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Substance Use Profiles of Urban American Indian Adolescents: A Latent Class Analysis

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Introduction

While substance use among all adolescents is a major public health challenge, it is of particular concern in many American Indian (AI) communities where adolescent alcohol and drug use is especially prevalent. AI adolescents engage in substance use at higher rates and earlier ages than their non-AI peers (Beauvais, Jumper-Thurman, & Burnside, 2008; Dixon et al., 2007; De Ravello, Everett Jones, Tulloch, Taylor, & Doshi, 2014; Miller, Beauvais, Burnside, & Jumper-Thurman, 2008; Stanley, Harness, Swaim, & Beauvais, 2014; Stanley & Swaim, 2015; Swaim, 2015) and experience more negative consequences of substance use that compromise their social, economic, and physical wellbeing (Indian Health Service, 2013; Keyes et al., 2012; Schinke, Tepavac, & Cole, 2000). Data from the 2007 to 2009 national Youth Risk Behavior Survey (YRBS) indicate that when compared to white adolescents, AI youth are significantly more likely to drink alcohol before age 13 (AI=29.3%; white=19.6%), and to use marijuana (AI=43.9%; white=36.8%), cocaine (AI=9.4%; white=6.8%), and inhalants (AI=18.7%; white=12.8%) in their lifetime (De Ravello et al., 2014). AI adolescent substance use is associated with deviant peer involvement (Whitesell et al., 2014), antisocial behavior (Beauvais, 1996), delinquency (Barnes, Welte, & Hoffman, 2002), conduct issues (O'Connell et al., 2007), and exposure to violence (Oetting, Edwards, Kelly, & Beauvais, 1997).

However, most research on AI adolescent substance use has been based on non-population-based samples of reservation-dwelling AIs, who account for a declining percentage of the total AI population (Beauvais, 1998; Chen, Balan, & Price, 2012; Miller, Stanley, & Beauvais, 2012). And, because substance use norms and practices can vary significantly

from tribe to tribe, estimates of AI substance use may be inflated and unrepresentative of certain AI communities (Beauvais, 1998). Notably, it is unclear how substance use disparities and risk factors apply to the growing majority—approximately two-thirds—of AIs living off reservations and in urban areas (Snipp, 2005; U.S. Bureau of the Census, 2010a). This study examined substance use patterns among urban AI youth using latent class analysis, exploring the existence of distinct profiles of urban AI youth substance use and their correlates.

Urban American Indian Adolescent Substance Use

Urban AI youth have been described as both particularly vulnerable to substance use, and potentially possessing unique protective factors. On one hand, the higher prevalence of substance use and substance use disorders among urban AI adolescents and adults has been linked to their unique migration experiences and socioeconomic position within the broader urban community (Dickerson et al., 2012; Farley & O'Connell, 2010; Rutman, Park, Castor, Taulaii, & Forquera, 2008; Wu, Woody, Yang, Pan, & Blazer, 2011). Problematic substance use by urban AIs has been attributed to widespread residential instability, homelessness, unemployment, poverty, and social isolation (Dickerson & Johnson, 2010; Evans-Campbell, Lindhorst, Huang, & Walters, 2006; Garrett & Herring, 2001; Huang & Gibbs, 1992; LaFromboise, Albright, & Harris, 2010), and limited access to health care, social support, and other resources (Hartman et al., 2014). Urban AIs often lack ties to cultural outlets and intra-group cohesion (Dickerson & Johnson, 2010), isolating them from community sources of social support, including vital extended kin support (LaFromboise & Dizon, 2003). Family histories of forced relocation, migration, and inter-marriage across tribes and racial/ethnic groups may lead to acculturation conflicts (Garrett & Herring, 2001; Stubben, 2001). Substance use may be employed as a coping strategy as a result of these struggles and the loss of protective cultural traditions (Caetano, Clark, and Tam, 1998; Frank, Moore, & Ames, 2000; Beauvais, 1998). Furthermore, exacerbated by wide geographic dispersion, urban AIs confront issues related to their “invisibility” in society, which limits access to culturally specific health and social services and evidence-based substance abuse interventions (Garrett & Herring, 2001; Lane & Simmons, 2011; Lobo, 1998).

On the other hand, some evidence suggests that AI adolescents may have substance use rates and risk factors similar to non-AI adolescents, and AI adults may be more likely to abstain from alcohol use (Eitle et al., 2013; May, 1996; May & Gossage, 2001; SAMHSA, 2008; Stagman, Schwarz, & Powers, 2011; Young & Joe, 2009; Whitesell et al., 2006). Using the nationally representative Add-Health data, Eitle, Eitle, & Johnson-Jennings (2013) found no significant differences between non-reservation dwelling AI adolescents and white adolescents in past 12-month heavy alcohol use. Other studies have reported that AI youth have lower or similar rates of alcohol use compared to white and Hispanic adolescents (SAMHSA, 2008; Young & Joe, 2009; Stagman, Schwarz, & Powers, 2011). Moreover, in studies of several tribal communities, AI adults reported current or past-year abstinence from alcohol at considerably higher rates than the general U.S. adult population (May, 1996; May & Gossage, 2001; Whitesell et al., 2006). However, these same studies also note the existence of subgroups of heavy episodic drinkers who may largely account for high rates of alcohol related morbidity and mortality in AI communities.

Cultural and social influences in AI communities may promote alcohol abstinence and recovery, including participation in traditional forms of Native spirituality (Beebe et al., 2008; Yu & Stiffman, 2007). Compared to other minority groups, AI adolescents report having more friends and more racially heterogeneous peer networks, which generally reduces the odds of drinking and other anti-social behaviors (Rees, Freng, & Winfree, 2013). When compared to whites, however, AI adolescents report less school connectedness and friendship reciprocity. While this may lead to negative effects of experiencing social rejection and isolation, it may also indicate a lack of opportunities to drink and may serve as a protective factor against substance use (Rees et al., 2013). Features of the urban environment may also provide AI adolescents protective supports that lower the chances of substance use. Compared to peers living on reservations, urban AI adolescents are more likely to report peers and schools as supportive assets (Stiffman et al., 2007) and as important components to their self-esteem and resilience (Stumblingbear-Riddle & Romans, 2012). Additionally, urban schools may be likely to provide effective universal substance use prevention programs (Medicine, 2007).

Latent Class Analyses of Substance Use

Latent class analysis (LCA) is a useful methodological tool to explore substance use patterns among urban AI youth (Rapkin & Luke, 1993). LCA is unlike variable-centered approaches, such as factor analysis, that examine relationships between variables in an overall sample or known subgroups and assume group homogeneity, thus producing findings that may be imprecise, over-generalized, or over-simplifications of complex behaviors (Rosato & Baer, 2012; von Eye & Bergman, 2003). In comparison, LCA is a person-centered analysis that empirically identifies homogenous subgroups of a larger population, distinguishes intragroup differences, and assumes heterogeneity in the data (Nurius & Macy, 2008; Reinke, Herman, Petras, & Ialongo, 2008). LCA can capture and summarize information on the use of multiple substances without posing a priori categories (Lamont, Woodlief, & Malone, 2014).

Numerous studies employing LCA with nationally representative samples have examined adolescent substance use (Bohnert et al., 2014; Marti, Stice, & Springer, 2010; Riehman, Stephens, & Schurig, 2009; Shin, Hong, & Hazen, 2010; Lamont et al., 2014), but findings have varied in the number and type of classes of adolescent substance users. The variability may be due to differences in the age of the sample, period of substance use examined, and number of substances in the analysis (Conway et al., 2013). Using the Add Health data of 7th–12th grade adolescents, five classes of past 30-day substance users were detected: (a) abstainers; (b) alcohol only; (c) alcohol and marijuana; (d) cigarettes; and (e) alcohol, cigarettes, and marijuana (Dierker, Vesel, Sledjeski, Costello, & Perrine, 2007). Using the NEXT Generation Health Study of 10th grade adolescents, four latent classes were found: (a) abstainers; (b) predominantly alcohol; (c) predominantly marijuana; and (d) polysubstance (Conway et al., 2013). Using the National Longitudinal Survey of Youth of 17 year-olds, four classes emerged: (a) abstainers; (b) alcohol and tobacco; (c) tobacco and marijuana; and (d) alcohol, cigarette, and marijuana (Lamont et al., 2014).

Only two studies, however, have used LCA to understand substance use among AI youth, both conducted with reservation communities (Mitchell & Plunkett, 2000; Whitesell et al., 2006). While the samples varied – from only adolescents to adolescents and adults up to age 49– in both studies, four subgroups emerged that best characterized lifetime substance use of reservation populations: (a) abstainers; (b) predominantly alcohol; (c) predominantly alcohol and marijuana; and (d) polysubstance. In an examination of risk factors associated with class membership Mitchell & Plunkett (2000) found that polysubstance users endorsed positive alcohol attitudes and anti-social peer values more than other latent classes.

The current study pursued three aims: to describe empirically heterogeneous patterns (i. e., latent classes) of urban AI youth substance use; to examine demographic correlates of the latent classes; and to test for latent class differences in other risk behaviors and prosocial outcomes. The study attempts to advance knowledge of adolescent substance use patterns in several ways. It is the first to use LCA to identify and explore distinct profiles of substance use among the expanding majority of AI adolescents who live in cities. It examines reports of recent substance use, which are both more reliable than the lifetime prevalence measures used in most prior LCA studies of reservation and general adolescent populations (Johnston, 1989; O'Malley, Bachman, & Johnston, 1983), and more reflective of the simultaneity of polysubstance use. Finally, the study analyzes a larger range of types of substances than in prior studies, details the particular combinations of substances used, and explores differences in occasional versus more frequent use. By generating a taxonomic structure of substance use, this study offers novel insights into intragroup patterns and correlates of substance use among urban AI adolescents, information that is critical to the development of prevention efforts, both universal and indicated.

Method

The data for this study come from the 2012 Arizona Youth Survey (AYS), a cross-sectional, state-wide, school-based study of 8th, 10th, and 12th grade students. The AYS assesses risk and protective factors for substance use, delinquency and other risk behaviors using measures from the Communities That Care model (Arthur, Hawkins, Pollard, Catalano, & Baglioni, 2002). Conducted by the Arizona Criminal Justice Commission (ACJC), all public and charter middle and high schools in Arizona were eligible to participate in the AYS. Parents of all 8th, 10th, and 12th grade students in the study schools received letters informing them of the upcoming survey, inviting them to preview the survey online, and providing instructions if they wished to exclude their child from participating. In early 2012, all students with implied parental consent and active youth assent completed the anonymous survey during a class period. Teachers administered the assent and survey procedures. The final sample includes 62,817 respondents from 349 schools and is designed to be “valid and representative of the students in 8th, 10th, and 12th grades in Arizona” (ACJC, 2012, p. 4).

The analytic sample for this study includes only respondents who self-identified on the survey as “American Indian or Alaskan Native” and who lived in a metropolitan urban area (defined as > 250,000 people). In the 2010 Census less than one percent (0.2%) of Arizona residents classified as “American Indian or Alaska Native” indicated that they had Alaska Native tribal backgrounds (U.S. Bureau of the Census, 2010b). Thus it is likely that the

sample for this study is comprised almost exclusively of youth who identify as American Indian, and hereafter we refer to the sample using that designation. Arizona urbanized areas were mapped in Google Earth (<https://www.google.com/earth/>) using the 2010 Census Urban Area Shapefile and associated files (https://www.census.gov/geo/maps-data/data/cbf/cbf_ua.html). Respondent's home zip code, reported in the AYS survey, was geocoded in Google Earth. Where home zip code was missing or incomplete, school zip code was used as a proxy. AI respondents were defined as living in a metropolitan urban area when their zip codes fell within the 2010 Census boundaries of a metropolitan urban area (N=2,407).

Measures

Survey items used in the current study included measures of recent substance use, other risk and prosocial behaviors, and demographic characteristics (see Table 1). Eight categories of recent (last 30 day) substance use were assessed: (1) alcohol ("beer, wine or hard liquor"); (2) heavy episodic drinking ("5 or more drinks in a row"); (3) tobacco ("smokeless tobacco" or cigarettes); (4) inhalants ("sniffed glue, ...aerosol spray..., or other gases to get high"); (5) marijuana; (6) other illicit drugs (any use of LSD, cocaine, "crack," methamphetamines, heroin, Ecstasy, "club" drugs, and steroids); (7) prescription drug misuse; and (8) over-the-counter (OTC) drug misuse. For the latent class analysis different types of prescription drug misuse were combined due to insufficient cases; misuse of prescription narcotics was more common (8%) than misuse of prescription stimulants (2%) or sedatives (3%). The original Likert response categories for substance use questions included a wide range, measured as the number of occasions (0, 1–2, 3–5, 6–9, 10–19, 20–39, 40+) or number of days (0, 1–2, 3–5, 6–9, 10–19, 20–29, all 30) of use. However, the distributions were skewed toward nonuse and, among the users, toward the least frequent levels of use. Skewness statistics ranged between 3 and 24. Accordingly, and as an aid to interpretation in the LCA, all recent substance use measures were dichotomized into nonuse (0) and any use (1).

As a check on the validity of the substance use latent classes, the study examined other risk and prosocial behavioral and attitudinal scales, which are detailed in Appendix A (Arthur et al., 2002; CDC, 2012; Glaser, Horn, Arthur, Hawkins, & Catalano, 2005; Hawkins & Catalano, 1992). These included the frequency of exposure to offers of alcohol, cigarettes, marijuana, and other drugs in the last 30 days (mean of four items, scored from 1=never, to 6=more than 10 times). Antisocial behavior was measured as past year frequency of stealing, carrying weapons, attacking someone, selling drugs, and being arrested or suspended from school (mean of 7 items, scored from 1=never, to 8=40+ times). Oppositional behavior was measured as the mean of three items—ignoring rules, not doing what you are told, and seeing how much you can get away with (scored from 1=very false, to 4=very true). Prosocial behavior was assessed as the past year frequency of school activities and community volunteering (mean of 3 items scored from 1=never, to 8=40+ times). Age of initiation of substance use was calculated as the earliest age of first using alcohol, cigarettes, marijuana, methamphetamines or prescription drug misuse, from 8 [or younger] to 19 [or older]. Age of initiation of antisocial behavior identified the earliest age of school suspension, carrying a handgun, attacking someone, or belonging to a gang, from 8 [or younger] to 19 [or older]. Antidrug attitudes were measured by the mean of five items asking "how wrong do you think it is for someone your age" to use alcohol, cigarettes,

marijuana, another illegal drug, and to misuse prescription drugs (scored from 1=not wrong at all, to 4=very wrong). Perceived harmfulness of substance use was assessed as the mean of items asking “how much do you think people risk harming themselves” by using six different substances (scored 1=no risk, to 4=great risk). Disapproval of antisocial behavior was measured by the mean of eight items asking “how wrong do you think it is for someone your age” to cheat, steal, use violence, carry a handgun, and skip school (scored from 1=not wrong at all, to 4=very wrong). Lastly, bullying victimization was calculated as a mean scale of four items reporting the past year frequency of being bullied at school, being cyber-bullied, staying home from school because of feeling unsafe, and being threatened or injured with a weapon (scored from 1=0 times, to 8=12 or more times).

Demographic characteristics examined in the analyses included the student’s gender (female=0, male=1), age (in whole years), grade level (8th, 10th, 12th), family type (two parent household=1, else=0), receipt of a free or reduced price school lunch (no=0, yes=1), mother’s educational attainment (1=grade school or less, to 7=graduate degree), and number of people living in the household. Dummy variables were created from racial and ethnic background checklists to identify students of mixed heritage. In response to the question, “what is your race,” those who checked “Asian,” Black or African American,” “Hawaiian or Other Pacific Islander” or “White” in addition to “American Indian or Alaska Native” were designated as multiracial (0=no, 1=yes). In a separate dummy variable, AI students who checked that they were “Hispanic or Latino” were designated as multi-ethnic (0=no, 1=yes), regardless of their racial category selection(s).

Analysis Plan

Latent class analysis (LCA) in Mplus 7.0 (Muthén & Muthén, 2012) was employed to identify clusters of individuals with similar patterns of alignment on recent substance use measures. Missing data were handled in Mplus using full information likelihood (FIML) estimation. After determining the optimal number of latent classes to describe combinations of types of recent substance use, the classes were interpreted and tentatively labeled. To test for variations across latent classes on the demographic characteristics listed above we utilized the Equality of Means Test available within Mplus (Asparouhov & Muthén, 2014) and included the set of demographic predictors as auxiliary variables within the LCA. With this method the latent class variable is multiply imputed from the posterior probabilities obtained by the LCA model estimation and then the imputed latent class variables are analyzed together with the auxiliary variables using the multiple imputation approach developed by Rubin (1987). We also used the Equality of Means test to examine latent class differences in other risk behaviors, prosocial behaviors, and attitudes toward risk behaviors, by including the set of outcome measures as auxiliary variables within the LCA. However, in order to control the demographic variables, when including the outcome measures as auxiliary variables we used residual measures that adjusted for the demographic variables (i.e., for each outcome measure we removed all variance associated with the set of demographic controls and then included this adjusted measure as an auxiliary variable within the LCA).

Results

Table 1 provides distributions and descriptive statistics for all variables used in the analyses. The sample of urban AI youth was nearly balanced in gender composition but not by grade level or age. About half the students were in eighth grade, 30% in 10th grade, and 20% in 12th grade. The average age was 15 years. About three-fifths of the students lived with both parents, in households with an average of four people. More than half their families would be considered lower income as indicated by the students' participation in the Federal school lunch program. The highest level of education attained by their mothers varied considerably: 23% had less than a high school degree, 40% were high school educated, and 37% had a post-secondary degree. Many of the AI urban students, over two-fifths, indicated they were multi-racial (AI and another race) and multi-ethnic (AI and Latino). Most often the multi-racial students reported that they were AI and "White" (83% of multi-racial respondents).

A substantial minority of the youth, over a quarter, reported recent use of alcohol. About one-in-six reported recent heavy episodic drinking, tobacco and marijuana use, and one-in-ten had misused prescription drugs recently. Only about one-in-twenty reported recent use of inhalants, other illicit drugs and over-the-counter drug misuse.

Scales measuring other antisocial and prosocial behaviors and attitudes demonstrated fair to good reliability ($\alpha = .66$ to $.86$). Means for exposure to substance offers, antisocial behavior, and bullying victimization clustered toward the lower or less frequent end of their respective ranges. The three attitudinal measures had means generally indicating disapproval of substance use and antisocial behavior. The average age of initiation of substance use and antisocial behaviors was between 12 and 13.

Aim 1. Heterogeneity in urban AI youth substance use patterns

The LCA examined the eight dichotomized categories of recent substance use, and determined the best latent class model to describe the patterns of different types of substance use (Table 2). The optimal number of latent classes was identified based upon established criteria (Nylund, Asparouhov, & Muthen, 2007). The first criterion involves the Bayesian information criterion (BIC) statistic, which balances two components, maximizing the likelihood and keeping the model parsimonious. The adjusted BIC accounts for sample size effects. Lower BIC values indicate a better fitting model. The second criterion, classification quality, can be determined by examining the posterior probabilities and model entropy values. Each respondent is given a posterior probability for membership to each latent class. When the model represents the data well, on average respondents will have a high posterior probability for membership to a single class and low posterior probabilities for membership to the remaining classes. Similarly, higher entropy values indicate relatively greater distinctiveness among the latent classes. The third criterion utilizes the Lo-Mendell-Rubin likelihood ratio test of model fit (LRT; Lo, Mendell, & Rubin, 2001) and the bootstrap likelihood ratio test (BLRT; Nylund et al., 2007). Both compare the estimated model with c classes to a model with $c - 1$ classes. A p value $< .05$ indicates that the estimated model fits the data better than the model with one less class.

Collectively, the different decision criteria clearly indicated that the optimal number of latent classes was four. The BIC values decreased across the 1- through 4-class solutions, but then increased between the 4- and 5-class solutions. Regarding classification quality, although the 2 and 3 class models had entropy values and average posterior probability values closer to 1 than the 4 and 5 class solutions, all these solutions adequately classified the cases (Reinke et al., 2008). For both the LMR and BLRT ratio tests, the test comparing the four-class model to the five-class model was the first non-significant test, indicating that the null model (i.e. the four-class model) failed to be rejected. Finally, more so than any other solution the four-class solution resulted in a set of latent classes that were distinctive, interpretable, and practical.

For each of the four latent classes determined by the LCA, Table 3 presents the conditional probabilities of recent use of each of the types of substances. Based on their class assignment, the different patterns of substance use of the four latent classes are illustrated in Figure 1. The first class (“nonusers”; 69% of the sample) is comprised of students who typically were not recent substance users. Only very small proportions of this class reported recent use of any of the eight types of substances. Substantial proportions of students in the second class (“ATM”; 17% of the sample) reported using alcohol, tobacco, and/or marijuana, but seldom used other types of drugs. The third latent class (“not alcohol”; 4% of the sample) was similar to the ATM class in use of tobacco and marijuana, but few in this class used alcohol and none reported heavy episodic drinking; compared to the ATM class, the “not alcohol” class also used prescription, OTC, inhalants and other illicit drugs at higher rates. The fourth class (“polysubstance”; 6% of the sample) displayed the highest rates of use of every type of substance: over half reported recent use of alcohol and heavy episodic drinking, tobacco, marijuana, and other illicit drugs, as well as prescription drug misuse. Moreover, substantial minorities of this polysubstance using class had also recently misused OTC drugs and inhalants.

In further analyses of the patterns of substance use, we investigated variations across latent classes in the frequency of substance use and in combinations of substances used. In these analyses (not presented in tables), the indicator of latent class membership was saved in Mplus, and employed as a grouping variable. One set of analyses trichotomized the original last 30-day substance use frequency measures, distinguishing nonusers, “occasional” users (defined as use once or twice), and more regular users (3 or more times) of each substance, cross-tabulated by latent classes. Another set of analyses identified the most common combinations of different types of recent substance use (use versus non-use) by latent class. The polysubstance latent class was distinctive in these analyses in notable ways. First, students in this class usually consumed many different substances, on average 4.7 of the seven types included in the LCA. More than half (54%) used five or more substances and nearly all (98%) used at least three different substances. Second, they were typically more regular rather than occasional users. Three-fourths or more of the polysubstance class reported using alcohol and marijuana three or more times in the past 30 days, and more than half used tobacco and misused prescription drugs that frequently. In contrast, students in the ATM latent class were more evenly divided between occasional and more regular users. They, too, were mostly users of multiple substances, although of far fewer types than the polysubstance class: in the ATM class 54% used two of three signifying substances (alcohol,

tobacco, marijuana), and 18% used all three. Of the remaining 28% who reported using only one of these three, nearly all used alcohol alone (27%). Use of substances other than the three ATM types was rare in this latent class; only 4% used a substance other than alcohol, tobacco, and marijuana. Students in the “not alcohol” latent class most commonly combined (mis)use of four substances: tobacco, marijuana, prescription and OTC drugs. Over half (60%) used two or more of these four substances, and 99% used at least one of the four. Like the ATM class, the “not alcohol” class was divided into roughly equal numbers of occasional and more regular users of the four substances that typified their pattern of use.

Aim 2. Demographic correlates of substance use latent classes

We found no significant differences across latent classes in gender, mixed racial and ethnic heritage, family type (two-parent household), federal school lunch participation, mother’s education, and household size (results not tabled). Reflecting developmental differences in substance use trajectories, however, there were significant differences by age (χ^2 [3 df] = 34.6, $p < .001$) and grade level (χ^2 [3 df] = 32.6, $p < .001$). In these tests the pairwise differences showed that students in the “nonuser” and “not alcohol” user classes were significantly younger and at lower grade levels than the ATM users and polysubstance users. The distribution across the latent classes within each grade level is depicted in Figure 2. From 8th to 10th to 12th grade the proportion of ATM users increased steadily at about the rate that nonusers declined. Polysubstance users increased by small proportions at each grade level, while “not alcohol” users declined after remaining steady at 8th and 10th grade.

Aim 3. Latent class differences in other risk behaviors and prosocial outcomes

To explore the validity of the latent classes, we examined their associations with other risk and prosocial behaviors and risk behavior attitudes, while controlling for demographics. The means for each of the four latent classes along with their set of pair-wise comparisons are presented in Table 4. These analyses demonstrated that the “nonuser” class consistently reported the most desirable outcomes—fewer substance offers, antisocial and oppositional behaviors, and experiences of bullying; the most delayed age of initiation of substance use and antisocial behaviors; and the strongest expression of prosocial behaviors and attitudes disapproving drug use and antisocial behavior. In contrast, the polysubstance user class reported the poorest outcomes on all measures, with statistically significant differences from other classes on all outcomes except prosocial behavior and bullying. The remaining two classes of ATM and “not alcohol” users generally fell between the extremes represented by “nonusers” and polysubstance users. Comparing these latent classes in the middle to one another, the “not alcohol” class reported relatively more desirable outcomes than the ATM class on six outcomes (substance offers, antisocial behavior, oppositional behavior, antidrug attitudes, drug use harmfulness, and disapproval of antisocial behavior) but were statistically indistinguishable from each other on the remaining four outcomes.

Discussion

Using a large, representative statewide survey of American Indian adolescents living in large metropolitan areas and employing LCA, this study found that their recent use of substances could be described in four patterns: a large group of nonusers, a substantial minority

consuming alcohol, tobacco, and/or marijuana, a smaller group of polysubstance users, and an even smaller group using tobacco and other drugs but rarely consuming alcohol. Evidence of the utility and validity of the substance use latent classes emerged in two ways. Except for age and grade level, the distributions of students across the latent classes were unrelated to other demographic characteristics, providing good representations of subgroups defined by gender, socioeconomic status, family type, and ethnic/racial mixed heritage. Moreover, the latent classes aligned in highly consistent patterns on other measures of risk and prosocial behaviors and attitudes, with polysubstance users reporting the most problematic and nonusers the least problematic outcomes, and the remaining ATM and “not alcohol” users distinct from those extremes but generally not from each other.

Patterns of substance use among this urban AI sample revealed some similarities but also notable differences with reports from other adolescent populations. In prior studies of AI adolescents living in tribal areas, latent classes of substance users emerged where alcohol use is a predominant or defining characteristic (Mitchell & Plunkett, 2000; Whitesell et al., 2006). Although the ATM substance users in the urban AI adolescent sample all reported recent alcohol use, and high percentages also reported recent heavy episodic drinking, they typically used marijuana and/or tobacco as well, and only a small minority consumed alcohol alone. Alcohol use was thus pervasive but not predominant in the urban AI ATM class. Among the urban AI youth, the latent class comprised of users of substances other than alcohol was the most distinctive. It has not emerged in prior studies of AI adolescents living on tribal lands or in studies of the general adolescent population. The urban AI “not alcohol” users were unlike other users in reporting less exposure to substance offers and less antisocial behavior than the ATM and polysubstance users as well as less approval of substance use and antisocial behavior than the polysubstance users. This finding might be due to factors in the urban school environment where AI adolescents have greater heterogeneous supportive peer networks but less school connectedness and friendship reciprocity (Rees, Freng, & Winfree, 2013). These factors may be protective against using the most prevalent substance among adolescents – alcohol (Johnston, O’Malley, Bachman, & Schulenberg, 2011). The pattern of eschewing use of alcohol and favoring other substances may be related to support for alcohol abstinence in some AI communities and families due to high awareness and concern about the devastating health, economic and social effects of disparately high rates of alcohol-related morbidity and mortality in AI communities. This may be particularly true in this urban sample with high numbers of AI youth living in two-parent and in relatively well educated households. These family factors may provide additional guidance, communication, support, and awareness regarding the negative impact of alcohol use. However, this small group was more prevalent among early AI adolescents, those in 8th and 10th grade, than older adolescents in their senior year of high school, possibly suggesting that alcohol may ultimately become incorporated into their substance use pattern over the course of adolescence.

In addition to its identification of distinctive substance use patterns among urban AI adolescents, this study adds to the body of knowledge from prior LCAs of adolescent substance use by detailing the most common combinations of substances used by these youth and the regularity of use. The large range of substances included in the analysis identified an especially problematic pattern of substance use among polysubstance users

who typically consumed a handful of different licit and illicit substances, each three times or more monthly. The ATM and “not alcohol” users also tended to combine use of at least two different substances, but both these groups were more equally divided between occasional and more regular users. Both the polysubstance and ATM users typically reported heavy episodic drinking rather than restricting their consumption to less intensive alcohol use, elevating their immediate and long-term health and safety risks and vulnerability to addiction.

Compared to most prior studies using LCA, the expanded set of substances examined in this study illuminated consumption patterns for substances growing in popularity and public health concern. Prescription drug misuse was reported at relatively elevated levels by the urban AI students, and was prominent in two distinct latent class patterns in combination with other substance use. The overall prevalence of last 30 day prescription drug misuse among the urban AI respondents was 10%, higher than the 7% reported among all 12th graders in the national Monitoring the Future study of the same year (Miech, Johnston, O’Malley, Bachman, & Schulenberg, 2015). Students in the polysubstance and “not alcohol” latent classes often reported misuse of prescription drugs, which, combined with use of other substances, is associated with vulnerability to other risk behaviors and later prescription drug dependence (Boyd, Young, Grey, & McCabe, 2009; Chen, Storr, & Anthony, 2009; McCabe, Boyd, & Teter, 2009). Rates of misuse of specific types of prescription and OTC drugs were low, preventing the inclusion of different types of prescription drug misuse in the latent class analyses. However, it should be noted that the most common form was misuse of narcotics rather than stimulants or sedatives. Future research is needed in order to delineate whether different types of prescription and OTC drug misuse add relevant information to the latent classes.

Although based on a large representative sample, interpretations of the results of this study are limited by its geographical restriction to one southwestern state and in-school sample. Although the state’s metropolitan areas have large AI populations representing many tribal backgrounds and the social and cultural challenges facing all urban AI communities (e. g., relocation and cultural disruptions, poverty, acculturation pressures, discrimination), the factors influencing substance use among urban AI adolescents may be different in other states and regions or present to differing degrees, producing different patterns of substance use. While beyond the scope of this article, future research should explore how substance use patterns are linked to culturally, socially, and historically relevant risk and protective factors for urban AI adolescents including measures of cultural identity, involvement in cultural activities and traditions, exposure to trauma, and family history of mental health and substance use. In addition, urban-specific protective factors can be explored, incorporating how having more heterogeneous peer networks (Rees, Freng, & Winfree, 2013) and supportive peers and schools (Stiffman et al., 2007) can protect against deleterious substance using patterns for AI youth living in the urban environment. Results are also limited to urban AI youth enrolled in public schools and present for in-school survey administration, failing to represent the substantial proportion of AI youth who drop-out before completing high school (Faircloth & Tippeconnic, 2010). While studies with larger urban and reservation-dwelling AI youth are needed, research should also be conducted with all adolescents to understand how substance use patterns and their associated risk factors are similar and

different across racial/ethnic groups, particularly as it relates to the “not alcohol” class and escalating rates of prescription and OTC drug misuse.

Conclusions

A large majority of the urban American Indian adolescents in this statewide sample reported no recent substance use, mirroring prior descriptions of lifetime substance use in the general adolescent population and reservation-dwelling AI adolescents. The remaining three groups of substance users presented somewhat distinctive combinations of alcohol, tobacco, and drug consumption. The urban AI polysubstance users who recently and regularly consumed combinations of alcohol, tobacco, marijuana, other illicit, and prescription or OTC drugs reported sharply elevated levels of other problematic risk behaviors and attitudes. ATM users not only used alcohol and typically engaged in heavy episodic drinking, but also used tobacco or marijuana in the same recent timeframe. The group that eschewed alcohol use but consumed other substances, not previously reported, appeared somewhat less at risk of other problematic behaviors, but was also more typical of early than later adolescence. For each group, additional research is needed to identify the social and cultural factors influencing AI adolescent substance use in urban settings, and to understand how to select or design universal or targeted prevention efforts for alcohol, tobacco, and other drugs.

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APPENDIX A

Substance Use Offers

In the last 30 days, about how many times were you offered... (a) alcohol? (b) cigarettes? (c) marijuana? (d) other drugs? (1=Never, 2=Once, 3=2–3 times, 4=4–6 times, 5=7–10 times, 6=More than 10 times).

Antidrug Attitudes

How wrong do you think it is for someone your age to...(a) drink beer, wine or hard liquor (for example, vodka, whiskey, or gin) regularly? (b) smoke cigarettes? (c) smoke marijuana? (d) use LSD, cocaine, amphetamines or another illegal drug? (e) use prescription drugs

without a doctor telling them to take them? (1=Not wrong at all, 2=A little bit wrong, 3=Wrong, 4=Very Wrong).

Perceived Harmfulness of Substance Use

How much do you think people risk harming themselves (physically or in other ways) if they... (a) smoke one or more packs of cigarettes per day? (b) try marijuana once or twice? (c) smoke marijuana regularly? (d) take one or two drinks of an alcoholic beverage (beer, wine, liquor) nearly every day? (e) have five or more drinks of an alcoholic beverage in a row once or twice a week? (f) use prescription drugs without a doctor telling them to take them? (1=No risk, 2=Slight risk, 3=Moderate risk, 4=Great risk)

Disapproval of Antisocial Behavior

How wrong do you think it is for someone your age to... (a) take a handgun to school? (b) steal anything worth more than \$5? (c) pick a fight with someone? (d) attack someone with the idea of seriously hurting them? (e) stay away from school all day when their parents think they are at school?, (f) cheat at school, (g) beat up people if they start the fight, (h). take something without asking if you can get away with it. (1=Not wrong at all, 2=A little bit wrong, 3=Wrong, 4=Very Wrong).

Prosocial Behavior

How many times in the past year (12 months) have you... (a) participated in clubs, organizations or activities at school? (b) done extra work on your own for school? (c) volunteered to do community service? (1=Never, 2=1 to 2 times, 3=3–5 times, 4=6 to 9 times, 5=10 to 19 times, 6=20 to 29 times, 7=30 to 39 times, 8=40+ times).

Anti-social Behavior

How many times in the past year (12 months) have you... (a) been suspended from school? (b) carried a handgun? (c) sold illegal drugs? (d) stolen or tried to steal a motor vehicle such as a car or motorcycle? (e) been arrested? (f) attacked someone with the idea of seriously hurting them? (g) taken a handgun to school? (1=Never, 2=1 to 2 times, 3=3–5 times, 4=6 to 9 times, 5=10 to 19 times, 6=20 to 29 times, 7=30 to 39 times, 8=40+ times).

Oppositional Behavior

A . I ignore rules that get in my way. (B) I do the opposite of what people tell me, just to get them mad.

(C) I like to see how much I can get away with. (1=Very False, 2=Somewhat False, 3=Somewhat True, 4=Very True).

Age of Initiation of Substance Use

How old were you when you first ... (a) smoked marijuana? (b) smoked a cigarette, even just a puff? (c) had more than a sip or two of beer, wine or hard liquor (for example, vodka,

whiskey, or gin)? (d) began drinking alcoholic beverages regularly, that is, at least once or twice a month? (e) used methamphetamines (meth, crystal)? (f) used prescription drugs without a doctor telling you to take them? (8 [or younger], 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 [or older]).

Age of Initiation of Antisocial Behavior

How old were you when you first...(a) got suspended from school? (b) got arrested? (c) carried a handgun? (d) attacked someone with the idea of seriously hurting them? (e) belonged to a gang? (8 [or younger], 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 [or older]).

Times Victimized by Bullying

During the past 12 months, how many times ...(a) has someone threatened or injured you with a weapon such as a gun, knife, or club on school property? (b) ...have you been picked on or bullied by a student on school property? (c) ...did you NOT go to school because you felt you would be unsafe at school or on the way to or from school? (d) ...have you been harassed, mistreated, or made fun of by another person while on-line or through a cell phone or other electronic device? (1=0 times, 2=1 time, 3=2–3 times, 4=4–5 times, 5=6–7 times, 6=8–9 times, 7=10–11 times, 8=12 or more times).

Figure 1.
Proportion reporting recent use of substances, by latent class assignment

Figure 2.
Proportion in each substance use latent classes, by grade level

Table 1

Descriptive statistics for variables used in analysis, urban AI sample

Variables	%	M	SD	Range	Cronbach Alpha
Gender: % Male	51.4%				
Age (Years)		15.1	1.68	12–19	
Grade Level		9.39	1.78	8–12	
8th Grade	50.6%				
10th Grade	29.5%				
12th Grade	19.9%				
% in Two-parent Home	63.3%				
% Federal School Lunch Program	51.6%				
Mother's Education		3.34	0.74	1–7	
Household Size		4.12	1.39	2–8	
% Mixed Racial Heritage	46.0%				
% Mixed AI & Latino Heritage	43.6%				
Last 30 Day Substance Use:					
Alcohol	28.5%				
Heavy Episodic Drinking	17.2%				
Tobacco	17.3%				
Inhalants	4.6%				
Marijuana	17.3%				
Other Illicit Drugs	5.5%				
Prescription Drug Misuse	10.2%				
Over-the-counter Misuse	5.6%				
Substance Offers		1.82	1.16	1–6	0.83
Antisocial Behavior		1.18	0.57	1–8	0.82
Oppositional Behavior		2.09	0.75	1–4	0.76
Prosocial Behavior		2.75	1.65	1–8	0.72
Age Initiated Substance Use		12.65	4.53	8–19	0.80
Age Initiated Antisocial Behavior		12.95	4.69	8–19	0.69
Antidrug Attitudes		3.35	0.74	1–4	0.85

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Variables	%	M	SD	Range	Cronbach Alpha
Drugs Harmful		2.88	0.82	1–4	0.86
Disapprove of Antisocial Behavior		3.10	0.59	1–4	0.83
Times Bullied		1.64	1.10	1–8	0.66

Table 2

Statistics for latent class analysis decision criteria, by number of classes extracted

	Number of classes extracted				
	1	2	3	4	5
BIC	13,139	10,559	10,451	10,437	10,484
Adjusted BIC	13,118	10,505	10,368	10,326	10344
Entropy	n/a	.917	.891	.805	.785
Average Posterior Probability	n/a	.969	.887	.847	.815
<i>p</i> value of Lo, Mendell, Rubin Test (LMR)	n/a	.000	.000	.000	.289
<i>p</i> value of Parametric Bootstrapped Likelihood Ratio Test (BLRT)	n/a	.000	.000	.000	.065
N for each latent class	C1: 2292	C1: 550 C2: 1742	C1: 1743 C2: 399 C3: 150	C1: 1674 C2: 398 C3: 128 C4: 92	C1: 131 C2: 404 C3: 129 C4: 41 C5: 1587

Note. Optimal solution is shaded in gray.

Table 3

Latent class conditional probabilities of using each substance in the last 30 days

Variables	Class 1		Class 2		Class 3		Class 4	
	Nonuser	ATM	ATM	Not Alcohol	Not Alcohol	Polysubstance	Polysubstance	Polysubstance
Alcohol	0.054	1.000	1.000	0.117	0.117	1.000		
Heavy Episodic Drinking	0.000	0.730	0.730	0.000	0.000	0.828		
Tobacco	0.032	0.445	0.445	0.389	0.389	0.707		
Inhalants	0.010	0.069	0.069	0.163	0.163	0.230		
Marijuana	0.037	0.426	0.426	0.341	0.341	0.850		
Other Illicit Drugs	0.004	0.048	0.048	0.129	0.129	0.562		
Prescription Drug Misuse	0.029	0.118	0.118	0.265	0.265	0.667		
Over-the-counter Misuse	0.014	0.049	0.049	0.141	0.141	0.449		

Table 4

Latent class differences in outcome measures, controlling for demographics

	Latent class means				Latent class mean differences (i - j)					
	Nonuser (1)	ATM (2)	Not alcohol (3)	Poly- substance (4)	1 vs. 2	1 vs. 3	1 vs. 4	2 vs. 3	2 vs. 4	3 vs. 4
Substance Offers	1.45	2.56	2.10	3.60	1.10***	.64***	2.15***	-.46***	1.04***	1.50***
Antisocial Behavior	1.09	1.31	1.17	1.84	.22***	.08*	.75***	-.14**	.52***	.67***
Oppositional Behavior	1.94	2.42	2.25	2.71	.48***	.31***	.77***	-.16*	.29**	.46***
Prosocial Behavior	2.82	2.57	2.65	2.54	-.25**	-.17	-.28	.09	-.03	-.11
Age Initiated Substance Use	15.87	12.04	12.71	10.73	-3.83***	-3.16***	-5.13***	.67	-1.31***	-1.98***
Age Initiated Antisocial Behavior	16.77	14.31	14.83	12.64	-2.46***	-1.95***	-4.14***	.52	-1.67***	-2.19***
Antidrug Attitudes	3.57	2.92	3.14	2.38	-.65***	-.43***	-1.19***	.22**	-.54***	-.76***
Drugs Harmful	3.01	2.58	2.75	2.32	-.43***	-.26***	-.69***	.17*	-.26**	-.43***
Disapproval of Antisocial Behavior	3.24	2.83	2.95	2.54	-.41***	-.29***	-.70***	.12*	-.29***	-.41***
Times Bullied	1.57	1.74	1.84	1.99	.18*	.27*	.42**	.09	.24	.15

Notes: Estimates are unstandardized and control for gender, age, grade level, mixed racial heritage, Latino heritage, two parent household, household size, Federal lunch program status, and mother's education.

*
p < .05.

**
p < .01.

p < .001.