



Smoking cessation patterns by socioeconomic status in Alaska

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ABSTRACT

The ongoing disparity in smoking prevalence across levels of socioeconomic status (SES) is a significant concern in the tobacco control field, and surveillance of cessation-related activity is key to understanding progress. Historically, lower SES smokers have had much lower quit ratios but this measure can be insensitive to recent quit-related behavior. It is therefore important to examine recent quit-related behavior to assess progress toward addressing this disparity, especially in states with tobacco control programs that focus on this priority population.

We compared recent quit attempts and successes among non-Native lower SES Alaska smokers to those of higher SES using data from the 2012–2013 Alaska Behavioral Risk Factor Surveillance System (BRFSS). We assessed quit ratios, one-year and five-year quit rates, and six-month abstinence between the two groups.

Cessation-related measures restricted to those who smoked in the previous one year did not significantly vary by SES. However, five year quit rates were significantly lower for persons of lower SES vs. higher SES (14% vs. 32% respectively, $p < .001$). Results were consistent after adjustment for age, sex, and other factors.

Results showed that in the previous year, smokers of lower SES in Alaska were trying to quit and succeeding at similar rates as their higher SES counterparts. However, the equivalent pattern of quit success was not reflected in the five-year time frame. Tobacco control programs should monitor cessation trends using both recent and longer-term time frames for this population. More research is needed on reasons for fewer long-term quits among lower SES smokers.

1. Introduction

The disparity in tobacco use between people of lower and higher socioeconomic status (SES) has been well-documented nationally (Centers for Disease Control and Prevention, 2011a). Smoking prevalence is approximately 50% higher among the low SES population (Centers for Disease Control and Prevention, 2011a), initiation rates are higher (Hanson and Chen, 2007), and quit ratios (the proportion of former smokers among ever smokers) are much lower (Flint and Novotny, 1997). The picture is similar in Alaska, and so the Alaska State Department of Health and Social Services Tobacco Prevention and Control Program has included persons of lower SES as a priority population. However, though smoking prevalence has decreased among Alaska adults of higher SES since the program start (23% to 13% from 1996 to 2012, $p > .001$) prevalence has remained high among those of lower SES (39% to 34% during the same years) (Alaska Department of Health and Social Services, Division of Public Health, 2014). Similarly, quit ratios increased from 1996 to 2012 among the higher SES group

(57% to 69%, $p < .01$) but have not changed significantly in the lower SES group (33% to 39%).

Successful surveillance of the population prevalence of adult smoking relies on the ability to precisely measure the extent to which smokers are quitting. To measure such progress, standard practice among state tobacco prevention programs (Centers for Disease Control and Prevention, 2012) has been to assess the quit ratio and the number of quit attempts in the prior year among current smokers. These indicators, however, may be insufficient. For example, the quit ratio includes the large quantity of former smokers who have quit many years before, and thus is insensitive to recent changes. Also, defining quit attempts in the past year as those attempts that resulted in failure alone can be misleading because past year attempts that resulted in success are obscured as they are included in the overall category of former smokers.

It is therefore valuable to also include measures that address recent cessation-related behavior in a basic set of surveillance indicators, especially when evaluating population-based tobacco control programs

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(U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute, 2000). In addition, it is worthwhile for programs to assess both components of smoking cessation – recent quit attempts, both successful and unsuccessful – in order to understand the need for motivating smokers to attempt to quit or for helping smokers sustain quits. Although there are surveillance reports that document past year quit attempts by socioeconomic status (Centers for Disease Control and Prevention, 2011b), no U.S. study, to our knowledge, has examined these cessation measures within the environment of a state comprehensive tobacco program in order to assess progress in reducing disparities by SES. The objective of our study was to describe patterns in recent quit rates by SES in the context of such a program.

2. Methods

We used population-based statewide surveillance data from the Alaska Behavioral Risk Factor Surveillance System (BRFSS). The Alaska BRFSS is a random-digit-dialed, cross-sectional household survey stratified on geographic region (*Alaska's Behavioral Risk Factor Surveillance System, 2012*). Eligible participants are aged 18 years or over, and living in households with a landline or cell telephone. We used data from BRFSS for 2012–2013; the total number of participants during this time was 8602. Response rates for BRFSS were calculated using standards set by the American Association of Public Opinion Research (AAPOR) Response Rate Formula #4 (*The American Association for Public Opinion Research, 2016*). Annual response rates for the data used in this study ranged from 60%–64%.

The inclusion criteria for the study were as follows: current or former smoker, age 25–64, not of Alaska Native race, and non-missing information on education, income and current or former smoking. These criteria yielded 2265 adults (838 current and 1427 former smokers). The criteria related to age, race, education and income derive from the definition we used for socioeconomic status. We included only adults aged 25 to 64 because a measure of SES based on income and education might not be appropriate for younger adults who may still be completing their education and for older adults who are more likely to be retired. In addition, only non-Native Alaska adults were included because there are well-documented cultural and geographic differences between Alaska Native and non-Native people that should be considered when designing programmatic interventions and analyses (*Alaska Department of Health and Social Services, Division of Public Health, 2007*). Furthermore, a comprehensive report on the burden of tobacco among Alaska Native people was published by the Alaska Department of Health and Social Services (*Alaska Department of Health and Social Services, Division of Public Health, 2007*) and included analyses of the association between SES and tobacco use.

2.1. Measures

Below, we briefly describe the measures used. The specific wording of all questions can be found at the website for the Alaska BRFSS (*Alaska's Behavioral Risk Factor Surveillance System, 2012*). BRFSS information about income, household size, and education was used to develop a marker of SES.

Low SES respondents had either a household income at or below 185% of the Alaska-adjusted poverty guidelines (the Medicaid eligibility guideline in Alaska), or an educational attainment that was less than a high school diploma or GED (General Education Diploma). Higher SES adults had a household income above the 185% poverty guideline and had achieved at least a high school diploma or GED.

We used BRFSS questions to create other demographic measures for gender, age, employment status, any children in the home, marital status, and race/ethnicity. Urbanicity and geographic region were determined based on the zip code or borough of residence.

We created several smoking and quit-related measures. Respondents

were asked whether they had smoked 100 cigarettes in their lives. If they responded “no,” they were categorized as never smokers. If they responded “yes,” they were asked if they currently smoked every day, some days, or not at all. Those answering “every day” or “some days” were categorized as current smokers; those answering “not at all” were categorized as former smokers. Current and former smokers together were considered “ever smokers.”

We determined the period of abstinence from regular smoking by asking former smokers “About how long has it been since you last smoked regularly?” Response options were, “Five years or more, more than a year ago but less than five years, about a year, at least six months but less than a year, at least three months but less than six months, at least 30 days but less than three months, at least seven days but less than 30 days, at least 24 h but less than seven days, or within the last 24 h.” Using this information, we categorized former smokers as having quit sometime within the past year, one to five years ago, or more than five years ago.

We then created a quit measure for respondents who smoked during the past year (i.e., those who were either current smokers or who were former smokers and had quit within the past year). Specifically, we grouped them into three categories: did not have a quit attempt in the past year, had an unsuccessful quit attempt in the past year, and successfully quit. We considered a respondent to have successfully quit if they were not currently a smoker, but we did not require that they be quit for any particular length of time. We determined if current smokers had an unsuccessful quit attempt in the past year using the question, “During the past 12 months, have you stopped smoking for one day or longer because you were trying to quit smoking?”

We examined the quit ratio and the one-year and five-year quit rates by socioeconomic status. The traditional quit ratio, which represents cumulative quit success, is defined as the proportion of former smokers among ever smokers. We then restricted the quit ratio to the most recent one-year and five-year time periods – a measure that is equivalent to the cumulative incidence rate for each of the two time periods (*Rothman, 1986*). The one-year quit rate was defined as the proportion of former smokers who had been quit for any length of time among those who had smoked in the past year. Within this group we further defined a six month abstinence rate as the proportion of former smokers who had been quit at least six months among those had smoked in the past year. The five-year quit rate was defined as the proportion of former smokers among those who had smoked in the past five years.

2.2. Statistical analyses

All analyses were conducted using Stata/IC v. 13.1 and procedures that took the study design into account. We weighted the data to adjust for differential sampling rates within each telephone bank and for the number of telephones and adults in the household, and to ensure that the distribution of participants matched that for Alaska adults not living in institutional settings, based on the Alaska Department of Labor and Workforce Development, Research and Analysis population estimates (*Population Estimates, 2010*). In addition to weighting for sampling design factors, data were weighted using iterative proportional fitting, or “raking,” a procedure used for BRFSS. This method allows for adjustment by multiple demographic factors, including education level, marital status, and renter/owner status, as well as region, gender, age, and race/ethnicity.

We used chi-square tests to compare low SES and higher SES participants with respect to demographic and cessation measures. We also used binary and multinomial logistic regression modeling to assess the effect of age, gender, marital status or presence of children in the home on the observed association between each cessation measure and SES. Statistical significance was based on a p value < .05.

Table 1
Demographic characteristics of 2265 ever smokers by Socioeconomic Status (SES), Alaska Behavioral Risk Factor Surveillance System, 2012–2013.

Characteristic		Socioeconomic status ^a		p value
		Low SES (N = 652)	High SES (N = 1613)	
Smoking status	Current smoker	65%	32%	< .001
	Former smoker	35%	68%	
Gender	Male	51%	59%	.02
	Female	49%	41%	
Age	25–34	30%	25%	.31
	35–49	30%	32%	
	50–64	40%	44%	
Employment	Employed	63%	83%	< .001
	Unemployed	19%	4%	
	Not in workforce	18%	13%	
Children in household	None	44%	58%	< .001
	One or more	56%	42%	
Marital status	Married	46%	65%	< .001
	Unmarried	25%	19%	
	Divorced or separated	29%	16%	
Urbanicity	Metro	73%	72%	.54
	Small town	14%	16%	
	Rural	13%	12%	
Race/Ethnicity	Hispanic	7%	4%	.03
	White, non-Hispanic	79%	88%	
	Other, non-Hispanic	13%	8%	

^a Weighted percents shown.

3. Results

The final sample consisted of 652 ever-smoker participants of lower SES and 1613 of higher SES. Of the lower SES participants 369 were current smokers and of the higher SES participants 469 were current smokers. The remainder was former smokers. Some demographic

characteristics varied by SES (Table 1). The lower SES group was significantly less likely to be male (51% compared to 59%, $p = .02$) and less likely to be white non-Hispanic (79% compared to 88%, $p = .03$). Participants of lower SES were also significantly less likely to be employed (63% compared to 83%, $p < .001$) and less likely to be married (46% compared to 65%, $p < .001$), but more likely to have children in the home (56% compared to 42%, $p < .001$). There were no significant differences between the two groups with respect to age or urban/rural residence.

The traditional quit ratio (former smokers divided by ever smokers) differed significantly by SES. Among the 652 low SES ever smokers, a total of 283 were former smokers, representing a quit ratio of 35%. Among the 1613 ever smokers of high SES, there were 1144 former smokers, representing a quit ratio of 68% ($p < .001$) (percentages shown in Table 1). The traditional quit ratio does not take into account time since quit for former smokers, so we examined the distributions of time since quit. We observed that persons of lower SES were significantly more likely to have quit within the past year, while those of higher SES were more likely to have quit > 5 years before (Table 2).

We then restricted analyses to past year smokers (Table 3), and found no significant differences by SES for overall patterns of quit attempts, successful or otherwise. Among those who smoked in the last year, one-year quit rates (shown in Table 3 as successful quits among past-year smokers) were not significantly different by SES. Restricting this measure to those who had been abstinent for at least six months did not alter results (5% of 408 low SES past-year smokers had abstained for at least 6 months, compared to 3% of 526 high SES past-year smokers, $p = .25$, (data not shown)). However, five-year quit rates were significantly lower among those of low SES (14% of 437 low SES participants compared to 32% of 642 for higher SES ($p < .001$) (data not shown)).

Because of the association between SES and demographic factors, we used binary and multinomial logistic regression to examine the role of these factors in the relationships between SES and the quit ratio; the one-year and five-year quit rates; and time since quit. Even after adjustment for age, gender, children in the home, marital status, and race/ethnicity, patterns remained similar by SES (results not shown).

Table 2
Length of time since quit among 1401 former smokers^a by Socioeconomic Status (SES), Alaska Behavioral Risk Factor Surveillance System, 2012–2013.

	Socioeconomic status ^b		p value ^c
	Low SES (N = 278)	High SES (N = 1123)	
Length of time since quit			
Within the past year	19%	6%	.0007
At least one year ago but fewer than five	12%	15%	
Five or more years ago	69%	79%	

^a 26 former smokers had missing information on length of time since quit.

^b Weighted percents shown.

^c p value given in table is for overall chi-square test. p values for linear contrasts for specific categories of low SES and high SES were: $p < .001$ (past year), $p = .36$ (1 to < 5 years ago), and $p < .05$ (≥ 5 years ago).

Table 3
Quit attempt patterns among 934 past-year smokers by Socioeconomic Status (SES), Alaska Behavioral Risk Factor Surveillance System, 2012–2013.

	Socioeconomic status ^a		p value
	Low SES (N = 408)	High SES (N = 526)	
No quit attempt	43%	42%	.74
Unsuccessful quit attempt	48%	46%	
Successful quit attempt (one-year quit rate)	9%	12%	

^a Weighted percents shown

4. Discussion

We compared quit rates and ratios of the lower SES population in Alaska to those of higher SES using population-based data and found them to be equivalent when limited to smokers who had quit within the previous year. This finding was in sharp contrast to comparisons of both five-year quit rates, and of quit ratios that include all former smokers, regardless of quit date.

There are several potential explanations for the differing cessation patterns when examined by time frame. If the one-year quit patterns are extrapolated to five years, we would see equivalent short-term quit behavior between the two groups, but fewer sustained quits (greater than six months) due to more frequent relapse to smoking among the lower SES group. However, we have no information on unsuccessful quit attempts prior to the previous year, so it is also important to consider that the differing longer-term rates may also be due to fewer quit attempts among low SES smokers.

The preceding patterns, whether due to more frequent relapse, or differences in quit attempts prior to the previous year, may be one reason for the lack of continued reductions in prevalence for the lower SES Alaska population. Even though short-term quitting appears to be continually occurring in this population, periods of abstinence may not yet be prolonged enough to achieve a prevalence reduction.

Despite the disparity in the longer-term measures, the early quit success among lower SES smokers was encouraging especially because six-month continued abstinence for past-year smokers in this group was similar to higher SES smokers. It has been established that about 80% of relapse to smoking occurs within the first month (Hughes et al., 2004) suggesting that many of these low SES quitters had survived the most difficult post-quit period.

This early success among low SES quitters may be at least partially related to policy changes that have accompanied tobacco control programmatic efforts in Alaska. Specifically, Alaska's tobacco tax is in the top 20% of states, but combined state and local taxes puts it near the top of the nation (Campaign for Tobacco-Free Kids, 2018a; Campaign for Tobacco-Free Kids, 2018b). A review on differential impact of tobacco control interventions by SES indicates that price increases are the intervention with the greatest potential to reduce SES disparities in adults (Hill et al., 2014). In addition, a report that assessed effects of tobacco control policy interventions on cessation behaviors documented that smokers living in a state with higher average prices were more likely to make a quit attempt (Levy et al., 2005).

Our study is generally consistent with previous studies that have documented much lower quit ratios (i.e., former smokers divided by ever smokers regardless of time since quit) in lower SES groups that have used education and income separately (Barbeau et al., 2004; Bosdriesz et al., 2015). Our results were also consistent with studies reporting similar rates of unsuccessful quit attempts in the previous year by education and income or social class (Barbeau et al., 2004; Kotz and West, 2009; Hyland et al., 2006; West et al., 2001). On the other hand, some studies have shown lower quit attempt rates by education (Centers for Disease Control and Prevention, 2011a; Levy et al., 2005; Hatziandreu et al., 1990; Lillard et al., 2007; Reid et al., 2010), though many of these showed no differences by either income or poverty status (Centers for Disease Control and Prevention, 2011b; Levy et al., 2005; Lillard et al., 2007; Reid et al., 2010).

Most of the studies that documented past-year quit attempts also assessed quit-related outcomes by education and income, and were thus reporting one-year quit rates. Almost all showed lower success rates in the previous year among those with less education (Levy et al., 2005; Hyland et al., 2006; Lillard et al., 2007; Centers for Disease Control and Prevention, 2011b) or in a lower social class (Kotz and West, 2009; West et al., 2001), though some have shown no association between quit success and income levels (Centers for Disease Control and Prevention, 2011b; Lillard et al., 2007). In general however, our finding of no difference by SES for one year quit rates is inconsistent with

previous reports. No other study that we know of has assessed five-year quit rates by either measure of SES.

One reason for differences between these studies may be the definitions used for SES. In our study, we used a definition that combined education and income, and then excluded from our analysis respondents under 25 and over 64 years old because of the relationship of age to education and income. As noted, previous work examining disparities in cessation-related behaviors by SES has generally used either education or income as a proxy for low SES, and these differences in definitions could affect comparability with our work.

4.1. Limitations

Our findings are subject to a number of limitations. First, data from the BRFSS exclude individuals who live in institutions as well as those who do not speak English or Spanish. Second, BRFSS response rates ranged from 60 to 64% and lower response rates can increase the possibility of bias. Third, smoking status was collected by self-report and could not be independently verified. Finally, our findings may not be generalizable to other states with low SES populations that have different characteristics.

5. Conclusions

The results from this study show that examining quit-related surveillance measures in both recent and longer-term time periods can be a useful technique to identify important patterns taking place in the presence of tobacco control efforts. States with comprehensive tobacco control programs should assess these measures among lower SES smokers to identify whether this population is indeed continuing to meet with greater quit success in the short term. Further research on the reasons for fewer long-term quits among lower SES smokers is needed, and could help design interventions to promote long-term cessation.

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