CULTURAL CONNECTEDNESS AND REGULAR SMOKING AMONG A COHORT OF URBAN
AMERICAN INDIAN YOUTH


BY MARGARET S. CARY


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CERTIFICATE OF APPROVAL

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Margaret Cary
has been approved

Chair

Member

Member

Member

Member

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# ABSTRACT

**BACKGROUND:** Cigarettes are one of the first drugs that youth try. Over 65% of youth smokers are estimated to become addicted to nicotine. Cigarette smoking is associated with both short-term and long-term morbidity and mortality among youth.

The prevalence of cigarette use is higher among American Indian youth than any other American racial or ethnic group, after adjustment for socioeconomic status. Reasons for this discrepancy are not well understood. In addition, most of the data on American Indian youth smoking have been derived from communities living on or near reservations. There is little research on factors associated with smoking among urban American Indian youth.

Compared to youth of other races, American Indian youth may be more susceptible to smoke in response to known risk factors, may be exposed to a greater number of risk factors, or experience risk factors for a longer period of time. There may be culturally-specific protective factors that uniquely influence smoking among American Indian youth as well.

**SPECIFIC AIMS:** The aim of this analysis was to investigate the relationship between markers of cultural connectedness and both current and future regular smoking among a cohort of 216 urban American Indian youth.

**METHODS:** This secondary analysis of data from a nine-year prospective cohort study examined cultural connectedness, cigarette use, and risk factor exposure among Seattle-area American Indian youth throughout their adolescence.

Youth perception of family cohesion and family conflict, self-identification as American Indian, and participation in traditional American Indian cultural rituals were selected to signify cultural connectedness for this analysis. The outcome variables were smoking regularly and the quantity and frequency of smoking among regular smokers. Age at enrollment in the study, gender, youth smoking history, youth alcohol use history, having peers who smoke, having siblings who smoke, the number of deviant behaviors peers engage in, the number of deviant behaviors that siblings engage in, having significant psychological distress, and family welfare status were assessed as potential confounders and additional smoking predictors.

Cross-sectional and prospective associations between cultural connectedness and regular smoking were investigated. Logistic and linear regression analyses were used to model the associations as well as adjust for confounders and significant additional risk factors. Effect modification of the relationship between cultural connectedness and regular smoking by gender also was evaluated.

RESULTS: Cohesive family dynamics reduced the odds of being a regular smoker compared to those with lower family cohesion or higher family conflict; whereas strong cultural involvement increased the odds, compared to those who participated in few cultural rituals or did not regularly tell others they are American Indian. Only high family cohesion remained marginally protective against future regular smoking after adjusting for confounders and significant risk factors, conferring a 45% reduction in the odds of smoking regularly during late adolescence (OR = 0.55, 95% CI: 0.27, 1.10). Gender did not modify the relationship between cultural connectedness and regular smoking.

# BACKGROUND

## I. YOUTH TOBACCO USE IN AMERICA

Adolescence, the years between age ten and twenty, are characterized by significant physical, psychological, and social maturation.[1,2] Many health behaviors that will become lifelong habits are established during this time.[3,4] Tobacco use, in particular, tends to be initiated during adolescence.[5,6]

### I.i PUBLIC HEALTH IMPACT OF YOUTH SMOKING

Cigarettes are one of the first drugs that youth try.[7] The U.S. Department of Health and Human Services has designated adolescent cigarette smoking as one of the top ten major health concerns in the United States.[8]

About three-quarters of youth who start smoking will become daily smokers by the time they are twenty years old and about two-thirds of youth smokers will become addicted to nicotine.[3,4,7,9-11] Eighty to ninety percent of adult smokers begin smoking before they are 18 years old.[3,4,7,9-12] Youth smokers develop nicotine dependence and experience withdrawal symptoms when trying to quit.[6,13,14] In a review of the literature on nicotine dependence among youth smokers, Colby et al. reported that those who smoke daily and heavily are at the highest risk for developing dependence, but even youth who smoke infrequently may become addicted.[13] They found that about 75% of youth who smoke daily develop tolerance to nicotine and 67% experience craving and other withdrawal symptoms when attempting to quit. Depending on the smoking frequency of the youth population studied, currently an estimated 20% - 70% are nicotine

dependent.[10, 13] Also, youth acknowledge that quitting is harder than anticipated. While only 5% of youth smokers expect to continue smoking after high school, 75% are still smoking upon graduation.[13]

Cigarette smoking is one of the primary risk factors for preventable premature disease and death in the United States.[6] Approximately one-third of youth smokers are predicted to die prematurely from a smoking related cause.[11] All smokers, regardless of pack-year history, are at increased risk for premature death as compared to non-smokers.[15] Smoking also places others at risk. Exposure to environmental tobacco smoke is estimated to account for 11% of smoking-related deaths.[16] Despite these well-established risks, current trends show that fewer youth acknowledge the health risks of smoking, fewer peers disapprove of smoking, and youth are starting to smoke at younger ages.[13]

Of all substances, tobacco may cause the most long-term morbidity. Although cigarette smoking is associated with immediate reduction in physical fitness,[6] the most serious health risks from tobacco use typically arise after years of smoking. Protracted smoking causes cardiovascular disease and lung cancer, the most common causes of adult all-cause mortality and cancer mortality.[6, 17] Tobacco use can cause lung, laryngeal, esophageal, bronchial, oral, pancreatic, renal, cervical, and bladder cancers.[18] It is also an independent risk factor for systemic vascular disease. Cerebral vascular disease increases the risk of stroke and cerebral aneurysm rupture. Coronary vascular disease increases the likelihood of myocardial infarction and congestive heart failure. In addition to these diseases associated with high mortality, tobacco use contributes to significant morbidity. Smoking leads to a variety of chronic lung diseases, particularly emphysema, chronic

bronchitis, and asthma. It disrupts endocrine function, increasing the risk of hypothyroidism, osteoporosis, and infertility. Smoking increases drug metabolism of a number of common medications, requiring increased doses. Finally, smoking increases the risk of peptic ulcers, esophageal reflux, and cataracts. Smoking is associated indirectly with other risky health behaviors among youth that directly contribute to adolescent morbidity and mortality including alcohol, marijuana, and other drug use, risky sexual behaviors, juvenile delinquency, and conduct disorder.[19] Smoking is becoming an increasingly considerable financial burden on individuals and the health system.[18]

## I.ii EPIDEMIOLOGY OF YOUTH SMOKING

The epidemiology of tobacco use among youth in the United States is primarily derived from school studies. Thus, the true prevalence of tobacco use is likely underreported, as youth not attending school are at higher risk for risky behaviors in general.[20-22] In addition, the majority of studies only report data for White, Black, and Hispanic youth. These studies attempt to capture a broad cross-section of youth, but they under-represent American Indian, Asian, and Pacific Islander racial groups. Tobacco use patterns also differ according to geographic region, gender, age, and socioeconomic level.[6, 17, 23]

From the *Monitoring the Future* study data, Johnston et al. described the trend in youth smoking prevalence over the past thirty years.[24] Youth smoking first peaked in 1976, when 39% of American youth reported smoking during the month prior to interview. The prevalence decreased annually to a low of about 30% in 1981. The

national proportion of youth smokers remained constant until 1992, but then rose again to a peak of 42% in 1996. At this time, a greater proportion of younger adolescents smoked than older adolescents, in contrast to earlier decades. During the late 1990s, through the turn of the millennium, youth smoking prevalence again began to steadily decrease and equalize among age groups. The smoking prevalence within birth cohorts has stayed constant throughout their lifetime, indicating the influence of temporal social factors on smoking behavior.[24] From 2003 to 2005, almost 60% of twelfth graders reported trying smoking, over 35% smoked during the month prior to interview, and about 20% smoked daily.[23, 25]

While the national prevalence of youth smoking is decreasing, certain youth sub-populations have increased tobacco use prevalence. Tobacco use among girls is increasing such that now an equal or greater proportion of girls smoke than boys.[26] Smoking among eighth and tenth graders of both genders is also increasing, while use among twelfth grade boys is decreasing.[13, 26] Finally, the proportion of youth who smoke frequently, at least twenty days a month, is linearly increasing.[8]

## I.iii RISK FACTORS FOR YOUTH SMOKING

Most of the existing research that investigates youth smoking behavior aims to determine the modifiable risk factors for smoking with the goal of reducing risk factor exposure. The risk factors considered in this research project are described below, in order of strength of association with youth smoking. Additional risk factors not evaluated in this analysis include tobacco advertising,[23, 27] parental smoking,[28-41] and parental attitudes about smoking.[7, 23, 25, 34, 36-40]

## a. Youth Tobacco and Alcohol Use History

A meta-analysis of existing cross-sectional and longitudinal studies, as well as a more recent longitudinal study, found that youth history of tobacco use was the most predictive risk factor of both current and future tobacco use among girls and boys.[32, 42] Greater frequency of smoking and quantity of cigarettes smoked is associated with greater risk of lifelong smoking.[13, 43] Youth who smoke daily are at the highest risk to become lifelong smokers; nevertheless, those who smoke less frequently are still at significant risk. It has been shown that smoking occasionally increases a youth's risk of being an adult smoker sixteen fold over youth who do not smoke.[13, 30, 43]

Youth alcohol use without parental permission also is associated with future initiation and progression of smoking.[7] In addition, youth who smoke regularly are at greater risk for alcohol and other drug use.[43] Such findings establish the bidirectional association between youth drinking and youth smoking.

## b. Peer Tobacco Use and Deviant Behaviors

Having peers who smoke or use other drugs is one of the most significant risk factors for youth smoking, nearly as strong as youth substance use history.[23, 32-34, 37-40, 42, 44] Youth participation in deviant or risky behaviors also increases the risk for smoking.[7, 23] Among a cohort of elementary and middle school youth, having peers who smoke was a sufficient risk factor for smoking initiation.[35] Both

initiation and progression of smoking are associated with having peers who smoke,[7, 25, 31, 43] for youth of all racial and ethnic groups.[33]

The association between having peers who smoke and smoking is bidirectional, such that youth with friends who smoke are at increased risk of smoking and youth who smoke choose friends who also smoke.[25] In addition, youth are at increased risk of initiating smoking simply from being around peers who smoke.[45] This finding suggests that direct pressure from friends is not necessary, rather that the broad social environment can be influential.

### c. Sibling Tobacco Use and Deviant Behaviors

Many studies representing diverse populations and methods report that having a parent or sibling who smokes significantly increases the risk for a youth to smoke.[31, 33, 34, 37-41] The positive association between youth smoking and having a sibling who smokes has not been as extensively studied as the association between parent and child smoking; nevertheless, the research shows a consistent association. Additionally, the influence of peer deviance on youth smoking is addressed more commonly than sibling deviance.

### d. Stress and Socioeconomic Status

Emotional stress increases a youth's risk for substance use in general, as well as tobacco use in particular.[34, 37-40, 46, 47] Youth report smoking when they are stressed or during stressful times, and nicotine can improve mood.[14, 23] Studies consistently report strong associations between depression or anxiety and youth

smoking.[14, 23] Nicotine also can focus concentration, thus, it is no surprise that youth with attention deficit and hyperactivity disorder and conduct disorder are at increased risk of smoking.[7, 14, 23]

In addition to internal stress, external stress is associated with youth smoking. Lower socioeconomic status, defined by lower income, less wealth, lower levels of education, and less prestigious occupations or occupation level, is a well-accepted risk factor for youth smoking and other drug use, though the strength of association varies among studies.[23, 48] Financial insecurity, discrimination, and other social stressors contribute to the stress associated with low socioeconomic status.[49]

**e. Gender**

The prevalence of smoking among girls and boys tends to be similar, though there is divergence in some racial and regional subpopulations,[23, 33] and these trends appear to be changing.[26] The *Monitoring the Future* study is showing that the prevalence of smoking among girls is beginning to overtake that among boys. Additionally, studies repeatedly show that girls and boys smoke for different reasons and are susceptible to disparate risk factors.[42, 50] For example, girls are more influenced by parental smoking, particularly maternal, than males; whereas males are more affected by socioeconomic status and concurrent deviant behaviors.[7, 25] Eating disorders and body image obsessions are significant smoking risk factors for girls.[23] In contrast, conduct disorder and aggression are important smoking risk factors for boys.[23] There are inconsistent findings on the

influence of depression between genders. Some report that both boys and girls are equally susceptible to smoke in response to a depressed mood,[12] whereas others find girls to be at a much higher risk.[23]

## f. Age

Studies report discrepant associations between age and risk for progression to regular smoking. Most accept that the younger a youth starts smoking, the greater the risk for continuing to smoke as an adult and to smoke more heavily.[6, 13] Also, smoking initiation at a younger age typically results in a longer exposure to cigarette toxins, thereby increasing the risk for premature disease.[13] However, Choi et al. report that older youth who experiment with smoking are more than twice as likely to progress to established smokers (at least 100 cig/lifetime) by the end of high school than younger experimenters.[51]

## II. TOBACCO USE AMONG AMERICAN INDIAN YOUTH

Throughout this document, American Indians, Alaska Natives, and mixed-race individuals who identify as American Indians are referred to collectively as American Indians.

Tobacco use in American Indian communities is a particularly complex issue because of the traditional and ceremonial importance of tobacco. As ceremonial tobacco use tends to be infrequent and minimal tobacco is inhaled, it likely confers no additional health risk. However, regular smoking contributes to the primary causes of all deaths and cancer deaths among American Indians: cardiovascular disease and lung cancer, respectively.[52] Additionally, smoking exacerbates other diseases, such as diabetes, that have exceptionally high prevalence among American Indians.[4] Youth, as well as adults, recognize the difference between ceremonial and non-ceremonial tobacco use.[37, 53]

### II.i AMERICAN INDIAN SPECIFIC PUBLIC HEALTH RESEARCH

Little is known about the factors that affect risky behaviors, including smoking, among American Indian youth.[34, 53] American Indians are often excluded from national studies due to the small size of their communities, though they have equal or greater health needs than other Americans.[19, 54, 55] One challenge in American Indian research is addressing the diversity of American Indian communities. Each tribe has its own history, traditions, and culture; thus, epidemiological findings from one community do not necessarily apply to other communities.

Despite the paucity of research and the diversity of study populations, studies examining the health status of American youth have shown that, in general, the health of

American Indian youth is persistently below the national average, as well as the average of other racial groups.[17, 20, 21, 26, 34, 54, 55] The majority of American Indian youth does not contend with significant health risk factors, such as inadequate nutrition, physical and sexual abuse, depression and anxiety, alcohol and drug use, suicidality, poor school performance, not wearing seatbelts, and being sexually active.[55] However, the minority with exposure to these risk factors is larger than that of youth from all other ethnic groups.[55, 56] In addition, many who are not struggling with risk factors still admit to feeling hopeless in general.[55] This finding emphasizes that general health and well-being may be more than the absence of risk factors for American Indians. American Indian youth are at greater risk to experience trauma or develop chronic disease from their risky behaviors than youth from other racial groups.[19, 40, 54, 55] They have higher rates of suicide, depression, anxiety, substance use, and school drop-out than the general US youth population.[55] The mortality rate for American Indian youth is twice the rate for any other racial group, and American Indian boys have three times the mortality rate of other racial groups.[19]

These results were derived primarily from studies investigating reservation and rural communities, and do not necessarily reflect the health behaviors and risks factors among urban American Indians. While, the majority (60-75%) of American Indians currently live in urban areas,[57, 58] urban American Indians are the least studied subpopulation of American Indians. American Indian youth living in urban communities are exposed to some of the same risk factors as adolescents living on reservations, for example parental, sibling, and peer substance abuse, peer pressure, low socioeconomic status, and ethnic dislocation.[34, 54, 56] Urban communities also contend with distinct

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stressors and have access to different resources than reservation communities. Urban areas are often distant from the sacred land that is vital to connect with in ceremony. Additionally, separation among families may strain extended family relationships, which are key supports.[56] These cultural stresses are compounded with other, general, urban stresses such as discrimination, crime, and increased cost of living. Urban American Indian youth may be more susceptible to risky behaviors than American Indian youth living on reservations.[59]

The cultural heterogeneity of urban American Indian communities, in comparison to reservation communities, complicates the interpretation of data among urban American Indians.[58, 59] Nevertheless, in order to address the drug use prevalence and health disparities, it is imperative to understand and confront the risk and protective factors significant for urban American Indian youth. As stated by Knopf, a former clinical supervisor at Fairbanks Regional Center for Alcohol and other Addictions, "We're not just talking about a generation at risk; we are talking about a race at risk."[54]

## II.ii EPIDEMIOLOGY OF AMERICAN INDIAN YOUTH SMOKING

Tobacco is the most common drug used by American Indian youth, after alcohol.[22, 54, 60] The prevalence of smoking among American Indian youth is higher than in any other American racial or ethnic group.[21, 52, 60] Over 70% of American Indian youth have smoked at least once by age 17, about 40% have smoked in the past month, and about 30% smoke daily.[20, 21, 60] In contrast to the national trend, the prevalence of tobacco use among American Indian youth did not decrease during the late 1990s.[17, 52] American Indian youth tend to begin experimenting with licit and illicit drugs at a younger age than

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non-Indian youth.[54, 55] However, while more American Indian youth smoke, they may not smoke as frequently or as heavily as youth of other races.[5, 55, 61] The difference in smoking prevalence and behaviors among races is likely due to interactions with social and cultural factors, including community norms, the cultural response to social stresses, and the distribution of risk factors.[23]

There are regional and tribal differences in tobacco use among American Indians. Tobacco use is a more accepted habit among American Indians living in the Pacific Northwest than in most other regions of the nation.[40] While disproportionately more American Indians smoke in Washington State, the majority of American Indian smokers smoke fewer cigarettes per day than the state average among all smokers.[61] In addition, the differences in smoking prevalence between American Indians living on reservations and in urban areas are dependent on the region studied. The BRFSS survey found that urban poor American Indian communities have a comparable or higher prevalence of risky behaviors, such as drug, alcohol, and tobacco use, and physical inactivity, than reservation communities.[62]

## II.iii FACTORS INFLUENCING AMERICAN INDIAN YOUTH SMOKING

The discrepancy in smoking prevalence between American Indian youth and youth of all other races likely is explained by a combination of both risk and protective factors.[3, 55, 56, 63-65] Despite the diversity among American Indians, they all share a history of colonization, displacement, forced assimilation, imposed governments, and compulsory boarding schools. The explicit aim of the colonization of American Indians was to destabilize the communities and undermine the health of individuals.[56] Currently,

American Indian communities contend with endemic unemployment, health disparities compared to individuals of other races, and an increasingly younger population.[5] Many tribes also share similar traditions and spiritual beliefs, particularly since colonization.[56] These commonalities are associated with risk and protective factors faced by American Indians exclusively. Cultural connectedness,[5, 54-56, 66-68] racial discrimination,[49, 56, 69] ethnic dislocation,[54] and historical trauma[56, 68] are all examples of culturally-specific factors that have been shown to influence substance abuse among American Indian youth. Additionally, some of the known risk factors may be more culturally significant for American Indians in comparison to youth of other races, resulting in the risk factors having more influence.[55, 56, 59, 70-73]

While previous studies have focused on risk factors, increasingly researchers are investigating factors that are associated with protecting youth against engaging in risky behaviors.[70, 74] These studies endeavor to reduce adolescent risky behaviors by increasing assets. Furthermore, a more complete understanding of the influences of youth behavior is gained through investigating protective as well as risk factors.

### a. Cultural Connectedness

Youth typically establish their ethnic identity during early adolescence, a time when they tend to struggle between valuing conformity and recognizing racial and cultural differences.[69] As identifying as American Indian may increase susceptibility to discrimination, American Indian youth may be particularly vulnerable to stress from negotiating connection with their culture while developing resiliency to the social risk factors associated with being American

Indian. American Indians are the only racial group in the United States still depicted by stereotyped images in mascots, team logos, and place names, contributing to the "overt institutional racism that pervades the life of American-Indian people."[49] Fear of discrimination alone has been linked with substance abuse by American Indians.[56] Whitbeck et al. cite substance use, as well as triggers for substance abuse such as decreased self-esteem, depression, suicide, academic difficulties, anger, deviant behavior, and conduct disorder, as some of the internalizing and externalizing symptoms that adolescents of minority races express in response to discrimination.[69]

Although discrimination associated with identifying as American Indian may increase the risk for substance abuse, American Indian culture provides assets such as religion, spirituality, traditionalism, ethnic identity, and family relationship that can influence substance use among American Indians.[49, 56, 66, 69] Ethnic dislocation, the separation from one's cultural identity, is among the most strongly associated risk factors for American Indian youth smoking.[54]

Enculturation, the knowledge of and identification with one's cultural background, has been shown to be protective against risky behaviors globally, as well as drug use in particular, among American Indian adolescents and adults, women and men.[5, 56, 66, 68] A study modeling enculturation among American Indian youth living on Upper Midwest reservations found that it explains about 30% of the variance in school grades and positive school attitudes, after adjusting for established risk factors such as age, gender, and parental characteristics.[66]

Family support is an aspect of American Indian culture as specific and important as enculturation.[55, 56, 59] American Indian families traditionally are not centered on the nuclear family. Instead, they are inclusive of and dependent upon the extended family, as well as other tribal members and adult role models.[55, 56] Families often influence individual wellness, engender resiliency to cope with historical and contemporary stress, and are frequently the primary social group.[56] Youth, in general, are predominantly dependent on their family. American Indian youth with extended family members living in different cities may experience less family support. This, along with differences in the racial, economic, and community environment, may contribute to urban American Indian adolescents adopting different coping mechanisms for dealing with discrimination than adolescents living on reservations.[69]

Connection with one's culture has been described by many different terms and criteria. Markers of both enculturation and family support often describe cultural connectedness for American Indians.

The influence of cultural connectedness on risky behaviors specifically among urban American Indian youth is largely unknown. All the studies that report protective effects of enculturation are derived from reservation communities. Cultural connectedness may have different implications for urban American Indian youth than for youth who live on reservations.[58] Walters et al. found an ostensibly contradictory relationship between enculturation and identification as American Indian among some urban American Indian adults.[56] Engagement in cultural rituals coexisted with negative attitudes about oneself and

American Indians in general. Also, strong racial identity was not strongly related to acculturation, or adjustment within the dominant culture. These findings reveal the complexity of cultural connectedness for American Indians, suggesting that strong cultural participation or identification do not necessarily facilitate bicultural competence. Bicultural competence is defined as the ability to integrate tribal values with general American society values and to feel comfortable existing in two cultures. In addition to enculturation, bicultural competence places youth at lower risk for using drugs.[54, 55, 67]

## b. Culturally-Specific Response to Known Risk Factors

In addition to culturally-specific factors, American Indian youth smoke in response to the same factors as all youth.[54-56] Concurrent alcohol use,[75] stress, socioeconomic status, parental or adult mentor substance abuse, and familial support have been shown specifically to influence smoking among American Indian youth, as well as youth of others races.[5]

Some of the known factors that influence behavior among youth of all races may be expressed in culturally-specific ways or be particularly significant for American Indian youth. For example, there are cultural differences in parenting styles that influence the risk for youth drug use.[71-73] Youth who do not believe their parents will punish them or who believe that their parents do not disapprove of tobacco use have higher incidence of smoking.[23, 34, 37-40] A study of youth predominately from urban centers in Minnesota found that American Indian youth were almost twice as likely to report that their parents rarely followed

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through with disciplining as White or Black youth.[59] They also report that more American Indian youth than youth of other races state that their parents do not have many rules. Among youth of all races, positive relationships between adolescents and their parents are associated with lower youth smoking rates;[25] whereas, low family connection and high family conflict are associated with both youth onset of smoking and rapid progression to regular smoking, independent of parental tobacco use.[7, 23, 25]

For American Indian youth, both familial bonds and supportive relationships with other adults are among the most influential assets for overall youth thriving.[55, 56, 59, 70] The absence of familial support is a more robust predictor of antisocial behavior for American Indian youth than for youth of other ethnic groups.[70] Therefore, cohesive family dynamics may be a particularly strong protective factor for American Indian youth.

# SPECIFIC AIMS

The aim of this analysis was to describe how cultural connectedness among a cohort of urban American Indian youth was associated with current and future regular smoking behavior.

For this analysis, cultural connectedness was described by family dynamics and cultural involvement variables in order to capture both the family and ethnic components that are integral to American Indian culture.[49, 54-56, 59, 66, 69] The two markers of family dynamics were youth perception of family cohesion and family conflict. The two markers of cultural involvement were participation in American Indian cultural rituals and telling others you are American Indian. Each of the four markers of cultural connectedness were modeled independently with regular smoking behavior to describe their individual effect and strength of association. All markers were hypothesized to protect against regular smoking, based on the literature.

This analysis utilized data from a prospective cohort study, allowing investigation of cultural connectedness as related to both current and future smoking behavior. This analysis investigated known smoking risk factors as potential confounders of the relationship between cultural connectedness and regular smoking, as well as included significant risk factors in the regression models. Because prevalence of reported enculturation[66] and smoking[26] differs between American Indian girls and boys, this analysis also evaluated effect modification by gender.

## RESEARCH QUESTIONS

1. Is cultural connectedness associated with *cross-sectional* status as a regular smoker during early, middle, and late adolescence?

2. Among youth who smoke regularly, does cultural connectedness affect the *cross-sectional* quantity and frequency of cigarette use?

3. Is cultural connectedness during *early* adolescence associated with smoking regularly during *late* adolescence?

4. Among youth who smoke regularly during late adolescence, does cultural connectedness during *early* adolescence influence the quantity of cigarettes smoked and frequency of smoking during *late* adolescence?

5. Does gender modify the association between *early* adolescence cultural connectedness and *late* adolescence smoking behavior?

## HYPOTHESES

1. Cohesive family dynamics, defined as perception of high family cohesion and low family conflict, protects against regular smoking and is associated with fewer cigarettes smoked and less frequent smoking, both cross-sectionally and prospectively.

2. Strong cultural involvement, defined as consistent self-identification as American Indian and youth participation in multiple culturally-specific American

Indian rituals, protects against regular smoking and is associated with fewer cigarettes smoked and less frequent smoking, both cross-sectionally and prospectively.

3. Gender interacts with cultural connectedness to modify its association with future regular smoking such that girls with high cultural connectedness are the least likely of all youth to be regular smokers.

## METHODS

### III. STUDY DESIGN AND DATA SOURCE

This research evaluated the association between cultural connectedness and both cross-sectional and prospective smoking behavior among a cohort of urban American Indian youth. This was a secondary analysis using data from a prospective longitudinal cohort study investigating substance use and abuse among a sample of urban American Indian youth, conducted by Dr. R. Dale Walker and Dr. Patricia Silk-Walker.[76] The complete set of survey instruments used in the original study is published elsewhere.[58]

The original cohort study[76] followed a cohort of Seattle-area American Indian youth and their primary caretakers for nine years. Demographic information, health behaviors, protective and risk factors for health and behavior outcomes, and substance use was collected through a self-report survey. Data were collected annually between 1988 and 1997.

The survey was a collection of assessment instruments that were culturally appropriate and reliable for an American Indian cohort.[58] A trained interviewer administered each survey one-on-one, at the research office, occasionally in homes, or over the phone if an in-person interview could not be arranged. Telephone interviews have been shown to generate similar information as face-to-face interviews when comparing two similar groups of adolescents.[77] Sixty percent of the interviewers were American Indian. Different interviewers interviewed participants at each time point in order to reduce potential information collection bias. The survey took approximately two and a half hours to complete. Study participants were reimbursed for their involvement, an average of $35 per caretaker, $35 per youth, and $5 for travel expenses for each interview. Finally, the information from the surveys was de-identified to ensure the confidentiality of subjects.

## IV. SOURCE POPULATION

Study participants were recruited from fifth and sixth grade rosters of the two school districts within the Seattle-area public school system that had the greatest number of American Indian students.[58] In addition to enrollment in the fifth or sixth grade, all study participants were required to have Indian Student Certification, validated by a completed HEW form 508 on file at the school. Indian race was verified with additional tribal membership information. Any students more than two years older than the mean age of their grade, with major cognitive or sensory deficits, or who participated in the pilot study were restricted from study participation. In order to minimize the age

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difference within the cohort, surveys were administered in the fall to the participants in the higher grade and in the following spring to the participants in lower grade.

Two hundred and twenty-four youth agreed to participate, representing 65% of the total eligible youth. Over 94% of the cohort participated in each of the first eight surveys administered and 90% in the final survey. Participants credit their continued involvement to the respectful and trusting interactions with the research staff, the long-term relationship, and confidence that the research would contribute to the Indian community.[58]

The youth came from more than 50 tribes and had lived in Seattle for an average of 9.2 years. Fewer than 15% of the youth participants, but more than 50% of their primary caretakers, had ever lived on a reservation or in a predominantly American Indian community. Both parents were American Indian for 43.3% of youth, 31.4% of youth had at least 50% Indian blood quanta, 28.7% with one quarter to one half Indian blood quanta, and 36.3% with less than one quarter blood quanta. One third of youth lived with both of their parents, one third with only their biologic mother, 15% with one biologic parent and one step-parent, 13% with extend family or an unrelated caretaker, and 6% with only their biologic father.[58] The mean annual family income of the cohort was $22,697, with 30.4% earning below the poverty line.

## V. DATA MANAGEMENT

The dataset consisted of data from nine time points representing each annual survey. For this analysis, the nine points were collapsed into the three developmental periods of adolescence:[1] early, middle, and late adolescence. Collapsing the data over the

developmentally relevant periods of adolescence smoothed out potential fluctuations in interview responses associated with adolescence being a time of experimentation and social exploration.[20]

Early adolescence tends to be between ages ten and thirteen years and is characterized by concrete thinking, self consciousness, and the early stages of seeking independence. Middle adolescence, between about fourteen and sixteen years old, is defined by increasingly abstract thinking, reduced emphasis on peer groups, increasing sexuality, and more demanding of independence. Late adolescence, which spans seventeen to twenty years of age, typically includes the stabilization of self-image, idealistic thinking and future planning, intimate relationships, and independence.[2] For this analysis, early adolescence corresponded to the first three interviews, middle adolescence to the second three interviews, and late adolescence to the final three interviews.

## VI. INCLUSION CRITERIA, EXCLUSION CRITERIA, AND MISSING DATA

All 224 youth from the original dataset were eligible for inclusion into both the cross-sectional and prospective analysis. Youth missing cultural connectedness data from all three time points during the early adolescence period (n = 3) or smoking behavior data from all three time points in the late adolescence period (n = 5) were excluded from the analysis dataset. Therefore, the cohort for these analyses was consisted of 216 participants. Youth missing all cultural connectedness data from middle adolescence (n = 1) and late adolescence (n = 2) were excluded from only the respective cross-sectional analyses. No additional youth were missing smoking behavior data from the early or

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middle adolescence periods. Youth missing all covariate data for any of the adolescence periods were excluded from only the relevant adjusted analyses (**Figure 1**). The adolescence period values were averages of the time point data present.

**Figure 1**: MISSING DATA

| N = 216 | EARLY ADOLESCENCE CROSS-SECTION | MIDDLE ADOLESCENCE CROSS-SECTION | LATE ADOLESCENCE CROSS-SECTION | PROSPECTIVE ANALYSIS |
|---|---|---|---|---|
| Crude Analysis | 216 | 215 | 214 | 216 |
| Adjusted Analysis | 208 | 205 | 191 | 208 |
| Missing Cultural Connectedness | 0 | 1 | 2 | 0 |
| Missing Regular Smoking Status | 0 | 0 | 0 | 0 |
| Missing Covariates | 8 | 10 | 23 | 8 |

## VII. STUDY VARIABLES

### VII.i EXPOSURE VARIABLES: CULTURAL CONNECTEDNESS

Four scales were used to measure cultural connectedness for this analysis, two described family dynamics and two described cultural involvement. Family dynamics was composed of youth self-report scores on the family cohesion and family conflict scales of the Moos Family Relationship Index.[78] Cultural involvement was composed of youth self-report scores of participation in American Indian cultural rituals[76] and youth self-identification as American Indian.[79, 80]

The markers of cultural connectedness were dichotomized into high cultural connectedness and lower or no cultural connectedness in this analysis, based on the

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assumption that a minimum threshold would be protective.[74] Given that no prior studies establish threshold levels of these four markers of cultural connectedness, quartiles were chosen as the threshold value of high cultural connectedness. The quartile values were derived from the average score of the three surveys constituting the adolescent period. Perception of family cohesion, participation in American Indian cultural rituals, and self-identification as American Indian were dichotomized at their upper quartiles of response, representing high connectedness. Perception of family conflict was dichotomized at its lower quartile of response, corresponding to low disconnectedness. Therefore, low family cohesion, low ritual participation, and infrequent Indian self-identification consisted of the lower three quartiles of values, and high family conflict consisted of the upper three quartiles of values.

### a. Family Dynamics

The two markers for family dynamics were youth perception of family cohesion and of family conflict (**Figure 2**). The instruments for both were developed by R. Moos and B. Moos[76] and validated by Silk Walker.[81] The average Cronbach alpha reliability coefficient for the family cohesion scale across all time periods was 0.77 (individual time period range: 0.66 to 0.82), and 0.70 for the family conflict scale (individual time period range: 0.60 to 0.77). The lowest alpha reliabilities occurred at the first time point when the instrument wording was higher than the youth's reading level. Each scale consisted of nine true/false questions pertaining to the family relationship. Items were coded as 0 for low family cohesion or conflict and 1 for high cohesion or high conflict; then summed

to create scale scores. The cut-points for the upper quartiles defining high family cohesion and the lower quartiles defining low family conflict were tabulated in the appendix (**Table A 2**).

**Figure 2**: MOOS FAMILY RELATIONSHIPS SCALES

| Family Cohesion | Family Conflict |
|---|---|
| 1. Family members really help and support one another | 1. We fight a lot in our family |
| 2. We often seem to be killing time at home | 2. Family members rarely become openly angry |
| 3. We put lot of energy into what we do at home | 3. Family members sometimes get so angry they throw things |
| 4. There is a feeling of togetherness in our family | 4. Family members hardly ever lose their tempers |
| 5. We rarely volunteer when something has to be done at home | 5. Family members often criticize each other |
| 6. Family members really back each other up | 6. Family members sometimes hit each other |
| 7. There is very little group spirit in our family | 7. If there is disagreement in our family, we try hard to smooth things over and keep the peace |
| 8. We really get along well with each other | 8. Family members often try to one-up or out-do each other |
| 9. There is plenty of time and attention for everyone | 9. In our family, we believe you don't ever get anywhere by raising your voice |

### b. American Indian Cultural Involvement

The two markers of American Indian cultural involvement were the number of traditional American Indian cultural rituals in which the youth participate and whether the youth self-identify as American Indian. The cultural rituals scale was developed by Walker, Cohen, and Silk Walker and was validated

by Silk Walker.[76] The self-identification as American Indian scale was developed by Oetting and Beauvais[79, 80] and validated by Silk Walker.[76]

The number of American Indian cultural rituals that the youth participated in was determined by assessing involvement in twelve specified rituals and a thirteenth open-ended category during the year prior to interview. The average Cronbach's alpha reliability coefficient of the scale across time points was 0.81. The twelve traditional customs queried were: having eaten or prepared traditional foods; gathered food by fishing, hunting, clamming, trapping, herding, berry picking, plant gathering, etc.; used Indian healing or doctoring; learned Indian language; learned about "Indian ways"; taken part in activities that help other Indians; attended potlatches, pow-wows, or give-aways; attended Indian religious ceremonies; made traditional arts and crafts; participated in Indian games; involved with canoe club, canoe building, or pulling; and taken part in traditional drumming, singing, and dancing. The upper quartiles defining high ritual participation during early, middle, and late adolescence were tabulated in the appendix (**Table A 2**).

Youth self-identification as American Indian was determined by the question: "*Do you tell other people that you are Indian?*" The four response choices and their corresponding numerical value were: never (0); only when asked (1); sometimes, even when not asked (2); or often, even when not asked (3). The upper quartile values defining regularly telling others you are American Indian were tabulated in the appendix (**Table A 2**).

This single question of self-identification as American Indian provided a limited measure of cultural identification; however, it was the only marker of cultural identification in the dataset during all adolescent periods. A cultural identification instrument was added to the original survey in 1991, during the middle adolescence period of this analysis. This instrument, also developed by Oetting and Beauvais, consisted of seven questions about cultural identification (See **Figure A 1** in the appendix for full instrument).[76] The Cronbach's alpha reliability coefficient of the American Indian identification scale was 0.89.

The cultural identification instrument was used to assess the validity of the single question that was used in this analysis. The mean values of the cultural identification scale score were calculated for the middle and late adolescence periods among those who regularly self-identify as American Indian and those who do not regularly self-identify as American Indian. T-tests were used to analyze the equality of mean values. The mean cultural identification scale values were found to be significantly higher in the regularly tells others you are American Indian groups for both middle ($p = 0.015$) and late ($p = 0.005$) adolescences periods. These findings support that the single question of telling others you are American Indian is a discriminating measure of American Indian identification.

## VII.ii OUTCOME VARIABLES: REGULAR SMOKING STATUS AND REGULAR SMOKING AMOUNT

The primary outcome of interest for this analysis was status as a regular smoker. Three additional variables described the quantity and frequency of smoking among regular smokers. Status as a regular smoker was chosen as the smoking outcome because it described youth at high risk to become life-long smokers and was the measure used in the 1994 Surgeon General report, *Preventing Tobacco Use among Young People*, as well as in much of the current literature.[6, 8, 10, 23, 82, 83] A regular smoker was defined as reporting having smoked at least once during the thirty days prior to interview. The assumption made was that youth who smoked within the past thirty days were likely to have smoked consistently throughout the past year and were more likely to continue smoking in the future than youth who smoked less frequently.[13, 43] The goal for our study was to identify how cultural connectedness influences regular smoking versus experimentation with or abstinence from smoking.

The quantity and frequency of smoking among the regular smokers were included in the analysis as secondary outcomes. The number of days regular smokers smoked during the thirty days prior to interview was recorded during all adolescence periods and the number of cigarettes regular smokers smoked per day was collected during the middle and late adolescence periods. The total number of cigarettes smoked during the thirty days prior to interview was calculated for the late adolescence period to represent the combined effect of quantity and frequency, which is known to further increase risk for becoming a life-long smoker.[54, 58] The outcomes for all three smoking amount variables

were maintained as continuous variables and were the averages of the three adolescence period time point values.

### VII.iii  Covariates: Known Risk Factors

Directed by prior research, ten risk factors were evaluated as potential confounders of the relationship between cultural connectedness and regular smoking behavior. These risk factors were described in detail in the background section. Three risk factors were continuous variables: age at enrollment in the study, the number of deviant behaviors in which the youth's peers engaged, and the number of deviant behaviors in which the youth's siblings engaged. The adolescence period values for these variables were the average of the values from the three time points. Seven of the risk factors were dichotomous variables. These were gender, history of smoking regularly during early adolescence, history of binge drinking, having at least one peer who smoked, having at least one sibling who smoked, significant psychological distress, and family welfare status. Dichotomous variables were collapsed across adolescence periods according to status as "ever" versus "never." "Ever" indicated exposure to the risk factor at least once during the adolescence period and "never" signified the variable never being present at any time point.

Binging was defined as having at least five alcoholic drinks in one sitting. Binging on alcohol has been shown to be strongly associated with regular smoking behavior.[43] The marker variable for significant psychological distress was a composite score of both internalizing and externalizing behaviors as reported by primary caretakers on the Achenbach Child Behavior Checklist.[76] This scale was validated for use in this

cohort by Silk Walker.[81] Higher scale scores indicated greater stress. The scale score was dichotomized at 60, the cut-point predictive for referral to counseling.[81] Family welfare status indicated whether the family received welfare during the year prior to interview and served as a proxy for family economic status. Peer and sibling cigarette use was recorded with respect to legality; therefore, peers and siblings who were of legal age to smoke were not included in this measure. Peer and sibling engagement in deviant behaviors was ascertained in a six-item scale developed by Oetting and Beauvais[76] and found reliable for use in this cohort by Silk Walker.[81] The deviant behaviors included in the scale were cigarette smoking; alcohol consumption without permission by parents; being in serious trouble with teachers; suspension from school; marijuana or other drug use; and illegal behavior within the police's jurisdiction, like stealing, selling drugs, or vandalism. The peer and sibling deviant behavior scores for each time point were averaged into adolescence period scores and the variable was analyzed as a continuous variable.

Because the deviant behavior variables contained questions of whether siblings and peers smoked, there was potential for collinearity with the sibling and peer smoking variables. Individual modeling of the effect of each covariate on the association between cultural connectedness and regular smoking addressed collinearity. The peer covariate (either smoking or deviant behavior) and sibling covariate (either smoking or deviant behavior) with the strongest association to regular smoking was used in the final model building.

**Figure 3**: VARIABLES FOR STUDY OF CULTURAL CONNECTEDNESS AND REGULAR SMOKING AMONG COHORT OF URBAN AMERICAN INDIAN YOUTH

| REGULAR SMOKING BEHAVIOR (DEPENDENT VARIABLES) | CULTURAL CONNECTEDNESS (INDEPENDENT VARIABLES) | KNOWN RISK FACTORS (COVARIATES) |
|---|---|---|
| 1. Status as Regular Smoker: Smoked at least once during the 30 days prior to interview during adolescence period<br><br>2. Average Quantity and Frequency of Smoking Among Regular Smokers<br> a. Average # Cigs per day smoked during the 30 days prior to interview during adolescence period<br> b. Average # Days smoked during the 30 days prior to interview during adolescence period<br> c. Average Total # cigarettes smoked during the 30 days prior to interview during late adolescence | 1. Family Dynamics<br> a. Perception of Family Cohesion<br> b. Perception of Family Conflict<br><br>2. Cultural Involvement<br> a. Participation in American Indian Cultural Rituals<br> b. Self-Identification as American Indian | 1. Age at entry into study<br>2. Gender<br>3. Smoking History Regular smoker during early adolescence<br>4. Alcohol Use History Binged during year prior to interview<br>5. Peers Smoke<br>6. Siblings Smoke<br>7. Peer Deviant Behaviors<br>8. Sibling Deviant Behaviors<br>9. Significant Psychological Distress<br>10. Family Welfare Status |

## VIII. STATISTICAL ANALYSIS

Four sets of analyses, all following a similar approach, were conducted to determine the cross-sectional and prospective associations between cultural connectedness and regular smoking. For the cross-sectional analyses, the associations among cultural connectedness, smoking covariates, and regular smoking were determined for the early, middle, and late adolescence periods. For the prospective analysis, the association among early adolescence cultural connectedness, early adolescence covariate exposure, and late adolescence regular smoking was determined. The four cultural connectedness markers were modeled in separate regression models for the cross-sectional and prospective analyses. Statistical analyses were performed with SPSS v14 software.

### VIII.i DESCRIPTIVE STATISTICS

The frequencies of the dichotomous variables and mean values with standard deviations of the continuous variables were calculated. Histograms displayed the range of quantity and frequency of cigarette use among regular smokers. Crude odds ratios were calculated with two-by-two contingency tables to measure the associations between regular smoking, cultural connectedness, and the dichotomous covariates for descriptive purposes. Chi-squared tests determined the statistical significance of the odds ratios in contingency tables with cell sizes all greater than five. Fisher's exact tests were used for tables with cell sizes five or less. Two sample t-tests were performed to describe the difference in mean values of the continuous outcome and covariate variables between cultural connectedness, regular smoking status, and gender groups. Throughout this

analysis, p-values <0.05 indicated statistical significance and p-values <0.10 indicated

marginal significance.

### VIII.ii REGRESSION ANALYSIS

Logistic regression analysis modeled the association between cultural

connectedness and status as a regular smoker. Linear regression analysis modeled the

association between cultural connectedness and amount of smoking among regular

smokers. Each cultural connectedness marker: family cohesion, family conflict, ritual

participation, and telling others you are American Indian, was modeled individually.

Known smoking risk factors were assessed for statistical significance in this cohort.

Additionally, these risk factors were evaluated as individual confounders of the

association between cultural connectedness and regular smoking. Confounding by a

single covariate was determined by comparing the odds ratio point estimate of the

univariate association between cultural connectedness and regular smoking outcomes

with the odds ratio of the bivariate association after addition of the covariate to the

model. An adjusted odds ratio point estimate that shifted more than 15% from the crude

estimate indicated confounding.[84] Also, the odds ratios of the final multivariate models

were compared with the odds ratios of the univariate associations between cultural

connectedness and regular smoking to evaluate the confounding effect of the set of

individual confounders and risk factors.

Final, parsimonious regression models for both the logistic and linear regression

models were achieved using backwards selection model building. These models

contained all confounders and only the risk factors that remained statistically significant

in the presence of other significant risk factors. To build the models, all covariates were included in the initial regression model. Covariates with Wald statistic p-values >0.10 that were not confounders were removed incrementally in order of those with the highest p-values. Wald statistic p-values of the remaining independent variables were reexamined after each exclusion.

The final regression models additionally were stratified by gender in order to evaluate for effect modification by qualitatively comparing the odds ratios of the gender-specific strata. A consistent gender difference in the association between cultural connectedness and the regular smoking outcomes would suggest that gender may be an effect modifier. The small sample size limited formal evaluation of effect modification.

Linear regression model assumptions were assessed with normality P-P plots to determine need for variable transformation and scatter plots of the residual values to assess the linearity of the association between the exposure and outcome variables as well as if the error terms displayed constant variance. The coefficient of partial determination, $r^2$, was determined in the final linear regression models.

# RESULTS

## IX. DESCRIPTIVES

### IX.i DEMOGRAPHICS

Eight subjects, three girls and five boys, were excluded from the dataset due to missing cultural connectedness data during the early adolescence period (n = 3) or missing smoking behavior data during the late adolescence period (n = 5). Compared to youth maintained in the study population, excluded youth, on average, were older, more had significant distress, more binged on alcohol and smoked regularly during early adolescence, and their peers engaged in slightly more deviant behaviors (See **Table A 1** in the appendix).

The baseline demographics of the cohort, as well as regular smoking behavior outcomes during early and late adolescence were summarized below and tabulated in **Table 1**. The data were presented for the cohort as a whole as well as separately for girls and boys to evaluate for a significant gender difference in exposure prevalence.

The final cohort of 216 for this analysis consisted of 110 girls (mean age = 11.6yrs, SD = 0.5yrs), and 106 boys (mean age = 11.7yrs, SD = 0.7yrs). While 20.4% of the youth smoked regularly during early adolescence, 66.2% were regular smokers during late adolescence. Those who were regular smokers during early adolescence smoked about 3.3 cigarettes per day (standard deviation 5.1 cigarettes), but those who were regular smokers during late adolescence smoked an average of 7.2 cigarettes per day (standard deviation 7.0 cigarettes) and 19.2 days per thirty days (standard deviation 10.3

days). For this population, 87% of the 161 youth who reported smoking within the past thirty days on one survey reported smoking within the past thirty days on subsequent surveys. Of the twenty-one youth who only reported smoking regularly on one survey, 19% reported smoking regularly for the first time on the last survey. Other than having peers who smoke, a risk factor with a prevalence of 83.3% in this population, a minority of youth reported experiencing the smoking behavior risk factors. The prevalence of the other risk factors ranged between 18.1% for having binged on alcohol, to 38.0% for having received welfare. Statistically significant gender differences were that 14.4% more girls reported regularly telling others they are American Indian during early adolescence than boys ($p = 0.026$), 10.8% more boys smoked regularly during late adolescence than girls ($p = 0.094$), and boys who regularly smoked as late adolescents smoked more than girls (mean difference = 3.3 more cigarettes per day, $p = 0.005$, 96.2 more cigarettes per thirty days, $p = 0.007$).

**Table 1**: FREQUENCY AND GENDER DIFFERENCES FOR EARLY ADOLESCENCE CULTURAL CONNECTEDNESS MARKERS AND COVARIATES AND LATE ADOLESCENCE REGULAR SMOKING BEHAVIOR

| | TOTAL | GIRLS | BOYS | SIGNIFICANCE* |
|---|---|---|---|---|
| Gender | ($n_{TOTAL}$ = 216) | 50.9% (n=110) | 49.1% (n=106) | |
| Age at Enrollment Mean (std dev) | 11.7yrs (0.6) | 11.6yrs (0.5) | 11.7yrs (0.7) | $p = 0.218$ |
| **Early Adolescence ▼** | | | | |
| Family Cohesion High: Low: | 26.4% (n=57) 73.6% (n=159) | 30.9% (n=34) 69.1% (n=76) | 21.7% (n=23) 78.3% (n=83) | $p = 0.125$ |
| Family Conflict Low: High: | 26.4% (n=57) 73.6% (n=159) | 28.2% (n=31) 71.8 (n=79) | 24.5% (n=26) 75.5% (n=80) | $p = 0.542$ |
| Tell Others you are American Indian Regularly: Not Regularly: | 34.7% (n=75) 65.3% (n=141) | 41.8% (n=46) 58.2% (n=64) | 27.4% (n=29) 72.6% (n=77) | $\boldsymbol{p = 0.026}$ |
| Ritual Participation High: Low: | 24.1% (n=52) 75.9% (n=164) | 25.5% (n=28) 74.5% (n=82) | 22.6% (n=24) 77.4% (n=82) | $p = 0.629$ |
| Regular Smoker Yes: No: | 20.4% (n=44) 79.6% (n=172) | 21.8% (n=24) 78.2% (n=86) | 18.9% (n=20) 81.1% (n=86) | $p = 0.590$ |
| Cigs/Day Mean # (std dev) | 3.3cigs (5.1) | 3.4cigs (6.5) | 3.2cigs (2.8) | $p = 0.900$ |
| Binged Yes: No: | 18.1% (n=39) 81.9% (n=177) | 15.5% (n=17) 84.5% (n=93) | 20.8% (n=22) 79.2% (n=84) | $p = 0.311$ |
| Significant Distress Yes: No: | 25.0% (n=54) 75.0% (n=162) | 28.2% (n=31) 71.8% (n=79) | 21.7% (n=23) 78.3% (n=83) | $p = 0.271$ |
| Family Received Welfare Yes: No: | 38.0% (n=82) 62.0% (n=134) | 38.2% (n=42) 61.8% (n=68) | 37.7% (n=40) 62.3% (n=66) | $p = 0.946$ |

**Table 1 (continued):** FREQUENCY AND GENDER DIFFERENCES FOR EARLY ADOLESCENCE CULTURAL CONNECTEDNESS MARKERS AND COVARIATES AND LATE ADOLESCENCE REGULAR SMOKING BEHAVIOR

| | TOTAL | GIRLS | BOYS | SIGNIFICANCE* |
|---|---|---|---|---|
| Peers Smoke | | | | |
| Yes: | 83.3% (n=180) | 82.7% (n=91) | 84.0% (n=89) | |
| No: | 14.4% (n=31) | 15.5% (n=17) | 13.2% (n=14) | $p = 0.659$ |
| Siblings Smoke | | | | |
| Yes: | 23.1% (n=50) | 19.1% (n=21) | 27.4% (n=29) | |
| No: | 75.5% (n=163) | 80.0% (n=88) | 70.8% (n=75) | $p = 0.138$ |
| Peer Deviant Behaviors | | | | |
| Mean (std dev) | 1.9 behav. (1.5) | 1.8 behav. (1.6) | 1.9 behav. (1.5) | $p = 0.622$ |
| Sibling Deviant Behaviors | | | | |
| Mean (std dev) | 1.1 behav. (1.4) | 1.2 behav. (1.4) | 1.0 behav. (1.3) | $p = 0.377$ |
| Late Adolescence ▼ | | | | |
| Regular Smoker | | | | |
| Yes: | 66.2% (n=143) | 60.9% (n=67) | 71.7% (n=76) | |
| No: | 33.8% (n=73) | 39.1% (n=43) | 28.3% (n=30) | **$p = 0.094$** |
| Cigs/Day | | | | |
| Mean (std dev) | 7.2cigs (7.0) | 5.4cigs (5.8) | 8.7cigs (7.7) | **$p = 0.005$** |
| Days Smoked/30d | | | | |
| Mean (std dev) | 19.2days (10.3) | 18.0days (10.1) | 20.2days (10.4) | $p = 0.213$ |
| Total # Cigs/30d | 185.0cigs | 133.9cigs | 230.1cigs | |
| Mean (std dev) | (217.3) | (173.3) | (242.0) | **$p = 0.007$** |

*: t-test for equality-of-means for continuous variables, $\chi^2$ for gender difference for dichotomous variables

During the late adolescence period, 143 of the 216 youth enrolled in the study were smoking regularly. The majority (88.6%) of the youth who began smoking regularly during early adolescence smoked regularly during late adolescence, and 79.7% of the youth who started smoking regularly during middle adolescence continued smoking regularly in late adolescence (**Table 2**). Of those youth who smoked regularly during late adolescence, 27.3% started smoking regularly during early adolescence and 44.1% started during middle adolescence.

**Table 2**: DURATION OF REGULAR SMOKING BY PERIOD OF ONSET

| (N LATE ADOLESCENCE REGULAR SMOKERS = 143)<br><br>ONSET OF REGULAR SMOKING ▼ | **SMOKED REGULARLY DURING LATE ADOLESCENCE** |
|---|---|
| **Early Adolescence**<br>**(N = 44)** | 88.6%<br>(n = 39) |
| **Middle Adolescence**<br>**(N = 79)** | 79.7%<br>(n = 63) |
| **Late Adolescence**<br>**(N = 41)** | 100%<br>(n = 41) |

## X. CROSS-SECTIONAL ANALYSIS

In crude association, high family cohesion was significantly associated with lower odds of being a regular smoker during early, middle, and late adolescence. During early adolescence, the odds of being a regular smoker among those with high family cohesion were almost 80% less than those with lower or no family cohesion (OR: 0.22, 95% CI: 0.08, 0.66). During middle and late adolescence, the odds of being a regular smoker among those with high family cohesion were over 50% less than those with lower or no family cohesion (middle adolescence OR: 0.47, 95% CI: 0.26, 0.86; late adolescence OR: 0.41, 95% CI: 0.23, 0.75) (**Table 3**). Among regular smokers, high family cohesion also was associated with smoking about three fewer cigarettes per day during early adolescence ($p = 0.005$) and about two fewer cigarettes during middle adolescence ($p = 0.016$). These findings supported the hypothesized association. In contrast, the odds of being a regular smoker among those with high ritual participation were over 100% greater than those with lower or no ritual participation during early and middle adolescence (early adolescence OR: 2.16, 95% CI: 1.05, 4.24; middle adolescence OR: 2.13, 95% CI: 1.14, 4.00) (**Table 4**). However, regular smokers with high ritual participation smoked over two fewer cigarettes during early and middle adolescence ($p = 0.032$ early adolescence, $p = 0.027$ middle adolescence) than regular smokers with lower or no ritual participation.

Low family conflict was protective against being a regular smoker during all three adolescence periods (early adolescence OR: 0.22, 95% CI: 0.08, 0.66; middle adolescence OR: 0.37, 95% CI: 0.20, 0.68; late adolescence OR: 0.56, 95% CI: 0.31, 1.00), but was not associated with the amount of smoking ($p > 0.436$ for all outcomes)

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(**Table 5**). Other than the number of cigarettes smoked per day during middle adolescence, telling others you are American Indian was not significantly associated with the regular smoking outcomes during any of the adolescence periods ($p > 0.224$ for all outcomes) (**Table 6**). Those who regularly told others they are American Indian smoked about two fewer cigarettes per day than those who did not regularly tell others they are American Indian ($p = 0.075$).

Cultural connectedness markers were not cross-sectionally associated with regular smoking after adjusting for significant confounders and smoking covariates (**Tables 3 through 6**). In addition to concurrent smoking covariates, the middle and late adolescence cross-sectional models were adjusted for early adolescence regular smoking status. Early adolescence regular smoking reduced the odds ratios of the middle adolescence cross-sectional associations between cultural connectedness and regular smoking by between about 15% and 20%, suggesting confounding. Additional significant covariates were included in the models. The covariates that were risk factors for smoking varied depending on the adolescence period.

**Table 3:** CROSS-SECTIONAL ASSOCIATION BETWEEN FAMILY COHESION AND REGULAR SMOKING BEHAVIOR

| n = sample number | High Family Cohesion | Low Family Cohesion |
|---|---|---|
| **Early Adolescence Regular Smoker** n = 44 | n = 4 | n = 40 |
| **Early Adolescence Not regular Smoker** n = 172 | n = 53 | n = 119 |
| Crude OR {95% CI} | **0.22 {0.08, 0.66}** | |
| Adjusted OR* {95% CI} | 0.67 {0.19, 2.32} | |
| **Middle Adolescence Regular Smoker** n = 117 | n = 25 | n = 92 |
| **Middle Adolescence Not regular Smoker** n = 98 | n = 36 | n = 62 |
| OR {95% CI} | **0.47 {0.26, 0.86}** | |
| Adjusted OR** {95% CI} | 0.60 {0.28, 1.30} | |
| **Late Adolescence Regular Smoker** n = 142 | n = 40 | n = 102 |
| **Late Adolescence Not regular Smoker** n = 72 | n = 35 | n = 37 |
| OR {95% CI} | **0.41 {0.23, 0.75}** | |
| Adjusted OR*** {95% CI} | 0.82 {0.39, 1.70} | |
| **Early Adolescence Cigs/Day** Mean (std dev) n = 44 | 0.75 (0.83) | 3.58 (5.27) |
| t-test p-value | ***p* = 0.005** | |
| **Middle Adolescence Cigs/Day** Mean (std dev) n = 117 | 2.69 (3.41) | 5.19 (7.18) |
| t-test p-value | ***p* = 0.016** | |
| **Middle Adolescence Days Smoked/Mo** Mean (std dev) n = 117 | 19.67 (12.72) | 17.24 (13.92) |
| t-test p-value | *p* = 0.422 | |
| **Late Adolescence Cigs/Day** Mean (std dev) n = 142 | 6.31 (6.50) | 7.48 (7.28) |
| t-test p-value | *p* = 0.353 | |
| **Late Adolescence Days Smoked/Mo** Mean (std dev) n = 142 | 18.70 (10.47) | 19.26 (10.22) |
| t-test p-value | *p* = 0.773 | |
| **Late Adolescence Total # Cigs/Mo** Mean (std dev) n = 142 | 158.29 (200.46) | 194.85 (224.58) |
| t-test p-value | *p* = 0.348 | |

Odds ratios with p-values < 0.05 indicated in bold

*: Adjusted for early adolescence age at entry into study, peer deviance, binging on alcohol, welfare status, and significant distress

**: Adjusted for middle adolescence peer deviance and binging on alcohol, and early adolescence regular smoking

***: Adjusted for late adolescence peer smoking, sibling smoking, binging on alcohol, and significant distress, and early adolescence regular smoking

**Table 4**: CROSS-SECTIONAL ASSOCIATION BETWEEN RITUAL PARTICIPATION AND REGULAR SMOKING BEHAVIOR

| n = sample number | High Ritual Participation | Low Ritual Participation |
|---|---|---|
| **Early Adolescence Regular Smoker** <br> n = 44 | n = 16 | n = 28 |
| **Early Adolescence Not regular Smoker** <br> n = 172 | n = 36 | n = 136 |
| OR {95% CI} | **2.16 {1.05, 4.24}** | |
| Adjusted OR* {95% CI} | 1.88 {0.70, 5.03} | |
| **Middle Adolescence Regular Smoker** <br> n = 118 | n = 40 | n = 78 |
| **Middle Adolescence Not regular Smoker** <br> n = 98 | n = 19 | n = 79 |
| OR {95% CI} | **2.13 {1.14, 4.00}** | |
| Adjusted OR** {95% CI} | 1.24 {0.56, 2.74} | |
| **Late Adolescence Regular Smoker** <br> n = 143 | n = 34 | n = 109 |
| **Late Adolescence Not regular Smoker** <br> n = 73 | n = 16 | n = 57 |
| OR {95% CI} | 1.11 {0.57, 2.18} | |
| Adjusted OR*** {95% CI} | 1.26 {0.55, 2.87} | |
| **Early Adolescence Cigs/Day** <br> Mean (std dev) <br> n = 44 | 1.54 (2.21) | 4.33 (5.96) |
| t-test p-value | **p = 0.032** | |
| **Middle Adolescence Cigs/Day** <br> Mean (std dev) <br> n = 118 | 3.18 (3.65) | 5.50 (7.62) |
| t-test p-value | **p = 0.027** | |
| **Middle Adolescence Days Smoked/Mo** <br> Mean (std dev) <br> n = 118 | 18.65 (13.25) | 17.49 (13.90) |
| t-test p-value | p = 0.667 | |
| **Late Adolescence Cigs/Day** <br> Mean (std dev) <br> n = 143 | 7.16 (7.36) | 7.16 (6.98) |
| t-test p-value | p = 0.998 | |
| **Late Adolescence Days Smoked/Mo** <br> Mean (std dev) <br> n = 143 | 20.70 (9.96) | 18.71 (10.35) |
| t-test p-value | p = 0.318 | |
| **Late Adolescence Total # Cigs/Mo** <br> Mean (std dev) <br> n = 143 | 186.30 (221.71) | 184.60 (216.91) |
| t-test p-value | p = 0.969 | |

Odds ratios with p-values < 0.05 indicated in bold

*: Adjusted for early adolescence age at entry into study, peer deviance, binging on alcohol, welfare status, and significant distress

**: Adjusted for middle adolescence peer deviance and binging on alcohol, and early adolescence regular smoking

***: Adjusted for late adolescence peer smoking, sibling smoking, binging on alcohol, and significant distress, and early adolescence regular smoking

**Table 5**: CROSS-SECTIONAL ASSOCIATION BETWEEN FAMILY CONFLICT AND CROSS-SECTIONAL REGULAR SMOKING STATUS

| n = sample number | Low Family Conflict | High Family Conflict |
|---|---|---|
| **Early Adolescence Regular Smoker** n = 44 | n = 4 | n = 40 |
| **Early Adolescence Not regular Smoker** n = 172 | n = 53 | n = 119 |
| OR {95% CI} | **0.22 {0.08, 0.66}** | |
| Adjusted OR* {95% CI} | 0.52 {0.15, 1.80} | |
| **Middle Adolescence Regular Smoker** n = 117 | n = 23 | n = 94 |
| **Middle Adolescence Not regular Smoker** n = 98 | n = 39 | n = 59 |
| OR {95% CI} | **0.37 {0.20, 0.68}** | |
| Adjusted OR** {95% CI} | 0.83 {0.38, 1.80} | |
| **Late Adolescence Regular Smoker** n = 142 | n = 42 | n = 100 |
| **Late Adolescence Not regular Smoker** n = 72 | n = 31 | n = 41 |
| OR {95% CI} | **0.56 {0.31, 1.00}** | |
| Adjusted OR*** {95% CI} | 0.88 {0.43, 1.81} | |
| **Early Adolescence Cigs/Day** Mean (std dev) n = 44 | 2.25 (2.96) | 3.43 (5.27) |
| t-test p-value | $p = 0.519$ | |
| **Middle Adolescence Cigs/Day** Mean (std dev) n = 117 | 3.87 (4.88) | 4.85 (6.99) |
| t-test p-value | $p = 0.436$ | |
| **Middle Adolescence Days Smoked/Mo** Mean (std dev) n = 117 | 17.74 (13.88) | 17.76 (13.68) |
| t-test p-value | $p = 0.995$ | |
| **Late Adolescence Cigs/Day** Mean (std dev) n = 142 | 7.25 (7.29) | 7.11 (7.01) |
| t-test p-value | $p = 0.912$ | |
| **Late Adolescence Days Smoked/Mo** Mean (std dev) n = 142 | 19.05 (9.75) | 19.13 (10.51) |
| t-test p-value | $p = 0.966$ | |
| **Late Adolescence Total # Cigs/Mo** Mean (std dev) n = 142 | 182.78 (228.66) | 185.29 (214.52) |
| t-test p-value | $p = 0.952$ | |

Odds ratios with p-values < 0.05 indicated in bold

*: Adjusted for early adolescence age at entry into study, peer deviance, binging on alcohol, welfare status, and significant distress

**: Adjusted for middle adolescence peer deviance and binging on alcohol, and early adolescence regular smoking

***: Adjusted for late adolescence peer smoking, sibling smoking, binging on alcohol, and significant distress, and early adolescence regular smoking

**Table 6**: CROSS-SECTIONAL ASSOCIATION BETWEEN TELL OTHERS YOU ARE AMERICAN INDIAN AND CROSS-SECTIONAL REGULAR SMOKING STATUS

| n = sample number | Regularly Tell Others you are American Indian | Do Not regularly Tell Others you are American Indian |
|---|---|---|
| Early Adolescence Regular Smoker n = 44 | n = 18 | n = 26 |
| Early Adolescence Not regular Smoker n = 172 | n = 57 | n = 115 |
| OR {95% CI} | 1.40 {0.71, 2.75} | |
| Adjusted OR* {95% CI} | 1.46 {0.60, 3.53} | |
| Middle Adolescence Regular Smoker n = 118 | n = 51 | n = 67 |
| Middle Adolescence Not regular Smoker n = 98 | n = 40 | n = 58 |
| OR {95% CI} | 1.10 {0.64, 1.90} | |
| Adjusted OR** {95% CI} | 1.11 {0.56, 2.21} | |
| Late Adolescence Regular Smoker n = 143 | n = 41 | n = 102 |
| Late Adolescence Not regular Smoker n = 73 | n = 14 | n = 59 |
| OR {95% CI} | 1.69 {0.85, 3.37} | |
| Adjusted OR*** {95% CI} | 1.65 {0.74, 3.71} | |
| Early Adolescence Cigs/Day Mean (std dev) n = 44 | 2.61 (2.40) | 3.81 (6.32) |
| t-test p-value | $p = 0.386$ | |
| Middle Adolescence Cigs/Day Mean (std dev) n = 118 | 3.54 (4.82) | 5.60 (7.63) |
| t-test p-value | $p = 0.075$ | |
| Middle Adolescence Days Smoked/Mo Mean (std dev) n = 118 | 18.88 (12.89) | 17.11 (14.22) |
| t-test p-value | $p = 0.487$ | |
| Late Adolescence Cigs/Day Mean (std dev) n = 143 | 7.49 (6.63) | 7.02 (7.23) |
| t-test p-value | $p = 0.711$ | |
| Late Adolescence Days Smoked/Mo Mean (std dev) n = 143 | 20.77 (10.05) | 18.54 (10.33) |
| t-test p-value | $p = 0.237$ | |
| Late Adolescence Total Cigs/Mo Mean (std dev) n = 143 | 198.99 (199.71) | 179.39 (224.65) |
| t-test p-value | $p = 0.610$ | |

Odds ratios with p-values < 0.05 indicated in bold

*: Adjusted for early adolescence age at entry into study, peer deviance, binging on alcohol, welfare status, and significant distress

**: Adjusted for middle adolescence peer deviance and binging on alcohol, and early adolescence regular smoking

***: Adjusted for late adolescence peer smoking, sibling smoking, binging on alcohol, and significant distress, and early adolescence regular smoking

## XI. PROSPECTIVE ANALYSIS

Consistent with expectation, early adolescence high family cohesion and low family conflict appeared protective against future regular smoking in crude association (family cohesion $p = 0.004$, family conflict $p = 0.061$) (**Tables 7** and **8**). Of the four cultural connectedness markers, only high family cohesion remained marginally protective against late adolescence regular smoking after adjusting for confounders and significant risk factors (adjusted $p = 0.092$) (**Table 7**). In contrast to expectation, early adolescence regularly telling others you are American Indian increased the risk of being a regular smoker during late adolescence (crude $p = 0.055$), although this association was not significant after adjusting for risk factors (adjusted $p = 0.234$) (**Table 9**). High ritual participation was not significantly associated with late adolescence regular smoking (crude $p = 0.229$, adjusted $p = 0.520$) (**Table 10**).

Ten early adolescence smoking covariates were considered as potential confounders of the associations between the early adolescence cultural connectedness markers and late adolescence regular smoking, as outlined in the methods. The univariate associations among the early adolescence cultural connectedness markers, early adolescence covariates, and late adolescence regular smoking outcomes, which helped to identify potential confounders, are fully described in the appendix (**Tables A 3** through **A 9**). One covariate, early adolescence regular smoking, confounded the prospective associations relating family cohesion (**Table 7**), family conflict (**Table 8**), and ritual participation with regular smoking (**Table 9**). None of the other nine covariates met criteria for confounding.

In addition, these ten covariates were assessed as risk factors for late adolescence regular smoking in this cohort. Only four early adolescence covariates, including early adolescence regular smoking, were significant risk factors for late adolescence regular smoking in the multivariate models. These four covariates, early adolescence regular smoking, having peers who smoke, having siblings who smoke, and receiving welfare, were the same in all four cultural connectedness models (**Tables 7** through **10**). The strength of the associations between the covariates and regular smoking was substantially stronger than the associations between the cultural connectedness markers and regular smoking in all of the models. Furthermore, the set of risk factors contributed to attenuating the prospective associations between the cultural connectedness markers and regular smoking to marginally significant (**Table 7**) or non-significant (**Tables 8** and **9**) associations.

### XI.i FAMILY COHESION

After adjusting for the confounder and risk factors, early adolescence family cohesion was associated with a 45% lower odds of smoking regularly during late adolescence in comparison to those with lower family cohesion (OR: 0.55, 95% CI: 0.27, 1.10) (**Table 7**). In univariate analysis, high family cohesion during early adolescence was associated with about a 60% lower odds of smoking regularly during late adolescence (OR: 0.41, 95% CI: 0.22, 0.76), a stronger association than the adjusted association.

Early adolescence regular smoking was the principal covariate that attenuated the univariate odds ratio of the association between early adolescence family cohesion and

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late adolescence regular smoking. Alone it reduced the odds ratio by approximately 16.8%, suggesting confounding. Further supporting confounding was the finding that early adolescence regular smoking was associated with early adolescence family cohesion (OR: 0.22, 95% CI: 0.08, 0.66) (**Table A 6**), and late adolescence regular smoking (OR: 5.10, 95% CI: 1.91, 13.59) (**Table A 4**).

Three other early adolescence covariates, peer smoking, sibling smoking, and receiving welfare were additional significant risk factors for future smoking. These covariates increased the odds for smoking regularly during late adolescence by about 100% to 250% (**Table 7**).

**Table 7:** ODDS OF BEING A REGULAR SMOKER DURING LATE ADOLESCENCE ASSOCIATED WITH EARLY ADOLESCENCE HIGH FAMILY COHESION

| FINAL MODEL (n = 208) | Regular Smoker Crude OR {95% CI} | Regular Smoker Adjusted OR {95% CI} |
|---|---|---|
| **High Family Cohesion** | **0.41 {0.22, 0.76}** | **0.55 {0.27, 1.10}** |
| **Early Adolescence Regular Smoker** | **5.10 {1.91, 13.59}** | **5.66 {1.63, 19.74}** |
| **Peers Smoke** | **4.60 {2.06, 10.28}** | **3.56 {1.47, 8.60}** |
| **Siblings Smoke** | **4.18 {1.77, 9.86}** | **3.37 {1.36, 8.38}** |
| **Received Welfare** | **2.03 {1.10, 3.74}** | **1.92 {0.95, 3.86}** |

Odds ratios with p-values < 0.10 indicated in bold

## XI.ii FAMILY CONFLICT

Early adolescence family conflict during was not significantly associated with late adolescence regular smoking after adjusting for the confounder and risk factors ($p = 0.439$) (**Table 8**). However, in crude association, low family conflict during early adolescence protected against regular smoking during late adolescence (OR: 0.55, 95% CI: 0.30, 1.03).

Early adolescence regular smoking was the major factor in the attenuation of the univariate odds ratio of the association between early adolescence family conflict and late adolescence regular smoking, causing about a 20% change in the odds ratio. Contributing to this evidence of confounding were the significant associations between early adolescence regular smoking and early adolescence family conflict (OR: 0.22, 95% CI: 0.08, 0.66) (**Table A 7**) and late adolescence regular smoking (OR: 5.10, 95% CI: 1.91, 13.59) (**Table A 4**).

Early adolescence peer smoking, sibling smoking, and receiving welfare were the only other covariates significantly associated with late adolescence regular smoking in multivariate analysis (**Table 8**). Similar to the other multivariate models, these covariates were associated with between a 100% to over 250% increased odds for smoking regularly during early adolescence.

**Table 8:** ODDS OF BEING A REGULAR SMOKER DURING LATE ADOLESCENCE ASSOCIATED WTH EARLY ADOLESCENCE LOW FAMILY CONFLICT

| FINAL MODEL (n = 208) | Regular Smoker Crude OR {95% CI} | Regular Smoker Adjusted OR {95% CI} |
|---|---|---|
| **Low Family Conflict** | **0.55 {0.30, 1.03}** | 0.76 {0.37, 1.53} |
| **Early Adolescence Regular Smoker** | **5.10 {1.91, 13.59}** | **5.89 {1.69, 20.58}** |
| **Peers Smoke** | **4.60 {2.06, 10.28}** | **3.77 {1.57, 9.01}** |
| **Siblings Smoke** | **4.18 {1.77, 9.86}** | **3.32 {1.34, 8.28}** |
| **Received Welfare** | **2.03 {1.10, 3.74}** | **2.02 {1.01, 4.03}** |

Odds ratios with p-values < 0.10 indicated in bold

### XI.iii TELL OTHERS YOU ARE AMERICAN INDIAN

Once risk factors were adjusted for, telling others you are American Indian during early adolescence was not significantly associated with smoking regularly during late adolescence ($p = 0.234$) (**Table 9**). In univariate analysis, telling others you are American Indian during early adolescence increased the odds of smoking regularly during late adolescence (OR: 1.83, 95% CI: 0.98, 3.40)

No single early adolescence covariate confounded the prospective association between telling others you are American Indian and regular smoking. The significant covariates, early adolescence regular smoking, peer smoking, sibling smoking, and receiving welfare, each reduced the univariate odds ratio by between 1% and 10%. Additionally, only sibling smoking was marginally associated with early adolescence telling others you are American Indian ($p = 0.098$) (**Table A 8**). However, the set of additional significant covariates together attenuated the prospective association between telling others you are American Indian and regular smoking to a non-significant relationship (**Table 9**). These covariates were associated with a 100% to 500% increase in the odds of late adolescence regular smoking.

**Table 9:** ODDS OF BEING A REGULAR SMOKER DURING LATE ADOLESCENCE ASSOCIATED WITH EARLY ADOLESCENCE REGULARLY TELLING OTHERS YOU ARE AMERICAN INDIAN

| FINAL MODEL (n = 208) | Regular Smoker Crude OR {95% CI} | Regular Smoker Adjusted OR {95% CI} |
|---|---|---|
| **Regularly Tell Others you are American Indian** | **1.83 {0.98, 3.40}** | 1.53 {0.76, 3.08} |
| **Early Adolescence Regular Smoker** | **5.10 {1.91, 13.59}** | **6.09 {1.76, 21.09}** |
| **Peers Smoke** | **4.60 {2.06, 10.28}** | **3.89 {1.62, 9.31}** |
| **Siblings Smoke** | **4.18 {1.77, 9.86}** | **3.16 {1.26, 7.92}** |
| **Received Welfare** | **2.03 {1.10, 3.74}** | **2.01 {1.01, 4.02}** |

Odds ratios with p-values < 0.10 indicated in bold

## XI.iv  RITUAL PARTICIPATION

In both univariate and multivariate analysis, early adolescence ritual participation was not significantly associated with late adolescence regular smoking (crude $p = 0.229$, adjusted $p = 0.520$) (**Table 10**).

Similar to the other multivariate findings, early adolescence regular smoking, peer smoking, sibling smoking, and receiving welfare were all significant risk factors for late adolescence regular smoking when modeled with ritual participation (**Table 10**). These covariates increased the odds of smoking regularly during late adolescence by approximately 100% to 500%.

**Table 10:** ODDS OF BEING A REGULAR SMOKER DURING LATE ADOLESCENCE ASSOCIATED WITH EARLY ADOLESCENCE HIGH RITUAL PARTICIPATION

| FINAL MODEL (n = 208) | Regular Smoker Crude OR {95% CI} | Regular Smoker Adjusted OR {95% CI} |
|---|---|---|
| **High Ritual Participation** | 1.52 {0.76, 3.04} | 1.31 {0.58, 2.97} |
| **Early Adolescence Regular Smoker** | **5.10 {1.91, 13.59}** | **6.12 {1.77, 21.23}** |
| **Peers Smoke** | **4.60 {2.06, 10.28}** | **3.76 {1.57, 8.96}** |
| **Siblings Smoke** | **4.18 {1.77, 9.86}** | **3.42 {1.37, 8.57}** |
| **Received Welfare** | **2.03 {1.10, 3.74}** | 1.92 {0.95, 3.89} |

Odds ratios with p-values < 0.10 indicated in bold

## XI.v EFFECT MODIFICATION BY GENDER

Stratifying the adjusted prospective logistic regression models by gender revealed roughly equivalent strata-specific odds ratios for the relationships of both family cohesion and tell others you are American Indian with regular smoking (**Table 11**). The 95% confidence intervals of the odds ratios largely overlapped. This suggested that gender was not an effect modifier of the adjusted relationships between early adolescence family cohesion or telling others you are American Indian and late adolescence regular smoking.

**Table 11:** ASSOCIATION BETWEEN EARLY ADOLESCENCE CULTURAL CONNECTEDNESS AND LATE ADOLESCENCE REGULAR SMOKING STATUS, STRATIFIED BY GENDER

| FINAL MODELS | TOTAL | GIRLS | BOYS |
| --- | --- | --- | --- |
| (n = 208) | Regular Smoker OR {95% CI} | Regular Smoker OR {95% CI} | Regular Smoker OR {95% CI} |
| **High Family Cohesion, Adjusted\*** | 0.55 {0.27, 1.10} | 0.51 {0.19, 1.33} | 0.64 {0.22, 1.86} |
| **Regularly Tell Others you are American Indian, Adjusted\*** | 1.53 {0.76, 3.08} | 1.68 {0.67, 4.22} | 1.91 {0.57, 6.48} |

\*: Adjusted for early adolescence regular smoking, peer smoking, sibling smoking, and welfare status

## DISCUSSION

The primary aim of this analysis was to investigate if cultural connectedness protected against being a regular smoker among a cohort of Seattle-area American Indian youth. In addition, the association between cultural connectedness and amount of smoking among regular smokers was examined. The four markers of cultural connectedness assessed in this analysis were family cohesion, family conflict, telling others you are American Indian, and ritual participation. High family cohesion during early adolescence was marginally protective against smoking regularly during late adolescence after adjusting for confounders and significant covariates. This was the hypothesized association. In univariate analysis, low family conflict during early adolescence also was protective against being a regular smoker during late adolescence, whereas regularly telling others you are American Indian was a risk factor. However, neither of these associations remained significant after adjusting for confounders and covariates, contrary to expectation. Furthermore, gender did not appear to act as an effect modifier of the association between cultural connectedness and regular smoking in this cohort. Additional studies with a larger cohort size would be necessary to verify this finding.

Multiple surveys have shown family cohesion to be protective against drug use and risky behavior for most youth, regardless of culture.[7, 23, 25] In a cross-sectional study of about 6000 urban Minnesotan youth, American Indian youth had less family connection and engaged in more risky behaviors than youth of other races.[59] The cross-sectional results from this analysis of Seattle-area youth corroborated the protective

association between family cohesion and smoking among other urban American Indian youth. The prospective results from this study further suggested that cohesive family dynamics exert a protective effect against regular cigarette use over a number of years. Given the importance of familial support among American Indians,[55, 56, 59] family cohesion may be a particularly valuable protective factor for urban American Indian youth. However, this analysis did not distinguish whether these urban American Indian youth were specifically receptive to cohesive family dynamics or were responding to the extent that most youth do.

The covariates that increased the risk of regular smoking among this urban cohort: having a history of smoking,[32, 42] having peers[23, 32-34, 37-40, 42, 44] and siblings[31, 33, 34, 37-41] who smoke, and receiving welfare,[23, 48] are known youth risk factors for tobacco use. These factors influenced both concurrent and future smoking in this cohort. The findings from this analysis indicated that Seattle-area American Indian youth were susceptible to some of the same risk factors as American youth in general. Also, because the risk factors identified for this urban American Indian cohort have been shown to be some of the most significant risk factors for other American Indian youth populations,[54] these Seattle-area youth were comparable to other American Indian youth.

Despite the similarities with the general youth population, a greater proportion of the American Indian youth within this urban cohort reported smoking regularly than the general population. In 1996 and 1997, when this study concluded, approximately 39% of youth of all races living in the Western United States smoked regularly. [24] In contrast, 66.2% of the youth in this cohort smoked regularly, using the same criteria for smoking

regularly. This finding corroborated other surveys that have found that proportionally more American Indian youth smoke than national and regional youth averages.[6, 20, 21, 26, 60]

Among the urban youth of this cohort, self-identification as American Indian and ritual participation did not appear to be associated with future regular smoking. Two published studies investigating cultural connection among reservation youth provide perspective. From a survey study of five rural and reservation communities in the Western States, LeMaster found that cultural involvement was not significantly associated with American Indian youth smoking; however, the direction of the association was towards increasing the smoking risk.[5] LeMaster defined cultural involvement with a scale comparable to the ritual participation scale used in this analysis, but only cross-sectional associations were analyzed. LeMaster had a population size over ten times larger than the urban cohort of this analysis, affording greater power to detect a small association if one existed. Therefore, her results support our findings that cultural involvement may not reduce the risk of youth smoking. In contrast, Whitbeck found enculturation to be a protective factor for school success among American Indian youth living on or near three reservations in the Upper Midwest.[66] Whitbeck's enculturation measure incorporated both ritual participation and racial self-identification, similar to this analysis. This set of findings suggests that cultural connectedness may only be a significant protective factor among reservation communities or in relation to select behaviors, but not cigarette smoking.

Alternatively, the youth in this Seattle-area cohort may not have had enough cultural involvement to serve as a protective asset. The upper quartiles of cultural involvement responses did not reflect particularly strong cultural connectedness as their

threshold values were only sometimes telling others you are American Indian and participating in four of thirteen possible traditional practices. Both LeMaster and Whitbeck used continuous outcomes for their cultural involvement variables and neither reports the response range for their populations.[5, 66]

The relatively low level of cultural involvement attained may have been due to little opportunity for participating in rituals or tribal specific rituals. Fewer than 4% of these Seattle-area youth were affiliated with Puget Sound tribes.[58] Stress generated from frustration with weak cultural grounding or few cultural resources has been associated with smoking.[14] Whitbeck reports an association between alcohol abuse and emotional distress from cultural losses among American Indian adults living in reservation communities in the Upper Midwest.[49] Stress specifically derived from lack of cultural connectedness was not measured in this study, limiting any evaluation. Significant psychological distress, as defined by the Achenbach Child Behavior Checklist, was a risk factor for cross-sectional regular smoking, but not for future regular smoking among this cohort.

Multiple studies have reported that American Indian youth and adults who can negotiate both American Indian and non-American Indian worlds or who come from tribes with strong cultural identity have the lowest levels of substance abuse.[54, 67] Schinke, et al. studied the efficacy of a ten-session bicultural competence skill building program on knowledge of drugs, attitudes towards drug use, and skills to refuse drugs, among 137 American Indian middle school students living on two reservations in Western Washington.[85] Half of the youth received the intervention, and half got no intervention. After six-months, the youth who received the bicultural competence skills

training scored higher on measures of drug knowledge, self-control, and assertiveness than those who did not receive any intervention. In addition, fewer youth who were taught bicultural competence skills smoked or used other drugs than the youth who received no training. While this study did not compare the efficacy of a general drug use intervention program against the one focused on bicultural competency, it indicated that bicultural competency was a useful paradigm for some American Indian youth. For urban American Indian youth who are constantly challenged to integrate their Indian culture with the dominant urban culture, bicultural competence may be a more important protective factor against drug abuse than simply enculturation. Cultural involvement may not ensure bicultural competency. We may not have addressed the most salient cultural construct for the urban youth population by studying cultural connectedness. Additionally, ethnic dislocation or lack of cultural-specific resources may impede bicultural competence.

Another possible explanation for why cultural involvement did not protect against regular smoking is that, in this urban population, those more strongly enculturated may have been at greater risk for experiencing racial discrimination. Whitbeck, in particular, has documented that American Indian youth experience discrimination, and substance use can be a coping mechanism to deal with this discrimination.[69] Whitbeck's research is derived from surveying about 200 American Indian youth living on three reservations in the Upper Midwest; his findings may be particular to those communities. This analysis did not have information about whether the youth in this cohort experienced discrimination and if they responded to such stress with smoking.

A final suggestion of why cultural involvement was not a protective factor in this cohort is that smoking may be a tolerated behavior among Seattle-area American Indians. Smoking is highly prevalent among the youth, as evinced by the data from this analysis. Similarly, Grossman found the prevalence of smoking among Seattle-area American Indian adults to be higher than the regional, all race average.[86] Moncher et al. found that among Pacific Northwest tribal communities, American Indian youth in the forth and fifth grades report that about 40% of their parents and close relatives, 14% of their brothers, and 16% of their sisters smoke cigarettes.[40] In addition, up to 16% of the youth were given cigarettes from family or family friends. If smoking was as common among adults known to the youth in this cohort, smoking may have been implicitly encouraged. Lack of strong anti-smoking beliefs is a primary risk factor for youth cigarette use.[33] Furthermore, cultural involvement may have increased youth exposure to respected mentors and family members who smoke.

## LIMITATIONS

The findings of this analysis were specific to a cohort of Seattle-area youth, and may not be applicable to American Indian youth living in other cities, in rural areas, or on reservations.

As a secondary analysis of an existing dataset, this analysis was constrained by the sample recruitment, the sample size of the original study, the assessment instruments, and the methods of data collection. While 65% of the eligible Seattle-area American

Indian youth chose to participate in the original study, a relatively large percentage, this cohort may have been a skewed description of the entire urban American Indian youth community. Without demographic, cultural connectedness, or smoking data available for the youth who chose not to participate in the cohort, it was difficult to predict how representative the data were. Comparison of the findings in this cohort with other urban American Indian youth cohorts and repeated studies among the Seattle-area community would be necessary to verify the generalizability of the results to other American Indian youth populations.

Although the study population may be the largest prospective cohort of urban American Indian youth, there were just over 200 participants. This sample size may have limited the power to detect potential associations between cultural connectedness and regular smoking.[87] Nevertheless, with a sample population of over 2000, LeMaster also found no association between cultural involvement and smoking among American Indian youth.[5] Therefore, cultural connectedness truly may have no association with regular smoking in this urban cohort.

There were sources of potential information and misclassification bias in this analysis. The accuracy of all of the outcome variables and all of the exposure variables except family welfare status and significant distress were reliant on youth self-report. Studies have shown that youth self-reports of smoking status are accurate. Tucker, et al. found that youth self-report of smoking was consistently confirmed by serum cotinine levels, a nicotine metabolite.[43] The *Monitoring the Future* study, an ongoing, now thirty-year old, database on youth substance use, determined that the substance use self-reports from its diverse population of youth are valid. Youth answered questions about their

substance use history consistently over a number of years, they reported similar use among linked substances and engaged in related risky behaviors, they contended that they would answer questions about substance abuse honestly, and lastly, their friends independently corroborated their responses.[88] Oetting and Beauvais reviewed a series of studies investigating youth self-report on substance use. They concluded that about 1% of youth over-reported their substance use, and between 0.2% and 7.4% of youth responded inconsistently, depending on the study and racial group. Under-reporting was more likely when youth were asked about substance use during the past year than during the past month.[89] Killen, et al. additionally described that reliability of self-reporting increased when confidentiality was assured.[90] In this analysis, past thirty days smoking was solicited and the confidentiality of the youth participants was assured in the original study. Also, youth self-reports about past thirty days smoking were internally consistent, such that youth who reported smoking during the past thirty days also reported smoking during the past year and ever in their lives. Therefore, the outcome data had a high likelihood of being accurate.

The possibility of exposure misclassification remains because the data were from youth recall. Although recall bias tends to be differential in case-control studies,[91] in this study, because the youth were blinded to the purpose of the study and data was collected prospectively, any bias likely would have been non-differential and would have biased the results towards no association. The probability of differential bias was reduced further for the prospective analysis because the early adolescence cultural connectedness information was collected independently from the late adolescence regular smoking behavior. Additionally, because interviewers did not know the future outcomes at the

time of data collection, any interviewer bias regarding youth cultural connectedness and regular smoking also would have been non-differential with respect to categorization. As the youth responded to standardized surveys and were interviewed by different people every year, the risk that interviewer bias would substantially affect the results was small.

Selection bias from loss to follow up or absence during a survey time was also a potential risk for this prospective cohort study. However, 90% of the youth originally enrolled in the study completed the final survey. There was a minimal amount of missing data for the independent variables and these missing data were distributed among a number of participants, reducing the probability of significant selection bias. Again, because this analysis was based on a prospective study and the youth were blinded to the goal of this analysis, any participant attrition was likely non-differential for smoking outcome. The resulting bias would have shifted the results towards no association.

The missing data points were ignored in the calculation of the adolescent period values and, thus, the period values could have been either an over or under-estimation of the "true" value of the adolescence period. However, because the collapsing of the time points into the adolescence periods was done without regard to exposure and outcome status, any information bias introduced in variable categorization was non-differential. This would have biased the results towards no effect. This was the most conservative approach to missing data. Additionally, there were few missing data points, the missing data were distributed among a number of participants, and only eight participants were lost to follow up.

The dichotomous exposure and outcome variables were collapsed into adolescence period values according to "ever" versus "never" such that if there were no

reports of experiencing the variable, the period was coded as "never" even if there were missing data points. If the missing data point was presence of the variable, the true value of the adolescence period would be underestimated. Although this misclassification bias would be non-differential, as collapsing was done blinded to exposure and outcome status, it may have underrepresented the total number of regular smokers in this cohort. Nevertheless, the majority of the cohort smoked regularly, even with this conservative estimate.

A second ramification of collapsing the data into ever versus never status for a three-year adolescent period was that it reduced the specificity of the exposure and outcome experience in the ever group. For example, a regular smoker could have been a youth who smoked during the thirty days prior to interview for only one survey or for the three surveys comprising the adolescence period. Similarly a youth was classified as having peers who smoked if the youth reported this on one, two, or all three surveys in the adolescence period. This categorization strategy may have reduced the difference between the exposed and unexposed groups, as well as the regular and non-regular smokers. This could have biased findings towards a null association. In regards to the outcome, however, only fifteen of the 77 youth who reported smoking regularly during early or middle adolescence did not report smoking regularly during late adolescence. Similarly, youth tended to report cultural connectedness experience and risk factor exposure consistently across adolescence periods.

Non-differential bias could have reduced the significance of the prospective association between family cohesion and regular smoking as well as caused the non-significant findings between family conflict, telling others you are American Indian, and

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ritual participation and the regular smoking outcomes. However, because the amount of probable misclassification was small, each participant's responses were largely consistent across time periods, and other studies have found similar null findings, the findings from this analysis most likely are not due to significant non-differential bias.

The survey questions about smoking behavior did not specifically distinguish between ceremonial and non-ceremonial use, possibly introducing outcome misclassification bias. However, ceremonial tobacco typically is not from cigarettes, only small amounts are used, and it is not significantly inhaled.[92] In addition, often only select individuals use tobacco during ceremonies.[53] Therefore, the chance that youth reported ceremonial tobacco use as cigarette smoking was quite small. Moreover, ceremonial tobacco use would be infrequent throughout the year, reducing the likelihood that it would be smoked during the thirty days prior to interview, the criterion for regular smoking classification. As such, any ceremonial tobacco use reported would be represented as not-regular or light cigarette use in this analysis. Given the improbabilities that the youth in this cohort would have participated in frequent ceremonial tobacco use and that they would have reported ceremonial tobacco as regular cigarette smoking, it is likely that ceremonial tobacco misclassification bias did not significantly contribute to the marginal and null findings of this analysis.

The final major limitation of this analysis was that there were no data on whether parents or primary caretakers smoked. Multiple studies have shown that parental smoking increases the risk of a youth smoking;[23, 36] however, the influence of parental smoking varies with the study population. For example, a study among sixth, eighth, and tenth graders, found that having at least one parent who smokes increases a youth's risk for

smoking regularly two and a half times.[36] Another study of a similar number of fifth through seventh graders reported that having a parent who smokes is sufficient for smoking initiation.[35] Yet, a meta-analysis found that there is only weak positive association between parental smoking and youth smoking.[32]

Family cohesion was found to be marginally protective against regular smoking. Failure to control for parental smoking could have confounded this association if parental smoking was independently associated with family cohesion. Literature reports that parental smoking is a risk factor for youth smoking.[28-41] Therefore, if parental smoking was associated with high family cohesion, it would be a potential negative confounder and may have biased the association to weaker significance. Thus, the findings of this analysis could be a conservative estimate. If parental smoking was associated with lower family cohesion, parental smoking would be a potential positive confounder of the association between family cohesion and regular smoking and could have biased the odds ratio towards a significant association. This could explain the findings of this analysis. However, sibling smoking, a factor likely correlated with parental smoking, was not associated with family cohesion in this cohort (Table A 6). Therefore, it is unlikely that uncontrolled confounding by parental smoking was responsible for marginal association found.

## STRENGTHS

Despite the limitations, this analysis benefited from strengths of the parent study and dataset. The first strength of the study was that it did not exclusively represent youth who are in school. While the study participants were initially recruited from school rosters, they were followed regardless of whether they remained in school. Absenteeism from school is one of the strongest risk factors for adolescent risky behavior and drug use.[29] The second strength of this dataset was that it was from a longitudinal cohort study, permitting investigation of prospective relationships between factors and future smoking. The 90% retention rate of the study participants over the ten-year period reduced the possibility of bias introduced by participant attrition and contributed to the accuracy of the data. The third major strength was that the parent study undertook the particular challenge of addressing the health behaviors of an urban community of American Indian youth. This community was culturally heterogeneous, indicated by the number of tribes represented by the youth, and was likely socioeconomically, educationally, and ideologically diverse as well. This made isolating specific shared risk factors exceptionally difficult. Nevertheless, the effort was essential to understand the risk and protective factors acting among the underrepresented urban American Indian population.

Other strengths of the original study included having American Indians as the majority of interviewers and study staff, having developed trusted and respected relationships between the study participants and the staff, and having assessed a wide variety of health behaviors along with potential mediating or moderating factors. An extensive collection of instruments was used that provided a significant amount of data

on cultural connectedness, regular smoking behavior, and potential confounders. All of the study instruments were found to be reliable within the cohort. The survey was administered in person, which facilitated a good response to the survey questions. Only eight subjects were excluded from this analysis due to insufficient data. The over 90% retention rate further corroborates the success of the interview methods.

There were additional strengths specific to this secondary analysis. The four markers selected to represent cultural connectedness have been shown to accurately describe American Indian cultural values and to influence behavior among American Indian adolescents.[5, 55, 56, 59, 66] Moreover, these markers have been demonstrated to be reliable within the study cohort.[76, 81] For this cohort, youth classified as regular smokers were found to have longer histories of smoking and greater tendencies to smoke larger amounts than those classified as non-regular smokers. These are the risk factors most predictive of life-long smoking.[13, 32, 42, 43] Although it could not be verified if the youth who smoke regularly will become chronic smokers, evidence from other studies suggests that they are at high risk.[13, 43] Finally, most of the significant risk factors were assessed as confounders.

## FUTURE STUDIES

This analysis offered a preliminary assessment of the relationship between cultural connectedness and regular smoking among Seattle-area, urban American Indian youth. Additionally, it raised questions for future study concerning the role of cultural

connectedness among urban American Indian youth. Some of these questions could be addressed using additional data included in the original cohort study, while others require further research.

The full dataset from the original study included information on a number of other risky behaviors that the youth participated in, including alcohol consumption, drug use, and sexual activity. Investigating whether cultural connectedness is associated with these risky behaviors may help better elucidate its paths of influence.

However, to more precisely understand if and how cultural connectedness influences risky health behaviors among urban American Indian youth, more information must be collected. The markers of cultural connectedness used in this analysis may not be the best markers of cultural connectedness for this urban community. Focus groups may help determine more relevant markers of cultural connectedness, what cultural resources are available, and the reactions youth have to cultural connectedness. This analysis did not address whether the youth felt stress from not being culturally connected or if they wanted to be culturally connected. Such information may be critical to understanding if the youth perceive benefit, harm, or indifference from being engaged in culturally-specific activities. There was no information on how much discrimination these urban adolescents contended with or how ethnically dislocated they felt. Such experiences likely affect youths' attitudes toward cultural connectedness. Additionally, cultural connectedness may not be the salient protective factor for these youth. Bicultural competence may be more instrumental in guiding behavior than cultural connectedness. The results from this analysis suggested that family dynamics influences youth behavior. Instead of racial culture, family culture, such as parenting style and family dynamics may

be the important factor to investigate. Lastly, if smoking was commonplace and tolerated among this urban American Indian community, youth smoking may not have been discouraged. It is important to determine whether there is an association between youth smoking and parental or caretaker smoking, how many of the peers reported to smoke are American Indian, and what the attitude and belief toward smoking is within the urban American Indian community. Answers to these questions are reliant on new analyses, new surveys, interviews, or focus groups.

New studies also are necessary to determine if culturally-specific factors contribute to the disproportionate prevalence of tobacco use among American Indian youth in comparison to youth of other races. This analysis suggested that the known risk factors contributed more to adolescent smoking than cultural connectedness. The purpose of the original cohort study was to describe a community of urban American Indian youth, and therefore it did not include a non-Indian comparison group. This cohort could be compared with a Seattle-area, non-Indian cohort to determine if there were racial differences in the experience of known risk factors. To better assess if regional American Indian culture influenced the association between risk factors, protective factors, and substance use, this American Indian youth cohort could be compared against American Indian adolescents living in other states. Currently there are not enough published studies to conduct an adequate meta-analysis for either of these comparisons. In addition, a more complete and precise definition of cultural connectedness or bicultural competence must still be compared against the known risk factors for strength of association. More prospective studies are imperative to provide evidence of causal associations. Finally, larger cohorts must be recruited to assure adequate power to detect small effect sizes.

The cross-sectional finding that high ritual participation increased the odds of smoking regularly but, among regular smokers, was associated with smoking two fewer cigarettes per day may indicate culturally-specific smoking behaviors. While it is unlikely that this finding is due to the misclassification of ceremonial tobacco use, as explained above, it may reflect a behavior that is consistent among American Indians. Other studies have found that although a greater percent of American Indian adolescents smoke, they do not smoke as frequently or as heavily as adolescents of other races.[5, 55, 61] Additional studies would be necessary to investigate this relationship further.

## PUBLIC HEALTH IMPLICATIONS

The results from this analysis demonstrated that Northwest urban American Indian youth are at high risk for smoking regularly during late adolescence. Not only did the majority of this cohort smoke regularly by late adolescence, but those who smoked display patterns of use consistent with addiction. The majority of youth continued smoking through the end of the study period, once they started. Those who started smoking at a younger age smoked both more cigarettes per day and more days per thirty days by late adolescence than youth who started smoking when older. The disproportionately high prevalence of regular smoking among this urban youth cohort may exacerbate the already established health disparities that American Indians contend with, especially when these youth reach adulthood. Regular smoking during adolescence is the major risk factor for becoming a life-long smoker. One step toward improving the

health of this American Indian community is to reduce regular smoking among youth. Strategies to achieve this may include supporting family cohesion and encouraging community-wide conversations about their health behaviors. As cohesive family dynamics were found to be protective against regular smoking in this study and others, prevention of regular smoking among these youth may be more successful if families are included in the intervention programs. Additionally, because having both peers and siblings who smoke are significant risk factors and smoking is widely prevalent, community-based intervention versus intervention targeted at the youth with highest risk would likely be most effective.

Among this urban cohort, smoking regularly during early adolescence was the risk factor that most strongly increased the odds of being a regular smoker during late adolescence. Intervention strategies to postpone smoking initiation within this population may reduce the likelihood of progression to regular smoking. However, a prospective cohort study of 400 youth progressing from fifth to seventh grade demonstrated that reducing environmental risk factors and increasing youth assets were additionally necessary to translate a delay in smoking onset into a lower risk of habitual smoking.[35] Among this urban American Indian cohort, peer and sibling smoking may have been environmental factors that influenced progression to regular smoking.

# CONCLUSION

The majority of Seattle-area urban American Indian youth in this analysis were at risk of smoking regularly during late adolescence. Having high family cohesion during early adolescence was associated with half the odds of smoking regularly during late adolescence, in comparison to those with low family cohesion during early adolescence. No other cultural connectedness marker assessed was significantly associated with regular smoking. Risk factors shown in multiple studies to affect diverse populations of adolescents were found to strongly influence regular smoking behavior in this urban American Indian cohort. These risk factors were a history of smoking regularly, having peers and siblings who smoke, and receiving welfare. These risk factors were associated with regular smoking both cross-sectionally and prospectively. Having a history of smoking during early adolescence also confounded the association between cultural connectedness and regular smoking.

Youth smoking, represented by individual, peer, and sibling smoking, was the primary risk factor for continued youth smoking. Therefore, smoking cessation must be addressed community-wide, among young and old adolescents. In addition, including families in smoking intervention may be particularly beneficial. The results from this analysis contribute to the emerging effort to understand the relationship between cultural connectedness and drug use among urban American Indian youth.

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## APPENDIX: FIGURES AND TABLES

**Figure A 1:** OETTING AND BEAUVAIS ETHNIC IDENTITY INSTRUMENT

| Question | Response Choices | Likert Scale |
|---|---|---|
| 1. How do you see yourself? (What is your ethnic identity?) | a. Black<br>b. Spanish/ Mexican-American<br>c. American Indian/Alaska Native<br>d. Caucasian or White American<br>e. Asian<br>f. Pacific Islander<br>g. Other (specify) | 1 = Not at all<br>2 = A little<br>3 = Mostly<br>4 = All or Nearly All |
| 2. Some families have special activities or traditions that take place every year at particular times (such as holiday parties, special meals, religious activities, trips, or visits). How many of these special activities or traditions does your family have that are based on… | a. Black Culture<br>b. Spanish/ Mexican-American Culture<br>c. American Indian/Alaska Native Culture<br>d. Caucasian or White American Culture<br>e. Asian Culture<br>f. Pacific Islander Culture<br>g. Other (specify) | 1 = None at all<br>2 = A few<br>3 = Some<br>4 = A lot |
| 3. When you are an adult and have your own family, will you do special things together or have special traditions that are based on… | a. Black Culture<br>b. Spanish/ Mexican-American Culture<br>c. American Indian/Alaska Native Culture<br>d. Caucasian or White American Culture<br>e. Asian Culture<br>f. Pacific Islander Culture<br>g. Other (specify) | 1 = None at all<br>2 = A few<br>3 = Some<br>4 = A lot |
| 4. Does your family live by or follow… | a. The Black-American Way of Life<br>b. The Spanish/ Mexican-American Way of Life<br>c. The American Indian/Alaska Native-American Way of Life<br>d. The White-American Way of Life<br>e. The Asian-American Way of Life<br>f. The Pacific Islander Way of Life<br>g. Other (specify) | 1 = None at all<br>2 = Not Much<br>3 = Some<br>4 = A lot |
| 5. Do you live by or follow… | a. The Black-American Way of Life<br>b. The Spanish/ Mexican-American Way of Life<br>c. The American Indian/Alaska Native-American Way of Life<br>d. The White-American Way of Life<br>e. The Asian-American Way of Life<br>f. The Pacific Islander Way of Life<br>g. Other (specify) | 1 = None at all<br>2 = Not Much<br>3 = Some<br>4 = A lot |

**Figure A 1 (continued):** OETTING AND BEAUVAIS ETHNIC IDENTITY INSTRUMENT

| Question | Response Choices | Likert Scale |
|---|---|---|
| 6. Is your family a success in… | a. The Black-American Way of Life<br>b. The Spanish/ Mexican-American Way of Life<br>c. The American Indian/Alaska Native-American Way of Life<br>d. The White-American Way of Life<br>e. The Asian-American Way of Life<br>f. The Pacific Islander Way of Life<br>g. Other (specify) | 1 = None at all<br>2 = A little<br>3 = Some<br>4 = A lot |
| 7. When you are an adult, will you be a success in… | a. The Black-American Way of Life<br>b. The Spanish/ Mexican-American Way of Life<br>c. The American Indian/Alaska Native-American Way of Life<br>d. The White-American Way of Life<br>e. The Asian-American Way of Life<br>f. The Pacific Islander Way of Life<br>g. Other (specify) | 1 = None at all<br>2 = A little<br>3 = Some<br>4 = A lot |

**Table A 1**: DEMOGRAPHICS OF EXCLUDED SUBJECTS

| Early Adolescence ▼ | EXCLUDED SUBJECTS | STUDY POPULATION |
|---|---|---|
| Age at Enrollment Mean (std dev) | 11.9yrs (0.8) (n=8) | 11.7yrs (0.6) (n=216) |
| Gender Female: | 37.5% (n=3) | 50.9% (n=110) |
| Male: | 62.5% (n=5) | 49.1% (n=106) |
| Regular Smoker Yes: | 37.5% (n=3) | 20.4% (n=44) |
| No: | 62.5% (n=5) | 79.6% (n=172) |
| Binged Yes: | 37.5% (n=3) | 18.1% (n=39) |
| No: | 62.5% (n=5) | 81.9% (n=177) |
| Peers Smoke Yes: | 12.5% (n=1) | 83.3% (n=180) |
| No: | na | 14.4% (n=31) |
| Siblings Smoke Yes: | 25.0% (n=2) | 23.1% (n=50) |
| No: | 75% (n=6) | 75.5% (n=163) |
| Peer Deviant Behaviors Mean (std dev) | 1.1 behav. (1.0) (n=5) | 1.9 behav. (1.5) (n=216) |
| Sibling Deviant Behaviors Mean (std dev) | 0.9 behav. (1.1) (n=5) | 1.1 behav. (1.4) (n=216) |
| High Distress Yes: | 37.5% (n=3) | 25.0% (n=54) |
| No: | 25.0% (n=2) | 75.0% (n=162) |
| Family Received Welfare Yes: | 25% (n=2) | 38.0% (n=82) |
| No: | 37.5% (n=3) | 62.0% (n=134) |

**Table A 2**: Quartiles of Cultural Connectedness Markers*

| | 25th Percentile | 50th Percentile | 75th percentile |
|---|---|---|---|
| Early Adolescence Family Cohesion (n=216) | 5.50 | 7.00 | **8.50** |
| Middle Adolescence Family Cohesion (n=215) | 5.00 | 6.50 | **8.00** |
| Late Adolescence Family Cohesion (n=214) | 5.00 | 7.00 | **8.00** |
| Early Adolescence Family Conflict (n=216) | **1.50** | 3.00 | 4.50 |
| Middle Adolescence Family Conflict (n=215) | **2.00** | 3.00 | 4.50 |
| Late Adolescence Family Conflict (n=214) | **1.50** | 3.00 | 5.00 |
| Early Adolescence Tell Others you are American Indian (n=216) | 1.00 | 1.50 | **2.00** |
| Middle Adolescence Tell Others you are American Indian (n=216) | 1.00 | 1.67 | **2.00** |
| Late Adolescence Tell Others you are American Indian (n=216) | 1.33 | 1.67 | **2.33** |
| Early Adolescence Ritual Participation (n=216) | 1.00 | 2.33 | **4.67** |
| Middle Adolescence Ritual Participation (n=216) | 1.00 | 2.17 | **4.33** |
| Late Adolescence Ritual Participation (n=216) | 0.67 | 2.33 | **4.67** |

*Variables dichotomized at values in bold

PROSPECTIVE ANALYSIS: UNIVARIATE ASSOCIATION BETWEEN EARLY ADOLESCENCE CULTURAL CONNECTEDNESS AND LATE ADOLESCENCE REGULAR SMOKING BEHAVIOR

In univariate analysis, high family cohesion ($p = 0.004$) and low family conflict ($p = 0.061$) during early adolescence reduced the odds of being a regular smoker during late adolescence. The odds of smoking regularly during late adolescence, among those with high family cohesion during early adolescence, were 59% less than those with lower or no family cohesion (OR: 0.41, 95% CI: 0.22, 0.76). Conversely, regularly telling others you are American Indian increased the odds of being a regular smoker by 83%, in comparison to those with lower or no cultural identification (OR: 1.83, 95% CI: 0.98, 3.40) (**Table A 3**).

None of the early adolescence cultural connectedness markers was significantly associated with the quantity or frequency of smoking among late adolescence regular smokers ($p > 0.118$ for all) (**Table A 3**).

**Table A 3:** UNIVARIATE ASSOCIATION BETWEEN EARLY ADOLESCENCE CULTURAL CONNECTEDNESS MARKERS AND LATE ADOLESCENCE REGULAR SMOKING BEHAVIOR

| Late Adolescence ▶ <br><br><br><br><br><br> Early Adolescence ▼ | Regular Smoker OR {95% CI}* (n = 143) | Not a regular Smoker (n = 73) | Regular Smoker # Cigs/Day mean # (std dev)** (n = 143) | Regular Smoker # Days Smoked/30d mean # (std dev)** (n = 143) | Regular Smoker Total # Cigs Smoked/30d mean # (std dev)** (n = 143) |
|---|---|---|---|---|---|
| *High* Family Cohesion | n=29 | n=28 | 5.8 (5.5) | 18.9 (10.3) | 142.8 (166.5) |
| *Low* Family Cohesion | n=114 | n=45 | 7.5 (7.4) | 19.2 (10.3) | 195.7 (227.8) |
| Family Cohesion | **0.41 {0.22, 0.76}** | | *p* = 0.181 | *p* = 0.875 | *p* = 0.164 |
| *Low* Family Conflict | n=32 | n=25 | 6.6 (6.1) | 19.8 (10.1) | 165.7 (188.3) |
| *High* Family Conflict | n=111 | n=48 | 7.3 (7.3) | 19.0 (10.4) | 190.6 (225.4) |
| Family Conflict | **0.55 {0.30, 1.03}** | | *p* = 0.572 | *p* = 0.719 | *p* = 0.532 |
| *Regularly* Tell Others are Amer. Ind. | n=56 | n=19 | 7.1 (7.0) | 19.2 (10.5) | 183.4 (213.9) |
| *Do Not* regularly Tell Others are Amer. Ind. | n=87 | n=54 | 7.2 (7.1) | 19.1 (10.2) | 186.0 (220.6) |
| Tell Others are Amer. Ind. | **1.83 {0.98, 3.40}** | | *p* = 0.887 | *p* = 0.950 | *p* = 0.943 |
| *High* Ritual Participation | n=38 | n=14 | 6.3 (6.9) | 21.3 (9.5) | 167.1 (210.5) |
| *Low* Ritual Participation | n=105 | n=59 | 7.5 (7.1) | 18.4 (10.5) | 191.5 (220.3) |
| Ritual Participation | 1.52 {0.76, 3.04} | | *p* = 0.394 | *p* = 0.118 | *p* = 0.548 |

Odds ratios with p-values < 0.10 indicated in bold
*$\chi^2$ p-value for difference across exposure groups
**t-statistic p-value for equality-of-means between exposure groups

## PROSPECTIVE ANALYSIS: UNIVARIATE ASSOCIATION BETWEEN EARLY ADOLESCENCE COVARIATES AND LATE ADOLESCENCE REGULAR SMOKING BEHAVIOR

Seven of the early adolescence covariates were significant risk factors for late adolescence regular smoking ($p < 0.022$ for all) (**Table A 4**). Gender and significant distress during early adolescence were marginal risk factors for late adolescence regular smoking ($p = 0.094$ and $p = 0.081$, respectively). Smoking regularly during early adolescence was the strongest risk factors for late adolescence regular smoking. Those who were regular smokers during early adolescence had over 400% greater odds of also being regular smokers during late adolescence compared to those who were not regular smokers during early adolescence (OR: 5.10, 95% CI: 1.91, 13.59). Having peers who smoke and having siblings who smoke were both associated with over 300% greater odds of being a smoker during late adolescence in comparison to youth without those risk factors (peer smoking OR: 4.60, 95% CIs: 2.06, 10.28; sibling smoking OR: 4.18, 95% CI: 1.77, 9.86). Youth in families that had received welfare during early adolescence had 100% greater odds of smoking regularly during late adolescence (OR: 2.03, 95% CI: 1.10, 3.74).

**Table A 4**: UNIVARIATE ASSOCIATION BETWEEN EARLY ADOLESCENCE COVARIATES AND LATE ADOLESCENCE STATUS AS A REGULAR SMOKER

| Late Adolescence ▶<br><br>($n_{TOTAL}$ = 216)<br><br>Early Adolescence ▼ | Regular Smoker | Not a Regular Smoker | OR {95% CI} |
|---|---|---|---|
| **Age at Enrollment** | | | |
| Mean (std dev) | 11.6yrs (0.6) | 11.7yrs (0.6) | *p* = 0.596* |
| **Gender** | | | |
| Female: | 46.9% (n=67) | 58.9% (n=43) | **1.63** |
| Male: | 53.1% (n=76) | 41.1% (n=30) | **{0.92, 2.87}** |
| **Regular Smoker** | | | |
| Yes: | 27.3% (n=39) | 6.8% (n=5) | **5.10** |
| No: | 72.7% (n=104) | 93.2% (n=68) | **{1.91, 13.59}** |
| **Binged** | | | |
| Yes: | 23.8% (n=34) | 6.8% (n=5) | **4.24** |
| No: | 76.2% (n=109) | 93.2% (n=68) | **{1.58, 11.38}** |
| **Peers Smoke** | | | |
| Yes: | 92.1% (n=129) | 71.8% (n=51) | **4.60** |
| No: | 7.9% (n=11) | 28.2% (n=20) | **{2.06, 10.28}** |
| **Siblings Smoke** | | | |
| Yes: | 30.7% (n=43) | 9.6% (n=7) | **4.18** |
| No: | 69.3% (n=97) | 90.4% (n=66) | **{1.77, 9.86}** |
| **Peer Deviant Behaviors** | | | |
| Mean (std dev) | 2.1 (1.5) | 1.5 (1.5) | ***p* = 0.016*** |
| **Sibling Deviant Behaviors** | | | |
| Mean (std dev) | 1.3 (1.4) | 0.7 (1.0) | ***p* < 0.001*** |
| **Significant Distress** | | | |
| Yes: | 28.7% (n=41) | 17.8% (n=13) | **1.86** |
| No: | 71.3% (n=102) | 82.2% (n=60) | **{0.92, 3.74}** |
| **Family Received Welfare** | | | |
| Yes: | 43.4% (n=62) | 27.4% (n=20) | **2.03** |
| No: | 56.6% (n=81) | 72.6% (n=53) | **{1.10, 3.74}** |

Odds ratios with p-values < 0.10 indicated in bold
*t-statistic p-value for difference between exposure groups

The majority of the covariates associated with being a regular smoker also were associated with a higher average quantity and frequency of smoking among late adolescence regular smokers (**Table A 5**). Boys who are regular smokers during late adolescence smoked over three more cigarettes per day than girls did ($p = 0.005$). Smoking regularly during early adolescence was associated with smoking over four more cigarettes per day ($p = 0.004$) than those who did not smoke regularly during early adolescence. Youth from families that received welfare during early adolescence was associated with smoking about four more days per thirty days during late adolescence ($p = 0.021$) than those whose families did not receive welfare.

**Table A 5:** UNIVARIATE ASSOCIATION BETWEEN EARLY ADOLESCENCE COVARIATES AND LATE ADOLESCENCE SMOKING AMOUNT AMONG REGULAR SMOKERS

| Late Adolescence ▶ (n = 143) Early Adolescence ▼ | # Cigs Smoked/Day | Sig.* | # Days Smoked/30d | Sig.* | Total # Cigs Smoked/30d | Sig.* |
|---|---|---|---|---|---|---|
| **Age at Enrollment** mean diff. {95% CI} | 2.7 more per year increase {0.77, 4.54} | $p = 0.006$ | 1.7 more per year increase {-1.09,4.52} | $p = 0.228$ | 74.1 more per year increase {15.66,132.51} | $p = 0.013$ |
| **Gender** mean (SD) Female: Male: | 5.4 (5.8) 8.7 (7.7) | $p = 0.005$ | 18.0 (10.0) 20.2 (10.4) | $p = 0.213$ | 133.9(173.3) 230.1(242.0) | $p = 0.007$ |
| **Regular Smoker** mean (SD) Yes: No: | 10.4 (8.4) 5.9 (6.1) | $p = 0.004$ | 23.3 (8.2) 17.7 (10.6) | $p = 0.001$ | 277.1(266.0) 150.5(185.9) | $p = 0.009$ |
| **Binged** mean (SD) Yes: No: | 10.3 (8.6) 6.2 (6.2) | $p = 0.013$ | 21.7 (8.5) 18.4 (10.7) | $p = 0.062$ | 267.9(273.2) 159.1(190.9) | $p = 0.036$ |

*t-statistic for equality-of-means

**Table A 5 (continued):** UNIVARIATE ASSOCIATION BETWEEN EARLY ADOLESCENCE COVARIATES AND LATE ADOLESCENCE SMOKING AMOUNT AMONG REGULAR SMOKERS

| Late Adolescence ► (n = 143) Early Adolescence ▼ | # Cigs Smoked/Day | Sig.* | # Days Smoked/30d | Sig.* | Total # Cigs Smoked/30d | Sig.* |
|---|---|---|---|---|---|---|
| **Peers Smoke** mean (SD) | | | | | | |
| Yes: | 7.3 (7.0) | | 19.4 (9.9) | | 188.1(217.9) | |
| No: | 6.8 (8.2) | *p* = 0.847 | 18.5 (12.6) | *p* = 0.823 | 186.0(236.1) | *p* = 0.979 |
| **Siblings Smoke** mean (SD) | | | | | | |
| Yes: | 9.1 (8.6) | | 21.1 (10.0) | | 250.5(266.7) | |
| No: | 6.4 (6.1) | ***p* = 0.073** | 18.4 (10.3) | *p* = 0.157 | 159.2(188.5) | ***p* = 0.046** |
| **Peer Deviant Behaviors** mean diff. {95% CI} | 1.0 more per one behavior increase {.19, 1.71} | ***p* = 0.015** | 1.3 more per one behavior increase {0.22, 2.44} | ***p* = 0.020** | 27.4 more per one behavior increase {3.92,50.95} | ***p* = 0.023** |
| **Sibling Deviant Behaviors** mean diff. {95% CI} | 0.8 more per one behavior increase {-0.06, 1.55} | ***p* = 0.069** | 0.9 more per one behavior increase {-0.24,2.11} | *p* = 0.119 | 23.5 more per one behavior increase {-1.36, 48.29} | ***p* = 0.064** |
| **Significant Distress** mean (SD) | | | | | | |
| Yes: | 9.0 (8.8) | | 21.4 (9.4) | | 245.8(273.7) | |
| No: | 6.4 (6.1) | ***p* = 0.085** | 18.3 (10.5) | ***p* = 0.079** | 160.6(186.0) | ***p* = 0.073** |
| **Family Received Welfare** mean (SD) | | | | | | |
| Yes: | 8.2 (7.2) | | 21.4 (9.1) | | 219.0(223.9) | |
| No: | 6.3 (6.8) | *p* = 0.118 | 17.5 (10.8) | ***p* = 0.021** | 159.0(209.7) | *p* = 0.105 |

*t-statistic for equality-of-means

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The odds of smoking regularly during early adolescence was lower among those early adolescence high family cohesion and low family conflict ($p = 0.004$ for both) (**Tables A 6** and **A 7**). In contrast, the odds of smoking regularly during early adolescence was higher among those with high ritual participation ($p = 0.033$) (**Table A 9**). Similarly, the peers of youth who had high family cohesion and low family conflict participated in about one fewer deviant behavior than peers of youth with low family cohesion and high family conflict ($p < 0.001$ for both) (**Tables A 6** and **A 7**); whereas, the peers of youth who had high ritual participation participated in almost one more deviant behavior than peers of youth with lower or no ritual participation ($p = 0.045$) (**Table A 9**). High family cohesion and low family conflict also reduced the odds of binge drinking (family cohesion $p = 0.003$; family conflict $p = 0.012$) and the number of deviant behaviors siblings participated in (family cohesion $p = 0.016$; family conflict $p = 0.026$) (**Tables A 6** and **A 7**). The odds of being a girl was increased among those who regularly told others they are American Indian ($p = 0.026$) (**Table A 8**).

**Table A 6**: UNIVARIATE ASSOCIATION BETWEEN FAMILY COHESION AND COVARIATES DURING EARLY ADOLESCENCE

| (n<sub>TOTAL</sub> = 216)<br><br>Early Adolescence▶<br>▼ | *High* Family Cohesion | *Low* Family Cohesion | OR {95% CI} | Significance |
|---|---|---|---|---|
| **Age at Enrollment**<br>Mean (std dev) | 11.6yrs (0.5) | 11.7yrs (0.6) | $p = 0.119$* | |
| **Gender**<br>Male:<br>Female: | 40.4% (n=23)<br>59.6% (n=34) | 52.2% (n=83)<br>46.8% (n=76) | 0.62<br>{0.34, 1.14} | $p = 0.125$ |
| **Regular Smoker**<br>mean (SD)<br>Yes:<br>No: | 7.0% (n=4)<br>93.0% (n=53) | 25.2% (n=40)<br>74.8% (n=119) | **0.22**<br>**{0.08, 0.66}** | |
| **Binged**<br>Yes:<br>No: | 5.3% (n=3)<br>94.7% (n=54) | 22.6% (n=36)<br>77.4% (n=123) | **0.19**<br>**{0.06, 0.64}** | **$p = 0.003$** |
| **Peers Smoke**<br>Yes:<br>No: | 77.2% (n=44)<br>22.8% (n=13) | 88.3% (n=136)<br>11.7% (n=18) | 0.45<br>{0.20, 0.99} | $p = 0.958$ |
| **Siblings Smoke**<br>Yes:<br>No: | 21.4% (n=12)<br>78.6% (n=44) | 24.2% (n=38)<br>75.8% (n=119) | 0.85<br>{0.41, 1.79} | $p = 0.674$ |
| **Peer Deviant Behaviors**<br>Mean (std dev) | 1.1 (1.1) | 2.2 (1.6) | **$p <0.001$*** | |
| **Sibling Deviant Behaviors**<br>Mean (std dev) | 0.7 (1.3) | 1.2 (1.4) | **$p = 0.016$*** | |
| **Significant Distress**<br>Yes:<br>No: | 19.3% (n=11)<br>80.7% (n=46) | 27.0% (n=43)<br>73.0% (n=116) | 0.65<br>{0.31, 1.38} | $p = 0.283$ |
| **Family Received Welfare**<br>Yes:<br>No: | 28.1% (n=16)<br>71.9% (n=41) | 41.5% (n=66)<br>58.5% (n=93) | 0.55<br>{0.28, 1.06} | $p = 0.247$ |

Odds ratios with p-values < 0.10 indicated in bold
*t-statistic p- value for difference between exposure groups

**Table A 7:** UNIVARIATE ASSOCIATION BETWEEN FAMILY CONFLICT AND COVARIATES DURING EARLY ADOLESCENCE

| ($n_{TOTAL}$ = 216)<br><br>Early Adolescence ► ▼ | *Low* Family Conflict | *High* Family Conflict | OR {95% CI} | Significance* |
|---|---|---|---|---|
| **Age at Enrollment**<br>Mean (std dev) | 11.6yrs (0.5) | 11.7yrs (0.6) | $p = 0.585$* | |
| **Gender**<br>Male:<br>Female: | 45.6% (n=26)<br>54.4% (n=31) | 50.3% (n=80)<br>49.7% (n=79) | 0.83<br>{0.45, 1.52} | $p = 0.542$ |
| **Regular Smoker**<br>mean (SD)<br>Yes:<br>No: | 7.0% (n=4)<br>93.0% (n=53) | 25.2% (n=40)<br>74.8% (n=119) | **0.22**<br>**{0.08, 0.66}** | |
| **Binged**<br>Yes:<br>No: | 7.0% (n=4)<br>93.0% (n=53) | 22.0% (n=35)<br>78.0% (n=124) | **0.27**<br>**{0.09, 0.79}** | **$p = 0.012$** |
| **Peers Smoke**<br>Yes:<br>No: | 80.0% (n=44)<br>20.0% (n=11) | 87.2% (n=136)<br>12.8% (n=20) | 0.59<br>{0.26, 1.32} | $p = 0.196$ |
| **Siblings Smoke**<br>Yes:<br>No: | 21.4% (n=12)<br>78.8% (n=44) | 24.2% (n=38)<br>75.8% (n=119) | 0.85<br>{0.41, 1.79} | $p = 0.674$ |
| **Peer Deviant Behaviors**<br>Mean (std dev) | 1.2 (1.1) | 2.1 (1.6) | **p <0.001*** | |
| **Sibling Deviant Behaviors**<br>Mean (std dev) | 0.8 (1.2) | 1.2 (1.4) | **$p = 0.026$*** | |
| **Significant Distress**<br>Yes:<br>No: | 15.8% (n=9)<br>84.2% (n=48) | 28.3% (n=45)<br>71.7% (n=114) | **0.48**<br>**{0.22, 1.05}** | **$p = 0.061$** |
| **Family Received Welfare**<br>Yes:<br>No: | 33.3% (n=19)<br>66.7% (n=38) | 39.6% (n=63)<br>60.4% (n=96) | 0.76<br>{0.40, 1.44} | $p = 0.401$ |

Odds ratios with p-values < 0.10 indicated in bold
*t-statistic p- value for difference between exposure groups

**Table A 8:** UNIVARIATE ASSOCIATION BETWEEN TELL OTHERS YOU ARE AMERICAN INDIAN AND COVARIATES DURING EARLY ADOLESCENCE

| (n<sub>TOTAL</sub> = 216)<br><br>Early Adolescence▶<br>▼ | *Regularly* Tell Others you are American Indian | *Do Not* regularly Tell Others you are American Indian | OR {95% CI} | Significance* |
|---|---|---|---|---|
| **Age at Enrollment**<br>Mean (std dev) | 11.6yrs (0.6) | 11.7yrs (0.6) | *p* = 0.542* | |
| **Gender**<br>Male:<br>Female: | 38.7% (n=29)<br>61.3% (n=46) | 54.6% (n=77)<br>45.4% (n=64) | **0.52**<br>**{0.30, 0.93}** | *p* = **0.026** |
| **Regular Smoker**<br>mean (SD)<br>Yes:<br>No: | 24.0% (n=18)<br>76.0% (n=57) | 18.4% (n=26)<br>81.6% (n=115) | 1.40<br>{0.71, 2.75} | |
| **Binged**<br>Yes:<br>No: | 21.3% (n=16)<br>78.7% (n=59) | 16.3% (n=23)<br>83.7% (n=118) | 1.39<br>{0.68, 2.86} | *p* = 0.361 |
| **Peers Smoke**<br>Yes:<br>No: | 85.1% (n=63)<br>14.9% (n=11) | 85.4% (n=117)<br>14.6% (n=20) | 0.98<br>{0.79, 2.17} | *p* = 0.958 |
| **Siblings Smoke**<br>Yes:<br>No: | 30.1% (n=22)<br>69.9% (n=51) | 20.0% (n=28)<br>80.0% (n=112) | **1.73**<br>**{0.90, 3.33}** | *p* = **0.098** |
| **Peer Deviant Behaviors**<br>Mean (std dev) | 1.9 (1.6) | 1.9 (1.5) | *p* = 0.920* | |
| **Sibling Deviant Behaviors**<br>Mean (std dev) | 1.3 (1.4) | 1.0 (1.3) | *p* = 0.213* | |
| **Significant Distress**<br>Yes:<br>No: | 29.3% (n=22)<br>70.7% (n=53) | 22.7% (n=32)<br>77.3% (n=109) | 1.41<br>{0.75, 2.63} | *p* = 0.283 |
| **Family Received Welfare**<br>Yes:<br>No: | 38.7% (n=29)<br>61.3% (n=46) | 37.6% (n=53)<br>62.4% (n=88) | 1.05<br>{0.59, 1.85} | *p* = 0.876 |

Odds ratios with p-values < 0.10 indicated in bold
*t-statistic p- value for difference between exposure groups

**Table A 9:** UNIVARIATE ASSOCIATION BETWEEN RITUAL PARTICIPATION AND COVARIATES DURING EARLY ADOLESCENCE

| (n<sub>TOTAL</sub> = 216)<br><br>**Early Adolescence►**<br>▼ | *High* Ritual Participation | *Low* Ritual Participation | OR {95% CI} | Significance* |
|---|---|---|---|---|
| **Age at Enrollment**<br>Mean (std dev) | 11.7yrs (0.6) | 11.6yrs (0.6) | $p = 0.637*$ | |
| **Gender**<br>Male:<br>Female: | <br>46.2% (n=24)<br>53.8% (n=28) | <br>50.0% (n=82)<br>50.0% (n=82) | <br>0.86<br>{0.46, 1.60} | <br><br>$p = 0.629$ |
| **Regular Smoker**<br>mean (SD)<br>Yes:<br>No: | <br><br>30.8% (n=16)<br>69.2% (n=36) | <br><br>17.1% (n=28)<br>83.4% (n=136) | <br><br>**2.16**<br>**{1.05, 4.24}** | |
| **Binged**<br>Yes:<br>No: | <br>19.2% (n=10)<br>80.8% (n=42) | <br>17.7% (n=29)<br>82.3% (n=135) | <br>1.11<br>{0.50, 2.50} | <br><br>$p = 0.800$ |
| **Peers Smoke**<br>Yes:<br>No: | <br>91.7% (n=44)<br>8.3% (n=4) | <br>83.4% (n=136)<br>16.6% (n=27) | <br>2.18<br>{0.72, 6.67} | <br><br>$p = 0.157$ |
| **Siblings Smoke**<br>Yes:<br>No: | <br>21.2% (n=11)<br>78.8% (n=41) | <br>24.2% (n=39)<br>75.8% (n=122) | <br>0.84<br>{0.39, 1.79} | <br><br>$p = 0.650$ |
| **Peer Deviant Behaviors**<br>Mean (std dev) | <br>2.3 (1.6) | <br>1.8 (1.5) | <br>**$p = 0.045*$** | |
| **Sibling Deviant Behaviors**<br>Mean (std dev) | <br>1.3 (1.5) | <br>1.1 (1.3) | <br>$p = 0.386*$ | |
| **Significant Distress**<br>Yes:<br>No: | <br>28.8% (n=15)<br>71.2% (n=37) | <br>23.8% (n=39)<br>76.2% (n=125) | <br>1.30<br>{0.65, 2.63} | <br><br>$p = 0.462$ |
| **Family Received Welfare**<br>Yes:<br>No: | <br>57.7% ( n=30)<br>42.3% (n=22) | <br>31.7% (n=52)<br>68.3% (n=112) | <br>**2.94**<br>**{1.54, 5.56}** | <br><br>**$p = 0.001$** |

Odds ratios with p-values < 0.10 indicated in bold

*t-statistic p- value for difference between exposure groups