



A prospective, longitudinal study of cigarette smoking status among North American Indigenous adolescents



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HIGHLIGHTS

- Female Indigenous youths had higher rates of smoking than male youths over time.
- Problem behavior theory guides us to identify predictors of smoking status.
- Generalized estimating equation model was used to investigate longitudinal predictors of smoking status.
- Family warmth and support was negatively associated with occasional smoking.
- Frequent smoking was associated positively with depression symptoms and negatively with positive school activity.

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1. Introduction

Although adolescent daily cigarette use has declined in the past decade from 32% in 2002 to 19% in 2013 (Substance Abuse and Mental Health Services Administration, 2014), American Indian or Alaska Native (AI/AN) adolescents have higher rates of cigarette smoking than other ethnic/racial groups. According to a national report, AI/AN youths aged 12–17 years had the highest rate of 30-day cigarette smoking (18.9%), followed by White (10.6%), Hispanic (7.9%), Black (5.0%) and Asian (3.8%) adolescents (SAMHSA, 2009). Such high rates of cigarette smoking increase the risk for the two leading causes of death—heart disease (18.4%) and cancer (18.2%)—among American Indians (CDC, 2015).

Additionally, AI/AN adults at aged 45 or older reported a significantly higher prevalence of cardiovascular disease than non-AI/AN adults (Harwell et al., 2001). We note that the prevalence rates of smoking and its consequences can vary by region and culture within AI/AN communities (Whitbeck, Yu, McChargue, & Crawford, 2009; Yu, 2011a, 2011b; Yu, Stiffman, & Freedenthal, 2005). Given the fact that AI/AN youth had the highest rates of current smoking and smoking-related health problems, efforts to provide information about establishing effective smoking cessation and prevention strategies for AI/AN smokers is an urgent public health need.

Eliminating adolescent smoking problems requires a greater understanding of various risk and protective factors. For our study, we employed Jessor and Jessor's (Jessor & Jessor, 1977) problem behavior theory (PBT) to identify factors associated with Indigenous adolescent smoking behavior. Here, Indigenous adolescents indicate American Indian youth who lived in North American Indians and Canadian First Nations tribes. The conceptual structure of PBT consists of three major systems explaining problem behavior: the personality system, the perceived environment system, and the behavior system. The theory asserts that each system serves either as instigations for or controls against engaging in problem behavior. The degree of problem behavior proneness is determined by the balance between instigations and controls across all three systems.

The personality system includes socio-cognitive variables reflecting social learning and developmental experience such as values and orientations toward self. For example, prior studies were conducted using samples of non-AI/AN youth and showed that intention to smoke (Ariza-Cardenal & Nebot-Adell, 2002; Hoving, Reubsaet, & De Vries, 2007; Skara, Sussman, & Dent, 2001) and depressive symptoms (Munafò, Hitsman, Rende, Metcalfe, & Niaura, 2008; Weiss, Mouttapa, Cen, Johnson, & Unger, 2011) may be associated with smoking status such as occasional smoking and frequent smoking.

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The perceived environment system includes social-contextual investigations toward involvement in and controls against problem behavior. A number of studies were conducted using samples of both AI and non-AI youth and reported that friends' smoking was one of the most consistent and strongest predictors of smoking (Dierker, Avenevoli, Goldberg, & Glantz, 2004; Fergusson, Lynskey, & Horwood, 1995; Mak, Ho, & Day, 2012; Yu et al., 2005). In terms of the association between racial discrimination and smoking behavior, most studies were conducted with non-AI samples, and reported that, for example, high levels of racial discrimination were significantly related to odds of lifetime smoking among African American girls aged 11 through 19 years (Guthrie, Young, Williams, Boyd, & Kintner, 2002) and of current smoking among Asian American adults ages 18 years or older (Chae et al., 2008). On the other hand, family support (e.g., spending time with family) served as a protective factor against cigarette smoking among non-AI/AN adolescents (Barnes, Hoffman, Welte, Farrell, & Dintcheff, 2007; Simons-Morton, Chen, Abroms, & Haynie, 2004).

The behavior system comprises both problem behavior (e.g., use of cigarette, alcohol and marijuana, and general deviant behavior) and conventional behavior that is socially approved for adolescents (e.g., participation in church or school activities) (Jessor & Jessor, 1977). Most research on the association between behavior system variables and smoking behavior was conducted using non-AI/AN youth. Smokers were more likely to drink alcohol and use illicit drugs than nonsmokers (Ariza-Cardenal & Nebot-Adell, 2002; Bentler, Newcomb, & Zimmerman, 2002; Dierker et al., 2004; J. Yu & Williford, 1992; M. Yu et al., 2005), and engage in deviant behavior (Brook, Balka, Rosen, Brook, & Adams, 2005; Crone & Reijneveld, 2007; Dierker et al., 2004; Forrester, Biglan, Severson, & Smolkowski, 2007). On the other hand, studies revealed that participation in positive school activities such as physical activities (Audrain-McGovern, Rodriguez, Wileyto, Schmitz, & Shields, 2006) and extracurricular activities (Brown et al., 2002; Elder, Leaver-Dunn, Wang, Nagy, & Green, 2000) were negatively related to adolescent smoking.

There are gaps in the above-mentioned studies. First, although the associations between PBT variables and adolescent cigarette smoking, there is a lack of research examining adolescent smoking status. Second, most studies were conducted using cross-sectional data. Third, only a few studies were conducted using a sample of AI/AN youth. In order to fill these gaps, this prospective, longitudinal study has two objectives: 1) to estimate prevalence of cigarette smoking status (nonsmoking, occasional smoking, and frequent smoking) over a three-year period in a sample of Indigenous adolescents; and 2) to examine the relative effects of personality system, perceived environment system, and behavior system variables on cigarette smoking status over time.

2. Methods

2.1. Research design and participants

The data were collected as part of a larger longitudinal prospective study to examine culturally specific resilience and risk factors that affect children's well-being and then to use information for the development of culturally-based interventions.

This current study is based on the first three waves of the larger study. Wave 1 data were collected from youth aged 10–13 years at each site from February through October 2002 ($N = 743$). There was a one-year lag between data collection for the subsequent two waves ($N = 704$ at Wave 2 and $N = 694$ at Wave 3). Four U.S. reservations and four Canadian reserves participated in the study. In our study, these reservations and reserves were classified as remote and rural. Rural locations were within somewhat close proximity to other towns, whereas remote locations were considerable distances from even small towns and were accessed by non-paved roads. Three of the Canadian Reserves were classified as "remote." Still, the reservations/reserves in this sample shared a common cultural tradition and language with minor regional

variations in dialects. The sample was representative of one of the most populous Indigenous cultures in the United States and Canada. To ensure confidentiality of tribe and participants, the study does not report participating reservation names.

The retention rates among the reservations/reserves were very high, ranging from 93% to 100%, with 93% overall retention from Wave 1 to Wave 3. Of those who left the study, 3.4% of the attrition was due to refusal to participate. Other reasons for attrition included the death of the study adolescent (two individuals) and loss of contact with the family (25 families). The attrition analyses showed that those youths who left the study had significantly higher occasional smoking (17.0% vs. 8.4%, $p = .045$) and frequent smoking (11.4% vs. 3.1%, $p = .007$) behaviors than those who remained in the study at Wave 3. Additionally, there was a significant gender difference in rates of frequent smoking among those who left the study (female, 41.7% vs. male, 0%, $p = .012$). Those who left the study also had significantly higher rates of living in the "remote" location (18.9% vs. 9.0%, $p = .034$), drinking alcohol (14.8% vs. 5.4%, $p = .009$) and smoking marijuana (11.1% vs. 4.8%, $p = .038$) than those who remained in the study.

Descriptive characteristics of the study sample are provided in Table 1. Details of sampling and interview procedures were published elsewhere (Whitbeck, Yu, Johnson, Hoyt, & Walls, 2008; Whitbeck et al., 2009).

2.2. Measures

2.2.1. Cigarette smoking status (Dependent variable)

Cigarette smoking status (Dependent variable) was measured at each time point. Youths were first asked if they had ever smoked cigarettes. If youths reported ever smoking, they were asked how often in the past 12 months they smoked. The responses to the combined question resulted in a 7-point scale assessing the intensity of adolescent cigarette smoking ("0 = never," "1 = one or two times a year," "2 = less than once a month," "3 = once a month," "4 = every week," "5 = nearly every day," and "6 = every day"). Based on a wide range of definitions of smoking status (CDC, 2000; Husten, 2009), cigarette smoking status was operationally defined as three categories based on the combined question in our study: nonsmokers (have never smoked in their life, "0"), occasional smokers (smoked monthly or less, "1, 2 & 3"), and frequent smokers (smoked weekly or more, "4, 5 & 6").

2.2.2. Intention to smoke (Personality system variable)

Intention to smoke (Personality system variable) was created for this study and measured by a single item regarding agreement to a statement: when I get older, I will smoke cigarettes. Intention to smoke was dichotomized with 1 indicating "agree" and 0 indicating "disagree."

2.2.3. Depressive symptoms (Personality system variable)

Depressive symptoms (Personality system variable) were measured using the Center for Epidemiologic Studies Depression Scale, a 20-item self-report scale to evaluate past week levels of depressive symptoms (Radloff, 1977) and has been used for Indigenous populations (e.g., Whitbeck et al., 2009). Responses were rated on a 4 point scale ("0 = 0 days," "1 = 1–2 days," "2 = 3–4 days," and "3 = 5–7 days"). Items to the 20 questions were summed. The scoring of positive items was reversed. The higher scores indicate higher depressive symptoms. The scale has a high internal consistency reliability across time with Cronbach's alpha of 0.85 at Wave 1 (actual range: 0–44), 0.83 at Wave 2 (actual range: 0–47) and 0.83 at Wave 3 (actual range: 0–46).

2.2.4. Best friends' smoking (Perceived environment system variable)

Best friends' smoking (Perceived environment system variable) was measured by a single item. Adolescents were asked, as far as they knew, how many of their three best friends smoke cigarettes. This question has

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