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Multivariate Family Factors in Lifetime and Current Marijuana Use Among American Indian and White Adolescents Residing On or Near Reservations

Randall C. Swaim^a and Linda R. Stanley^a

Randall C. Swaim: randall.swaim@colostate.edu; Linda R. Stanley: linda.stanley@colostate.edu

^aDepartment of Psychology, Colorado State University, Fort Collins, CO, USA

1. Introduction

1.1 Marijuana use among American Indian youth

Indigenous youth throughout the world often report higher rates of cannabis compared to their non-indigenous counterparts including First Nation (Tu et al., 2008) and Australian (Lee et al., 2009) youth. Data from population-based studies of adolescent substance use in the U.S. consistently indicate higher rates of marijuana use among American Indian (AI) adolescents as compared to other ethnic/racial groups (Clark et al. 2013; Johnson et al., 2015; Stanley et al., 2014a). Furthermore, the incidence of marijuana use is likely to increase substantially during the adolescent years (Cheadle and Sittner Hartshorn, 2012; Novins and Barón, 2004; Walls et al., 2013). Heavy use of marijuana is associated with numerous negative outcomes including neurocognitive deficits (Bolla et al., 2002), reduced affective response (Gruber et al., 2009), lowered task performance associated with reduced motivation (Lane et al., 2005), and a variety of psychosocial problems including school dropout, unemployment, and increased risk for delinquency (Fergusson et al., 2008; Green et al., 2010; Lynskey and Hall, 2000). This raises serious public health concerns regarding the substance use trajectories of AI youth, especially considering their early initiation of marijuana use (Stanley and Swaim, 2015; Whitesell et al., 2012). While various risk factors for substance use have been identified for the general population of adolescents (Hawkins et al., 1992), there is evidence that family factors may be especially important in relation to indigenous youth in general (Calabria et al., 2013) and AI youth in particular (LaFromboise et al., 2006; Swaim et al., 1993).

Corresponding Author: Randall C. Swaim, 106 Sage Hall, Tri-Ethnic Center for Prevention Research, Department of Psychology, Colorado State University, Fort Collins, CO, USA, Phone: (970) 491-0527; FAX (970) 491-0527.

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Conflict of Interest

The authors declare no conflicts of interest in the conduct of this study.

Contributors

Randall Swaim and Linda Stanley each conceptualized the study. Randall Swaim conducted the analyses, wrote the introduction and methods, and assisted in writing the results and discussion. Linda Stanley wrote the major portions of the results and discussion. Both authors have read and approved the submission of the final version of this manuscript to *Drug & Alcohol Dependence*.

1.2 Family factors and American Indian substance use

The nature of family influence, though important to all adolescent development, is unique among AI populations. With time, AI families move farther away from the sad legacy of the early boarding school experience, forced removal from lands, and the loss of cultural and family traditions through these and other loss experiences (Edmunds, 1995; Evans-Campbell, 2008; Glover, 2001). But the intergenerational effects of these traumatic events continue to impact current day Native families (Evans-Campbell, 2008). Despite these ongoing challenges, many AI families are important sources of strength and resilience to their children (Limb et al., 2014; LaFromboise et al., 2006). Various authors (Red Horse, 1997; Stiffman et al., 2007) point to the unique characteristics of strength within Native families such as expectations for kinship responsibility, non-competitiveness, and unobtrusiveness in parenting, along with informal caregiving. This is opposed to the more typical deficit model that emphasizes non-involvement, substance use, and other behavioral problems. Both strengths and deficits are part of the picture among families of all cultural groups. Accordingly, we consider in this study, family variables that fall into both categories. Variation in familial influences may help explain differences in AI youth and their white counterparts who use and do not use marijuana.

1.3 Family factors across developmental stages

The impact of family also varies across the developmental span. As youth age into later adolescence, other social influences, most notably peers, begin to impact values and life choices, with family influences becoming less influential (Sawyer and Stevenson, 2008). Therefore, it is important to consider how family variables may shift in relative importance across differing developmental periods. This study examines differences in the relationship between family variables and lifetime and current marijuana use across middle (MS) and high school (HS) students.

1.4 Ethnic comparisons of American Indian to other youth

The other consideration we address is whether family influences differ across ethnicity. Numerous cross-ethnic studies of U.S. adolescent youth have been conducted to determine potential differences both in epidemiology and etiology of substance use. The findings from these studies point both to similar and unique patterns of use, and risk and protective factors related to use (Barrera et al., 2001, 1999; Oetting et al., 1989; Swaim et al., 1993). This study is part of an ongoing effort to track population-based trends in substance use among reservation AI students in grades 7 through 12. But because the sample includes substantial numbers of white youth attending the same schools on or near reservations, it offers the opportunity to compare effects across these two ethnic/racial groups. In comparison to other studies in which AI youth are contrasted to samples of national youth, the current sample partially controls for some of the socio-economic factors present on reservations, due to surveying youth who reside in the same areas.

1.5 Proximal and distal family factors

As noted in the next section, each of the family variables we considered has shown associations with adolescent substance use in AI or general populations including family

structure, family attitudes toward substance use, family communication regarding substance use, family involvement in school, parental monitoring, and family conflict. We employed a common strategy when multiple risk and protective factors are considered, classifying them into distal and proximal categories, and then comparing sequential models that included increasing sets of variables (Salvy et al., 2014; Storvoll et al., 2015), and examining changes in the relative influence of factors. This approach permitted us to assess the influence of distal versus proximal factors as well as first accounting for the effects of the control variables. Factors that directly related to marijuana use (family attitudes toward marijuana use, family communication about marijuana use) were classified as proximal and factors that were non-specific to marijuana use (parental monitoring, family involvement in school, family conflict) were classified as distal. Family structure and sex, measures of classification, served as control variables.

1.6 Review of family variables and adolescent substance use

1.6.1 Family structure—The constellation of family structure is associated with adolescent substance use. Youth living with both parents are less likely to use alcohol and other substances and this has been well documented in AI samples (Eitle et al., 2013; Henry et al., 2011; Lonczak et al., 2007).

1.6.2 Family sanctions against marijuana use—Negative parental attitudes toward substance use, including marijuana, reduce adolescent risk for use in the general population (Bahr et al., 2005; Kelly et al., 2002) and in AI samples (Beauvais, 1992).

1.6.3 Family communication about substance use—Beyond the effects of parental attitudes toward use, substance-specific parent-child communication also decreases risk. While there does not appear to be current research addressing this factor in AI families, a wide body of research supports the importance of this variable in the general population (Kam and Yang, 2014).

1.6.4 Parental monitoring—Parental monitoring is a robust protective factor in the prevention of adolescent substance use (Dishion et al., 2003; Racz and McMahon, 2011). While Native parents often assume a less active and more indirect approach to parenting (Bigfoot and Funderburk, 2011; Forehand and Kotchick, 1996), several studies confirm that AI families who monitor their child's behavior more effectively, reduce substance use risk (Boyd-Ball et al., 2014; Moon et al., 2014; Rodgers and Fleming, 2003).

1.6.5 Family participation in school—One variable that receives less attention in the literature is family participation in school activities. Kumar et al. (2014) noted both developmental and socioeconomic differences in this factor. They found that parental participation was unrelated to substance use among 10th graders, but associated with higher levels of alcohol use among 12th graders. Additionally, this variable was related to lower levels of adolescent substance use among higher educated parents, but higher levels of use among lower educated parents. The authors suggest that this difference may relate to proactive versus reactive participation, with the latter being in response to student behavioral problems. Others have found that parental school participation related negatively to

substance use transitions in urban samples (Mistry et al., 2015). We are aware of no study that has specifically examined this factor in AI samples.

1.6.6 Family conflict—Finally, family environments characterized by arguing, fighting, and conflict are associated with elevated risk for adolescent substance use, and this relationship is supported among AI families (Barrera et al., 2001; Stanley et al., 2014b).

1.7 The current study

The current study examines the relative relationship of family influence variables on lifetime and current marijuana use among a population-based sample of AI youth who live on or near reservations. Comparisons are made to white youth attending the same schools, and variations across developmental level (MS, HS) are assessed. This study expands our knowledge of the nature of familial strengths and risk in an ethnic/racial group that is at high risk for marijuana and other substance use. The inclusion of a wide variety of variables allows for investigation of the relative strength of a broad range of familial influences, and the comparison to the largest non-Indian ethnic/racial group residing on reservations helps identify both similarities and variations in risk and protective patterns. While association with substance using peers is an additional risk factor of importance, its inclusion can overshadow the unique effects of family variables. Therefore, peer use, association with substance-using peers, and other forms of risk and protection were not included in the models.

2. METHODS

2.1 Participants

This study is part of an ongoing surveillance of substance use epidemiology and etiology among youth who attend schools that are on or near AI reservations. Participants were from 35 middle schools and 17 high schools across the school years for 2009 through 2014. Schools were eligible for participation if they had at least 20% AI students. For the ongoing project, schools are sampled across seven geographic regions (Northwest, Northern Plains, Upper Great Lakes, Northeast, Southeast, Southern Great Plains, Southwest) to approximate the percentage of AI youth residing in each region. The current sample included the following regional distribution of students (Northwest 5%, Northern Plains 38%, Upper Great Lakes 27%, Southeast 9%, Southwest 21%). Students who self-identified as AI or white (non-Indian) were included in the sample, and students were divided into two age groups, middle school (MS, 7–8th graders), and high school (HS, 9–12th graders). The total sample size included 4942 students (AI 68.4%; white 31.6%; MS 33.6%; HS 66.4%; Females 49.2%).

2.2 Procedure

All survey procedures were conducted in compliance with the university institutional review board. When required, school board and/or tribal authority resolutions were obtained. Further information about survey procedures can be found in Stanley et al. (2014a). Parents were notified about the survey through a letter mailed to their home along with a broad local media release, and were given the opportunity to opt their child out of the survey. Less than

one percent of students did not complete the survey due to lack of parental consent. Students were informed that they were not required to participate in the survey and that if they chose to participate, they could refuse to answer any questions with which they were not comfortable.

2.3 Measures

Students completed The American Drug and Alcohol Survey™. This survey has been validated for use with AI students, majority youth, and other ethnic minority groups (Oetting and Beauvais, 1990). Lifetime marijuana use was measured with the item, “Have you ever tried marijuana (pot, grass, hash, herb, etc.)?” with responses of yes or no coded as 1 or 0. Current marijuana use was measured with the item, “How many times have you used marijuana in the last month?” Students who reported at least one use of marijuana in the last month were coded as 1, and those reporting no use in the last month were coded as 0. Students self-reported their sex and ethnicity.

All measures were based on student report. No data were obtained from family report. To assess family structure, students were asked, “Who do you live with most of the time?” (mother, father, stepmother, stepfather, etc.). Students were classified as living with either both or less than both parents, coded as 1 or 0. For all remaining measures, each ranged from 1 to 4 (not at all, not much, some, a lot). Perceived family sanctions against marijuana use were measured with one item that asked, “How much would your family try to stop you from using marijuana?” Family communication (marijuana) was measured with one item, “How much has your family talked to you about the dangers of using marijuana?” The remaining measures consisted of summed scales of multiple items, divided by the number of scale items to retain the original 1 to 4 scaling. Parental monitoring was measured with four items (“My parents... allow me to go out as often as I want,... let me go anywhere I want without asking,... are less strict than most parents in letting me have fun with my friends,... let me stay out as late as I want to; Cronbach alpha = .83). Family school participation was measured with three items (“Does your family... go to school events like music programs, sports events, etc.? know what is going on at school? go to school meetings like PTA or PTO, back to school night, etc.? Cronbach alpha = .76). Family conflict was measured with two items followed by the stem “Do the members of your family... fight with each other,... argue with each other (Cronbach alpha = .83).

2.4 Missing data procedures

Rates of missing data across all variables ranged from 0% to 11% percent. Similar patterns of missingness were observed across ethnicity and there were no indications of systematic missingness, justifying the use of multiple imputation (Shafer and Graham, 2002). Ten datasets were imputed and estimates were combined within the missing data function for IBM SPSS, Version 23. In addition to covariates, the imputation model included auxiliary variables (sex, ethnicity, grade) to improve estimation of imputed values.

2.5 Data Analysis

Two-way (ethnicity X grade level) factorial ANOVA's evaluated mean differences for each of the family variables, testing for main effects and the interaction. For each grade level

within ethnicity group, three logistic regression models (GEE) were conducted. The first model, control, included sex and family structure as factors. This was followed by the distal model while controlling for sex and family structure. The final model was comprised of the control, distal, and proximal variables. In order to account for the effects of clustering within schools, all analyses were conducted with generalized estimating equations (GEE) within IBM SPSS, Version 23, with a unique identifier for each school used as the clustering variable. While an additional level of clustering (region) was present, there were insufficient units for this variable to provide accurate estimates. The GEE models for binomial outcomes (lifetime marijuana, last month marijuana) with logit link function were employed. This type of model was chosen over a mixed effects binomial regression model as the purpose of the current study was to uncover the population average effects of the family covariates. Odds ratios and 95% confidence intervals are reported for each model variable.

3. RESULTS

3.1 Proportions and mean values of study variables

Table 1 presents the proportions, means, and standard deviations for all measures. As shown, AI students reported greater lifetime and current use of marijuana. Among AI-MS students, 54.9% reported ever trying marijuana and 33.9% reported use in the last month, as compared to 18.8% and 11.4%, respectively, for W-MS students. For AI-HS students, 65.3% reported ever using marijuana and 38.9% reported use in the last month. This compares to 30.6% lifetime use and 16.8% last month use for W-HS students. Two-sample z-tests conducted on each of the ethnicity within grade level comparisons were all significantly different ($p < .001$). A higher proportion of white students at each grade level reported living with both parents. Each of the two-sample z-tests conducted on these proportions across ethnicity, within grade level were also significantly different ($p < .001$).

Two-way factorial ANOVA's (ethnicity X grade level), including the interaction, were run for each of the independent family variables. For parental monitoring, each source of variation was significant (ethnicity, $F(1,5131) = 20.62$, $p < .001$; grade level, $F(1,5131) = 10.05$, $p = .002$, interaction, $F(1,5131) = 15.77$, $p < .001$). While both main effects were significant, the significant interaction showed that W-MS students reported higher levels of parental monitoring than the other three groups. Results for family conflict indicated a significant main effect for ethnicity, but no significant effects for grade level or the interaction. AI students reported higher levels of family conflict as compared to their white counterparts. For family participation in school, significant effects were found for each main effect and the interaction (ethnicity, $F(1,5131) = 22.96$, $p < .001$; grade level, $F(1,5131) = 11.53$, $p < .001$; interaction, $F(1,5131) = 11.37$, $p < .001$). White students reported higher levels of family participation in school as compared to their AI counterparts, and this difference was more pronounced at the MS level. Family sanctions against marijuana also produced significant effects for both main effects and the interaction (ethnicity, $F(1,5131) = 66.70$, $p < .001$; grade level, $F(1,5131) = 4.04$, $p = .05$; interaction, $F(1,5131) = 4.30$, $p = .04$). White students reported higher levels of family sanctions as did MS students, with the difference between ethnicities being greater at the MS level. Finally, family communication about marijuana produced no significant effects for either main effect or the interaction.

3.2 Logistic regression models - lifetime marijuana use

Table 2 presents odds ratios (OR) and confidence intervals (CI) for logistic regressions for lifetime marijuana use conducted for the four groups of students - AI-MS; AI-HS; W-MS; and W-HS. Model 1 provides the unit-specific OR and their CI estimates for the control variables only (i.e., sex and family makeup); Model 2 provides OR and CI estimates with the distal variables added to Model 1; and Model 3 provides OR and CI estimates with the proximal variables added to Model 2.

Model 1 results show that sex was not significant in association with lifetime marijuana use for any group. However, living with both parents reduced the likelihood of ever trying marijuana for all groups. This relationship was strongest for W-MS students. The odds of lifetime marijuana use for a W-MS student living with both parents was 0.24 times the odds of a similar white student not living with both parents (CI: 0.10 to 0.60). This compares to the estimated odds ratio of 0.58 for AI-MS students (CI: 0.46 to 0.73); 0.67 for AI-HS students (CI: 0.47 to 0.78), and 0.44 for W-HS students (CI: 0.34 to 0.57).

Model 2 presents odds ratios and confidence intervals for lifetime marijuana use with the distal variables added. As in Model 1, sex was not associated with lifetime use. However, living with both parents was still highly significant for all groups of students, with odds ratios ranging from 0.32 (CI: 0.12 to 0.87) for W-MS students to 0.79 (CI: 0.63 to 0.98) for AI-HS students. Parental monitoring was highly significant in relation to lifetime marijuana use for all students, with relative odds ranging from 0.54 (CI: 0.37 to 0.78) for W-MS students to 0.72 (CI: 0.66 to 0.79) for W-HS students. A one standard deviation increase in parental monitoring (e.g., $SD_{AI-MS} = 0.75$) was associated with odds ratios ranging from 0.45 for W-MS students to 0.78 for W-HS students. For American Indian middle school students living with both parents and with mean values of all variables, the mean probability of ever using is .50 while for these same students but with a level of parental monitoring one standard deviation below the mean, the probability of ever using is .57. Likewise, the mean probability for this same student decreases to .43 when the level of parental monitoring is one standard deviation above the mean. Family conflict was significantly related to lifetime marijuana use for three of the four groups, with relative odds near 1.40 for all groups; for W-MS students, the odds ratio was 1.46 but with a confidence interval encompassing 1. If we compare two students who are the same on all variables except one has a level of family conflict one unit above the other, the student with higher family conflict will have odds of lifetime use approximately 40% higher than the odds of ever using for the student with lower family conflict. Family participation in school was significantly related to lifetime use for only W-HS students with relative odds of 0.89 (CI: 0.86 to 0.91).

Model 3 presents odds ratios and confidence intervals for lifetime marijuana use with the proximal variables added into Model 2. Sex remained non-significant. Living with both parents was significantly related for all groups except AI-HS students. This represents a change from the Model 2 results for AI-HS students, where there was a significant relationship between living with both parents and marijuana use. For W-MS students, the odds of lifetime marijuana use for a student living with both parents was 0.31 times (CI: 0.12 to 0.84) that of a similar white student not living with both parents. The comparable odds ratios for AI-MS students and W-HS students were both 0.68 (CI_{AI-MS}: 0.54 to 0.85;

CI_{W-HS}: 0.51 to 0.91). For W-HS students, this odds ratio is greater than that found in Model 2 while for AI-MS students it is nearly the same as that found in Model 2.

Parental monitoring was significantly related for all groups except W-MS students (OR=0.70; CI: 0.42 to 1.18), with odds ratio very similar to those in Model 2. Results for family conflict were also similar to Model 2, with odds ratios varying between 1.37 and 1.45, though the odds ratio for W-MS students was non-significant. Family participation in school was again significantly related to lifetime marijuana use for only W-HS students, with relative odds of 0.92 (CI: 0.89 to 0.94).

Of the two proximal variables – family sanctions and family communications, only family sanctions against marijuana was significant in relation to lifetime marijuana use, and it was significant for all groups. The relative odds for W-MS students was about one-half that for AI-MS students (OR_{AI-MS} = 0.79; OR_{W-MS} = 0.40), suggesting a significantly greater relationship between family sanctions and lifetime marijuana use for W-MS students as compared to their AI counterparts. The odds ratio for W-HS students was somewhat less than that for AI-HS students, with the confidence intervals around these odds ratios overlapping considerably (OR_{AI-HS} = 0.58, CI: 0.44 to 0.76; OR_{W-HS} = 0.52, CI: 0.41 to 0.66). These odds ratios indicate that AI-HS students with family sanctions one unit greater than the mean will have odds of ever using marijuana 42% less than the odds of ever using for otherwise similar students but with the mean level of family sanctions.

3.3 Current marijuana use

Table 3 presents the estimates for current marijuana use for Models 1–3. Model 1 results indicate that, as with lifetime use, sex was not significant for current use among AI students. However, W-HS males had a significantly greater probability of current marijuana use as compared to female W-HS students (OR_{W-HS}=1.62; CI: 1.37 to 1.92). The odds ratio for W-MS students was not significantly different than 1, indicating no significant difference between males and females for this group; however, the odds ratio was 1.99 with a confidence interval from 0.56 to 7.05, suggesting low power. Living with both parents reduced the likelihood of current marijuana use for AI-HS and W-HS students, with relative odds of 0.58 (CI: 0.46 to 0.73) for AI-MS students, 0.65 (CI: 0.57 to 0.75) for AI-HS students, and .38 (CI: 0.30 to .49) for W-HS students. The odds ratio for W-MS students was similar to their high school counterparts but was not significantly different from 1.0 (OR_{W-MS} = 0.40; CI: 0.12 to 1.32).

Model 2 results for current marijuana use were similar to those for lifetime use, with a few exceptions. Unlike lifetime use but consistent with Model 1 for current use, W-HS males had significantly greater odds of current marijuana use compared to their female counterparts (OR_{W-HS} = 1.66, CI: 1.38 to 2.02), even after controlling for family measures. Greater parental monitoring was associated with a lower likelihood of current marijuana use for all groups except W-MS students (OR_{AI-MS}=0.62, CI: 0.54 to 0.73; OR_{AI-HS}=0.64, CI: 0.57 to 0.71; OR_{W-HS}=0.57, CI: 0.46 to 0.69). For AI students, the odds of current use for a student with mean level of parental monitoring are just under 40% lower than the odds for an otherwise-similar student with a level of parental monitoring one unit higher than the mean. As with lifetime use, family conflict was significantly related to current use for three of the

four groups, AI-MS ($OR_{AI-MS}=1.30$, CI: 1.15 to 1.47) and AI-HS students ($OR_{AI-HS}=1.42$, CI: 1.33 to 1.52) and W-HS students ($OR_{W-HS}=1.56$, CI: 1.28 to 1.91), with higher levels of family conflict increasing the likelihood of current marijuana use. Family participation in school was significantly related to current marijuana use for both groups of high school students, with relative odds of 0.92 for AI students (CI: 0.86 to 0.99) and 0.89 for white students (CI: 0.85 to 0.94).

Model 3 results show estimates with all variables included. Sex remained significant in relation to current use for W-HS students, with males at greater risk ($OR_{W-HS}=1.57$, CI: 1.32 to 1.88). Living with both parents lowered the likelihood of current use for AI-MS ($OR_{AI-MS}=0.71$, CI: 0.57 to 0.88) and W-HS ($OR_{W-HS}=0.69$, CI: 0.52 to 0.91) students. As with lifetime use, this represents a change from the Model 2 results for AI-HS students, where there was a significant relationship between living with both parents and marijuana use. For both groups of high school students, the odds ratios increased over 50% when all family function variables were included (Model 3), as compared to when they were not included (Model 1). The distal variables of parental monitoring and family conflict had similar results to those in Model 2, with greater parental monitoring significantly reducing the likelihood of current marijuana use for both groups of AI students and for W-HS students. Family conflict increased the likelihood of current marijuana use for three of the four groups ($OR_{AI-MS}=1.30$, CI=1.15 to 1.48; $OR_{AI-HS}=1.42$, CI=1.31 to 1.54; $OR_{W-HS}=1.56$, CI=1.29 to 1.89), the exception once again being W-MS students ($OR_{W-MS}=1.30$, CI: 0.55 to 3.04).

For Model 3, family sanctions against marijuana was once again significant for all four groups, with relative odds ranging from 0.29 (CI: 0.12 to 0.66) for W-MS students to 0.67 (CI: 0.57 to 0.78) for AI-MS students. For both groups of high school students, the odds ratios were the same at 0.47, indicating that for high school students, the odds of current use for a student with a level of family sanctions one unit above the mean are 53% less than the odds of current use for a student with a mean level of family conflict. Although family communication was not significantly related to current use for AI students or for W-HS students, it was significantly related for W-MS students, with more family communication associated with a lower likelihood of current marijuana use.

4. DISCUSSION

4.1 Discussion of study findings

The results show that, as expected, family factors are highly related to adolescent marijuana use across both developmental periods and ethnicity. Furthermore, there are many similarities between AI and white adolescents who attend schools on or near reservations. At the same time, several important differences between these groups emerged. Before discussing these results, it is important to note the anomalies associated with the results for W-MS students. In many cases, the odds ratios were similar to the other three groups but the confidence intervals associated with these odds ratios were comparatively wide and encompassed an odds ratio of 1.0. There was also instability in several coefficients comparing results in Models 2 and 3 for current use. These issues are likely the result of too little data or data that are too variable to make more precise estimates. W-MS students

comprise 3.9% of the sample (201 students). Given these results, our discussion will center on the remaining three groups.

Focusing on the control variables first, males and female students did not differ in their likelihood of lifetime use for any of the four groups in any of the three models estimated. However, for current use, W-HS males were significantly more likely to have used in the last month compared to their female counterparts, whereas AI males and females of both grade groups were equally likely to use in the past month. The results for W-HS students are consistent with Johnston et al. (2014) who found that in their nationally representative sample, 10th and 12th grade males had higher 30-day use than females. However, our results mirror national trends in which at younger ages, male and female students are using marijuana at similar rates.

Living with both parents was associated with a lower likelihood of lifetime and current marijuana use for both ethnicities, even when other family functioning variables were included in the models. This is consistent with a significant amount of research on single parent households and risky behavior (Hemovich and Crano, 2009). Likewise, for AI youth, Lonczak et al. (2007) found that the likelihood of marijuana use increased in both one-parent and non-parent family members' homes as compared to two-parent homes. Our results also suggest that the relationship between living with both parents and marijuana use are stronger for MS youth as compared to HS youth. This finding is consistent with research that finds youth spend less time with family and rely more on peers for social support as they move through adolescence and strive for more autonomy (Furman and Buhrmester, 1992; Larson et al., 1996; Moretti and Peled, 2004; Sawyer and Stevenson, 2008). Finally, a comparison of relative odds and confidence intervals across the two ethnicity groups suggests that the relationship between living with both parents and marijuana use, both current and lifetime, is stronger for white youth. For example, comparing odds ratios across W-HS and AI-HS students shows that once all family variables are included in the model, the relationship between living with both parents and current marijuana use for AI-HS students is non-significant while for their white counterparts, the odds ratio is 0.69 (CI: 0.52 to 0.91), suggesting that living with both parents may be more protective for white adolescents.

The lack of relationship between family structure and marijuana use for AI-HS students may be due to differences in their family compositions and functioning. In general, AI youth are more likely to be raised in homes that are not two-parent compared to white youth (Annie E. Casey Foundation, 2016), and our data are consistent with this finding. Table 1 shows that 35.9% of AI-HS youth reported living with both parents compared to 59.9% of W-HS youth. However, it is not uncommon on reservations for Native youth to be raised, at least in part, by extended family and as such, there is less reliance on the nuclear unit for important functions of the family (Mooradian et al., 2007). Barrett and Turner (2006) found that having an additional relative in a one-parent household provided protective benefits to youth and that this did not translate to youth living with stepparents. In addition, the number of grandparents raising grandchildren is relatively high in AI homes as compared to the general population (Mooradian et al., 2007; Mutchler et al., 2007). This is sometimes the result of the inability of parents to provide adequate childrearing due to substance use and other

negative events and behaviors. In these cases, the grandparent homes may provide a more stable, less stressful, and higher functioning environment.

It has often been reported that AI parents provide more independence and autonomy to their children and let them learn through natural consequences (Glover, 2001). For this sample, while there was a significant main effect for ethnicity for parental monitoring, the significant interaction indicated that the primary difference across ethnicity occurred at the MS level, with AI-MS students reporting lower levels of monitoring by parents compared to W-MS students. Our results also show that greater parental monitoring is associated with both lower lifetime and current marijuana use for all three groups, and the odds ratios are similar. Other studies are consistent in their findings of strong relationships between parental monitoring and marijuana use, and this study is no exception. Moreover, these relationships are similar across ethnicity, indicating that parental monitoring is equally protective across these ethnicities.

Also similar across ethnicities is the relationship between family conflict and marijuana use. For both groups of AI youth and for W-HS youth, an increase in family conflict increases the likelihood of both lifetime and current marijuana use. Additionally, as with parental monitoring, the odds ratios are similar across the two ethnicities. For example, for lifetime use, the relative odds for AI-HS youth are 1.45 while for W-HS youth the relative odds are 1.37, with both being significant. Barrera et al. (2001) argue that families with high levels of conflict find it easier to avoid interacting, and thus parents do not effectively monitor their children. However, our results indicate that even with parental monitoring accounted for in the model, family conflict still increases risk for marijuana use. In a review of studies, Hyman and Sinha (2009) found that marijuana is commonly used as a stress-coping strategy, and our results may be an indication of that. However, further research is needed to assess this.

Turning to the more proximal variables, parental sanctions against marijuana use relates to lower lifetime and current marijuana use for all groups. LaBrie et al. (2010) found that even for college students, perceived parental approval of marijuana use was significantly related to own marijuana use (a composite measure for past month and past year). These results lend support for targeting parents/families in prevention efforts for MS and HS students, whether AI or white. However, it must also be noted that with the relatively high rates of adult use of marijuana on reservations (Whitesell et al., 2007), this may prove challenging. Comparing the means of this variable across the two ethnicities shows that family sanctions against marijuana use were significantly higher for the white students, as compared to the AI counterparts, with this difference being more pronounced at the MS level.

Family communication about marijuana use was not associated with marijuana use for any of the three groups. This may be due, in part, to using a one-item measure that gauges parental communication about the dangers of marijuana use. Past research notes that parent-child communication about substance use and its effect on initiation and use of drugs and alcohol is not well understood (Miller-Day, 2008; Miller-Day and Kam, 2010). Yet it has become relatively commonplace for organizations to recommend that parents talk to their children about drugs and alcohol as a preventative effort. Without understanding how parents

execute this communication (e.g., content and delivery), along with the perceived barriers to such communication, what types of messages are most effective, and so on, such recommendations, though well-meaning, may be nonproductive or even counterproductive to preventing youth substance use.

4.2 Study limitations

Several limitations should be considered when interpreting these findings. First, because this sample is cross-sectional in nature, we cannot directly infer causality between variables where significant relationships were found. Additionally, although this study investigated a large sample of adolescents living on or near reservations, it does not reflect a random sample of all schools on or near reservations due to voluntary participation, and thus, the results may differ from those obtained from the entire population of AI and white youth who live on or near reservations. However, this sample does represent the largest sample of adolescents living on or near reservations of which we are aware and included students across broad geographic locations where reservation-based AI students reside. In addition, because the survey took place in schools, the sample does not include adolescents who have dropped out of school. With very high rates of dropout among AI youth, findings may be different than if all youth in these age groups were included (Swaim et al., 1997).

An additional limitation was the measure of family structure. Based on prior findings, we decided to use the most commonly reported measure of family structure in relation to adolescent substance use, whether or not the youth resides with both parents. We recognize, however, that additional kin influences (grandparents, aunts, uncles) often serve key roles in child-rearing and behavioral modeling of prosocial behaviors in AI families (Red Horse, 1997). While one purpose of the current study was to compare our sample to past results on the commonly used measure of family structure to past findings, and to compare across ethnicities, future study should consider using less traditional measures of this variable that incorporate the variations in family relationships among AI families. With respect to other measures, the two proximal variables were one-item measures – perceived family sanctions and family communications about marijuana use. However, single item measures have been found to be reliable for a variety of constructs, especially those where a holistic impression is informative (Youngblut and Casper, 1993; Zimmerman et al., 2006).

4.3 Conclusions

In summary, results from this study show that family variables are strongly related to both lifetime and current marijuana use among AI and white students who attend schools on or near reservations. While some differences may be present both across ethnicity and developmental levels, there is considerable similarity in the family variable and marijuana relationships across these groups. These results highlight the importance of incorporating families as an important source of protection both against the uptake and continuing use of marijuana.

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Highlights

- Family factors served as sources of risk and protection for lifetime and current marijuana use.
- Some differences but more similarities between American Indian and white youth.
- Important to incorporate families as sources of protection against uptake, current marijuana use.

Means/Percentages and standard deviations for distal and proximal variables by ethnicity and grade group

Table 1

	American Indian			White		
	Middle School	High School	High School	Middle School	High School	High School
	Percent	Percent	Percent	Percent	Percent	Percent
Lifetime marijuana use	54.9%	65.3%	18.8%	30.6%		
Current marijuana use	33.9%	38.9%	11.4%	16.8%		
Live with both parents	31.60%	35.9%	56.7%	59.9%		
	Mean	SD	Mean	SD	Mean	SD
Family cohesion	3.63	0.63	3.73	0.54	3.80	0.52
Parental monitoring	3.01	0.75	3.03	0.78	3.27	0.66
Family participate school	2.66	0.92	2.66	0.91	2.93	0.81
Family conflict	2.33	0.90	2.30	0.89	2.23	0.90
Family stop marijuana	3.46	0.95	3.46	0.92	3.83	0.57
Family discuss marijuana	3.02	1.10	3.01	1.09	3.10	1.13

Note: MS = Middle School; HS = High School

Table 2

Logistic regression model results for lifetime marijuana use by ethnicity and grade level

	American Indian				White			
	Middle School		High School		Middle School		High School	
	OR	CI	OR	CI	OR	CI	OR	CI
Model 1: Control								
Intercept	1.48*	1.04,2.10	2.30**	1.37,3.89	0.37	0.13,1.01	0.77	0.59,1.02
Male	0.96	0.77,1.19	0.93	0.67,1.29	1.26	0.53,3.02	1.10	0.93,1.29
Live with both parents	0.58***	0.46,0.73	0.67***	0.57,0.78	0.24**	0.10,0.60	0.44**	0.34,0.57
Model 2: Control + Distal								
Intercept	1.46*	1.07,2.01	2.32***	1.42,3.79	0.29*	0.11,0.77	0.64**	0.47,0.86
Male	0.92	0.75,1.14	0.88	0.65,1.20	1.24	0.54,2.84	1.10	0.94,1.29
Live with both parents	0.66***	0.52,0.83	0.79*	0.63,0.98	0.32*	0.12,0.87	0.58***	0.45,0.75
Parental monitoring	0.67***	0.56,0.80	0.66***	0.58,0.75	0.54**	0.37,0.78	0.72***	0.66,0.79
Family conflict	1.40***	1.23,1.60	1.46***	1.35,1.58	1.46	0.98,2.18	1.36***	1.23,1.51
Family participate school	0.96	0.91,1.00	0.96	0.91,1.01	0.96	0.82,1.12	0.89***	0.86,0.91
Model 3: Control + Distal + Proximal								
Intercept	1.49*	1.08,2.04	2.41***	1.47,3.95	0.26*	0.09,0.74	0.60**	0.43,0.83
Male	0.89	0.72,1.11	0.85	0.62,1.16	1.47	0.56,3.86	1.02	0.87,1.19
Live with both parents	0.68***	0.54,0.85	0.85	0.71,1.03	0.31*	0.12,0.84	0.68**	0.51,0.91
Parental monitoring	0.69***	0.57,0.83	0.72***	0.63,0.83	0.70	0.42,1.18	0.77***	0.70,0.85
Family conflict	1.40***	1.23,1.60	1.45***	1.34,1.58	1.39	0.96,2.03	1.37***	1.22,1.55
Family participate school	0.99	0.94,1.03	0.98	0.93,1.04	1.02	0.83,1.25	0.92***	0.89,0.94
Family stop marijuana	0.79**	0.65,0.95	0.58***	0.44,0.76	0.40***	0.27,0.60	0.52***	0.41,0.66
Family discuss marijuana	0.97	0.88,1.07	1.02	0.91,1.15	0.92	0.74,1.16	1.08	0.97,1.20

Note: OR = Odds ratio; CI = Confidence Interval; Intercept = Female + Not Both Parents

Logistic regression model results for current marijuana use by ethnicity and grade level

Table 3

	American Indian				White			
	Middle School		High School		Middle School		High School	
	OR	CI	OR	CI	OR	CI	OR	CI
Control								
Intercept	0.60***	0.44,0.81	0.73	0.50,1.07	0.11***	0.03,0.40	0.26***	0.21,0.33
Male	1.00	0.83,1.20	1.02	0.77,1.36	1.99	0.56,7.05	1.62***	1.37,1.92
Live with both parents	0.59***	0.47,0.73	0.65***	0.57,0.75	0.40	0.12,1.32	0.38***	0.30,0.49
Control + Distal								
Intercept	0.57***	0.42,0.78	0.69*	0.48,0.98	0.10***	0.03,0.34	0.18***	0.13,0.26
Male	0.94	0.76,1.16	0.94	0.72,1.26	1.94	0.71,5.35	1.66***	1.38,2.02
Live with both parents	0.67***	0.53,0.85	0.79*	0.65,0.96	0.51	0.14,1.89	0.54***	0.42,0.70
Parental monitoring	0.62***	0.54,0.73	0.64***	0.57,0.71	0.63	0.36,1.11	0.57***	0.46,0.69
Family conflict	1.30***	1.15,1.47	1.42***	1.33,1.52	1.25	0.57,2.76	1.56***	1.28,1.91
Family participate school	0.95	0.89,1.01	0.92*	0.86,0.99	0.98	0.79,1.21	0.89***	0.85,0.94
Control + Distal + Proximal								
Intercept	0.57***	0.43,0.77	0.66**	0.49,0.91	0.05***	0.01,0.29	0.15***	0.11,0.21
Male	0.88	0.71,1.10	0.90	0.67,1.20	3.67	0.90,	1.57***	1.32,1.88
Live with both parents	0.71**	0.57,0.88	0.92	0.79,1.09	0.40	0.13,1.25	0.69**	0.52,0.91
Parental monitoring	0.67***	0.57,0.78	0.75***	0.68,0.82	1.28	0.58,2.84	0.63***	0.50,0.78
Family conflict	1.30***	1.15,1.48	1.42***	1.31,1.54	1.30	0.55,3.04	1.56***	1.29,1.89
Family participate school	0.98	0.92,1.05	0.96	0.90,1.04	1.24	0.98,1.57	0.94**	0.90,0.98
Family stop marijuana	0.67***	0.57,0.78	0.47***	0.39,0.58	0.29***	0.12,0.66	0.47***	0.38,0.59
Family discuss marijuana	0.98	0.86,1.12	0.91	0.82,1.03	0.50***	0.33,0.77	1.00	0.89,1.13

Note: OR = Odds ratio; CI = Confidence Interval; Intercept = Female + Not Both Parents;