Correlates of Cigarette Smoking Among Selected Southwest and Northern Plains Tribal Groups: The AI-SUPERPFP Study

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Objectives. We describe the prevalence and correlates of cigarette smoking in 2 American Indian tribal groups.

Methods. We performed multinomial logistic regression on epidemiological data from a population-based, cross-sectional study of Southwest and Northern Plains American Indians aged 15 to 54 years.

Results. We found that 19% of Southwest men, 10% of Southwest women, 49% of Northern Plains men, and 51% of Northern Plains women were current smokers. Male gender and younger age were associated with higher odds of smoking in the Southwest tribe, whereas current or former marriage and having spent less time on a reservation were associated with higher odds of smoking in the Northern Plains population. Alcohol consumption was strongly associated with higher odds of smoking in both groups.

Conclusions. Cigarette smoking is a major public health concern among American Indians. Because correlates and smoking patterns vary among different tribal groups, each group's unique characteristics should be considered when designing and implementing comprehensive, culturally appropriate interventions in American Indian communities. (*Am J Public Health.* 2005;95:867–872. doi: 10.2105/AJPH.2004.050096)

American Indians and Alaska Natives maintain high rates of commercial (as opposed to traditional) tobacco use, especially cigarette smoking, despite longstanding explicit health warnings about the addictive nature of nicotine and its association with cancer and cardiovascular diseases.[1,2] American Indians overall have higher rates of current smoking compared to the general US population,[1,2] especially those populations in the Northern Plains.[3–6] Yet these high rates are not universal; smoking prevalence in Southwest tribes is often lower than in the general US population.[6,7] The reasons for these differences are unclear, but given that smoking-related diseases are leading causes of death in these specific American Indian populations,[8] understanding tribal differences in the epidemiology of smoking is necessary to develop culturally appropriate prevention and treatment strategies.

Several studies have described correlates of cigarette smoking in diverse ethnic populations. Among Asian Americans and Hispanics, acculturation variables such as use of the English language, language spoken at home, education level, and practice of ethnic traditions are strongly associated with increased tobacco use.[9–12] Other studies have suggested lower income may be a key risk factor for smoking.[13] Very few studies, however, have examined correlates of smoking in American Indian or Alaska Native populations.[14,15] In this analysis we describe the prevalence of current and former smoking in 2 American Indian reservation populations and examine the association of select sociodemographic variables with smoking status, using data from a population-based, cross-sectional study of American Indians aged 15 to 54 years.[16]

METHODS

Data Source and Participants

We used data from the American Indian Service Utilization, Psychiatric Epidemiology, Risk and Protective Factors Project (AI-SUPERPFP). The study design and survey methods of the AI-SUPERPFP have been described previously.[16] Briefly, AI-SUPERPFP is a population-based, cross-sectional survey of American Indian tribal members aged 15 to 54 years from 2 tribal groups, 1 living in the Northern Plains (comprising 2 different tribes) and 1 living in the Southwest. The selection of these tribes provided an opportunity to examine similarities and differences between 2 tribal groups within the relatively small yet extremely diverse American Indian population. To protect the confidentiality of the tribal communities involved in this research,[17] we refer to the tribes throughout this paper using the general descriptors of Northern Plains and Southwest tribal groups rather than specific tribal names.

The total population of the 2 tribal groups exceeds 100 000, according to the 2000 US census.[18] These communities belong to different linguistic families, have different histories of migration, subscribe to different principles for reckoning kinship and residence, and historically have pursued different forms of subsistence. Yet both tribal groups share experiences common to many American Indians. They have similar histories of colonization, including dramatic military resistance, externally imposed forms of governance, forced dietary changes, mandatory boarding school education, and active missionary movements.

The staff of the American Indian and Alaska Native Programs, University of Colorado Health Sciences Center, Aurora, conducted interviews with tribe members between 1997 and 1999. Random sampling procedures were used, and data were stratified by age, gender, and tribe. In order to include only those tribe members covered by the Indian Health Service, samples were re-

stricted to people living on or near their reservations. Tribal and institutional review board approvals were obtained prior to data collection. All adult participants provided informed consent; parent/guardian consent was obtained before requesting minor assent.

Interviews were computer-assisted personal interviews, and were administered by tribal members intensively trained in research and interviewing methods. Extensive quality control procedures verified that location, recruitment, and interview procedures were conducted in a standardized, reliable manner. These included recontacting 10% of those deemed ineligible due to living away from the reservations, verifying 10% of the refusals, and reviewing more than 10% of the audiotaped interviews to ensure that questions were read verbatim with appropriate tempo and that the interviewer established suitable rapport with the participant.

The overall response rate was 75.3%. The full instrument and training manual may be found online (available at: http://www.uchsc.edu/ai/ncaianmhr/presentresearch/superprj.htm).

Measures

In this analysis we examined information on smoking status, gender, marital status, age, education level, percentage of life lived on the reservation, and lifetime alcohol use. The criterion for inclusion of a subject in this analysis was complete data for all variables.

Smoking status was ascertained by asking participants whether they were current smokers at the time of the interview and if they had smoked more than 100 cigarettes in their lifetime. Participants were classified as current smokers if they answered "yes" to both questions, and were classified as former smokers if they answered "no" to the former and "yes" to the latter. Participants who answered "no" to smoking more than 100 cigarettes in their lifetime were classified as never smokers. These questions and classifications were identical to a smoking status measure used in a national survey.[19]

Demographic variables were ascertained using a question format common to many such surveys;[20] these variables included marital status (separated/widowed/divorced; never married; married/living as married) and education level (less than a high school education; high school diploma/GED attainment; education beyond high school). We dichotomized the percentage of life spent on a reservation as more or less than 75%. No established threshold for this measure exists, but we chose 75% to indicate whether participants had lived most of their lives on the reservation. Alcohol use was measured by a "yes" response to the question "In any one-year period of your entire life, did you have at least 12 drinks of any kind of alcoholic beverage?" This question was identical to an alcohol measure used in 2 large national surveys.[20,21]

Statistical Analysis

We constructed variables using the SPSS (SPSS Inc, Chicago, Ill) and SAS (SAS Institute Inc, Cary, NC) statistical software packages. We used the SVY procedures of Stata (Stata Corp, College Station, Tex) to perform all descriptive and inferential analyses with sample and nonresponse weights.[22] In keeping with AI-SUPERPFP conventions[16] we stratified the initial descriptive analysis into 4 groups—Southwest men, Southwest women, Northern Plains men, and Northern Plains women—and the descriptive analyses were conducted separately for each of the 4 tribe/gender strata.

We used crosstabs to describe the weighted prevalence of smoking status within each sociodemographic variable, and tested for unequal distributions with the global χ^2 statistic. To assess smoking correlates, we used multinomial logistic regression to evaluate the odds of current and former smoking, with "never smoking" as the reference group. This allowed us to simultaneously evaluate the odds of current and former smoking in a single model.

For the regression analysis we combined men and women into a single model for each tribe, after testing for and ruling out gender interactions with any of the other sociodemographic variables in the model. All variables were evaluated as main effects in the regression models, and the odds ratios for each variable were adjusted for all other variables in the model.

We evaluated the overall association of each sociodemographic variable with smoking status using a Wald test, adjusting for multiple comparisons to avoid inflating the type I error rate. We set a significance threshold of $\alpha = 0.01$ to accommodate the high number of statistical tests in the analyses, and all inferential statistics are presented as weighted point estimates with 99% confidence intervals.

RESULTS

We excluded 187 people (6.1%) from the analysis owing to incomplete data. Of the 2897 remaining participants, 1338 (46%) were from the Southwest, and 1559 (54%) were from the Northern Plains. Women made up 57% of the Southwest and 50% of the Northern Plains populations, and both populations were distributed in approximate quartiles across 4 age categories (15–24, 25–34, 35–44, 45 and older). Approximately 30% of both populations had never been married, whereas 61% of the Southwest and 52% of the Northern Plains tribal members were currently married/living as married. Among the Southwest tribal members, 40% had graduated high school and 30% had attended some postsecondary education, compared to 47% and 26%, respectively, of the Northern Plains tribal members. Finally, 70% of the Southwest and 73% of the Northern Plains tribal members had lived at least three-quarters of their life on a reservation, and 50% and 69%, respectively, had consumed at least 12 alcoholic drinks in their lifetime.

Overall, 14% of the Southwest and 50% of the Northern Plains tribal members were current smokers, and 20% of both populations were former smokers (Table 1). In the Southwest tribe 19% of men and 10% of women were current smokers, compared to 49% of men and 51% of women in the Northern Plains tribal group. Never smoking rates showed the inverse trend: 56% and 75% of Southwest men and women, respectively, never smoked, compared to 31% and 30% of Northern Plains men and women. Former smoking rates were fairly similar (range=16%–25%) by tribe and gender.

Smoking status was distributed unequally across age categories in the Southwest tribe, with higher rates of current smoking and lower rates of never smoking in the younger participants ($P=.01$ for men; $P<.001$ for women). Southwest men also had higher

TABLE 1—Smoking Status Among Members of the Southwest and Northern Plains Tribal Groups, by Sociodemographic Characteristics

	Men				Women			
	Current Smoker	Former Smoker	Never Smoker	P^a	Current Smoker	Former Smoker	Never Smoker	P^a
Southwest Tribe								
Total, %	19	25	56		10	16	75	
Age, y, %				.01				<.001
15–24	28	24	48		17	15	68	
25–34	19	26	55		13	16	71	
35–44	20	20	59		5	18	77	
≥45	8	30	62		4	12	85	
Marital status, %				.15				.001
Never married	22	18	60		16	12	72	
Separated/widowed/divorced	18	24	58		12	14	74	
Married/living as married	18	29	53		6	17	76	
Education, %				.15				.08
Did not graduate high school	23	20	57		9	12	79	
High school graduate	16	25	59		12	14	74	
Beyond high school	20	30	50		8	20	72	
Proportion of life spent on reservation, %				.01				.06
≥75%	18	22	60		9	14	77	
<75%	23	31	46		11	20	69	
Drinking status, %				<.001				<.001
Nondrinker	13	14	73		7	9	84	
Current or former drinker[b]	22	31	47		15	26	59	
Northern Plains Tribal Group								
Total, %	49	21	31		51	19	30	
Age, y, %				.15				.47
15–24	54	16	30		53	17	30	
25–34	46	18	35		46	20	35	
35–44	48	22	30		53	18	28	
≥45	48	28	25		56	20	24	
Marital status, %				<.001				.01
Never married	40	19	41		49	14	37	
Separated/widowed/divorced	52	20	28		61	17	22	
Married/living as married	54	22	24		50	22	29	
Education, %				.08				.26
Did not graduate high school	52	16	32		50	15	35	
High school graduate	48	20	32		50	20	30	
Beyond high school	46	28	26		54	21	25	
Proportion of life spent on reservation, %				.003				<.001
≥75%	46	20	35		48	17	35	
<75%	56	23	21		61	22	17	
Drinking status, %				<.001				<.001
Nondrinker	37	13	50		38	17	45	
Current or former drinker	53	24	24		58	20	22	

[a]From χ^2 global test.
[b]Answered "yes" to the question "In any one-year period of your entire life, did you have at least 12 drinks of any kind of alcoholic beverage?"

rates of current smoking and lower rates of never smoking than Southwest women in each age category. The Northern Plains tribal group showed no apparent differences in the distribution of smoking status by age (P=.15 and .47 for men and women, respectively) or gender.

The χ^2 test for marital status was significant for all tribe/gender strata ($P \leq .01$) except Southwest men (P=.15). There was some indication that respondents with higher education had higher prevalence rates of former smoking, but the χ^2 test was not significant for either tribal group. Respondents in all 4 strata who had lived less than 75% of their lives on a reservation had higher rates of current smoking than respondents who had spent most of their lives on a reservation, although the global association was not significant for Southwest women (P=.06; for all others $P \leq .01$). Current and former smoking rates were higher for drinkers compared to nondrinkers in all groups (P<.001).

In the multinomial logistic regression models (Table 2), younger age and male gender were associated with higher odds of both current and former smoking compared to never smoking in the Southwest tribe (P<.001). In the Northern Plains tribal group, however, gender was not associated with smoking status (P=.50), and age showed only a marginally significant association (P=.01), likely driven by the higher odds of current smoking in the 15- to 24-year-olds compared to the 45-and-older age category. The conflict between the P value and the confidence interval is due to rounding error of the former.

Marital status and percentage of life spent on the reservation were associated with smoking status in the Northern Plains tribal group (P=.01 and <.001, respectively), but neither variable was associated with smoking status in the Southwest tribe at the α=0.01 level (P=.02 and .04, respectively). In the Northern Plains, both separated/widowed/divorced and married/living as married respondents had higher odds of current smoking compared to never married respondents. Likewise, among the Northern Plains participants, living less than 75% of one's life on a reservation was associated with higher odds of current and former smoking compared to spending at least 75% of one's life on a reservation.

TABLE 2—Odds Ratios (ORs) for Current/Former Smoking vs Never Smoking Among Members of the Southwest Tribe and the Northern Plains Tribal Group

	Southwest					Northern Plains				
	Current Smoker		Former Smoker			Current Smoker		Former Smoker		
	OR	(99% CI)	OR	(99% CI)	P^a	OR	(99% CI)	OR	(99% CI)	P^a
Gender					<.001					.50
Female	1.0	. . .	1.0	. . .		1.0	. . .	1.0	. . .	
Male	2.1	(1.3, 3.5)	1.7	(1.1, 2.5)		1.1	(0.8, 1.6)	1.0	(0.6, 1.5)	
Age, y					<.001					.01
15–24	7.0	(3.1, 15.6)	2.2	(1.2, 4.1)		1.6	(0.9, 2.8)	1.1	(0.6, 2.2)	
25–34	3.6	(1.7, 7.8)	1.4	(0.8, 2.4)		0.8	(0.5, 1.2)	0.7	(0.4, 1.2)	
35–44	2.3	(1.0, 5.0)	1.1	(0.6, 1.8)		0.9	(0.5, 1.5)	0.8	(0.4, 1.4)	
≥45	1.0	. . .	1.0	. . .		1.0	. . .	1.0	. . .	
Marital status					.02					.01
Never married	1.0	. . .	1.0	. . .		1.0	. . .	1.0	. . .	
Separated/widowed/divorced	1.6	(0.6, 3.9)	1.4	(0.6, 3.1)		1.9	(1.1, 3.5)	1.4	(0.7, 2.9)	
Married/living as married	0.9	(0.6, 1.6)	1.7	(1.0, 2.9)		1.6	(1.1, 2.4)	1.6	(1.0, 2.8)	
Education					.30					.36
Less than high school	1.0	. . .	1.0	. . .		1.0	. . .	1.0	. . .	
High school	1.0	(0.6, 1.7)	1.2	(0.7, 1.9)		1.1	(0.7, 1.6)	1.3	(0.8, 2.3)	
Beyond high school	1.1	(0.6, 2.0)	1.5	(0.9, 2.6)		1.1	(0.7, 1.8)	1.6	(0.9, 3.0)	
Proportion of life spent on reservation					.04					<.001
≥75%	1.0	. . .	1.0	. . .		1.0	. . .	1.0	. . .	
<75%	1.4	(0.9, 2.3)	1.5	(1.0, 2.2)		2.0	(1.3, 3.1)	2.0	(1.2, 3.2)	
Drinking status					<.001					<.001
Nondrinker	1.0	. . .	1.0	. . .		1.0	. . .	1.0	. . .	
Current or former drinker[b]	3.4	(2.0, 5.7)	3.8	(2.4, 5.8)		2.9	(2.0, 4.1)	2.5	(1.6, 4.0)	

Note. CI = confidence interval.
[a]*P* value for variable main effect in adjusted multinomial logistic regression model.
[b]Answered "yes" to the question "In any one-year period of your entire life, did you have at least 12 drinks of any kind of alcoholic beverage?"

Education was not significantly associated with smoking status in either tribal group. Alcohol consumption was strongly associated with higher odds of both current and former smoking in the Southwest and Northern Plains respondents ($P<.001$).

DISCUSSION

In this population-based, cross-sectional study we examined the relationship of sociodemographic and cultural factors with smoking status among Southwestern and Northern Plains tribal members living on or near a reservation. The prevalence of smoking varied dramatically between the tribal groups. The high rates of smoking among the Northern Plains tribal group reflect the findings of other studies.[3,4,6] The Southwest tribe had low rates of smoking,[6,7] although rates of smoking may be increasing as evidenced by higher rates among the younger tribal members.

We also identified several significant correlates of smoking among the Southwest and Northern Plains tribal groups. Understanding the similarities and differences in smoking epidemiology among these tribes versus other populations may inform and improve the development of future smoking interventions.

The association of some variables with smoking status differed between the tribes. Most strikingly, younger age and male gender were strongly associated with higher odds of current smoking in the Southwest tribe but not the Northern Plains tribal group. These findings are consistent with other studies that suggest cigarette smoking among the tribes of the Southwest region is on the rise, especially among the younger male population.[23–25] Factors such as peer influence and use of other nicotine products (e.g., smokeless tobacco), as well as changes in both tribal and individual practices, beliefs, and behaviors toward smoking may contribute to this trend.

Although we did not find a significant relationship between age and smoking status in the Northern Plains respondents, smoking rates there are twice that of the general population,[5,6] and the high prevalence of current smoking for all Northern Plains age and gender groups is disturbing. Studies indicate that the earlier people start smoking, the harder it is to quit later in life.[26,27] The extremely high rates of smoking observed in young people in both the Southwest and Northern Plains tribes represent a major public health concern. Smoking intervention and prevention programs are essential for all age groups, but especially the younger tribal members.

The association of other sociodemographic variables and smoking status varied between the tribes. For example, ever having been married or having lived as married was associated with higher odds of current smoking in the Northern Plains tribal group, whereas it was insignificant among the Southwest tribe. This contradicts previous studies where marriage was associated with lower odds of smoking.[28–30] Although we did not obtain information on smoking status of partners and other household members, studies strongly suggest that it is easier to quit smoking if one has peer support.[31,32] Many of the Northern Plains smokers may have partners who are also current smokers, thus making it more difficult to quit smoking.

In the general population, low educational attainment is strongly associated with cigarette smoking.[9] However, our findings did not show a significant association between level of education and smoking status. There are increasing numbers of tribal members receiving college degrees, but the rates are still low compared to the general population.[33] Thus, there is a relatively narrow range of education among the participants of this study.

Follow-up studies with larger numbers of participants may further clarify this association.

Spending less than 75% of one's life on a reservation was associated with higher odds of smoking among Northern Plains respondents, and elevated (though not statistically significant) odds in the Southwest tribe. These findings suggest that living off the reservation may increase the likelihood of smoking for Northern Plains and possibly Southwest tribal members. A previous study among American Indians in Northern California also pointed out this rural/urban distinction, specifically that American Indians who leave the reservation to live in an urban environment may experience increased stress levels (e.g., the pressure of looking for a job or a place to live, feelings of isolation).[34] Further studies of non–reservation dwelling American Indians are needed to elucidate the factors associated with smoking in this population and to target appropriate interventions.

The relationship between alcohol use and smoking has been discussed at length over the years. Previous studies indicated a strong positive association between smoking cigarettes and drinking alcohol.[35,36] Our findings support these studies. Southwest and Northern Plains respondents who reported having 12 or more alcoholic drinks in their lifetime had higher odds of current and former smoking compared to those who did not drink. Although we cannot tell from this cross-sectional study which behavior came first, studies strongly suggest that cigarettes may be a "gateway" drug to alcohol use.[35,37,38] Smoking intervention and prevention programs that also focus on the health hazards of drinking need to be implemented in these American Indian communities.

Our study has several limitations. First, although 3 American Indian tribes from 2 distinct tribal groups are represented in this study, these results show that smoking patterns vary from tribe to tribe and may not be generalizable to other American Indian and Alaska Native tribes or communities. However, this limitation is also an important finding of our analysis and suggests that the common practice of combining people from geographically and culturally diverse tribes into a single "American Indian" sample is inappropriate for many epidemiologic studies.

Second, smoking status was ascertained by self-reported data. These measures were not evaluated through formal questionnaire validation, chart review, or clinical test. Studies have shown that self-reporting of smoking status can introduce bias toward a socially desirable response.[39]

Third, the AI-SUPERPFP did not ascertain uses of tobacco for ceremonial purposes. It is uncertain whether there is a higher correlation of cigarette smoking among tribal members who use tobacco for ceremonial purposes. For centuries many American Indian and Alaska Native tribes have viewed tobacco as a sacred plant with powerful properties, and in these tribes tobacco has been an integral part of many ceremonies and prayers.[40–43] The Northern Plains tribal group, in particular, bases a large part of their spiritual philosophy around the concept of the "sacred pipe,"[44] considerably more so than the Southwest tribe. Further, the oral record of the Northern Plains tribes describes ceremonial tobacco use as far back as the 17th century. Therefore, a large part of the difference in cigarette smoking rates that we observe could have a significant cultural basis. Unfortunately, this and many prior studies have noted that many Native people are misusing commercial tobacco in the form of cigarettes, snuff, dip, and other products. The challenge for many tribal communities is to establish effective tobacco control and prevention policies and activities, while remaining respectful of the historical and contemporary roles of traditional tobacco use, which have had and continue to have significant cultural and spiritual meaning.

We have found possible correlates of smoking in 2 distinct American Indian tribal populations represented in the AI-SUPERPFP study. These relationships, as well as the smoking patterns themselves, differ between the 2 populations, and the results underscore the need to consider each tribal group's unique characteristics when designing and implementing culturally sensitive smoking intervention programs in American Indian communities. ■

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Contributors

P. Nez Henderson conceptualized and led the writing of the article, and supervised all aspects of its implementation. C. Jacobsen conceptualized ideas, synthesized the analyses, interpreted findings, and reviewed drafts. J. Beals and the AI-SUPERPFP Team conceptualized ideas, interpreted findings, and reviewed drafts.

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Human Participant Protection

We received approvals from the Colorado Multiple Institutional Review Board and from each tribe.

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