultural factors:			
11. Acculturation (U.S. born/English interview)	ref		
Foreign born/English interview	0.64	0.60 – 0.69	<0.001
U.S. born/foreign language interview	0.63	0.50 – 0.81	<0.001
Foreign born/foreign language interview	0.43	0.39 – 0.47	<0.001

	AOR	95% CI	p-value
12. Highest educational achievement in family (HS graduate)	ref		
0–8 years	0.84	0.74 – 0.96	<0.012
9–12 years (no diploma)	0.90	0.84 – 0.98	<0.012
GED	1.09	0.97 – 1.23	0.148
Some college	1.00	0.95 – 1.07	0.787
College degree or higher	0.76	0.71 – 0.81	<0.001
Economic status indicators:			
13. Family income (<100% federal poverty level (FPL))	ref		
100%<200% FPL	0.99	0.94 – 1.04	0.694
200%<400% FPL	0.98	0.93 – 1.03	0.430
400%+ FPL	0.83	0.78 – 0.88	<0.001
14. Income assistance (no income assistance)	ref		
Receives income assistance	1.07	1.00 – 1.14	<0.046
15. Food stamps (no food stamps)	ref		
Receives food stamps	1.27	1.18 – 1.36	<0.001
16. Work status (works)	ref		
Looking for work	1.07	0.97 – 1.18	0.153
Not working	1.09	1.05 – 1.14	<0.001
17. Family work (no family member looking for work)	ref		
One or more family members looking for work	1.25	1.16 – 1.35	<0.001
Access to health care indicators:			
18. Health insurance (private insurance or Medicare)	ref		
Insured < 12 months last year	1.26	1.15 – 1.37	<0.001
On Medicaid	1.29	1.23 – 1.37	<0.001
No insurance	1.29	1.23 – 1.35	<0.001
19. Place of usual care (primary care provider or clinic)	ref		
Hospital	1.51	1.40 – 1.64	<0.001
No definite place	1.40	1.33 – 1.46	<0.001
20. Transportation (has transportation)	ref		
Has no transportation	1.38	1.27 – 1.50	<0.001
21. Medication affordability (yes)	ref		
Not affordable	1.40	1.34 – 1.46	<0.001
Mental health indicators:			
22. Emotional health (no depression or anxiety reported)	ref		
Has depression or anxiety.	1.54	1.42 – 1.67	<0.001
23. Mental disorder (no mental disorder reported)	ref		
Has ADD, schizophrenia, bipolar	1.84	1.31 – 2.60	<0.001

Number of observations = 235,031; Population size estimate = 198,845,096;

Design df = 300; F(63, 238) = 248.47; p > F < 0.0001

Source: National Health Interview Survey, 2006–2014

Table 4

Domain-specific adjusted odds ratios (AOR) (95% CI) for prevalence of current smoking among US adults aged 25 and older, by level of education

Model 1: Demographic^b	AOR (95% CI)
High school diploma (ref.)	1.00
0–8 years	1.08 (1.00,1.15) *
9–12 years (no diploma)	1.68 (1.60,1.76) ****
GED	2.29 (2.13, 2.46) ****
Some college	0.75 (0.76, 0.78) ****
College degree or higher	0.25 (0.24, 0.26) ****
Model 2: Environmental^c	
High school diploma (ref.)	1.00
0–8 years	0.61 (0.58,0.65) ****
9–12 years (no diploma)	1.38 (1.32,1.45) ****
GED	2.38 (2.21, 2.24) ****
Some college	0.94 (0.91,0.98) **
College degree or higher	0.37 (0.36, 0.39) ****
Model 3: Sociocultural^d	
High school diploma (ref.)	1.00
0–8 years	0.94 (0.86, 1.04)
9–12 years (no diploma)	1.62 (1.52, 1.73) ****
GED	2.26 (2.04, 2.50) ****
Some college	0.92 (0.87, 0.97) **
College degree or higher	0.44 (0.41, 0.47) ****
Model 4: Economic^e	
High school diploma (ref.)	1.00
0–8 years	0.55 (0.51,0.58) ****
9–12 years (no diploma)	1.29 (1.23,1.35) ****
GED	2.18 (2.04,2.34) ****
Some college	0.85 (0.81, 0.88) ****
College degree or higher	0.33 (0.31, 0.34) ****
Model 5: Health care access^f	
High school diploma (ref.)	1.00
0–8 years	0.48 (0.45,0.51) ****
9–12 years (no diploma)	1.23 (1.18, 1.29) ****
GED	2.17 (2.02, 2.32) ****
Some college	0.87 (0.84, 0.91) ****

Model 1: Demographic ^b	AOR (95% CI)
College degree or higher	0.34 (0.33, 0.36) ***
Model 6: Mental health ^g	
High school diploma (ref.)	1.00
0–8 years	0.61 (0.58, 0.65) ***
9–12 years (no diploma)	1.45 (1.39, 1.52) ***
GED	2.47 (2.31, 2.64) ***
Some college	0.85 (0.82, 0.88) ***
College degree or higher	0.30 (0.28, 0.31) ***
Model 7: All characteristics ^h	
High school diploma (ref.)	1.00
0–8 years	1.11 (1.00, 1.22) *
9–12 years (no diploma)	1.46 (1.36, 1.56) ***
GED	1.73 (1.56, 1.93) ***
Some college	0.85 (0.80, 0.90) ***
College degree or higher	0.46 (0.43, 0.49) ***

^aCurrent smokers smoked 100 cigarettes in lifetime and smoked every day or some days at time of interview.

^bDemographic covariates: education, sex, age, age-squared, race, Hispanic ethnicity, and marital status. All subsequent models include education, sex, age, age-squared, and race-ethnicity in addition to the other analytic variables.

^cEnvironmental covariates: region, current occupation's smoking rate > 25%, works in industry with smoking rates > 25%, living in transient/mobile home, military veteran status.

^dSociocultural covariates: acculturation, highest education in family.

^eEconomic: Federal poverty status, income assistance, food stamps, disability income, work status (self) work status (family).

^fHealth care access covariates: health insurance coverage, transportation to health care, usual source of health care, changed health insurance, couldn't afford care

^gMental health covariates: Limitation of activity due to depression, anxiety/emotional problems; limitation of activity due to ADD, bipolar, or schizophrenia.

^hIncludes all variables from models 1–6

Data source: National Health Interview Survey, 2006–2013

* p<0.05;

** p<0.01;

*** p<0.001

Table 5

Adjusted odds ratios predicting successful smoking cessation among adult ever smokers aged 25 and over by educational attainment and age started smoking (reference categories shown in parentheses)

	AOR	95% CI	p-value
Educational attainment (HS diploma)	ref		
0–8 years	0.97	0.84 – 1.11	0.638
9–12 years (no diploma)	0.82	0.76 – 0.90	<0.001
GED	0.83	0.73 – 0.94	<0.005
Some college	1.23	1.15 – 1.32	<0.001
College degree or higher	1.77	1.63 – 1.92	<0.001
Age started smoking (reference category: < 13 years old)	ref		
13–14	1.03	0.94 – 1.13	0.479
15–16	1.09	1.01 – 1.19	<0.032
17–18	1.11	1.03 – 1.21	<0.011
19–20	1.01	0.93 – 1.10	0.789
21–25	0.77	0.70 – 0.84	<0.001
26+	0.56	0.50 – 0.63	<0.001

Number of observations = 98,518; Population size estimate = 84,540,242;

Design df = 300; F(70, 231) = 152.58; p < 0.0001

Note: Model controls for the 23 covariates listed in Table 2

Source: National Health Interview Survey, 2006–2014.