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School Context and American Indian Substance Use

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Abstract

The present study extends prior research exploring the role of school contextual factors in predicting individual adolescent substance use by examining how a school's racial composition is associated with American Indian adolescent tobacco and marijuana use. Using a subsample of 523 American Indian students from the restricted use Add Health data, we consider both individual and school contextual factors across 99 schools. Our results suggest that a school's racial composition is associated with individual tobacco and marijuana use among American Indian youth, but in different ways depending upon the substance. Our findings illustrate the importance of extending research on the correlates of substance use for racial and ethnic minorities beyond studies examining African-Americans and/or Hispanics.

Keywords

school racial composition; American Indians; substance use

Of the voluminous number of studies that have explored the risk and protective factors associated with adolescent substance use, scholars have only recently begun to fully consider the role of the larger social context in understanding individual substance use behaviors (Galea, Rudenstine, & Vlahov, 2005; Ennett & Haws, 2010). And while this research area has clearly blossomed in the past couple of decades, most of the studies exploring contextual and individual correlates of adolescent substance use have examined either non-Hispanic white populations, or white, Black, and (less frequently) Latino adolescent groups—other racial groups have largely been omitted from these multilevel studies. In particular, there exists only a few published studies that have examined the role of school characteristics on American Indian adolescent substance use, despite considerable evidence that American Indian adolescents may be more likely to engage in certain substance use behaviors (relative to others). Further, while research has established racial differences in adolescent substance

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use behaviors (e.g., Johnston, O'Malley, Bachman, & Schulenberg, 2007), there exists a relatively sparse literature examining the role of contextual factors' influence on racial and ethnic minority substance use behaviors, including the potential role that the racial composition of schools may play in understanding such behavior (Cronley, White, Mun, Lee, Finlay, & Loeber, 2012). In the present study, we expand prior research by examining the influence of the school contextual and individual factors in understanding substance use behaviors among a national sample of adolescents (the National Longitudinal Study of Adolescent to Adult Health) with an exclusive focus on the American Indian students.

Background

While researchers have generated a large amount of research exploring the role of individual, peer, and family characteristics associated with adolescent substance use, the role of contextual factors has received considerably less attention (Galea et al., 2005; Cronley et al., 2012). Although the use of multilevel models to assess the complex associations between contextual factors and individual level factors on health generally is still a relatively recent phenomenon (Kawachi & Berkman, 2003), there is an emerging literature that examines the role of contextual factors for a variety of health outcomes (Boardman et al. 2001; Kawachi and Berkman, 2003; Latkin and Curry 2003; Boardman, Saint Onge, Rogers, & Denney, 2005; Hill, Ross, & Angel, 2005; Choi, Harachi, & Catalano, 2006; Wright, Bobashev, & Folsom, 2007; Ross & Mirowsky, 2009; see Leventhal & Brooks-Gunn 2000 for a review). A strong trend in health research is multilevel explorations of the role of school factors/ characteristics in explaining various adolescent health outcomes (e.g., Kulis, Marsiglia, Nieri, Sicotte, & Hohmann-Marriott, 2004; Leatherdale, Brown, Cameron, & McDonald, 2005; Monshouwer et al., 2007).

Despite the rapid growth in research exploring the role that contextual factors play in influencing physical and mental health outcomes, only more recently has research explored how such characteristics may be predictive of substance use and misuse specifically (Galea et al., 2005). Only a handful of studies have explored the role of school contextual factors in explaining individual substance use behaviors using multilevel statistical modeling (e.g., Kulis et al., 2004; Leatherdale et al., 2005; Monshouwer et al., 2007; Botticello, 2009; Mrug, Gaines, Su, & Windle, 2010). Generally, these studies have found support for the basic thesis that school context is associated with student substance use behaviors. In their comprehensive review of multilevel studies of the role of school context on student substance use, Ennett and Haws (2010) note that such variables as school-level substance/ alcohol use prevalence rates (Leatherdale et al. 2005; Botticello, 2009; Mrug et al., 2010), peer disapproval/perceived harm (Kumar, O'Malley, Johnston, Schulenberg, & Bachman, 2002), school climate or school attachment (Henry & Slater, 2007; Mayberry, Espelage, & Koenig, 2009), and school enforcement/prevention policies (Wakefield, Chaloupka, Kaufman, Orleans, Barker, & Ruel, 2000; Kumar et al, 2002) have been found to be predictive of individual substance use behaviors, either directly or in interaction with individual level variables. Although not unequivocal, the majority of such research denotes that school context should be considered when explaining adolescent substance use.

Student Racial Composition and Substance Use

One of the quandaries facing those interested in examining and understanding the role of both context and individual factors associated with substance use is the race/ethnicity/SES paradox. For example, most community-level explanations of crime and delinquency have emphasized the causal role that economic deprivation plays in explaining high crime and delinquency rates in impoverished communities (e.g., social disorganization theory, relative deprivation, concentrated disadvantage). However, multilevel studies of neighborhood disadvantage and substance use have produced mixed results, with some studies finding economic disadvantage to be positively associated with substance use behaviors (e.g., Hoffmann, 2002; Chuang, Ennett, Bauman, & Foshee, 2005; Frank, Cerda, & Rendon, 2007; Henry & Slater, 2007; Xue, Zimmerman, & Caldwell, 2007; Whaley, Smith, & Hayes-Smith, 2011; see Gardner, Barajas, & Brooks-Gunn 2010 for a comprehensive review), while others have found that community *affluence*, rather than disadvantage is associated with a higher likelihood of adolescent substance use (Snedker, Herting, and Walton 2009; Reboussin, Preisser, Song, & Wolfson, 2010; Cronley et al, 2012). Likewise, despite the reality that many racial and ethnic minorities disproportionately reside in economically disadvantaged communities, cumulative evidence suggests that most racial and ethnic minority youth in America use substances less frequently than (both non-Hispanic and Hispanic) whites (SAMHSA 2009; Wallace, Vaughn, Bachman, O'Malley, Johnston & Schulenberg, 2009). As Cronley and colleagues noted, "it appears that community characteristics may be differently associated with substance use than they are with delinquency" (2012: 54–55; see also Amey & Albrect, 1998).

The same can be said about school characteristics as well. A number of multilevel studies of adolescent substance use have explored the role of a school's racial/ethnic composition in explaining individual student substance use, either directly or indirectly in cross-level interactions, with racial/ethnic composition serving as a moderator (e.g., Kulis et al. 2004; Monshouwer et al. 2007; Wallace, Yamaguchi, Bachman, O'Malley, Schulenberg, & Johnston, 2007; Mrug, Gaines, Su, & Windle, 2010). Of these studies, most have found that percent minority is associated with a lower probability of individual student substance use (e.g., Kulis et al. 2004; Monshouwer et al. 2007; Wallace et al. 2007), although some inquiries have failed to find school racial/ethnic composition to be a predictor of individual substance use (Mrug et al. 2010).

As to *why* racial/ethnic composition may influence individual student substance use, Kulis and colleagues (2004) noted that a number of different explanations that have been forwarded, including the insulation hypothesis, the subjective culture hypothesis, and the bicultural competence hypothesis. Both the *insulation* and *subjective culture* hypotheses suggest that the experiences associated with being an ethnic/racial minority in a predominately white student body creates adverse consequences for minority students. In the former, while white students experience cultural reinforcement, minority students experience dissonant cultural environments (Kulis et al. 2004: 372). The subjective culture hypothesis suggests that minority students will be evaluated unjustly by white standards (Kulis et al. 2004: 372). Alternatively, the bicultural competence hypothesis suggests that rather than produce stress for minority students, being a numerical minority in a predominately white

student population creates the opportunity for minority students to develop superior coping skills (Kulis et al. 2004: 372). Hence, while the first two hypotheses suggest that being a minority student in a predominately white population will produce stress that serves to increase the risk of substance use, the bicultural competence hypothesis implies that minority students will be less likely to engage in substance use due to exposure to a predominately white student body that might contribute to the development of protective coping skills. Conversely, each of these hypotheses implies that a school racial composition that is comprised of more minorities would not significantly influence the risk of substance use for minority students.

School Climate and Substance Use

In addition to explanations that focus on the racial composition of the school, we also consider another explanation of the role of context on individual substance use behaviors: *school effectiveness/school climate*. School effectiveness/school climate models emphasize “the ability of the social organization to maintain order and meet its goals; school effectiveness is the ability to exert effective social control” (Rountree & Clayton, 1999: 501). Schools can exert effective social control through both formal and informal mechanisms that inhibit unwanted student behaviors, including substance use. Formal mechanisms of social control include rule clarity and enforcement practices and the degree of student involvement in decision-making about the school, while informal mechanisms of social control include the degree of bonding or attachment between students and the school. A school climate, or school personality as conceptualized by Anderson (1982), that promotes a sense of community among students, with a pro-academic focus, clear rules and disciplinary practices, and a sense among students that educators care about them will experience fewer substance use problems (Welsh, Stokes, & Greene, 2000; Eitle & Eitle 2004; Henry & Slater, 2007; Ennett & Haws, 2010). Overall, studies exploring measures of school climate, including school attachment (Henry & Slater, 2007; Mayberry, Espelage, & Koenig, 2009; see also Sellstrom & Bremberg, 2006) and school enforcement practices (Moore, Roberts, & Tudor-Smith, 2001; Maes & Lievens 2003), have found these aspects of the school climate to be predictive of individual substance use behaviors.

School Context, American Indians, and Substance Use

None of the multilevel studies mentioned above have examined the role of student racial/ethnic composition for the substance use of American Indian students, however—studies exploring the role of racial/ethnic composition on individual student substance use have looked at white, Black, and Latino (and one study examining Asian and Pacific Islander, see Kim & McCarthy, 2006) students. In these cases, the ethnic/racial minority in question has been a group that has been found to be less likely (at the individual level) to engage in substance use, relative to whites. But what about American Indian adolescents, who, according to some research, are at significantly *greater risk* of substance use and abuse than their white counterparts (SAMSHA, 2009; Young & Joe, 2009)? Would exposure to a white majority group lead to *lower risk* of substance use for American Indians, consistent with a bicultural competence explanation? Or will being an ethnic minority serve to increase substance use behavior, consistent with an insulation/subjective culture explanation?

Despite evidence that American Indian adolescents are at a heightened risk for many types of substance use behaviors, we are aware of no prior published study that has examined the role of school contextual factors in predicting American Indian substance use behaviors using multilevel modeling. However, studies have found that various school-related factors—at the individual level—predict American Indian substance use, including a sense of belonging in school (Napoli, Marisglia, & Kulis, 2003), school bonding (Dickens, Dieterich, Henry, & Beauvais, 2012; Heavyrunner-Rioux and Hollist, 2010) and student perceptions of school safety (Nalls, Mullis, & Mullis, 2009). Overall, these studies suggest that school-related factors may be important for understanding American Indian substance use behaviors, but none have explored school contextual factors using multilevel modeling.

In summary, the present study examines the potential role of school contextual factors generally, with a particular focus on the role of the school ethnic composition in understanding American Indian adolescent substance use behaviors. Based on the bicultural competence explanation, we would expect that increases in the size of the white student population would be associated with lower levels of American Indian student substance use. Conversely, based on an insulation/subjective culture explanation, we would expect American Indian student substance use behavior to increase as the size of the white student population increased. We employ multilevel modeling techniques to consider the predictive utility of school contextual factors as well as a number of individual level characteristics to predict adolescent substance use.

Methods

We use data from Wave I of the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally-representative school-based sample of adolescents in grades 7–12 (Harris et al. 2009). Data collection took place during the 1994–1995 school year and included an in-school questionnaire of students ($n=90,118$) and school administrators ($n = 144$) as well as an at-home questionnaire for a subset of students ($n = 20,745$). Information for the current study about the school context was drawn from both the in-school and administrator questionnaires and includes 99 schools who were not missing on school-level data and had American Indian (AI) students attending that school. The Wave I at-home questionnaire provided the individual level data on the health and social behavior of the adolescent respondents. Our analytic sample include AI students with a valid sample weight who were not missing information on any variables ($n = 523$). Due to the unequal probability of sample selection in Add Health (Chantala, 2006), all analyses were weighted to account for the Add Health design effects.

Measures

Dependent Variables—Two measures of substance use behavior were considered in the current study. *Tobacco smoking* was based on a question asking respondents how many cigarettes they smoked per day in the past month. *Marijuana smoking* was a measure of how many times respondents reported smoking marijuana in the past month. In order to linearize these data, a log transformation of each of these variables was performed.

School Contextual Variables—Measures of the school context were created by aggregating information from the in-school questionnaire of students (using the full sample of $n=90,118$ students) as well as using school-specific information from the administrator's questionnaire. These school-level measures include: racial composition and school environment. Two measures of racial composition were included in the current study: *percent American Indian* (range .01 – .48) and *percent Non-Hispanic White* (range 0 – 0.94).

Principal component analysis (PCA) was used to create measures of the school environment using eight indicators of the school setting: average student grade-point average (GPA), school attachment, percentage of seniors in college-preparatory classes, size of the school, average class size, whether the school was private, the severity of punishment for rule violations, and a count of school rules (percent of families participating in PTA was also considered in original PCA, but it failed to exhibit high loadings on any of the retained components, so it was dropped from further analyses and the PCA was conducted again). Student GPA and school attachment were aggregated from the in-school questionnaire of students, while the remaining variables were taken from the administrators' questionnaire. School attachment is a mean-scale created from a series of questions asking students how much they agree or disagree with the following statements (1 “strong disagreement” to 5 “strong agreement”): they feel they are a part of the school, feel close to people at school, they are happy to be at their school, they feel safe at their school, and the teachers at their school treat students fairly. Responses were aggregated to the school level. School punishment severity is a mean-scale created from a series of questions asking school administrators about the severity of the punishment for twenty-four rule violations (1 “no policy”, 2 “verbal warning”, 3 “minor action”, 4 “in-school suspension”, 5 “out-of-school suspension”), including cheating, fighting, alcohol possession, and stealing school property. School rules is a count index created from a series of questions asking school administrators about the presence of five different rules of the school for students in grades 10th, 11th, or 12th grade (0 “no” 1 “yes”): hall pass is required, visitors must sign in, students must stay on school property, students may not smoke at school, and students have a dress code.

After running a principal component analysis of these eight variables with a varimax rotation, four factors were retained and the resultant factor scores were used to represent four measures of school environment. Our decision to retain four factors was based on the eigenvalue-one criterion, but also supported by analysis of the scree plot and a consideration of the proportion of variance accounted for by the factors (see Appendix A for the results of the principal component analysis, including factor loadings and variance explained). These four measures are labeled positive *school climate*, *resource advantage*, *school dimensionality*, and *school punitiveness*, based on the original measures that had the highest loadings on each factor (although the factor scores were produced from the PCA on all nine variables). The positive school climate measure captures aspects of support in the school environment including: greater average attachment to the school and higher average student GPA. The resource advantage measure captures dimensions of the school environment associated with more financial resources for students, including a greater number of students enrolled in college preparatory courses and a higher likelihood that the school is private. School dimensionality captures such aspects as school size and average class size. The

school punitiveness measure captures the strictness of a school's disciplinary policies, including more rules for students and greater severity in punishments for rule violations.

In addition to the four measures of the school environment, two binary indicators of school program availability were included at the school-level and measured with questions asked of school administrators. *Drug awareness program* was a binary indicator (0 “no” 1 “yes”) of whether the school had a drug awareness program for students on campus. *Drug abuse program* was a binary indicator of whether the school had a drug abuse program for students on campus.

Student Level Variables—Several individual characteristics of adolescents have been found to be predictive of substance use behavior and are included as individual-level predictors: family structure, parental education, gender, age, GPA, self-esteem, social support, parental alcohol use, self-control, religiosity, depressive symptomology, and recent life events. *Family structure* was comprised of four dummy variables: biological married parents (the referent category), married stepfamily, single parent family, and other family form. A measure of the highest level of *parental education* among available parents included three categories: 1 “no parent graduated from high school”, 2 “at least one parent graduated from high school”, 3 “at least one parent graduated from college”. *Gender* was measured with females serving as the reference group (0 “males” 1 “females”), and *age* was measured in years. Information on the students' grades in their English, history, math, and science classes (1 “D or lower” to 4 “A”) were used to calculate their *grade point average (GPA)*; range 1 – 4). A mean scale of the youth's sense of *self-esteem* was calculated from seven items which asked respondents how much they agreed or disagreed (1 “strongly disagree” to 5 “strongly agree”) with statements such as: you have a lot of good qualities, you like yourself the way you are, and you feel socially accepted ($\alpha = 0.85$). *Parental control* was measured as a count index of the number of decisions that parents make about seven of youths' behaviors (0 “youth makes own decision” 1 “parent helps to make the decision”), including, for example: what time they must be home on weekend nights, the people they hang around with, how much television to watch, and what youth wear. A higher value on this scale indicates greater parental control over adolescent decision-making. *Social support* was calculated from six items asking how much they feel adults care about them, teachers care about them, parents care about them, their family understands them, their family has fun together, and their family pays attention to them (0 “not at all” to 4 “very much”; $\alpha = 0.79$). *Parental Alcohol Use* was measured with a single ordinal variable capturing of how often the parent who completed the parental questionnaire (usually the biological mother) reported drinking alcohol (1 “never” to 6 “nearly everyday”). Our three-item measure of *self-control* includes such questions as “when you have a problem to solve, one of the first things you do is get as many facts about the problem as possible” and “when you are attempting to find a solution to a problem, you usually try to think of as many different ways to approach the problem as possible.” Higher scores indicated greater self-control ($\alpha = .78$). We constructed an additive *religiosity* scale from three items (questions assessing the importance of religion in their lives, participation in religious services and youth groups; $\alpha = .81$). *Depressive symptomology* was a scale calculated from 19 items from the Center for Epidemiologic Studies Depression (CES-D) scale. Each item utilized a 4-point ordinal

response measuring depressive symptoms. The resulting scale was a summation of students' responses to the 19 items ($\alpha = .86$). And peer substance use was measured as a count index of three questions asking respondents how many of their three best friends smoked at least one cigarette a day, drank alcohol at least once per month, and used marijuana at least once per month (range 0 – 9).

And finally, *recent life events* is a count index of respondents' experience in the past year of eighteen stressful life events: school suspension, school expulsion, moving residence, mother died, father died, female respondent reported becoming pregnant in the past year, female respondent reported being raped in the past year, serious injury, respondent attempted suicide, friend attempted suicide, family member attempted suicide, needed medical attention but didn't receive it, tested or treated for an STI in the past year, saw someone shoot or stab someone else, had someone pull a knife on them, had someone shoot them, had someone cut or stab them, and were jumped. A dummy variable was also included to indicate whether the respondent attended a *junior high school* (the default is that the student attended high school).

Analysis Strategy

A hierarchical linear modeling procedure is employed to generate parameter estimates because the data are multilevel (Bryk, Raudenbush, & Congdon, 1996). There are a number of methodological advantages for using multilevel modeling: multilevel models do not violate the assumption of independence among observations because they account for the clustering of individuals within higher-level units such as counties; they are advantageous for estimating cross-level effects since all estimates are adjusted for the covariates, despite whether they are measured at the individual or contextual level; and they both partition the variance between levels and statistically separate the variance of the individual-level parameters from sampling variance. The inability to factor out the sampling variance when data are hierarchical results in an underestimation of the explanatory power of contextual variables. All level 2 (school-level) measures and the level 1 variables (except for dichotomous measures) were grand mean centered prior to analyses (Kreft, De Leeuw, & Aiken, 1995).

Our basic analysis strategy first examined a model considering individual level measures only, followed by a model considering both individual and school level measures. The intercept, β_{0j} , represents the mean level of substance use behavior in school j when all individual-level variables are at their means and when the dichotomous variables values equal zero. Table 1 provides the descriptive statistics for each of the variables considered in the analyses.

Results

Table 2 presents the results of the multilevel models predicting substance use. The intraclass correlation (ICC), derived from the estimated null model for both tobacco and marijuana smoking (not reported, results available upon request), suggests that only a small percentage of total variation is explainable at the school level ($p = .034$ for tobacco smoking and $p = .032$ for marijuana smoking, respectively). However, as noted by Kreft and de Leeuw (1998),

even small values of ICC can invalidate hypotheses tests if multilevel modeling is not used, so we consider the results of such models here.

The first two columns present models predicting tobacco smoking while the last two columns present models predicting marijuana smoking. In the first column, only the individual level predictors are included in the model predicting tobacco smoking. Of these measures, only four are found to be statistically significant predictors of tobacco smoking—family structure, parental alcohol use, exposure to recent life events, and peer substance use. Being raised in an ‘other’ parent family (as opposed to a 2 biological parent family) serves to lower the risk of tobacco smoking, holding all other variables constant. Likewise, being raised by a parent who consumes more alcohol, having friends who are substance users, and being exposed to more stressors (in the form of recent life events) are each associated with an increased risk of tobacco use, holding all other variables constant.

The inclusion of the school contextual factors (column 2) does little to change the pattern of significant findings at the individual level, with the same four variables—family structure, parental alcohol use, recent life events and peer substance use—still found to be statistically significant predictors of the dependent variable. However, a number of contextual factors are also found to be statistically significant predictors of tobacco use, including percent non-Hispanic white, positive school climate, school resource advantage, school punitiveness, and whether a school has a drug awareness program or not. With regards to racial composition, the greater the relative size of the non-Hispanic white student population, the greater the risk of tobacco use (holding all other variables constant). However, the relative size of the American Indian student population, while not statistically significant, approaches statistical significance ($p = .086$). If one accepts a more liberal threshold of significance (i.e., $p = .1$), then this measure of racial composition would be seen as a protective factor, lowering the risk of student tobacco use.

Somewhat surprisingly, the degree of positive school climate and school punitiveness were both associated with a *greater* risk of tobacco use (holding all other variables constant) rather than a reduced risk, which was expected. However, schools that were relatively more resource advantaged were associated with a lower risk of tobacco use (holding all other variables constant). Finally, as expected, schools with drug awareness programs were associated with a lower risk of tobacco use.

Column 3 presents the individual level predictors for the model exploring marijuana smoking. According to these findings, a number of factors were found to be significant predictors of marijuana smoking. Females and those being raised by a parent who did not graduate from high school (relative to one who graduated from college) had a lower risk of marijuana use relative to their counterparts. Respondents with relatively greater self-esteem, greater exposure to recent life events, and substance using peers are at a heightened risk of marijuana use, holding all other variables constant.

Unlike the multilevel model predicting tobacco use, our model predicting marijuana smoking that included both contextual and individual level factors failed to produce any statistically significant predictors of marijuana use among the school level factors. However,

one variable, the relative size of the non-Hispanic white student population neared statistical significance ($p=.079$). If one accepts a less conservative level of alpha than is convention, this coefficient suggests that the relative size of the non-Hispanic white student population is associated with a lowered risk of marijuana smoking, holding all other variables constant.

Finally, we also examined a few measures of alcohol use, including measures of binge drinking and problem drinking. Because we failed to find any evidence that our school contextual factors were statistically significant predictors of any of the alcohol use measures, we do not report these results here (available upon request).

Discussion

In the present study, we extended prior research exploring the importance of the school context in understanding student substance use behaviors by examining an understudied racial minority in the United States—American Indians. The results of our analyses suggest that racial composition is associated with individual student substance use, albeit the influence is relatively modest and dependent upon the particular type of substance being explored. With regards to our hypotheses driven by extant explanations of how racial composition may influence student behavior, we fail to find consistent evidence to support either an insulation/subjective culture explanation (which would predict that AI substance use behavior would increase as percent non-Hispanic White increased) or a bicultural competence explanation (which would predict that AI substance use behavior would decrease as percent non-Hispanic White increased). It may be the case that different mechanisms and processes influence tobacco use, which is legal behavior for adults in the United States, versus marijuana use, which was illicit behavior for almost anyone (at the time of the data collection), regardless of age. Unfortunately, our findings cannot adjudicate between these competing explanations and additional research is warranted to provide more clarity to how the school's racial/ethnic composition influences AI youth substance use behavior.

With regards to tobacco smoking, we also uncovered some novel findings regarding some of the other school contextual factors. For instance, we found that the more *positive* a school climate, the greater the average AI individual tobacco use (contrary to expectations). However, as expected, schools with fewer resources (lower SES) have higher individual AI tobacco use than schools with greater resources, a finding that is consistent with the school climate/environment thesis. And while school punitiveness was unexpectedly found to be positively associated with AI individual tobacco use, some prior studies of substance use have failed to find that a school's disciplinary policies are associated with substance use rates (e.g., Kandel, Kiros, Schaffran, & Hu, 2004). It should be noted that our measure of school climate is an indirect one; several studies measure school climate by surveying (and aggregating) student, parents, and school personnel attitudes about the norms, goals, values, interpersonal relationships, as well as organizational features (National School Climate Council, 2007). Thus, our measure may not be adequately measuring school climate. Furthermore, race/ethnicity has been found to be an important predictor in understanding differences in perceptions of school climates (Thapa, Cohen, Guffey, & Higgins-

D'Alessandro, 2013: 365). Hence, our measures of school climate may not be capturing how AI students in these schools perceive of the school climate.

With regards to the individual level predictors, the major finding was that stress exposure, captured in our measure of recent life events, and peer substance use, were the two robust predictors of tobacco and marijuana smoking for AI youth. No other individual-level predictor was found to be a significant predictor across each of the four models. This is not a novel finding, since other studies have also found that such stressors (LeMaster, Connell, Mitchell, & Manson, 2002; Whitesell, Beals, Mitchell, Keane, Spicer, & Turner, 2007; Cheadle & Whitbeck, 2011) and exposure to delinquent peers (Cheadle & Whitbeck, 2011) are predictive of AI substance use, but it does promote further confidence in the generalizability of such predictors of substance use across racial and ethnic groups.

On the other hand, we also uncovered somewhat novel, albeit inconsistent, individual predictors of tobacco and marijuana smoking, including the findings that: a) other family structures (relative to two parent families) are negatively associated with tobacco smoking; b) self-esteem was positively associated with marijuana smoking; and c) low parental education was associated with lower marijuana use. Regarding the novel finding that 'other' family form was found to be inversely associated with tobacco smoking, it is important to note that extended family members play an essential role in parenting in many American Indian families (Light & Martin, 1986) and that AI youth are more than twice as likely to live with a grandparent present than other youth (U.S. Census Bureau, 2007). Given the structural and historical circumstances confronting AI families today (e.g., the legacy of Indian boarding schools, poverty, and unemployment), non-traditional families, including those with grandparents playing the primary parenting role, may be better situated (due to experience) to provide effective parenting to AI youth. Indeed, Eitle, Johnson-Jennings, & Eitle (2013), also using data from the Add-Health study, found that being in a non-parent family (compared to a mother-father family) was a protective factor for alcohol use problems.

And while the finding that self-esteem was positively associated with marijuana smoking may be surprising to the reader, evidence overall is somewhat mixed regarding the relationship between self-esteem and substance use (Baumeister, Campbell, Krueger, & Vohs, 2005). Indeed, some research has found evidence that self-esteem may be positively associated with marijuana use among racial minorities, although the evidence is modest at best (e.g., Wright & Fitzpatrick, 2004). Additionally, evidence that American Indian adolescent's self-esteem is shaped by both a personal identity and strong collective bicultural identity further complicates interpreting the present findings of the association between self-esteem and substance use (Whitesell, Mitchell, Kaufman, Spicer & the Voices of Indian Teens Project Team, 2006). Further research should attempt to examine the associations between ethnic identity, self-esteem, and substance use among American Indian adolescents.

Finally, the unexpected finding that low parental education was associated with lower marijuana use is consistent with some studies that have found that adolescents with higher SES may have a higher likelihood of substance use, largely due to the opportunity that

having greater financial resources provides youth (Bellis, Hughes, Morleo, Tocque, Hughes, Allen, Harrison, Fe-Rodriguez, 2007; Humensky, 2010 [a sample of college students]). Again, additional research is necessary to evaluate whether such a finding could be replicated across other American Indian adolescent samples.

Limitations

As with any study, our study has a number of limitations that bears mention. We have already mentioned the issues with our measures of school climate. An additional concern is that our sample size is somewhat limited (with the obvious effect on the ability to detect significant associations). We should also note that while the Add-Health study is a nationally representative sample of high school students, no reservation schools were selected in the sample. Indeed, as the range suggests, AI youth represented a numerical minority in every school in our sample. The reported results may have limited applicability to AI adolescents who attend schools on Tribal or Indian land, or schools that border such territory. Indeed, readers should remember that AIs are not a monolithic racial category, an assumption that was mandatory in this data analysis because tribal affiliation was not reported. Given that there are 565 federally recognized tribes and many more tribes that are not so acknowledged by the United States, readers should be cautious in interpreting these results. Finally, in addition to the school contextual factors examined in this analysis, school level rates of substance use may also be associated with individual substance use behavior. Aggregate rates of substance use in a school environment may also mediate or confound the association between contextual factors measured in this study (e.g. positive school climate) and student substance use. However, we were not able to include this measure as questions about marijuana use were not asked on the in-school questionnaire.

Despite these limitations, our study advances our understanding of the role that school factors play in shaping substance use behaviors for racial and ethnic minority youth. Future work in this area might investigate the role of school factors in shaping tobacco use behaviors for AI youth attending schools on or near tribal areas, to determine if such characteristics have similar predictive utility as was demonstrated in the present study. Additionally, further inquiries could explore whether substance use dependence or abuse is associated with school context factors, including a school's racial composition; there may be important differences that emerge when exploring more serious and problematic forms of substance use than mere frequency measures.

These findings also have significant policy implications for adolescent substance use prevention. First, schools with minority AI student populations should explore culturally sensitive programs that empower students with effective coping mechanisms to manage stressors in legitimate ways. Even if the bicultural acceptance hypothesis is supported, supporting minority student populations in culturally appropriate mechanisms to strengthen coping skills is warranted, given considerable evidence that AI youth experience considerable stressors in their lives (Manson, Beals, Klein, Croy, & the AI-SUPERPFP, 2005). Additionally, efforts to promote diversity and cultural awareness among all students in racially heterogeneous schools may indirectly reduce substance use behaviors by reducing the potential stress experienced by minority students by feeling excluded or isolated in

majority white schools. Such efforts should also reinforce the strength of the positive school climate for all students, racial minority and majority alike.

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Appendix A

Summary of Principal Component Analysis Results using Orthogonal Varimax Rotation

Item Factor Loadings	School Climate	Resource Advantage	School Dimensionality	School Punitiveness
Average Student Grade Point Average	0.65	0.06	0.23	−0.11
Average School Attachment	0.61	−0.03	−0.11	−0.01
Seniors enrolled in college preparatory courses	−0.05	0.76	0.04	−0.00
School Size	−0.29	0.29	0.49	−0.28
Average class size	0.12	−0.06	0.78	0.12
School is private	0.27	0.53	−0.19	0.12
Severity of punishment for rule violations	−0.14	0.19	−0.07	0.68
Number of school rules	0.06	−0.15	0.21	0.65

Item Factor Loadings	School Climate	Resource Advantage	School Dimensionality	School Punitiveness
Percent of variance explained	23.5%	17.4%	17.1%	16.4%

Note: Factor loadings over .40 are in bold

Highlights

- We examined the association between school contextual factors, including school racial composition, and AI adolescent tobacco and marijuana use.
- AI teen tobacco use was positively associated with the percentage of students that were white.
- AI teen tobacco use was negatively associated a factor representing school resources.
- AI marijuana use was not significantly associated with any school contextual factors.
- School contextual may have different effects on minority substance use depending upon the drug.

Table 1

Descriptive Statistics.

	Mean	SD	Min.	Max.
Dependent Variables				
Smoking Tobacco (original)	1.37	5.98	0	50
Smoking Tobacco (natural log)	.45	.83	0	3.93
Smoking Marijuana (original)	4.36	43.93	0	666
Smoking Marijuana (natural log)	.40	.99	0	6.50
Individual characteristics				
Gender (female)	.51	.50	0	1
Family Structure (2 parent family)				
Single parent	.24	.43	0	1
Step parent	.20	.40	0	1
Other parent	.06	.24	0	1
Parental Education (college)				
No high school	.23	.42	0	1
High school graduate	.52	.5	0	1
Age	15.23	4.92	12	19
Depressive Symptomology	12.99	8.23	0	45
Religiosity	6.90	4.39	0	13
Social Support	2.92	.69	0	4
Parental Control	2.00	1.62	0	7
Self Control	3.78	1.42	1.25	5
Self esteem	3.98	1.10	1.71	5
Parental Alcohol Use	1.90	1.13	0	6
Recent Life Events	2.07	2.02	0	11
Grade Point Average	2.62	.81	1	4
Junior High School Student	.29	.46	0	1
Peer Substance Use	2.85	2.85	0	9
School Characteristics				
% Non-Hispanic White	.55	.29	.00	.94
% American Indian	.07	.06	.01	.48
Positive School Climate	−.12	1.36	−3.31	2.92
Resource Advantaged	.07	1.24	−2.02	3.75
School Dimensionality	.04	1.21	−3.73	2.45
School Punitiveness	.04	1.17	−3.75	2.81
Drug Awareness Program	.86	.35	0	1
Drug Abuse Program	.39	.49	0	1

n=99 schools, 523 students

Table 2

Multilevel Regression Results Predicting Tobacco and Marijuana Smoking among American Indian High School Students (with robust standard errors).

	Tobacco Smoking		Marijuana Smoking	
	1	2	3	4
Gender	-.007 (.076)	-.024 (.071)	-.199 *** (.059)	-.192 *** (.057)
Family Structure (2 parent)				
Single parent	-.041 (.103)	-.005 (.092)	-.121 (.089)	-.154 (.090)
Step parent	.061 (.081)	.082 (.080)	-.122 (.081)	-.172 * (.086)
Other parent	-.390 * (.192)	-.356 * (.180)	.466 (.287)	.455 (.281)
Parental Education (college)				
No high school	.105 (.126)	.042 (.097)	-.178 * (.090)	-.184 * (.088)
High school graduate	.079 (.095)	.039 (.077)	-.014 (.096)	.006 (.102)
Age	.003 (.057)	-.031 (.059)	.014 (.067)	.016 (.067)
Depressive Symptomology	-.002 (.008)	.001 (.008)	.008 (.007)	.008 (.007)
Religiosity	.006 (.009)	.003 (.007)	.012 (.012)	.012 (.012)
Social Support	-.029 (.079)	-.010 (.064)	-.062 (.068)	-.065 (.071)
Parental Control	-.012 (.018)	-.024 (.019)	-.036 (.027)	-.038 (.025)
Self Control	-.044 (.045)	-.049 (.039)	-.031 (.041)	-.027 (.042)
Self esteem	-.006 (.054)	-.014 (.060)	.091 * (.038)	.090 * (.038)
Parental Alcohol Use	.154 * (.067)	.147 * (.061)	.075 (.040)	.080 * (.038)
Recent Life Events	.114 * (.046)	.104 * (.045)	.128 ** (.047)	.132 ** (.048)
Grade Point Average	-.066 (.044)	-.081 (.041)	-.021 (.040)	-.010 (.039)
Junior High School Student	.100 (.098)	-.010 (.082)	.066 (.137)	.105 (.141)
Peer Substance Use	.119 *** (.020)	.113 *** (.019)	.136 *** (.027)	.140 *** (.027)
School Characteristics				
% Non-Hispanic White		.382 *** (.115)		-.269 (.151)
% American Indian		-.495 (.285)		-.453 (.462)
Positive School Climate		.063 * (.029)		-.027 (.051)
Resource Advantaged		-.076 * (.032)		.012 (.053)
School Dimensionality		-.022 (.029)		.033 (.038)
School Punitiveness		.091 *** (.027)		.005 (.034)
Drug Awareness Program		-.372 ** (.140)		-.249 (.200)
Drug Abuse Program		.137 (.079)		-.031 (.098)
Intercept	.404 *** (.128)	.731 *** (.134)	.472 *** (.124)	.732 ** (.242)
<i>Goodness of Fit</i>				
Deviance Estimated # of parameters	1063.78 (21)	1006.72 (29)	1058.48 (21)	1047.99 (29)

Note: Referents are in parentheses.

n=99 schools, 523 students

*
p < .05,

^{**}
 $p < .01$, and

^{***}
 $p < .001$ (two-tailed tests).

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