

Patterns of Cigarette Smoking Initiation in Two Culturally Distinct American Indian Tribes

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Smoking rates in the US population have declined overall in the past several decades, from a high of 42% in 1960 to an estimate of 21% in 2007.¹ However, this decline has not been observed among all racial/ethnic groups nor among all age groups. The prevalence of smoking among American Indians and Alaska Natives, for example, is greater than 50% in many communities, roughly 2.5 times the prevalence in the US general population.^{2–7} Furthermore, over the past 3 decades, rates of smoking have been rising in some tribal communities that have historically low rates,^{2,8} roughly paralleling the increases in smoking-related diseases, including lung cancer and respiratory and cardiovascular diseases, in American Indians and Alaska Natives.^{9,10} Smoking also contributes to the observation that American Indians and Alaska Natives trail only African Americans in years of potential life lost,¹¹ a key indicator of population health. Finally, adverse health outcomes associated with smoking are adding inordinately high health care costs to a dramatically underfunded Indian Health Service.¹²

One of the key factors linked to nicotine dependence is age of smoking initiation. Studies have shown that an earlier age of smoking initiation is related to current and daily smoking^{13,14} and that the transition from smoking initiation to established smoking generally takes 2 to 3 years.^{15,16} However, a more recent study among a cohort of sixth graders reported that youth were susceptible to a rapid loss of autonomy over tobacco. This occurred within 1 or 2 days of first inhalation, and dependency was likely to appear before reaching a consumption rate of 2 cigarettes per day.¹⁷ In addition, smokers who begin smoking at younger ages are more likely than those starting later to develop nicotine dependence, thus making quitting more difficult.^{13,14,18}

Studies among African Americans have revealed major declines in smoking prevalence among adolescents during the 1980s, which

Objectives. To better understand patterns of initiation among American Indians we examined age-related patterns of smoking initiation during adolescence and young adulthood in 2 American Indian tribes.

Methods. We used log-rank comparison and a Cox proportional hazard regression model to analyze data from a population-based study of Southwest and Northern Plains American Indians aged 18 to 95 years who initiated smoking by age 18 years or younger.

Results. The cumulative incidence of smoking initiation was much higher among the Northern Plains Indians (47%) than among the Southwest Indians (28%; $P < .01$). In the Southwest, men were more likely than women to initiate smoking at a younger age ($P < .01$); there was no such difference in the Northern Plains sample. Northern Plains men and women in more recent birth cohorts initiated smoking at an earlier age than did those born in older birth cohorts. Southwest men and women differed in the pattern of smoking initiation across birth cohorts as evidenced by the significant test for interaction ($P = .01$).

Conclusion. Our findings underscore the need to implement tobacco prevention and control measures within American Indian communities. (*Am J Public Health*. 2009;99:2020–2025. doi:10.2105/AJPH.2008.155473)

were offset by increased initiation among young adults during this period.¹⁹ Such data helped to enhance public health efforts to promote cessation and discourage initiation among African Americans. However, little is known about patterns of smoking initiation among American Indians and Alaska Natives. In a recent survey of South Dakota high school students, more than 45% of American Indian adolescents who were smoking reported starting to smoke before the age of 13 years.²⁰ To better understand the patterns of smoking initiation among American Indians, we conducted a study that examined the age of smoking initiation in 2 culturally distinct American Indian tribal groups across birth cohorts.

METHODS

We used data from the Education and Research Toward Health (EARTH) Study. The design and methods of the EARTH Study have been previously published.²¹ Briefly, EARTH is a multicenter cohort study among American Indians and Alaska Natives that investigates associations between diet, lifestyle, physical

activity, and cultural factors and the development of cancer and other chronic diseases. The Black Hills Center for American Indian Health conducted the EARTH Study among 2 closely related, reservation-based Lakota Sioux tribes from western South Dakota and a prominent, reservation-based tribe from central Arizona. To protect the confidentiality of the tribal communities involved in this research, we referred throughout this article to the Lakota Sioux tribes collectively as the “Northern Plains” tribes and to the Arizona tribe as the “Southwest” tribe. Each tribe maintains unique customs, traditions, social organizations, and ecologic relationships. Despite these differences, however, the 2 tribes also share an array of experiences common to many American Indian and Alaska Native tribes that have influenced the infrastructure of the tribes, such as federal assimilation and termination policies, diminishment of Indian lands through a variety of means, and the outlawing of the practice of Native religion.

Data Collection

In a baseline examination, data were collected from individuals between the ages of 18 and 95

years residing on the 3 American Indian reservations. Personal interviews were conducted with all study participants between 2003 and 2006 by trained staff from and associated with the Black Hills Center for American Indian Health, which is headquartered in Rapid City, SD. All interviewers and recruiters were tribal members. Appropriate tribal and institutional review board approvals were obtained before data collection, including both Aberdeen and Phoenix Area Indian Health Service institutional review boards, and all adult participants provided informed consent. Interviews were computer-assisted and included extensive quality control procedures. Because of our interest in smoking initiation during adolescence and young adulthood, we restricted this analysis to individuals who initiated smoking at the age of 18 years or younger.

Measures

We classified participants as having a lifetime history of smoking if they (1) had ever smoked more than 100 cigarettes and (2) had ever smoked at least one cigarette per day for 3 months or longer. For lifetime smokers, we asked about current smoking at the time of the interview. Participants were classified as current smokers if they answered yes to “Do you smoke regularly now?” and were classified as former smokers if they answered yes to the questions on lifetime history of smoking, but no to smoking regularly now and no to the latter. Participants who answered no to smoking more than 100 cigarettes in their lifetime were classified as never smokers. Age of smoking initiation was ascertained from smokers by asking, “How old were you when you first started smoking cigarettes regularly?” These questions were identical to those used in a recent validated national survey on smoking.^{22,23} Demographic factors included age, gender, marital status (married or living as married, widowed, divorced, separated, or never married), employment status (employed or not employed), and education level (less than a high school education, high school diploma or general equivalency diploma, or some college or higher).

Statistical Analysis

An initial descriptive analysis examined the distribution of demographic and smoking characteristics in the Northern Plains and

Southwest tribes. The cumulative incidence of smoking initiation from ages 5 to 18 years was plotted according to age of initiation for each tribe separately. We also explored the age of initiation by using life-table graphs stratified by gender and tribe. The log-rank procedure was used to compare the cumulative smoking initiation curves.

To examine the distribution of smoking initiation across birth cohorts, we examined the proportion of participants who initiated smoking by age 18 years or younger. Logistic regression was used to conduct a test for trend in the proportion who initiated smoking according to birth cohorts. This was a one degree of freedom chi-square test directed toward detecting a monotonic trend in proportions with an ordinal independent variable, such as ordered birth cohorts. The influence of birth cohort on the rate of smoking initiation was also examined by using a Cox proportional hazard regression model. In these models, we estimated the hazard ratios for smoking initiation for 6 different birth cohorts (1930s and earlier, 1940–1949, 1950–1959, 1960–1969, 1970–1979, and 1980–1988) after stratification by tribe and gender; the oldest birth cohort served as the reference group. The birth cohort groups were each treated as an ordinal variable to test the trend in smoking initiation across birth cohorts. Additionally, we fit models that included interaction terms for gender by cohort group to examine whether there were male–female differences in the trend within each tribe. For this study, we conducted a complete case analysis that included 4757 of the 5132 participants in the data set. We required that all participants have complete data for all model covariates such as smoking, gender, birth cohort, and tribe.

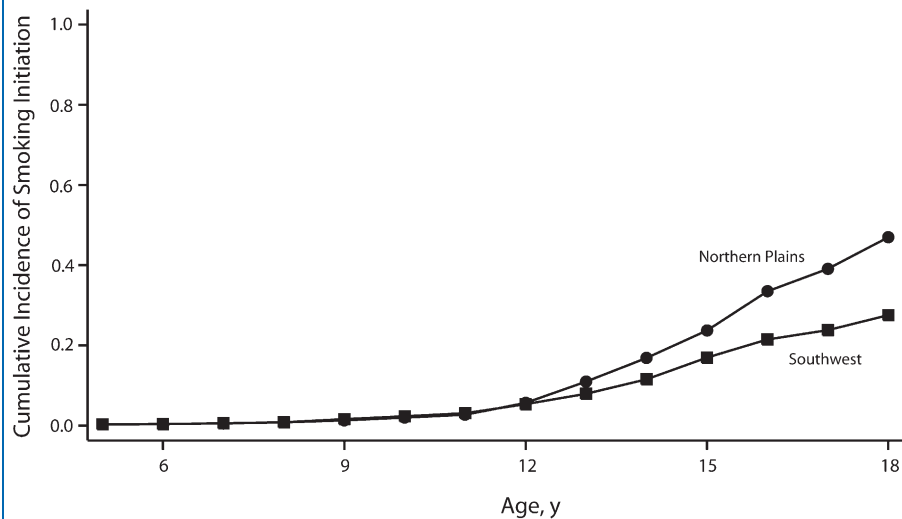
RESULTS

Approximately two thirds of the EARTH participants ($n=3207$) were from the Northern Plains, and the remaining one third were from the Southwest ($n=1550$). Men made up 47% of the Northern Plains sample and 41% of the Southwest sample; the mean (SD) ages of the participants were 37 (15) years in the Northern Plains sample and 36 (13) years in the Southwest sample. Thirty-six percent of the Northern Plains sample and 32% of the Southwest

sample were married or living as married. The percentage of Northern Plains participants reporting high school graduation or any post-secondary education (71%) was higher than that reported in the Southwest (48%). Twenty-two percent of the Northern Plains and 16% of the Southwest EARTH participants were employed. The cumulative incidence of smoking initiation by the age of 18 years was higher for Northern Plains participants than for Southwest participants (47% versus 28%; $P<.01$; Figure 1). In the Southwest (Figure 2), men were more likely to initiate smoking by age 18 years than were women ($P<.01$); in the Northern Plains, men and women did not differ significantly in their age of smoking initiation.

The percentage of participants from each region who initiated smoking by the age of 18 years or younger according to birth cohort is shown in Table 1. Northern Plains men and women showed a consistent increase in the percentage of smoking initiation by age 18 years in more recent birth cohorts ($P_{\text{trend}}<.01$). Conversely, Southwest men revealed little change in the percent of smoking initiation by age 18 years ($P_{\text{trend}}=.5$) across birth cohorts, whereas Southwest women showed an increase in smoking initiation by age 18 years across birth cohorts ($P_{\text{trend}}=.01$), albeit not to the same extent as seen in Northern Plains participants. For example, 10% of Southwest women, 23% of Northern Plains women, and 28% of Northern Plains men born in the 1930s initiated smoking by the age of 18 years; however, by the 1980s, these same prevalences were found for participants who initiated smoking by the much younger ages of 13, 15, and 15 years, respectively.

Hazard ratios by tribe and gender for the influence of birth cohort on age of smoking initiation are shown in Table 2. In the Northern Plains, participants initiated smoking at earlier ages in more recent birth cohorts compared with those born in older birth cohorts. For example, Northern Plains women born during 1980 to 1988 were on average 3 times as likely to initiate smoking by age 18 years as were those born in the 1930s. In the Southwest, men and women differed in their patterns of smoking initiation across birth cohorts as evidenced by a significant test for interaction between birth cohort and gender ($P=.01$). The rate of smoking initiation in Southwest men



Note. $P < .01$

FIGURE 1—Cumulative incidence of smoking initiation by age 18 years or younger in the Northern Plains and Southwest American Indian populations: Education and Research Toward Health Study, 2003–2006.

was fairly constant across birth cohorts ($P_{\text{trend}} = .42$), but in women, those born in more recent birth cohorts initiated smoking at a younger age than did those born in older birth cohorts ($P_{\text{trend}} = .01$).

DISCUSSION

This study was the first to examine patterns of smoking initiation among 2 culturally distinct American Indian tribal groups. Overall, the cumulative incidence of smoking initiation by age 18 years among Northern Plains participants was higher than in the Southwest. Furthermore, the ages of smoking initiation reported by Southwest tribal women and Northern Plains men and women were significantly younger for members of more recent birth cohorts than for older birth cohorts. The decreasing age of smoking initiation observed in these tribal groups is of considerable concern for the health of these communities.

An earlier age of smoking initiation is a strong indicator of long-term nicotine addiction and subsequent smoking-related diseases.^{13,14} These consequences have been studied among Northern Plains tribal members, who in addition to a high smoking prevalence have the highest rates of lung cancer and coronary

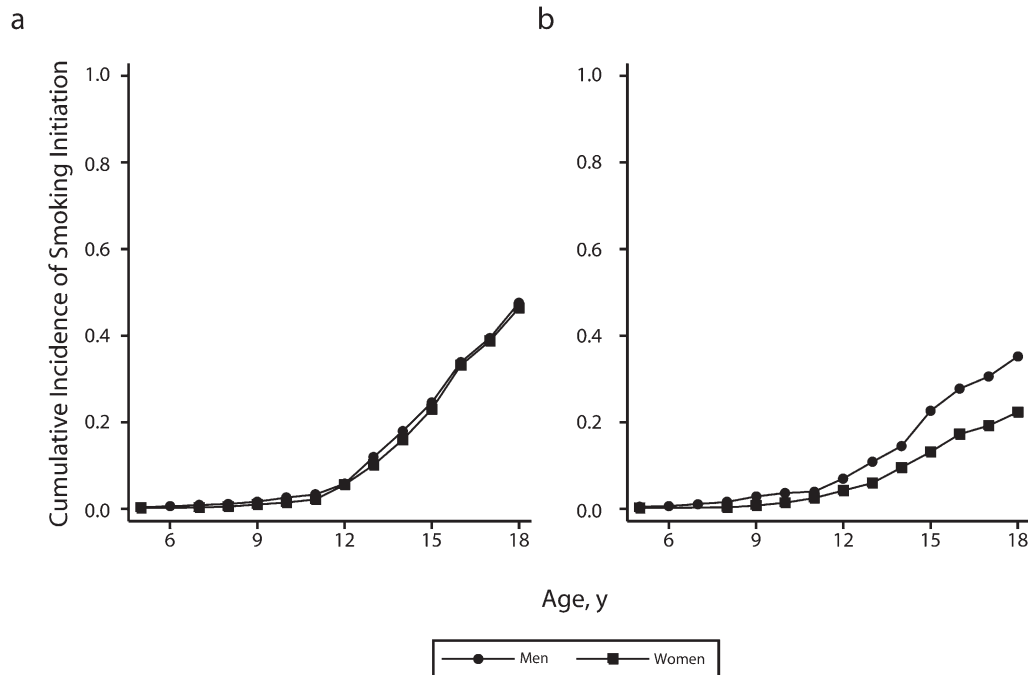
heart disease among American Indians.^{10,24} The higher cumulative incidence of smoking initiation in Northern Plains men and women, as compared with the Southwest, suggests that there may be complex social, cultural, environmental, and biological factors that influence smoking initiation. We know from other studies among American Indians that earlier age of initiation is associated with having other family members who smoke, peer influence, and acceptance of smoking in community and cultural gatherings.^{25–27} For example, the Northern Plains tribes base a large part of their spiritual philosophy around the concept of the “Sacred Pipe,”²⁸ considerably more so than among Southwest tribes. Furthermore, in many Northern Plains tribal communities, *cañsása* (a traditional tobacco obtained from the red willow used in ceremonies) has been largely replaced by or is used in combination with commercial tobacco (e.g., cigarettes and smokeless tobacco). Cigarettes are given as gifts and offerings, and they are smoked at cultural gatherings, including pow-wows, wakes, and ceremonies.

Other possible explanations for the higher cumulative incidence of smoking initiation observed among Northern Plains tribes, compared with Southwest tribes, are strategies historically used by the tobacco industry.

Targeted tobacco marketing is known to increase rates of smoking initiation, especially among youth.^{29–34} For example, significant increases in uptake among young women were observed after a targeted marketing strategy employed by Philip Morris.^{29–31,34} On American Indian reservations on the Northern Plains, tobacco companies have performed pervasive targeted marketing via direct and indirect sponsorship of local rodeos, pow-wows, and community organizations (e.g., donations to tribal colleges) for many decades.

Our study highlights the changing patterns of age of smoking initiation within Southwest and Northern Plains tribal populations. Southwest tribal women in more recent birth cohorts, in particular, reported earlier ages of initiation than did women in older birth cohorts. The causes of this shift are unclear but may in part be due to this particular tribe’s tighter integration into the majority culture. For many centuries, this Southwest tribe was protected from the influence of Western society. Gender roles were clearly defined in the community, and cigarette smoking among women was socially unacceptable. However, over the past 3 decades, urban growth has encroached upon this tribe’s reservation boundaries and has likely had considerable effects on the traditional social structure of the tribe. As for many tribes across the United States, urbanization has caused a decrease in a shared sense of tribal identity, decreased the ability to speak Native languages, and decreased participation in cultural activities.^{35–37} Finally, like in so many other Native communities, the tobacco industry in recent decades has built its image and credibility by aggressive sponsorship of cultural events and its targeted marketing strategies within Indian gaming casinos. Finally, several studies show that smoking initiation in women is more strongly influenced by societal factors than is smoking initiation in men.³⁸ All these factors have likely contributed to earlier ages of smoking initiation among the Southwest tribal women.

Our findings underscore the need to aggressively implement tobacco prevention and control measures among adolescents and young adults within American Indian communities. Ample evidence indicates that tobacco policies, including increased tobacco taxation and establishing smoke-free environments aimed at reducing the demand for tobacco



Note. $P = .41$ for Northern Plains; $P < .01$ for Southwest populations.

FIGURE 2—Cumulative incidence of smoking initiation by age 18 years or younger among men and women in the (a) Northern Plains population and (b) Southwest American Indian population: Education and Research Toward Health Study, 2003–2006.

products, are highly effective in preventing initiation, promoting cessation, and reducing tobacco consumption among tobacco users, especially among youth and young adults.³⁹ However, owing to the sovereign status of federally recognized tribes, tobacco policies implemented by the states are not necessarily

enacted on Indian reservations. For example, whereas states and municipalities have implemented comprehensive tobacco control policies statewide or in many communities, many tribal reservations have yet to adopt any tobacco policy ordinances. Of the 562 federally recognized tribes, the Blackfeet and Fort Peck Nations are

the only 2 tribes in the United States to have adopted comprehensive commercial tobacco-free ordinances on their reservations. Further, taxation on tobacco products on many tribal lands is below that of surrounding nontribal lands. The changing patterns of smoking initiation in the younger reservation population make it imperative that tribal leaders and community members begin a dialogue about implementing comprehensive tobacco control policies to reverse this trend.

Our study has limitations. First, the measurement of smoking initiation was not ideal and it is possible that EARTH participants did not understand the difference between initiation of smoking experimentation versus regular smoking; questions to differentiate between the 2 categories of smoking patterns were not collected. Second, smoking status was ascertained by self-report and not was confirmed by biochemical methods. Studies show that self-report of smoking status can introduce bias toward a socially desirable response.⁴⁰ However, self-reports for smoking have been validated by serum cotinine concentrations in other

TABLE 1—Percentage of Participants Who Initiated Smoking by Age 18 Years or Younger in the Northern Plains and Southwest American Indian Populations, by Gender and Birth Cohort: EARTH Study, 2003–2006

Birth Cohort	Northern Plains		Southwest	
	Men, No. (%)	Women, No. (%)	Men, No. (%)	Women, No. (%)
1930s and before	72 (28)	110 (23)	16 (31)	30 (10)
1940–1949	80 (34)	152 (33)	44 (39)	64 (17)
1950–1959	200 (46)	257 (48)	92 (37)	144 (18)
1960–1969	352 (41)	359 (43)	158 (35)	233 (19)
1970–1979	387 (47)	399 (48)	147 (38)	238 (30)
1980–1988	409 (61)	430 (58)	171 (32)	213 (23)
P_{trend}	<.01	<.01	.5	.01

Note. Sample sizes were Northern Plains men (n = 1500), Northern Plains women (n = 1707), Southwest men (n = 628), and Southwest women (n = 922).

TABLE 2—Hazard Ratios (HRs) for Age of Smoking Initiation Among Men and Women in the Northern Plains and Southwest American Indian Populations, by Birth Cohort: EARTH Study, 2003–2006

Birth Cohort	Northern Plains		Southwest	
	Men (n=1500), HR (95% CI)	Women (n=1707), HR (95% CI)	Men (n=628), HR (95% CI)	Women (n=922), HR (95% CI)
1930s and before	1.0	1.0	1.0	1.0
1940–1949	1.3 (0.7, 2.3)	1.4 (0.9, 2.3)	1.3 (0.5, 3.6)	1.8 (0.5, 6.4)
1950–1959	1.8 (1.1, 3.0)	2.5 (1.6, 3.8)	1.2 (0.5, 3.1)	1.9 (0.6, 6.1)
1960–1969	1.6 (1.0, 2.6)	2.1 (1.4, 3.3)	1.1 (0.5, 2.9)	2.0 (0.6, 6.5)
1970–1979	1.9 (1.2, 2.9)	2.5 (1.6, 3.8)	1.3 (0.5, 3.1)	3.2 (1.0, 10.3)
1980–1988	2.8 (1.8, 4.4)	3.3 (2.2, 5.0)	1.0 (0.4, 2.5)	2.6 (0.8, 8.2)
<i>P</i> _{trend}	<.01	<.01	.42	.01

Note. CI=confidence interval. *P*=0.97 for a birth cohort by gender interaction in the Northern Plains. *P*=0.01 for a birth cohort by gender interaction in the Southwest. Women born in the most recent cohorts are at higher risk of initiating smoking by age 18 years or younger although there is no obvious pattern of changing age of smoking initiation in men across birth cohorts.

studies.^{41,42} Third, the EARTH study did not ascertain use of tobacco for ceremonial purposes. It is uncertain whether there is a higher prevalence of cigarette smoking among tribal members who use tobacco for ceremonial purposes or what the impact of these cultural factors is on smoking initiation. Other potential sources of bias are recall errors and differential mortality between smokers and nonsmokers, which is a consequence of the deleterious health effects of smoking and is enhanced in older cohorts. Recall decay resulting from advanced age generally underestimates the time since first use, thus leading to a bias that underestimates the prevalence and leads to a decline in early initiators, which may confound intercohort comparisons.^{43–47}

We found an alarming change in onset of smoking initiation among young Indian women living in the Southwest as well as continued alarmingly high rates of smoking among Northern Plains participants. The United States has directed substantial resources toward educating communities on the dangers of smoking ever since the first US Surgeon General's report in 1964.⁴⁸ These efforts have involved the design and implementation of comprehensive tobacco prevention and control programs that have resulted in a steady decrease in national smoking prevalence and have delayed the typical age of smoking initiation. Yet, our EARTH data

indicate that many American Indians continue to initiate smoking at high rates and are initiating at younger ages. More research is needed, both to verify these findings and to help establish a more comprehensive understanding of factors associated with age of smoking initiation in American Indian youth. Other domains of measurement might include environmental, social, cultural, and biological factors that may be related to smoking initiation in tribal communities. This more complete picture can, in turn, help to guide the design and implementation of more effective, culturally relevant, youth- and young adult-oriented tobacco prevention and intervention strategies in American Indian communities. ■

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Contributors

P. Nez Henderson originated the study, led the writing of the article, and supervised all aspects of its implementation. Y. Wen and J. Goldberg conceptualized ideas, synthesized the analyses, interpreted findings, and reviewed drafts. S. Kanekar, D. Buchwald, W. Choi, K. S. Okuyemi, J. Ahluwalia, and J. A. Henderson conceptualized ideas, interpreted findings, and reviewed drafts.

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Human Participant Protection

We received written approvals from the tribal institutional review boards.

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