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Regional Differences in Drug Use Rates Among American Indian Youth

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Abstract

Background—Research over the past several decades has shown that, compared to other American ethnic and racial groups, American Indian (AI) youth use alcohol and other drugs at significantly higher rates than their non-AI peers. However, to date, much of the research on AI adolescent substance use has been limited in the types of data used.

Methods—We used a national sample of AI youth living on or near reservations to estimate how lifetime and 30-day use of four substances (alcohol, marijuana, inhalants, and methamphetamine) differ by gender, grade in school, and region of the country.

Results—Female use was equal to or greater than use by otherwise similar males for all substances assessed. Substance use also increased as grade increased except in the case of inhalants, where use peaked in the 8th grade and then decreased. Regional differences proved to be one of the most salient findings in that individuals in the Northern Plains and Upper Great Lakes were more likely to have used substances at much higher rates than those living in the Southwest and Oklahoma, except in the case of methamphetamine, where individuals in the Southwest were most likely to have used.

Conclusions—It is clear that substance use continues to be a problem for AI youth although the severity of use differs by region of the country, grade, and gender. Future research is needed to better understand the reasons behind these differences. Such research will aid in the development of targeted, regionally-tailored prevention.

Keywords

adolescent substance use; American Indian; Native American

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Contributors

Dr. Beauvais served as PI on the project, wrote the grant, assisted in study design and wrote the protocol, he also provided editing of the final manuscript. Dr. Miller was in charge of writing the literature review, discussion and limitation sections, and assisted Dr. Stanley with data analysis and writing the results section. Dr. Stanley took the lead on data analysis and assisted in writing the results section and was the main editor for all other sections of the manuscript. All authors contributed to and approved the final manuscript.

Conflict of Interest

All authors declare they have no conflicts of interest.

1. Introduction

Research over the past several decades has shown that, compared to other American ethnic and racial groups, American Indian (AI) youth use alcohol and other drugs at significantly higher rates than their non-AI peers (Beauvais, et al., 2004, 2008; Beauvais and LaBoueff, 1985). Moreover, reservation AI youth have been found to have higher substance use and other related problems than non-reservation AI youth (Beauvais, 1992; Freedenthal and Stiffman, 2004). Although only about one-third of AIs live on designated reservations or tribal areas (Snipp, 2005), these findings are troubling in light of the persistent substance use related problems that many tribes experience, such as academic failure, delinquency, violent criminal behavior, and suicidality (Stiffman et al. 2003; U.S. Census Bureau, 2007; U.S. Department of Health and Human Services, 2009; Welty, 2002). Though a number of studies have examined the epidemiology substance use for reservation youth, these studies have typically used local or regional samples of reservation AI youth, often focusing on just one or two tribes or a subset of a tribe. However, tribes are highly diverse in terms of history, cultural traditions, geography and other qualities, making generalizations to larger populations of reservation AIs difficult (Snipp, 2005). At the same time, studies that have relied on large national samples of American youth have included a relatively small number of American Indians, with most of those being non-reservation AIs (Whitesell et al., 2007a).

In this paper, we use a large sample of AI youth living on or near reservations across the U.S. to explore lifetime and 30-day use of four substances - alcohol, marijuana, inhalants, and methamphetamines. For each of these substances, we examine whether the likelihood of having used in the specified time period differs by gender, grade in school, or region of the country. We examine alcohol, marijuana and inhalants because these substances are second only to tobacco in prevalence among AI youth (Beauvais et al., 2008). In addition, methamphetamine use is examined because AI youth have a high rate of use compared to all other ethnic groups (Iritani, et al., 2007). A better understanding of how use of these substances differs by gender, grade, and region can help to better and more efficiently target prevention and treatment efforts for these youth.

1.1 Substance use by gender, grade, and region

In national samples of adolescents, the presence of gender and grade differences in substance use rates depends on the substance. For example, males tend to have higher prevalence rates for marijuana and methamphetamine while alcohol use rates are similar for males and females (Eaton et al., 2006; Wallace et al., 2003; Center for Disease Control and Prevention, 2006). For inhalants, females typically have higher use rates in 7^{th} and 8^{th} grades, but males have higher rates in 12^{th} grade (Johnston, et al., 2011). With respect to grade, lifetime and 30-day prevalence rates generally increase as grade increases (Beauvais et al., 2004, Johnston et al., 2005, Wallace et al., 2003) except for inhalants where use has been found to peak at about ages 13–14 and then decrease through young adulthood (Beauvais et al., 2002; Johnson, et al., 2001).

Looking specifically at AI youth, there is evidence that AI females have greater prevalence rates than males for at least some substances. Spear et al. (2005) found significantly greater lifetime alcohol use for female AI 7^{th} graders living in the Northern Plains (NP) as compared to their male counterparts. Conversely, MTF found that 8^{th} and 10^{th} grade males had higher 30 day use rates than their female counterparts, but nearly equal rates by 12^{th} grade (Wallace et al., 2003). For marijuana, 10^{th} grade AI males showed greater rates of lifetime and 30-day use than 10^{th} grade females, but by 12^{th} grade, female rates were higher than those of males (Wallace et al., 2003). However, Spear et al. (2005) found no significant differences for lifetime or 30-day marijuana use between AI 7^{th} grade males and females living in the NP. For inhalants, AI females were found to have higher lifetime and 30-day prevalence rates than males, regardless of grade (Beauvais, et al., 2002; Bates et al., 1997). Finally, little is known about the epidemiology of AI adolescent methamphetamine use.

There is limited information regarding regional variations in AI adolescent substance use. In research comparing Northern Plains (NP) and Southwest (SW) AIs, Whitesell and colleagues (2007b) found that AIs ages 15–24 living in the NP had significantly greater past year drug use than their SW peers.

2. Method

2.1 Sample

Each year, from 1993–2005, eight to twelve schools on or near reservations (or tribal land for Oklahoma) were surveyed. Surveyed schools had a high percentage of AI youth who were representative of tribes from the major American Indian cultural/linguistic groups. It is our standard practice to not identify the tribes with which we work in order to respect the confidentiality of the communities participating in this research. Participants included 9,717 self-identified AI youth (4,536 male, 4,942 female) in grades 7–12, with 37% from the Southwest (SW), 28% each from the Northern Plains (NP) and Oklahoma regions, and 7% from the Upper Great Lakes (UGL). A total of 130 schools participated in this survey. Schools from three regions (Northwest, Southeast, and Northeast) were deleted for this study due to an inability to survey a sufficient number of schools to make generalizations about substance use in those regions.

2.2 Procedure

All procedures for this study received approval by the Colorado State University Institutional Review Board. Once tribal and school approvals were obtained, surveys were administered by school staff during normal classroom sessions. Parents could opt out their child by returning a form sent in the mail, calling the school, or visiting the school. Students could also decline to participate or choose to leave blank any questions they did not wish to answer. Teachers and/or staff were instructed to remain in the area but not close enough to observe any students' specific responses. Students placed their completed surveys in a large envelope, which was then sealed and sent back to the University for processing.

Surveys were scanned and run through 40 different computerized checks that identified inconsistent responders and exaggerators. Individuals who fell into these categories (3.3%) were eliminated from the data set prior to analysis.

2.3 Instrument and measures

Students were administered the American Drug and Alcohol Survey, an instrument that has been in use, with substantial updates, since the mid-1980's. Its various measures, including substance use measures, have been shown to be reliable and valid (Oetting and Beauvais, 1990), and it is listed in SAMHSA's Measures and Instruments Resource guide (SAMHSA, 2007).

For each substance (alcohol, marijuana, inhalants, and methamphetamine), two variables were constructed – one for lifetime use and one for 30-day use. Each variable was dummy coded to measure whether the student had used the substance in the specific time period (lifetime or last 30 days). In addition, two other variables measure whether the student had ever been drunk and had been drunk in the last 30 days.

At the student level, measures included gender and grade, where gender was dummy coded so that a female was coded as 1 and a male as 0, and grade was measured with 5 dummy-coded variables such that grade 7 was the base grade. At the community level, we included two measures - region and year of the survey. We based our regional designations on those delineated by Snipp (2005) who noted that although there is significant diversity among tribes, different areas of the country are identified with tribes that share some common qualities. For this study, we use data from 4 regions (states with data are in parentheses) – Northern Plains (Montana, Nebraska, North Dakota, South Dakota, Wyoming), Southwest (Arizona, New Mexico), Upper Great Lakes (Michigan, Minnesota, Wisconsin), and Oklahoma. The Southwest was arbitrarily chosen as the base category. The state of Oklahoma is designated by Snipp (2005) as its own region because of its differences from other regions. It has more tribes represented than any other part of the country, and Oklahoma AIs fare relatively well economically and socially compared to AIs in other regions. In addition, with a few exceptions, most Oklahoma tribes do not occupy reservations as such, but rather live in areas designated as Oklahoma Tribal Statistical Areas (OTSAs) that are intended to represent former reservations that existed prior to Oklahoma statehood.

2.4 Analysis

Because students are nested within schools, non-independence of observations within communities/schools must explicitly be accounted for to avoid biased significance tests. Thus, we utilized a multilevel analytic approach to evaluate the simultaneous effects of the individual-level (level 1) variables, gender and grade, and the community-level variables (level 2), region and year, on lifetime and 30-day substance use. The dichotomous substance use variables were analyzed with HLM6 using Bernoulli's logistic regression (Raudenbush and Bryk, 2002). The population-average odds ratios (OR) or relative odds are reported for these models. Missing data was well below 5% for every analysis except one (7.9% for gotten drunk in the last 30 days). Therefore, we use listwise deletion of cases as recommended by Fichman and Cummings (2003). Interaction terms between gender and grade and between individual and community level variables were tested using HLM's multivariate hypothesis testing feature (Bryk, et al., 2004). Where multivariate hypothesis tests showed insignificance ($p > .05$) of sets of coefficients (e.g., coefficients corresponding to the region by gender interaction variables), these variables were excluded from the final analysis. In addition, the multivariate hypothesis testing feature was used to test composite hypotheses that include linear combinations of coefficients.

3. Results

Table 1 provides frequencies for lifetime and 30-day use of all substances for 1997 and 2002. These years are shown because they each have the best representation from all four regions and thus give an illustration of AI youth substance use during the time period studied. The highest rates of use were found for alcohol, getting drunk, and marijuana. For example, of the 8th graders surveyed in 1997, 58% reported ever using alcohol, 39% reported ever being drunk, and 64% reported ever using marijuana. These rates compare to 14% reporting ever using inhalants and 8% ever using methamphetamine.

Tables 2 and 3 present population-average odds ratios (OR) and confidence intervals for lifetime and 30-day use, respectively, for each substance. For all models, the intercept represents a seventh grade, AI male residing in the Southwest in 1993.

3.1 Alcohol

Lifetime Use—The likelihood of ever using alcohol varied significantly by gender, grade, region, and year. Significant gender by region interactions were found; thus, differences in the likelihood of use between males and females must be discussed by region. Lifetime use for SW males was not significantly different from that of their female SW counterparts, as shown by the inclusion of the value "1" in the confidence interval for the gender odds ratio (.95 < OR < 1.40). This was also the case for Oklahoma (.72 < OR < 1.23). However, NP females and UGL females were both significantly more likely to have tried alcohol compared to their male counterparts (OR=1.35 and 1.66, respectively).

Turning to grade level, the odds of lifetime alcohol use increased steadily as grade increased, with a 12th grader's odds of using alcohol 5.68 times those of an otherwise similar 7th grader. The largest increase in relative odds occurred from 9th to 10th grades, increasing from 2.53 to 4.30.

In comparing lifetime alcohol use by region, NP youth were significantly more likely to have ever used alcohol when compared to their SW counterparts (OR = 1.59 for males; OR = 2.15 for females, i.e., being an NP female increases the likelihood of use by an additional factor of 1.35 above 1.59). In addition, UGL females were more likely to have tried alcohol compared to their SW female counterparts (OR = 1.66 assuming OR_{UGL} set equal to 1). However, lifetime use by UGL males was not significantly different from SW youth nor was lifetime use of alcohol by SW youth different from that of Oklahoma youth. In terms of year, the odds ratio of .96 translates into a decrease in the odds of lifetime alcohol use by approximately 1.8% per year.

Using the estimated coefficients from the analysis, we calculated the mean probabilities of ever using alcohol for 8th, 10th, and 12th grade males and females in 1999 (the mean year of the data) by region (see Figure 1). As reflected in the results discussed above, 8th grade NP and UGL females have a significantly higher mean probability (P=.78) of having ever used alcohol than their SW and Oklahoma counterparts (P=.62 and .67, respectively). In addition, NP males show significantly higher mean probabilities of lifetime alcohol use compared to males in other regions, and as grade increases, so does the probability of alcohol use for each region/gender group.

30-day use—The results for 30-day alcohol use (Table 3, column 1) were different from lifetime use in that no gender, regional, or year differences were found. However, as with lifetime use, as grade increased, the relative odds of using alcohol in the last 30 days also increased, with relative odds of 1.74 for 8th graders and 3.43 for 12th graders.

3.2 Drunkenness

Lifetime use—The odds of ever having been drunk were predicted by grade and region but not by gender or by a gender/region interaction. As with lifetime alcohol use, there was a steady increase in the odds of having ever been drunk as grade increased. NP and UGL students were significantly more likely to have ever been drunk (OR= 1.80 and 1.56, respectively) while students in Oklahoma were least likely to have been drunk (OR= 0.64).

Figure 2 shows the estimated mean probability of having ever been drunk for 8th, 10th, and 12th grade youth in 1999 by region. The graph demonstrates that for each grade level, NP youth had the highest mean probabilities of having been drunk ($P_{8th\ grade}$=.57; $P_{10th\ grade}$ = .73; $P_{12th\ grade}$ =.81), followed by UGL youth ($P_{8th\ grade}$ =.53; $P_{10th\ grade}$ = .70; $P_{12th\ grade}$ =.79). Oklahoma AI youth had the lowest mean probabilities of lifetime drunkenness ($P_{8th\ grade}$ =.32; $P_{10th\ grade}$ = .49; $P_{12th\ grade}$ =.61).

30-day use—As with lifetime drunkenness, grade and region significantly predicted differences in 30-day drunkenness, but gender did not (Table 3, column 2). The odds ratios for grade steadily increased until grade 11 but then leveled off to 3.42 for both 11th and 12th graders. NP and UGL students were more likely to have been drunk in the last 30 days compared to their SW counterparts (OR =1.40 and 1.55, respectively). Additionally, Oklahoma students were less likely to have been drunk in the last 30 days compared to their SW counterparts (OR=0.66).

3.3 Marijuana

Lifetime use—The likelihood of ever using marijuana varied by grade, region, and year but not by gender. There was a steady increase in the relative odds as grade increased until a leveling off occurred in 11th grade ($OR_{11th\ grade}$ =4.83; $OR_{12th\ grade}$ =4.71). NP youth had 1.87 times greater odds of having ever used marijuana than otherwise similar SW youth, while the odds for Oklahoma students were 0.28 times the odds for otherwise similar SW students. There was a significant increase in lifetime marijuana use over time with relative odds of 1.03, an increase in the odds of approximately 1.3% per year or 15% from 1993 to 2005.

Figure 3 shows the estimated mean probability of ever using marijuana for 8th, 10th, and 12th grade adolescents in 1999 by region. The graph shows that NP students had the highest mean probabilities across all grade levels ($P_{8th\ grade}$=.72; $P_{10th\ grade}$ = .83; $P_{12th\ grade}$=.85), followed closely by UGL students ($P_{8th\ grade}$ =.67; $P_{10th\ grade}$ =.80; $P_{12th\ grade}$=.82). In contrast, Oklahoma students were the least likely to have ever used marijuana ($P_{8th\ grade}$ =. 28; $P_{10th\ grade}$ = .43; $P_{12th\ grade}$=.47).

30-day use—The likelihood of using marijuana in the past 30 days varied by grade and region, but not by gender or year (Table 3, column 3). The likelihood of past 30 day marijuana use increased from grade 7 to grade 10, with the peak odds ratio occurring in the 10th grade at 2.36 and then dropping to 1.88 for 12th graders. With respect to region, the odds of using marijuana in the last 30 days were greater for NP and UGL youth when compared to SW youth (OR= 1.88 and 1.89, respectively), but less for Oklahoma youth (OR= 0.32).

3.4 Inhalants

Lifetime use—The likelihood of ever using inhalants varied by region, gender, grade and year. Females in all regions were more likely to have used inhalants than their male counterparts (OR= 1.45). Eighth graders were slightly more likely to have ever used inhalants than 7th graders (OR=1.17), but no other significant differences for grade were found. As to regional differences, Oklahoma adolescents were less likely to have ever used inhalants as compared to their SW counterparts (OR = .52); there were no significant differences found between SW, NP, or UGL youth. Finally, use of inhalants decreased by about 2% per year (OR=.95).

Figure 4 shows the estimated mean probability of ever using inhalants for 8th, 10th, and 12th grade males and females in 1999 by region. As shown, 8th grade NP females have a higher probability of having tried inhalants (P =.35) when compared to their 8th grade male counterparts (P =.27). AI youth in Oklahoma were the least likely to have ever tried inhalants, with 8th grade females and males having probabilities of .17 and .13, respectively.

30-day use—Thirty-day inhalant use varied by gender and grade but not by region or year (Table 3, column 4). The gender difference found in the lifetime model remained robust, with females having 1.53 times the odds of using in the past 30 days compared to their male counterparts. Eighth grade likelihood of use did not significantly differ from that of 7th graders, but the odds of using in the past 30 days fell significantly for 9th–12th graders ($OR_{12th\ grade}$=.18).

3.5 Methamphetamine

Lifetime use—Methamphetamine lifetime use differed significantly by gender, grade, and region. The odds of a female ever using methamphetamine were 1.19 times greater than those of an otherwise similar male. There was a steady increase in the relative odds of ever using methamphetamine until the 10th grade where the ratio peaked at 2.39 and then leveled off. In terms of regional differences, SW youth were significantly more likely to have ever used methamphetamine compared to their NP, UGL, and Oklahoma counterparts (OR= .58, .33, and .31, respectively).

Figure 5 shows the estimated mean probability of ever using methamphetamine for 8th, 10th, and 12th grade males and females in 1999 by region. The graph indicates that SW males and females have significantly higher mean probabilities of having tried methamphetamine at all grade levels compared to their counterparts in the other regions.

30-day use—Methamphetamine 30-day use differed significantly by gender, grade, region, and year (Table 3, column 5). Females were more likely to have used methamphetamine in the last 30 days compared to their male counterparts (OR = 1.52). The likelihood of using methamphetamine in the past 30 days was similar for youth in 9th through 12th grades ($OR_{9th\ grade}$ = 2.51; $OR_{12th\ grade}$ = 2.71), and UGL and Oklahoma adolescents were less likely to have used methamphetamine in the past 30 days compared to their SW counterparts (OR=.33 and .30, respectively). Finally, 30-day methamphetamine use was found to increase at 3.7% year.

4. Discussion

In this study, we used multilevel analyses to determine how lifetime and 30-day use of alcohol, drunkenness, marijuana, inhalants, and methamphetamine differed by gender, grade, region, and year for a large sample of AI youth who lived on or near a reservation or tribal land.

Regarding gender differences, results indicated that female use was equal to or greater than use by otherwise similar males for all substance use measures. The only differences between male and female alcohol use rates were that NP and UGL females were more likely to have ever used alcohol than their male counterparts. These alcohol results are consistent with other studies showing few differences by gender (Wallace et al., 2003; CDC, 2006) and with Spear et al. (2005) who reported that NP AI 7th grade females had higher lifetime prevalence than males, but the same prevalence in 30-day use. For marijuana, we found no differences between male and female lifetime or 30-day use, a result also consistent with Spear et al. (2005). For inhalants and methamphetamine, the likelihoods of ever using and using in the last 30 days were significantly greater for females than males. These inhalant results are consistent with findings for lower grade levels (Beauvais et al., 2002; Bates et al., 1997) while the methamphetamine results differ from past research in that males have been found to use methamphetamine at higher rates (Springer et al., 2007).

In general, teenage girls have been closing the gap with boys in terms of usage of marijuana, alcohol and other drugs (SAMSHA, 2010), and for AI youth, it appears that the gap has closed or been exceeded. A number of studies have found that girls are particularly vulnerable to drug and alcohol use because of greater prevalence of depression, anxiety and stress (National Center on Addiction and Substance Abuse, 2003). These risk factors are likely to be at significantly greater levels for many AIs (Duran et al. 2004), especially given the higher levels of trauma and stress found in reservation communities (Beals, et al., 2005; Manson, et al., 2005). Females may also be more vulnerable to drug-using peers than males.

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Rayle et al. (2006) found that SW females experienced significantly more drug offers and had a harder time refusing those offers than their male counterparts.

Turning to grade level, generally as grade increased, the likelihood of lifetime and 30 day use increased with the exception of inhalants, where the likelihood peaked in the 8th grade and then decreased. This general upward trend is supported by research that demonstrates as youth age they are more likely to experiment with substances (Johnston et al., 2008). However, the probabilities of methamphetamine and marijuana use leveled off in the 10th grade and for marijuana use, declined for 12th graders. These findings may be a result of the high level of school dropout by AI youth (Faircloth and Tippeconnic, 2010; Freeman and Fox, 2005; Swaim, et al., 1997) combined with the strong relationship between substance use and dropping out of high school (Townsend, et al., 2007). A final interesting finding about grade was the large odds increase seen for lifetime alcohol use between 9th and 10th grades. This suggests that the time between the 9th and 10th grades is a critical period of risk for increased alcohol use.

Regional differences were one of the most salient findings in this study. NP and UGL students were more likely to have gotten drunk during their lifetime and in the past 30 days. In addition, NP youth were more likely to have ever tried alcohol and marijuana and to have used marijuana in the past 30 days. These regional differences are consistent with studies that found that NP AI youth have greater lifetime drug use rates than their SW counterparts (Whitesell et al. 2007a; 2007b), and studies that show high rates of alcohol abuse among upper Midwest tribal members (UGL region; Whitbeck et al., 2006). Though researchers have speculated that poverty, isolation, historical trauma, and other factors are behind these higher rates (Whitesell, et al. 2007b), a better understanding of these differences is needed, especially since Beals et al. (2003) found similar differences between NP and SW adults, and Whitbeck et al. (2006) found high levels of alcohol abuse among caretakers of children 10–12 living in the Upper Midwest (the UGL region). In contrast to these findings for alcohol, adolescents in the SW were the most likely to have used methamphetamine, a finding consistent with reports showing higher methamphetamine use in the Southwest during the survey time period (Farabee, et al., 2002).

AI youth in Oklahoma were consistently found to be least likely to have used any of the substances in the study, except for lifetime and 30-day alcohol use, where the regional differences were, for the most part, not significantly different from zero. These lower rates may be due to lower poverty rates and fewer single-parent families for Oklahoma AIs compared to other AIs (Snipp, 2005). In addition, Hamill (2000) speculates that, unlike other North American tribes, Oklahoma AIs have blurred the tribal boundaries in forming inter-tribal alliances. This allows them to successfully compete for limited resources and political power and thus strengthen their members, relative to members of other tribes. Future research should examine these and other possible reasons for the significantly lower Oklahoma substance use rates found in this study.

Although the year of the sample was included in the analysis as a control variable, it was difficult to draw conclusions about trends due to the nature of the sample. The sample was not geographically representative each year because participation in the study was voluntary, and we had little control over whether schools participate. However, in general, results indicated that the likelihood of lifetime alcohol use decreased over time while lifetime marijuana use and 30-day methamphetamine increased.

Finally, comparing prevalence rates for our AI sample to those from MTF during the time period 1993–2005, shows that at each grade level, AI youth in our sample had equal or higher rates of use for all substance use measures compared to their MTF counterparts

(Johnston et al., 2006). The differences in use were greatest for marijuana. For example, lifetime marijuana use was greater than 50% for AI 8th graders, but less than 25% for MTF 8th graders.

Overall, the results suggest that although substance use, particularly alcohol and marijuana, are a problem among this sample of AI youth, important differences in the epidemiology of substance use rates exist. Given the nature of this data set, future research should include measures of socioeconomic status, geographic and ethnic isolation, historical events, and other variables to find those measures that explain variation in substance use rates between regions and/or tribes. Regional efforts that directly address the common factors that are contributing to use across tribes could move prevention efforts targeted to AI youth forward and lead to a greater likelihood of long-term success. In addition, better understanding the lower rates of use for Oklahoma could help AI communities in other regions develop prevention and intervention efforts that build those particular strengths in their own communities.

5. Limitations

Although this study used a large sample of AI adolescents living on or near reservations, it does not reflect a random sample of all schools on or near reservations due to voluntary participation. A further limitation of the sample is the lack of representation in the northwest, southeast, and northeast. We are, thus, not able to give “nationally representative” prevalence measures nor generalize our findings to AI youth living in these areas. Likewise, whether our results can be generalized to states without survey data but within the sampled regions needs further study.

Another limitation lies in the descriptive nature of this study. We examined differences in substance use by grade, gender, year and region, but we purposely did not explore precursors to substance use. Future research should examine why the estimated differences in substance use arise, especially as these differences relate to region. When considering the high rate of school dropout among AI youth, it is important to note that our results may have actually underestimated the rates of substance use. Finally, since our data were gathered between 1993 –2005 there might have been changes in the patterns and rates of use among AI adolescents since that time.

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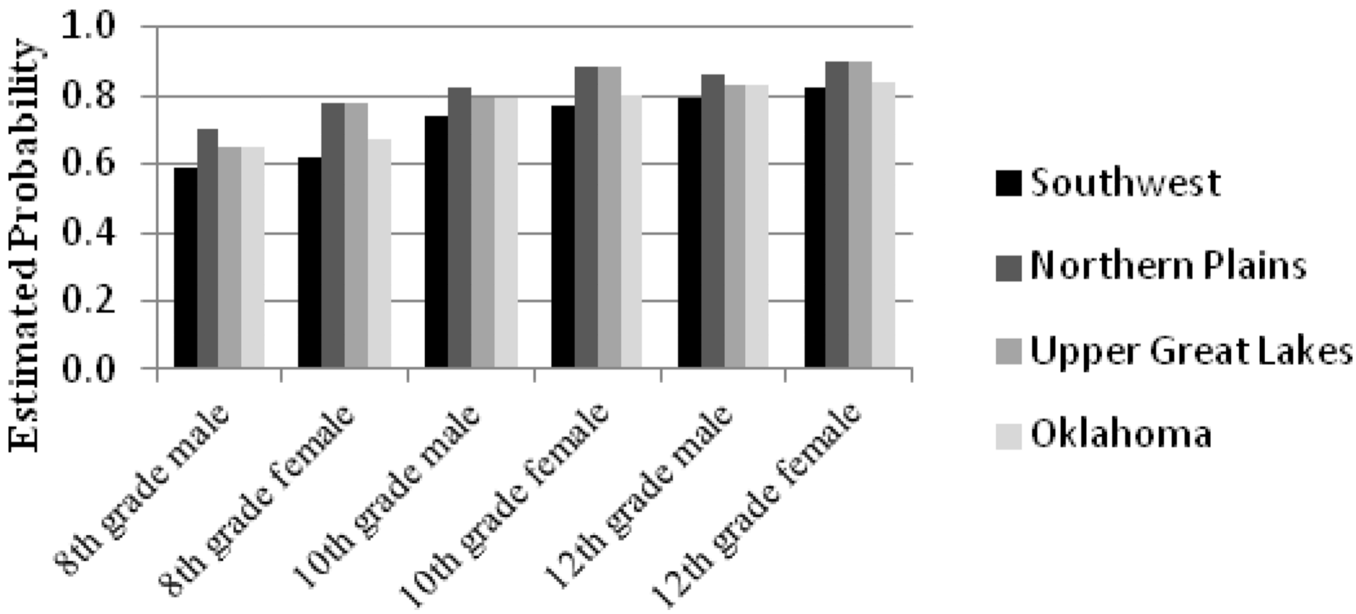

Figure 1.
Ever tried alcohol by gender, grade and region (1999).

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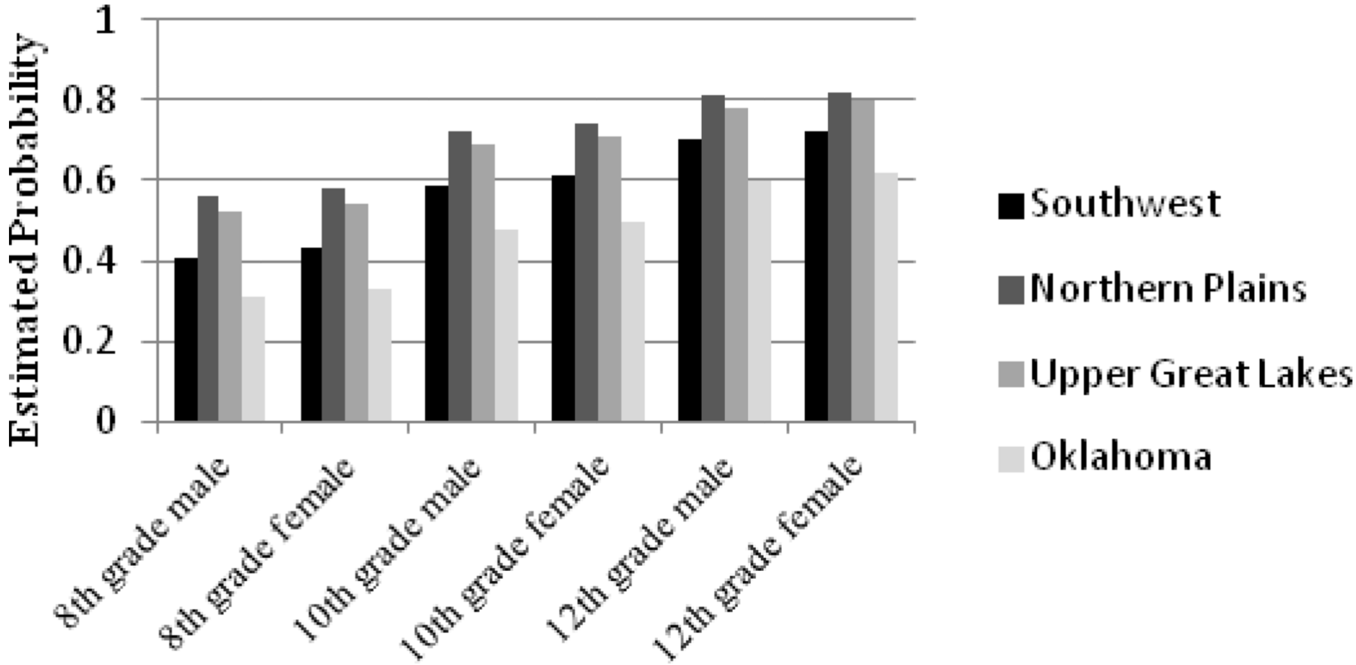

Figure 2.
Ever drunk by gender, grade and region (1999).

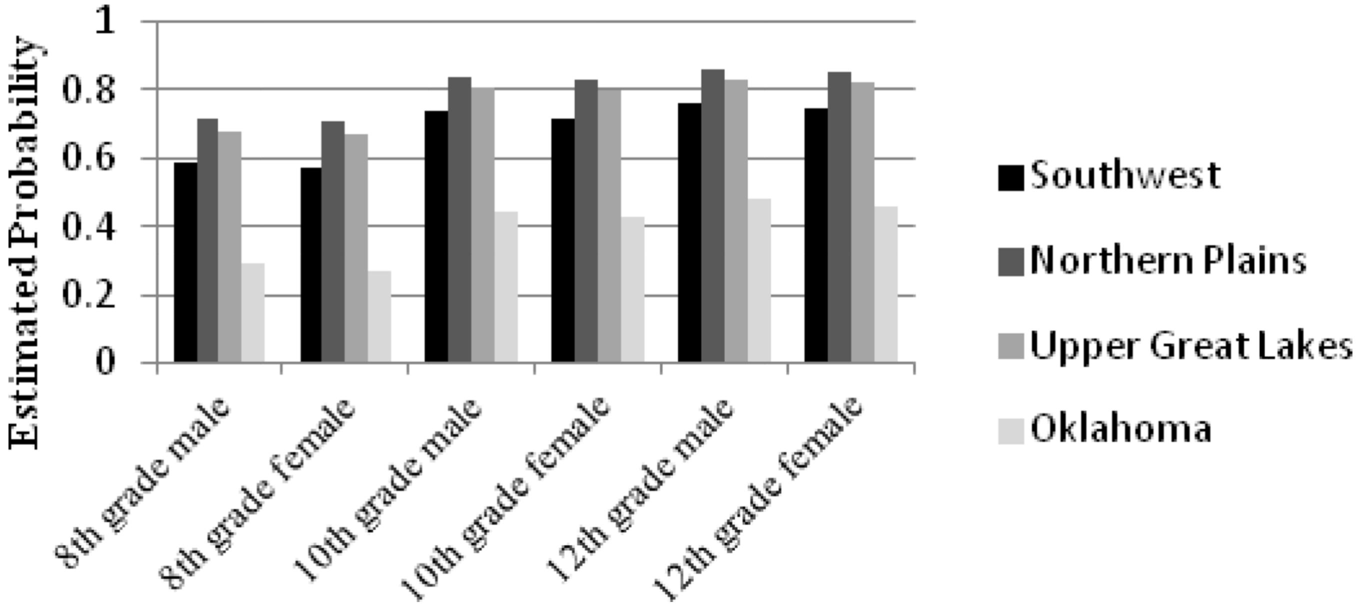

Figure 3.
Ever tried marijuana by gender, grade and region (1999).

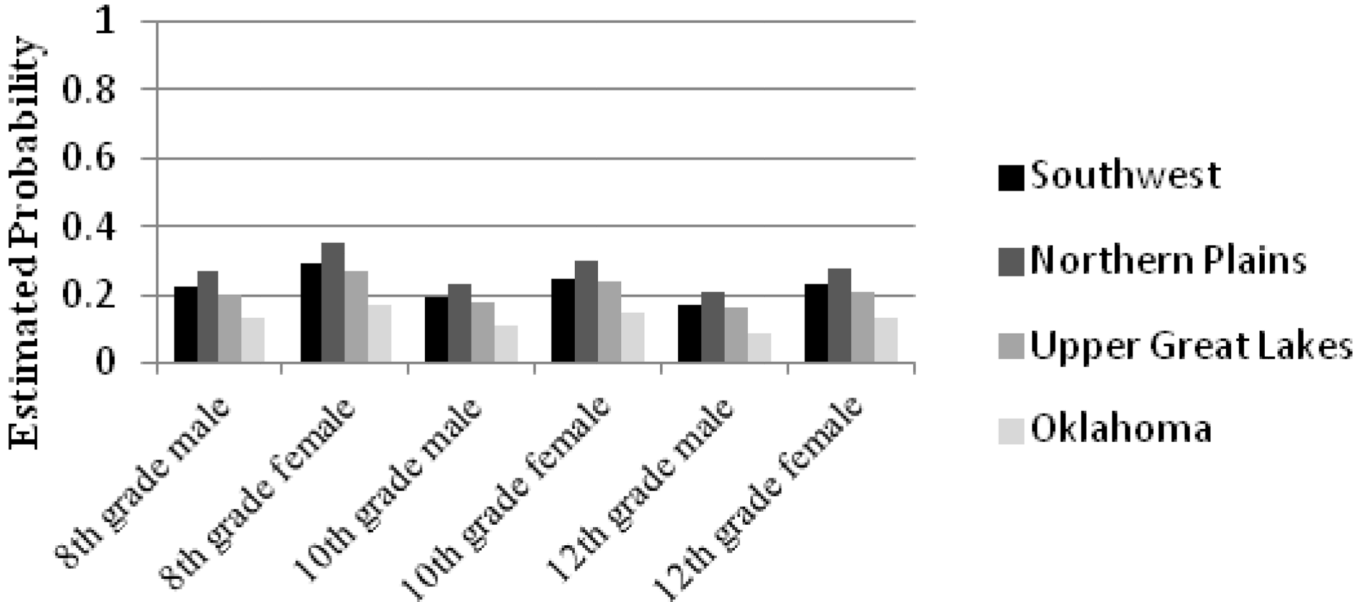

Figure 4.
Ever tried inhalants by gender, grade and region (1999).

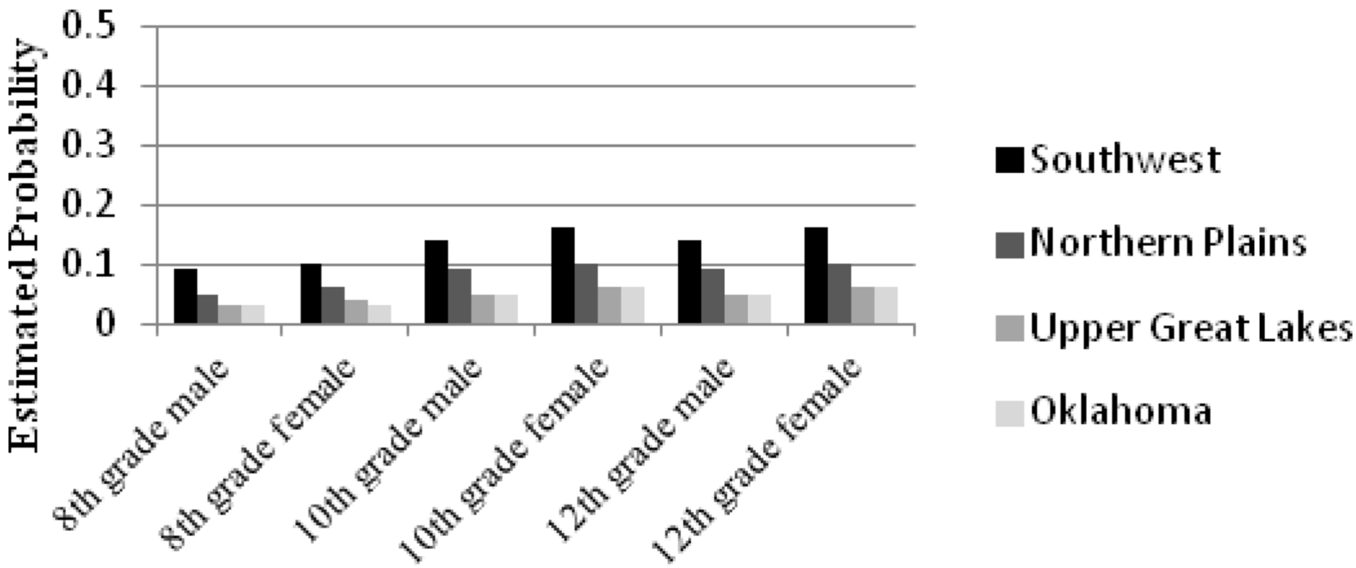

Figure 5.
Ever tried methamphetamine by gender, grade and region (1999).

Table 1

Lifetime and 30-Day Prevalence Rates by Grade and Substance for 1997 and 2002

	Alcohol		**Drunk**		**Marijuana**		**Inhalants**		**Methamphetamine**	
	1997	**2002**	**1997**	**2002**	**1997**	**2002**	**1997**	**2002**	**1997**	**2002**
Lifetime prevalence										
8^{th} grade	58%	67%	39%	43%	64%	54%	14%	20%	8%	6%
10^{th} grade	80%	77%	67%	56%	81%	69%	20%	7%	13%	12%
12^{th} grade	80%	84%	63%	70%	66%	75%	8%	5%	8%	12%
30-day prevalence										
8^{th} grade	28%	28%	16%	20%	34%	32%	4%	6%	3%	2%
10^{th} grade	40%	48%	26%	29%	42%	35%	1%	.7%	3%	6%
12^{th} grade	38%	45%	23%	28%	27%	38%	1%	1%	1%	7%

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Table 2

Population Average Odds Ratios for Lifetime Use of Alcohol, Gotten Drunk, Marijuana, Inhalants, & Methamphetamine Among 7–12th Graders

Variable	Ever Tried Alcohol		Ever Gotten Drunk		Ever Tried Marijuana		Ever Tried Inhalants		Ever Tried Meth	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Intercept	0.88	(0.68, 1.14)	0.40**	(0.31, 0.51)	0.57**	(0.43, 0.75)	0.32**	(0.23, 0.45)	0.06**	(0.04, 0.09)
Individual-level variables										
Gender	1.15	(0.95, 1.40)	1.09	(0.97, 1.23)	0.94	(0.83, 1.07)	1.45**	(1.31, 1.61)	1.19*	(1.02, 1.40)
Grade 8	2.14**	(1.87, 2.44)	2.01**	(1.76, 2.31)	2.07**	(1.84, 2.34)	1.17*	(1.00, 1.36)	1.36*	(1.02, 1.82)
Grade 9	2.53**	(2.15, 2.98)	2.71**	(2.31, 3.18)	2.85**	(2.38, 3.42)	0.85	(0.71, 1.03)	1.65**	(1.20, 2.28)
Grade 10	4.30**	(3.57, 5.18)	4.21**	(3.54, 5.00)	4.09**	(3.33, 5.03)	0.96	(0.79, 1.17)	2.39**	(1.73, 3.30)
Grade 11	5.28**	(4.33, 6.45)	5.57**	(4.64, 6.68)	4.83**	(4.10, 5.71)	0.82	(0.66, 1.01)	2.39**	(1.72, 3.33)
Grade 12	5.68**	(4.56, 7.08)	6.70**	(5.49, 8.16)	4.71**	(3.92, 5.66)	0.84	(0.68, 1.06)	2.32**	(1.64, 3.30)
Community-level variables										
Northern Plains (NP)	1.59**	(1.17, 2.16)	1.80**	(1.37, 2.38)	1.87**	(1.37, 2.54)	1.31	(0.89, 1.93)	0.58*	(0.38, 0.89)
Upper Gr. Lakes (UGL)	1.30	(0.83, 2.02)	1.56*	(1.04, 2.33)	1.53	(0.90, 2.60)	0.93	(0.53, 1.62)	0.33**	(0.16, 0.65)
Oklahoma	1.30	(0.98, 1.72)	0.64**	(0.50, 0.82)	0.28**	(0.21, 0.39)	0.52**	(0.34, 0.75)	0.31**	(0.20, 0.47)
Year	0.96**	(0.93, 0.98)	0.98	(0.95, 1.00)	1.03*	(1.00, 1.06)	0.95*	(0.91, 0.99)	1.03	(0.99, 1.08)
Individual-level × community-level[a] variables										
Gender * NP	1.35*	(1.01, 1.80)								
Gender * UGL	1.66*	(1.05, 2.62)								
Gender * Oklahoma	0.94	(0.72, 1.23)								
% community-level variance explained by region and year[b]										
Intercept	26%		29%		57%		33%		28%	
Gender	35%									
N	9458		9455		9453		9443		9330	

Note: OR = odds ratio; CI = 95% confidence interval,

*: p<.05;

**: p<.01;

[a]: Interactions terms were excluded from final analysis when likelihood-ratio tests revealed insignificance of the group of variables.

[b]: Shows whether the community-level variables help explain differences in community intercepts and slopes.

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Table 3

Population Average Model Results for 30- Day Use of Alcohol, Gotten Drunk, Meth, Marijuana, & Inhalants Among 7–12th Graders

Variable	30 Day Alcohol		30 Day Drunkenness		30 Day Marijuana		30 Day Inhalants		30 Day Meth	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Intercept	0.27**	(0.21, 0.35)	0.13**	(0.10, 0.17)	0.27**	(0.20, 0.37)	0.12**	(0.08, 0.18)	0.01**	(0.01, 0.02)
Individual-level variables										
Gender	1.16	(1.04, 1.30)	0.97	(0.88, 1.07)	0.93	(0.82, 1.06)	1.53**	(1.27, 1.83)	1.52**	(1.18, 1.97)
Grade 8	1.74**	(1.508, 2.01)	1.88**	(1.56, 2.26)	1.67**	(1.45, 1.94)	0.93	(0.74, 1.16)	1.60	(.098, 2.61)
Grade 9	2.08**	(1.77, 2.46)	2.39**	(1.96, 2.92)	1.87**	(1.57, 2.23)	0.41**	(0.30, 0.57)	2.51**	(1.50, 4.20)
Grade 10	2.58**	(2.17, 3.07)	2.76**	(2.24, 3.40)	2.36**	(1.96, 2.83)	0.31**	(0.21, 0.49)	2.95**	(1.74, 5.01)
Grade 11	2.90**	(2.43, 3.47)	3.42**	(2.77, 4.22)	1.94**	(1.57, 2.39)	0.18**	(0.11, 0.28)	2.69**	(1.56, 4.64)
Grade 12	3.43**	(2.84, 4.15)	3.42**	(2.74, 4.27)	1.88**	(1.54, 2.31)	0.18**	(0.11, 0.30)	2.71**	(1.53, 4.81)
Community-level variables										
NP	1.21	(0.92, 1.61)	1.40*	(1.06, 1.85)	1.88**	(1.32, 2.67)	0.74	(0.46, 1.19)	0.65	(0.36, 1.15)
UGL	1.48	(0.99, 2.22)	1.55*	(1.04, 2.30)	1.89*	(1.14, 3.14)	0.69	(0.34, 1.40)	0.33*	(0.13, 0.84)
Oklahoma	0.90	(0.70, 1.17)	0.66**	(0.51, 0.87)	0.32**	(0.23, 0.44)	0.65	(0.41, 1.03)	0.30**	(0.16, 0.53)
Year	0.98	(0.95, 1.00)	1.00	(0.97, 1.03)	1.02	(0.99, 1.06)	0.96	(0.91, 1.00)	1.09**	(1.02, 1.16)
% Level-2 Variance Explained										
Intercept (γ_{00})	15%		43%		15%		63%		−5%	
N	9478		8943		9267		9465		9457	

Note: OR = odds ratio; CI = 95% confidence interval,

*: p<.05;

**: p<.01.

No individual-level × community-level effects were significant; thus, they were excluded from the final analysis.