DISSERTATION

SUBSTANCE USE, RISK, AND PROTECTIVE FACTORS AMONG INDIGENOUS YOUTH: AN EXAMINATION OF EVIDENCE FROM RECENT DECADES

Submitted by

Theodore J. Fetterling

Department of Psychology

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Colorado State University

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Doctoral Committee:

Advisor: Mark Prince

Nathaniel Riggs
Noah Emery
Randall Swaim

ABSTRACT

SUBSTANCE USE, RISK, AND PROTECTIVE FACTORS AMONG INDIGENOUS YOUTH: AN EXAMINATION OF EVIDENCE FROM RECENT DECADES

American Indian (AI) youth have consistently been identified as an at-risk population for elevated rates of substance use relative to non-AI peers. Reliance upon single-site and regional substance use research with Indigenous samples has led to substantial variability in the magnitude of estimates in the extant literature. This variability is exacerbated by demographic differences shown to influence substance use prevalence as well as the ceremonial use of tobacco in many tribes. Ceremonial practices involving tobacco also present a unique impact on perceptions of availability and harm of substances, however little research has investigated the salience of these perceptions as either risk or protective factors among AI youth. The present study addresses the variability in estimates and limited representation of AI youth by consolidating nearly three decades of repeated cross-sectional data to provide accurate and precise estimates of alcohol, cannabis, and cigarette use. The hypotheses that perceived availability and harm would differentially predict substance use among AI youth compared to White peers were also tested. **Method.** The sample was drawn from data collected between 1993-2019 as part of ongoing epidemiology research with reservation-dwelling AI youth and White peers. Descriptive statistics were used to provide substance use estimates for alcohol, cannabis, and cigarettes, stratified by race/ethnicity (i.e., AI vs White), grade group, sex, and region. After stratifying for demographic comparisons, estimates were presented for each year of available data and aggregated across years for all substance use variables. Binary logistic and quasi-Poisson regressions were used to test study hypotheses regarding the influence of perceived availability and harm on substance use separately for AI and White youth. A subset of years was selected for an exploratory application of time-varying effect modeling (TVEM) for trend analysis. **Results.** Similar patterns emerged across demographic comparisons for average cannabis use, showing elevated rates among AI youth relative to White peers. Average lifetime prevalence of cigarettes was consistently higher among AI youth than White peers, however this pattern was not found for average frequency of cigarette use or for any average alcohol use comparison. Hypotheses were partially supported, in that perceived harm was significantly more protective for White youth than for AIs, but perceived availability showed no significant differences in protective influence for lifetime prevalence comparisons of any substance. TVEM trends mirrored descriptive statistic comparisons found for stratification by race/ethnicity and region. **Discussion.** Findings revealed stark contrasts in rates of substance use and the influences of perceived availability and harm between AI and White youth. These differences are interpreted within the context of historical trauma (HT) and ceremonial practices involving tobacco found in many Indigenous communities. For prevention and intervention programs to be culturally responsive, they should be developed at the community level and incorporate strategies for coping with HT. Additionally, distinguishing recreational tobacco use from ceremonial use can enhance accuracy of estimates in future epidemiology research and contribute to culturally informed prevention and intervention programming for AI youth.

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INTRODUCTION

Substance use among adolescents in the United States is a persistent public health concern, with lifetime prevalence estimates of 41.5% for alcohol and 34.8% for any illicit drug among 8th-12th grade students (Johnston et al., 2020). These rates are especially concerning given that adolescent substance use has been linked to a variety of negative outcomes including impairments to brain development, affective disorder onset (e.g., depression, anxiety; Spear, 2016), and school disengagement/dropout (Henry, Knight, & Thornberry, 2012). American Indian (AI) youth are at disproportionate risk for substance use. Research indicates that AI youth report substantially higher lifetime prevalence rates for nearly all substances compared to predominantly White students in national survey data (cf. Swaim & Stanley, 2018). While these disparate rates of substance use have been consistently reported over several decades (e.g., Beauvais 1992; Swaim & Stanley, 2018), little research has been dedicated to investigating the stability and variation in the association between AI status and substance use over time.

The present study expands upon the available literature for AI youth substance use and related risk factors in several ways. First, the accuracy and precision of prevalence rates and point estimates of alcohol, cannabis, and cigarette use were evaluated for AI youth and their White peers spanning approximately three decades. Next, relationships between key demographic variables (i.e., sex, grade, region) and known risk/protective factors (i.e., perceived harm and availability) were characterized, similar to what has been conducted for adolescents of other ethnicities (cf., Johnston et al., 2020). Finally, a trend analysis was conducted to illustrate the comparisons in alcohol, cannabis, and cigarette use for years of data that met tenability criteria for such analysis.

Race/Ethnicity Differences

For more than four decades, researchers have collected prevalence data tracking the epidemiology of adolescent substance use in the United States (Johnston et al., 2020). These data provide researchers with the ability to track trends in the onset and prevalence rates of use, identify contributors to substance use trajectories, and even inform strategies for prevention and treatment of substance use (Kessler & Zhao, 1999). Currently, the bulk of epidemiologic evidence in the U.S. is based on predominantly White samples and does not provide nationally representative data on AI youth. This lack of representation of AI youth limits prevention scientists and interventionists from developing programing that is specifically designed to meet the unique needs of AI youth and their surrounding communities.

Part of the issue in providing adequate representation of AI youth in national epidemiology data stems from persistent challenges with obtaining a truly representative sample of this population. Of the 574 federally recognized tribal nations, 345 are distributed across 34 of the contiguous United States, with the remaining 229 residing in Alaska (National Congress of American Indians, 2020). While some may share similarities, substantial variation exists based on tribal affiliation. Despite these challenges, some research has attempted to approximate a nationally representative sample. For example, in a large-scale comparison of AI youth with Monitoring the Future (MTF) and National Household Survey data, Beauvais (1996) obtained annual stratified samples of five to seven tribes with varying demographic and cultural characteristics (i.e., regional distribution, education level, language) and aggregated data in two- to three-year intervals to reduce sampling bias. Findings indicated that AI youth exhibited markedly higher levels of substance use than their non-AI peers (Beauvais, 1996). However, there were notably sharper inflection points among AI youth than what was seen in trends for non-AI youth (Beauvais, 1996), suggesting low precision of estimates for Indigenous youth substance use.

Limited precision of estimates for substance use rates with AI youth has continued to present challenges in more recent research. While the bulk of evidence points toward elevated substance use rates among AI youth relative to their non-AI peers (Swaim & Stanley, 2018; Johnson et al., 2019; Spillane, Treloar Padovano, & Schick, 2020), other evidence suggests an inverse pattern in some cases (Stanley, Harness, Swaim, & Beauvais, 2014). For example, Stanley and colleagues (2014) found that past-month alcohol use among AI 10th graders did not significantly differ from national rates (26.1% vs 28.3%, respectively), and that AI 12th graders had significantly lower past-month alcohol use (26.6% vs 41.4%, respectively). Further, considerable variation exists in the magnitude of differences across studies. For instance, two large-scale studies found that AI youth had significantly higher past-month cigarette use than non-AI peers (Swaim & Stanley, 2018; Spillane et al., 2020), but the estimates of those differences were markedly higher among one sample (Swaim & Stanley, 2018) than were found for the other (Spillane et al., 2020).

Given the heterogeneity in substance use prevalence comparisons of AI and non-AI youth (Swaim & Stanley, 2018; Spillane et al., 2020), as well as differences seen across exclusively Indigenous samples (Tragesser, Beauvais, Burnside, & Jumper-Thurman, 2010), researchers have cautioned against broad generalizations and have called for consideration of other demographic variables (i.e., sex, age, region) in epidemiology studies (Volkow & Warren, 2012). This is illustrated by large-scale epidemiology research that has shown substantial variability across demographic variables including race/ethnicity, sex, grade, and region (Johnston et al., 2020). Taken together, these findings highlight a need for more precise point estimates of substance use prevalence with AI youth and inclusion of key demographic characteristics beyond race/ethnicity alone.

Sex assigned at birth (sex)

A large body of research has found evidence of sex differences in prevalence estimates for substance use. For example, Carliner and colleagues (2017) found that, while both males and females showed an increase in cannabis use from 2002-2014, the rate of increase was significantly higher for males, resulting in a widening of the gender gap for this substance. These findings are consistent with national trend data which has shown that increases in sex differences often coincide with increased prevalence rates for a given substance (Johnston et al., 2020). Similarly, Banks, Rowe, Mpofu, and Zapolski (2017) found that adolescent males were more likely than their female peers to engage in concurrent use of alcohol, cannabis, and/or tobacco, in any combination (e.g., alcohol and cigarettes without cannabis; alcohol, cannabis, and cigarettes). Most notably, males in the sample were 82% more likely to use cannabis and cigarettes concurrently than their female peers (Banks et al., 2017). However these findings were based on a sample with limited AI representation. Therefore, while sex differences were observed in the sample, the magnitude of differences may not be an accurate reflection of true differences among AI youth, specifically.

Given the notably higher prevalence rates for lifetime and past 30-day use among AI youth relative to their non-AI peers (Swaim & Stanley, 2018), the evidence for a gender gap in substance use would suggest that potentially large differences in substance use prevalence exist between AI males and females. Johnson and colleagues (2015) found evidence of this, where AI youth had the highest prevalence of cannabis use relative to all other races/ethnicities in the sample, as well as the largest differences by sex, with AI males using at a significantly higher rate than AI females.

Contrary to research indicating that males use substances at higher rates than females (e.g., Banks et al., 2017; Carliner et al., 2017; Haberstick et al., 2014), some studies conducted with Indigenous youth have reported an inverse pattern. Spear, Longshore, McCaffrey, and Ellickson, (2005) found that lifetime alcohol, cannabis, and cigarette use were higher among AI females than White adolescents regardless of sex. Additionally, AI females were significantly higher than AI males for alcohol and cigarette use, however cannabis use differences were nonsignificant (Spear et al., 2005). In longitudinal research with AI adolescents, Walls (2008) found that AI females reported significantly higher lifetime prevalence of alcohol and cannabis than male peers, but these differences were limited to only one of the three total time points assessed. Differences in trajectories of substance use for AI male and female adolescents have also been noted, with AI females showing higher rates of growth for use of alcohol, cannabis, (Stanley & Swaim, 2018; Walls, Hartshorn, & Whitbeck 2013) and cigarettes (Stanley & Swaim, 2018), though these differences diminished in higher grades. Together, these data suggest that sex differences with this population are both complex and dynamic.

Despite the substantial body of evidence for sex differences in substance use in the general population, recent trend data has shown a narrowing of sex differences in adolescent use of alcohol, cannabis, and tobacco (Johnston et al., 2020). These changes are congruent with evidence from multiple studies showing increasingly similar rates of use across sex for alcohol (Slade et al., 2016), cannabis (Chapman et al., 2017), and tobacco (Colell, Sánchez-Niubò, & Domingo-Salvany, 2013). However, Indigenous youth are not represented in these data, calling into question the generalizability of such findings. Considering the historic pattern of variability in substance use trends between AI and non-AI youth (Beauvais, 1996), exploration of such differences should be conducted with a predominantly AI sample before attempting to relate this narrowing of differences to Indigenous populations. Moreover, exploration of how sex differences have changed over recent decades with AI youth samples provides a logical starting point for establishing the directionality and magnitude of those changes. Fostering a clearer understanding of these differences has implications for how interventions are developed, delivered, and evaluated in AI youth samples.

Grade

Adolescence marks a time when individuals begin to explore possible identities and is subject to a great deal of peer and normative influences. Therefore, it is important to consider the effects of age on substance use initiation and the implications it has for prevalence and trajectories of use. One of the most important predictors of psychosocial problems related to substance use is age of initiation (Poudel & Gautam, 2017). Earlier initiation of substance use has been linked to impairments in brain development and may predispose youth for severe use later in life (Ivanov et al., 2021). Such findings are of particular importance for AI epidemiology research due to consistent evidence indicating that alcohol, cannabis, and cigarette use occur at younger ages compared to White youth (Swaim & Stanley, 2018; Stanley et al., 2014; Whitesell, Beals, Crow, Mitchell, & Novins, 2012). For example, Swaim and Stanley (2018) found that 8th grade AI adolescents had lifetime prevalence rates of 43.7% for cannabis, 39.7% for alcohol, and 29.7% for cigarettes. These were notably higher than rates seen for non-AI youth, with average estimates of 12.8% for cannabis, 22.8% for alcohol, and 9.8% for cigarettes among non-AI youth (Swaim & Stanley, 2018). This pattern was also found in comparisons of older cohorts (i.e., 10th and 12th grade), though the differences are less pronounced (Swaim & Stanley, 2018).

The comparatively early initiation of alcohol, cannabis, and cigarette use for AI youth relative to their non-AI peers is especially relevant due to the implications it has for later use. Evidence from multiple studies shows that earlier initiation of use for alcohol, cannabis, and tobacco, is strongly associated with more substance-related problems (Nelson, Van Ryzin, & Dishion, 2015; Moss, Chen, & Yi, 2014) and contributes to higher use trajectories for each substance into early adulthood (Richmond-Rakerd, Slutske, & Wood, 2017; Nelson et al., 2015). Stanley and Swaim (2018) found when determining latent classes of substance use, patterns of use were similar for AI middle and high schoolers, whereas patterns of use among White students were less established at earlier ages (i.e., in middle school). These findings suggest that, not only do AI youth initiate substance use earlier, but are at increased risk of developing problematic patterns of use compared to their White peers.

Region

Few studies have approximated nationally representative samples of AI youth that allow for comparisons of substance use rates across regions. Available evidence indicates complex differences in substance use for comparisons of AI youth residing in different regions, as well as for race/ethnicity (i.e., AI vs White) and region (Spillane et al., 2020; Miller, Stanley, & Beauvais, 2012). For instance, Spillane and colleagues (2020) found regional variation in that AI youth from the Upper Great Lakes (UGL), Northern Plains (NP), and Southeast (SE) exhibited significantly higher levels of lifetime and past month cigarette use when compared to AI youth in the Southwest (SW). Comparisons between AI and non-AI youth showed no differences for smoked tobacco in the Northwest (NW) and SW regions, however AI youth from the UGL, SE, and NP were significantly more likely than non-AIs to have smoked tobacco in their lifetime (OR = 4.15, 1.90, 3.30, respectively; Spillane et al., 2020).

Regarding alcohol and cannabis, Miller and colleagues (2012) found substantial variability among AI youth of different regions for lifetime and past-month comparisons of use. For example, AI youth in the Northern Plains (NP) exhibited significantly higher lifetime prevalence of alcohol for males (OR = 1.59) and females (OR = 2.15) than their SW counterparts (Miller et al., 2012). Further, AI females in the UGL exhibited significantly higher lifetime prevalence of alcohol than SW females (OR = 1.66). However, UGL males did not differ from SW males (Miller et al., 2012). There were also no differences noted between SW and Oklahoma youth in lifetime prevalence of alcohol, nor were any differences found across all regions for past 30-day alcohol use (Miller et al., 2012).

When matched for grade, gender, and year, AI youth in the NP were significantly more likely than SW peers to have a lifetime prevalence of cannabis (OR = 1.87; Miller et al., 2012). Conversely, lifetime prevalence of cannabis was significantly lower among AI youth in Oklahoma (OR = 0.28) compared to SW peers. Past 30-day use of cannabis was also significantly higher for NP and UGL youth compared to SW peers (OR = 1.88, OR = 1.89, respectively), and lower for Oklahoma youth (OR = 0.32) than SW peers (Miller et al., 2012).

Several single- and double-site studies provide additional novel insight into substance use variability for AI youth. After matching for grade group, some research found significantly higher lifetime prevalence of cannabis for non-Oklahoma AI youth (63.0%) than their Oklahoma (28.0%) peers in 7-9th grade (Tragesser et al., 2010). However, Spear and colleagues (2005) found lifetime prevalence of cannabis for 7th grade AI males (29.4%) and females (32.5%) in a NP state (i.e., non-Oklahoma) which closely resemble those of Oklahoma youth (28.0%; Tragesser et al., 2010). Similar variability in estimates can be found for past-month alcohol use comparisons for AI 7th graders in the NP region (i.e., 12.4%; Steinman & Hu, 2007; vs 19.1% for males and 25.8% for females; Spear et al., 2005).

Finally, evidence also indicates differences by race/ethnicity (i.e., AI vs White) and region for alcohol and cannabis use. Among a sample of 7th grade AI and White youth in a NP state, Spear and colleagues (2005) found AI females to report significantly higher past-month use of alcohol (25.8%) and cannabis (17.3%) than White females (alcohol: 11.0%; cannabis: 1.4%) and White males (alcohol: 14.9%; cannabis: 2.5%). Similarly, AI males reported significantly higher past-month alcohol (19.1%) and cannabis use (14.1%) than White females, but only differed from White males for past-month cannabis use. Steinman and Hu (2007) also found AI youth to report significantly higher past-month use for alcohol (12.4%) and cannabis (8.5%) than White peers (alcohol: 6.1%; cannabis: 3.7%) in a NP state, however the magnitude of differences appear considerably smaller.

In sum, these findings provide two key pieces of evidence. First, alcohol, cannabis, and smoked tobacco prevalence among AI youth appears to have wide variability based on region. Second, there are considerable differences in the magnitude of differences for alcohol, cannabis, and smoked tobacco prevalence between AI youth and their non-AI peers across studies. Taken together, these findings demonstrate the heterogeneity of AI substance use and suggest that regional data may serve as a proband for more precise estimation of variability that is likely to be found at multiple levels (e.g., regional, state, school variability). An open question is whether differences primarily exist between individuals or between groups (e.g., regions, schools). Examining the amount of variability present at each level as well as examining effects at both levels (as appropriate given adequate between-group variability) will elucidate the appropriate target for prevention scientists and interventionists. For example, if differences exist primarily on the school level, then school level prevention programs could be developed. In contrast, if differences exist primarily at the individual level, then personalized interventions (e.g., personalized normative feedback) could be provided to those at highest risk.

Perceived Harm and Availability

Given that differences in substance use and related trends between AI youth and other ethnicities remain poorly understood, insight may be gained from a theoretical perspective. Behavioral economics theory posits that substance use occurs as a function of demand (i.e., perceived costs and reinforcement associated with use) and discounting (i.e., amount of value that a reinforcer loses due to delay, probability of encountering, or low personal investment in a substance-free alternative; Bickel, Johnson, Koffarnus, MacKillop, & Murphy, 2014). In the context of adolescent substance use, demand refers to affordability and availability of substances, while discounting represents disregard of potential long-term benefits of non-use (e.g., educational and career goals; Murphy & Dennhardt, 2016). In short, the perception of substances as easily accessed, coupled with low value ascribed to any substance-free alternatives and their potential long-term benefits, would place youth at an elevated risk of seeking and using substances.

Perceptions of harm and availability have been a focus of substance use epidemiology research for many years. For example, in recent decades Johnston and colleagues (2020) have shown evidence that perceiving greater harm corresponds with less lifetime use for cannabis and cigarettes, and less perceived availability is associated with lower rates of lifetime use for cigarettes and alcohol. Thornton, Baker, Johnson, and Lewin (2013) also found that risk perceptions were inversely and significantly related to cannabis and cigarette use among adolescents. Similar findings were reported by Villagrana and Lee (2018. With a large adolescent sample (n=13,600), greater risk perception for alcohol, cannabis, and cigarettes significantly predicted lower rates of use for each substance. These findings are consistent with behavioral economics theory of substance use, such that greater perceptions of harm and lower perceived availability would be expected to coincide with decreases in use for the associated substance. Additionally, harm perceptions have been shown to vary by race/ethnicity, in that greater risk is often perceived by ethnic minorities compared to White youth (Pacek et al., 2015). Despite the exclusion of AI youth in nationally representative data (i.e., Johnston et al., 2020; Pacek et al., 2015), findings collectively suggest that perceptions of harm and availability are reliable predictors of substance use, and that their influence likely varies as a function of race/ethnicity.

Consistent with findings reported for other race/ethnicities, evidence from recent studies indicates an inverse relationship between risk perception and cannabis use among AI adolescent samples (Nalven, Schick, Spillane, & Quaresma, 2021; Spillane, Schick, Nalven, & Kirk-Provencher, 2021). For instance, Nalven and colleagues (2021) found greater perceptions of risk for cannabis use to predict significantly lower frequency of past-month cannabis use among AI youth (b = 0.02, p = 0.002). Greater risk perceptions for cannabis use have also been shown to have a significant negative association with past-year cannabis use (b = -0.27, p < 0.001; Spillane et al., 2021). Further, research exploring classes of substance use with Indigenous middle and high school students have shown that increases in perceived harm lowered the likelihood for classification in any substance user class (Swaim & Stanley, 2020). In particular, perceived harm for cannabis was negatively related to classification in the cannabis-cigarette class for both middle and high schoolers, as well as the alcohol-cannabis-cigarette class for high schoolers (Swaim & Stanley, 2020). While this body of research suggests that greater perceived harmfulness of cannabis is protective against use for AI youth, there is also evidence indicating that the magnitude of this effect may be smaller for AI youth than non-AI peers (Lee, Kim-Godwin, & Hur, 2021). Specifically, Lee and colleagues (2021) found that AI youth in their sample had significantly lower odds of perceiving cannabis as harmful (OR = 0.58) than their White peers as well as significantly higher likelihood for lifetime prevalence (OR = 2.52), past-year (OR = 2.74), and past-month (OR = 3.09) cannabis use than their White peers. In sum, research investigating perceived harm with AI youth indicates that, while greater harm perceptions appear protective against use, the magnitude of effects are markedly different for AI youth than their non-AI peers.

A similar pattern is evident among AI youth compared to other race/ethnicities for the influence of perceived availability on substance use. In a comparison of AI and White youth, Friese and Grube (2008) found that AI youth reported having easier access to alcohol and were twice as likely to have consumed alcohol in their lifetime. Among a sample of AI youth, Morrell, Hilton, and Rugless (2020) found that ease of access to alcohol, cannabis, and cigarettes predicted significantly greater odds of both lifetime and current use for each substance. These associations are consistent with previous data that indicates exposure to sources of alcohol (i.e., bars, off-reservation liquor stores) led to greater access via peers and subsequent alcohol use (Morrison et al., 2019). Moreover, in qualitative interviews with Indigenous adults from multiple regions, interviewees identified the availability of alcohol as a persistent concern for adolescent use, including personal experience with availability as a contributor to their own use in adolescence (Yuan et al., 2010). For cannabis, studies have shown that perceived availability remained a significant predictor of use even after accounting for the influence of norms (Spillane et al., 2021; Lee et al., 2021; Leban & Griffin III, 2020). Collectively, this body of research suggests that greater perceptions of substance availability may be an important predictor of use in adolescence, and that AI youth may be an increased risk of exposure to substances relative to their non-AI peers.

Perceptions of harm and availability are also potentially influenced by spiritual and religious practices for Indigenous youths. From an early age, many AI adolescents learn about the ceremonial use of tobacco as a means of connection with a higher power and its intended use as a healing herb (Struthers & Hodge, 2004). In many settings (e.g., Pow Wows, wakes, sweats) modern tobacco (i.e., cigarettes) is used as a substitute for traditional (i.e., homegrown) tobacco despite the commonly held belief that cigarettes are more harmful than traditional sources of tobacco (Unger, Soto, & Baezconde-Garbanati, 2006). Qualitative research has shown that many tribal elders share concerns about commercial tobacco use lowering harm perceptions among AI youth and blurring the distinction between ceremonial and recreational tobacco use (Hodge, 2006; Margalit et al., 2013; Wilson et al., 2019; Denny, Lerma, & Lerma, 2020).

The relatively limited research regarding the influences of spirituality and ceremonial practices on recreational substance use behaviors has produced mixed findings. For example, Unger, Sussman, Begay, Moerner, and Soto (2020) found an association between spirituality and higher odds of past-month cigarette (OR=2.34) and cannabis (OR=1.90) use, but no association between prior ceremonial tobacco use with past-month alcohol, cannabis, or cigarette use. In contrast, earlier research found no association between either spirituality or AI-specific spiritual practices with alcohol, cannabis, or cigarette use (Kulis, Hodge, Ayers, Brown, & Marsiglia, 2012). However, spirituality did significantly predict the receipt of more drug offers among the AI youth sample (Kulis et al., 2012). Thus, while the association between spirituality and substance use behaviors remain unclear, current evidence suggests that spirituality and ceremonial practices may lower perceptions of harm and increase perceived availability of substances among AI youth compared to their non-AI peers.

The Present Study

A necessary step in bridging the gap in representation for Indigenous youth in epidemiology research is to improve understanding of how substance use, in recent decades, with this population has varied across demographic characteristics (i.e., race/ethnicity, sex, grade, region) and known risk/protective factors (i.e., perceived harm and availability). Doing so may help prevention scientists and interventionists develop approaches tailored for AI youth, overcoming the limitations of interventions developed from research conducted with predominantly non-AI samples, or with limited samples of AI youth.

Johnston and colleagues (2020) have shown the utility of repeated cross-sectional data in tracking trends and providing accurate estimates of adolescent substance use in the U.S. over several decades. Although the challenges in obtaining a nationally representative sample of AI youth have precluded similar trend analyses for this population, available repeated cross-sectional data may be aggregated across years to improve accuracy and precision of substance use estimates with this population. These data also provide continuity of evidence for differences in patterns of use and the magnitude of those differences across key demographic characteristics (i.e., race/ethnicity, sex, grade, region). The present study expands upon the available literature for AI youth substance use in three ways:

Aim 1: Identify lifetime prevalence and point estimates of alcohol, cannabis, and cigarette use among AI youth and their White peers spanning approximately three decades and establish accurate and precise estimates for each substance.

Aim 2: Characterize the relationships between demographic variables (i.e., race/ethnicity, grade group, sex, region) and alcohol, cannabis, and cigarettes across time, and explore the magnitude of differences between groups.

Aim 3: Examine the direction and magnitude of effects for known risk/protective factors (i.e., perceived harm and availability) on lifetime prevalence and recent use rates (i.e., past-year, past-month, frequency) for alcohol, cannabis, and cigarettes by year and aggregated across years.

- **Hypothesis 1:** Higher levels of perceived harmfulness for alcohol, cannabis, and cigarettes will be associated with lower prevalence and recent use rates for the associated substance.
    - **Hypothesis 1a:** The magnitude of effects for perceived harm will be smaller for AI youth than for their White peers.
- **Hypothesis 2:** Lower levels of perceived availability for alcohol, cannabis, and cigarettes will be associated with lower prevalence and recent use rates for the associated substance.
    - **Hypothesis 2a:** The magnitude of effects for perceived availability will be smaller for AI youth than their White peers.

Following analyses conducted for the primary study aims, trend analyses were conducted to compare substance use rates between AI and White youth. Due to variability within the available data, a subset of years was selected based on tenability requirements for the statistical model used to conduct trend analyses. These analyses were used as a "proof of concept" for illustrating use rates via an emerging statistical approach (i.e., Time-Varying Effects Modeling).

Exploratory Aim: Identify and compare trends in substance use between AI youth and their White peers.

METHOD

Participants and Procedure

The present study is a secondary analysis of survey data collected as part of ongoing epidemiologic research with AI youth. Data were collected using the American Drug and Alcohol Survey (ADAS) versions 7-9 and the Prevention Planning Survey (PPS) versions 1 and 2 (Beauvais & Swaim, 2013) Swaim & Stanley, 2020), and the Our Youth, Our Future (OYOF) survey (Swaim & Stanley, 2018). The ADAS is a validated measure for use with minority samples and has been refined for its use with AI youth (Oetting & Beauvais, 1990). Questions from the ADAS assess substance use, substance-related consequences, and peer influence on substance use. The PPS was internally developed by Oetting, Edwards, and Beauvais (1996) as a supplement to the existing ADAS survey. While the PPS was not formally published, items included in the survey were either comparable to those in existing validated surveys (i.e., ADAS, MTF) or validated stand-alone measures (i.e., Orthogonal Cultural Identity Scale; Oetting, Swaim, & Chiarella, 1998). Items on the PPS assess risk and protective factors associated with substance use, such as school engagement, parental and peer influences, and cultural identity (Oetting et al., 1996). The ADAS and PPS were administered as separate surveys between 1993-2006 and were combined into a single survey for subsequent data collection. From 2015-2019, the survey was renamed to Our Youth Our Future (OYOF), and items were revised to more closely mirror wording used by other large scale epidemiology research (i.e., MTF).

Data collection occurred during multiple grant cycles including: 1993-2000, 2001-2006, 2009-2013, and 2015-2019. Number of participating schools were relatively consistent across the 1993-2000, 2001-2006, and 2009-2013 grant cycles with 71, 74, and 75 schools administering surveys across each cycle, respectively. School representativeness increased for the 2015-2019 grant cycle, in which 103 schools participated in the survey. Participating schools, tribes, and reservations were not identified in the data to protect confidentiality. Ethical approvals were obtained from tribal authorities, school districts, and the Colorado State University Institutional Review Board (IRB) prior to collection of data with all participating schools and across all survey years.

For data collected between 1993-2013, school selection was primarily based on previously established relationships between the researchers and tribal authorities. Accordingly, a convenience sampling approach was used for all grant cycles in this range of years in the data. Participating schools received an incentive of $500 financial compensation and a comprehensive report of their survey findings approximately two months post-survey. At least one teacher or staff member at each school received online or telephone training and certification in Human Subjects research prior to survey administration. This trained school representative was responsible for supervising administration of surveys and reporting deviations from administration protocol. Respondents received instructions about their ability to withdraw from participation and skip items prior to administration. To ensure confidentiality, no identifying information was collected, and survey administrators were instructed to avoid direct observation of student responses. Completed surveys were stored in a sealed envelope. Survey notification was conducted using a media release and letters allowing parents to withdraw their child (either verbally or by returning the withdrawal form to the school) from the study. Fewer than 1% of participants from all survey periods withdrew due to lack of parental consent or opting out.

Sampling procedures were updated substantially for data collected from 2015-2019 as compared to prior years. Beginning in 2015, a sampling frame was developed by stratifying schools into defined geographic regions based on the 2010 US Census data (U.S. Census Bureau, 2021, November 23). Participating schools were stratified by state and subsequent regions (when appropriate) based on regional profiles identified by Snipp (2005), with several adjustments. Modifications to regions as defined by Snipp (2005) include: the addition of NW, Northeast (NE), and Southern Great Plains (SGP) regional categories; inclusion of Iowa in the UGL region, Colorado, Utah, Nevada, and SW Texas in the SW region, and SE Texas in SE region; and the omission of California (due to a state mandated survey already in place) and Alaska (due to political differentiation from other regions studied). Regional stratification in the OYOF data is as follows: NW (Washington, Oregon, Idaho), NP (Montana, Wyoming, Nebraska, North Dakota, South Dakota), UGL (Michigan, Minnesota, Wisconsin, Iowa), NE (Connecticut, Massachusetts, Maine, New Jersey, New York, Rhode Island), SE (Virginia, North Carolina, South Carolina, Louisiana, Mississippi, Florida, Alabama, SE Texas), SW (Arizona, New Mexico, Colorado, Utah, Nevada, SW Texas), and Oklahoma. Following stratification into regional profiles in 2015, representative samples of AI youth in each region were obtained through random sampling, as compared to convenience sampling used in prior years.

In addition, new inclusion criteria were implemented along with updated survey administration procedures for the 2015-2019 grant cycle. To be included in this cycle, participating schools were required to be on or within 25 miles of a recognized reservation with a minimum of 20% of enrolled students identifying as AI. The updated criteria and regional profile development resulted in a sampling frame of 353 schools and included students in seventh grade or higher. Grade configurations of schools were primarily K-8 or similar (35%), followed by junior/high schools (i.e., grades 6-8 or 9-12, respectively; 34%), K-12 or similar (16%), combined junior and high school (i.e., grades 7-12; 11%), and other (4%). Updates to survey administration procedures included the use of Qualtrics online survey software instead of paper-and-pencil administrations used in prior years. Additionally, financial compensation for participating schools was increased to a range of $750 - $5000 for resources needed to complete surveys. Amount of financial compensation for each school was based on enrollment numbers, and median reimbursement was $1500. Recent research with these data provide a comprehensive description of the expanded sampling frame developed in 2015 (c.f., Stanley, Crabtree, & Swaim, 2021).

Measures

Demographic Variables

Self-reported demographic variables to be used in the present study analyses include race/ethnicity, sex, and grade group. Race/ethnicity was obtained via dichotomous questions (e.g., "*Are you American Indian/Native American?"*). Due to limited representativeness for race/ethnicity in the sample, exclusive identification as either AI or White was required for inclusion in the present study. Depending on survey year, sex was obtained as either a dichotomous response option (i.e., female, male; ADAS), or through the question, "*How do you describe yourself?*" with options including "*Male*", "*Female*", and "*Another*" (OYOF). Grade was assessed with the question, "*What grade are you in?*" with possible response options ranging from 7^{th}-12^{th} grades. Grade groups were established for middle school (7^{th} and 8^{th} grade) and high school (9^{th} – 12^{th} grade) students.

Region and Year

A "region" variable was created for each participant based on regional profile assignment, detailed in study procedures. Additionally, a Southern Plains (SP) region was created by combining Oklahoma (from 1993-2013 data) with SGP (from 2015-2019 data) to accommodate differences in sampling strategies used during data collection across the different cycles. Regions represented in the present study data include NW, NP, UGL, NE, SE, SW, and SP. The "year" variable was assigned by researchers to signify the academic year in which data were collected at the schools (e.g., "1993" represents data collected from fall 1993 through spring 1994).

Substance Use

Items which assessed the prevalence rates for each substance are described separately due to slight variations in question format and response options. Despite these variations, response options for all substance use variables were coded such that higher values represented more use of the substance.

Alcohol

Lifetime prevalence of alcohol use was assessed with the question, "*Have you ever had alcohol to drink?*" with response options dichotomized as either "*No*" or "*Yes*". Past-year alcohol use was assessed with the question, "*How often in the last 12 months have you . . . had alcohol to drink?*" and response options "*None*", "*1-2 times*", "*3-9 times*", "*10-19 times*", "*20-49 times*", and "*50+ times*". Past-month alcohol use was assessed with the question, "*How often in the last month have you . . . had alcohol to drink?*" with response options including "*None*", "*1-2 times*", "*3-9 times*", "*10-19 times*", and "*20+ times*". Alcohol prevalence items were updated in survey administrations from 2015-2019. During this period, lifetime prevalence was assessed with the question, "*How many times (if any) have you had any ALCOHOL to drink -- more than just a few sips...IN YOUR LIFETIME?".* Past-year use was assessed with the question, "*How many times (if any) have you had any ALCOHOL to drink -- more than just a few sips...DURING THE LAST 12 MONTHS*?". Past-month use was assessed with the question "*How many times (if any) have* *you had any ALCOHOL to drink -- more than just a few sips...DURING THE LAST 30 DAYS?*". Response options were consistent for lifetime, past-year, and past-month alcohol use and included, "*0 times*", "*1-2 times*", "*3-5 times*", "*6-9 times*", "*10-19 times*", "*20-39 times*", and "*40 or more times*".

For the present study, response options from each survey were recoded for consistency across all data collection cycles. For 2015-2019 data, lifetime prevalence of alcohol was recoded to match the dichotomous formatting used in 1993-2013 data. For past-year and past-month alcohol use, response options were recoded as "*None*", "*1-2 times*", "*3-9 times*", "*10-19 times*", and "*20+ times*".

Cannabis

Lifetime prevalence of cannabis use was assessed with the question, "*Have you ever tried marijuana (pot, grass, hash, herb, etc.)?*" with response options dichotomized as either "*No*" or "*Yes*". Past-year cannabis use was assessed with the question, "*How often in the last 12 months have you used marijuana?*" and response options "*None*", "*1-2 times*", "*3-9 times*", "*10-19 times*", "*20-49 times*", and "*50+ times*". Past-month cannabis use was assessed with the question, "*How often in the last month have you used marijuana?*" with response options including "*None*", "*1-2 times*", "*3-9 times*", "*10-19 times*", "*20+ times*", and "*Several times every day*". Cannabis prevalence items were updated in survey administrations from 2015-2019. During this period, lifetime prevalence was assessed with the question, "*How many times (if any) have you used MARIJUANA (weed, pot) or HASHISH (hash, hash oil)...IN YOUR LIFETIME?*". Past-year use was assessed with the question, "*How many times (if any) have you used MARIJUANA (weed, pot) or HASHISH (hash, hash oil)...DURING THE LAST 12 MONTHS?*". Past-month use was assessed with the question "*How many times (if any) have you used MARIJUANA (weed,* *pot) or HASHISH (hash, hash oil)...DURING THE LAST 30 DAYS?*". Response options were consistent for lifetime, past-year, and past-month cannabis use and included, "*0 times*", "*1-2 times*", "*3-5 times*", "*6-9 times*", "*10-19 times*", "*20-39 times*", and "*40 or more times*".

Response options from each survey were recoded for consistency across all data collection cycles in the same format as for alcohol. For 2015-2019 data, lifetime prevalence of cannabis was recoded to match the dichotomous formatting used in prior cycles. For past-year and past-month cannabis use, response options were recoded as "*None*", "*1-2 times*", "*3-9 times*", "*10-19 times*", and "*20+ times*".

Cigarettes

Lifetime prevalence of cigarette use was assessed with the question, "*Have you ever used . . . cigarettes?*" with the dichotomous response options "*No*" and "*Yes*". Frequency of cigarette use was assessed with the question "*Do you (How often do you) smoke cigarettes?*" with response options including "*Not at all*", "*Once in awhile*", "*1-5 times a day*", "*Half a pack a day*", and "*A pack or more a day*". Items assessing cigarette use were updated in survey administrations from 2015-2019. During this period, lifetime prevalence was assessed with the question, "*Have you EVER smoked CIGARETTES?*", and response options, "*Never*", "*Once or twice*", "*Occasionally but not regularly*", "*Regularly in the past*", and "*Regularly now*". Frequency of cigarette use was assessed with the question, "*How much have you smoked CIGARETTES...DURING THE LAST 30 DAYS?*", and response options, "*Not at all*", "*Less than 1 cigarette per day*", "*1 to 5 cigarettes per day*", "*About one-half pack per day*", "*About one pack per day*", "*About one and one-half packs per day*", and "*Two packs or more per day*".

For the present study, responses from 2015-2019 for lifetime prevalence of cigarettes were recoded to match dichotomous responses collected from 1993-2013. Response options for frequency of cigarette use were standardized across data collection cycles to "*Not at all*", "*Less than 1 cigarette per day*", "*1 to 5 cigarettes per day*", "*Half a pack per day*", and "*A pack or more per day*".

Perceived Harm and Availability

Perceived harm of alcohol was assessed using the question "*How much do you think people harm themselves (physically or otherwise) if they . . . . . . Use alcohol regularly*?", with the response options "*No harm*", "*Very little harm*", "*Some harm*", and "*A lot of harm*". The question stem "*How much do you think people harm themselves if they . . .*" was paired with "*use marijuana regularly*" and "*use tobacco regularly*" to assess perceived harm for cannabis and cigarettes, respectively. Response options for cannabis and cigarette harm perceptions included "*No harm*", "*Very little harm*", "*Some harm*", "*A lot of harm*", and "*I don't know*". From 2015-2019, perceived harm was assessed using the question stem, "*How much do you think people risk harming themselves (physically or in other ways) if they ...*" paired with "*Use alcohol regularly?*", "*Use marijuana regularly/Smoke marijuana regularly?*", and "*Smoke 1 to 5 cigarettes per day?*". Response options were changed to "*No Risk*", "*Slight Risk*", "*Moderate Risk*", and "*Great Risk*". For the present study, response options were combined with the most similar option across the two versions of the survey (i.e., "*No harm*" and "*No Risk*", "*Very little harm*" and "*Slight Risk*", "*Some harm*" and "*Moderate Risk*", "*A lot of harm*" and "*Great Risk*") and coded from 0-3, with higher values representing greater perceptions of harmfulness/risk.

Perceived availability was assessed for alcohol, cannabis, and cigarettes with the question "*How easy do you think it would be for you to get each of the following types of drugs if you wanted some?*". Response options were provided after each individual substance and included "*Very easy*", "*Fairly easy*", "*Hard*", "*Very hard*", and "*Probably impossible*". From 2015-2019, perceived availability was assessed with the question stem "*How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?*". Response options for each individual substance were changed to "*Can't say, Drug Unfamiliar*", "*Probably Impossible*", "*Very Difficult*", "*Fairly Difficult*", "*Fairly Easy*", and "*Very Easy*". For analyses, response options from 2015-2019 were reverse coded to match the format of data collected between 1993-2013. Response options were coded from 0-4 from *"Very Easy"* to *"Probably impossible"*. All other responses (i.e., "*Can't say, Drug Unfamiliar*") were recoded as missing data and not included in analyses. Since response options for perceived availability were coded in increasing order of difficulty for obtaining each substance, higher scores on this variable correspond with a perceived *lack of* availability for the associated substance.

Analysis Plan

Crosstabulations in SPSS Version 28.0 (IBM Corp., 2021) were used to obtain the mean, standard deviation (SD), and sample size for each substance use outcome variable, stratified by race/ethnicity and with other key demographic variables (i.e., race/ethnicity by grade group, sex, or region). These descriptive statistics were used to provide estimates of lifetime prevalence rates (i.e., proportions) and other effect sizes (i.e., means, confidence intervals) for substance use variables across time. Next, the proportions and means from each year were aggregated to calculate either a mean of proportions or a mean of means, depending on the variable. Since confidence intervals (CI) provide a range of plausible values for the population mean derived from the sample (Cumming, 2012), 95% CIs were used to present interval estimates for substance use prevalence rates and point estimates for each year, as well as for aggregated years (i.e., means of proportions, means of means). The CIs of means provide estimates of accuracy and precision, because they contain the largest likely error in estimation for values above and below the mean (i.e., point estimate; Cumming, 2012). Detailed descriptions of how analyses applied to each study aim are as follows:

Aim one

After stratifying the sample according to race/ethnicity (i.e., AI and White), proportions and 95% CIs were calculated for lifetime prevalence variables for each substance and across all years. Next, lifetime prevalence estimates from each year were aggregated to calculate a mean of proportions and CI of proportions. Point estimates (i.e., means, SDs, 95% CIs) were calculated for past-year and past-month use of alcohol and cannabis, and frequency of cigarette use for each year. Means of means and CIs of means were calculated from the established point estimates across individual years for past-year and past-month alcohol and cannabis use, as well as frequency of cigarette use. Proportions and point estimates from each year, means of proportions and means of point estimates, and 95% CIs were used to create custom figures in Microsoft Excel illustrating annual estimates of each substance use variable separately for AI (Appendix A) and White (Appendix B) youth. Means of proportions and means of means (i.e., point estimates) were also used to create comparison figures, illustrating the most accurate and precise estimates possible for AI and White youth for all substance use variables (Appendix C). The knitr package in R was used to compile the figure list for all appendices (Xie 2021, 2015, 2014).

Aim two

Relationships between demographic characteristics were evaluated by stratifying the sample according to sex (i.e., female and male), grade group (i.e., middle and high school), and region (i.e., NE, SE, NP, SP, NW, SW, UGL) separately for AI and White youth. First, for lifetime prevalence, proportions and CIs were obtained, in sequence, for grade group, sex, and region among AI youth for each year. For all remaining substance use variables (i.e., past-year and past-month alcohol and cannabis use, frequency of cigarette use) means, SDs, and CIs were also obtained, in sequence, for grade group, sex, and region among AI youth for each year. Next, the same analyses were repeated for White youth. Yearly lifetime prevalence rates, stratified by race/ethnicity, were combined to calculate a mean of proportions and CI of proportions separately for grade group, sex, and region. Yearly point estimates for remaining substance use variables, stratified by race/ethnicity, were combined to calculate a mean of means and CI of means separately for grade group, sex, and region.

Figures displaying substance use estimates for AI youth are reported by year for grade group (Appendix D), sex (Appendix E), and region (Appendix F). Similar figures were generated for White youth by grade group (Appendix G), sex (Appendix H), and region (Appendix I). Finally, figures were generated to show race/ethnicity comparisons of substance use estimates, aggregated across all years of available data, for grade group (Appendix J), sex (Appendix K), and region (Appendix L).

Aim three

The direction and magnitude of effects for perceived availability and perceived harm, stratified by race/ethnicity, were analyzed in three steps. First, the MASS package for R Venables & Ripley, 2002) was used to conduct a series of binary logistic and quasi-Poisson (QP) regressions to test study hypotheses regarding the influence of perceived availability and perceived harm on substance use for AI and White youth. Binary logistic regressions were used for all dichotomous lifetime prevalence variables. QP regressions were used for all other substance use outcomes to account for the non-normally of these count variables.

Using the WebPower package in R (Zhang & Yuan, 2018), power analysis for the binary logistic and QP regression models indicated that a sample of at least n = 52 was required to obtain 80% power with alpha = .05. This criterion was not met among White youth for the years 1995 (n = 17), 1998 (n = 5), and 2010 (n = 29). Thus, the years 1995, 1998, and 2010 were excluded from regression analyses for the White youth sample. Since data were not collected for frequency of cigarette use in 2015 and 2016, and perceived harm of regular alcohol use was not collected for 2018 and 2019, regressions were not run for the associated years of missing data. Across all eight substance use outcome variables, the total number of regressions run for AI youth was 174 for perceived availability and 168 for perceived harm while White youth totals were 150 for perceived availability and 144 for perceived harm.

Next, all coefficients and the accompanying 95% CIs were exponentiated to obtain the odds ratios (OR) for lifetime prevalence and rate ratios (RR) for substance use frequency (i.e., past-year and past-month of alcohol and cannabis, frequency of cigarettes) for all outcome variables, stratified by race/ethnicity. Finally, custom figures were created in Microsoft Excel to quantify and display the effects of perceived availability (AI: Appendix M; White: Appendix N) and perceived harm (AI: Appendix O; White: Appendix P) across years, stratified by race/ethnicity and compiled using the knitr package in R (Xie 2021, 2015, 2014). The comparison of effects for both perceived availability and perceived harm for all substances by race/ethnicity is available in Appendix Q.

Exploratory aim

A series of intercept-only Time Varying Effects Models (TVEMs; Tan et al., 2012) were conducted to obtain comparative trends in substance use between AI and White youth for select years of data. Since race/ethnicity was the sole predictor for each substance use outcome variable, TVEMs were restricted to being specified as intercept-only (Dziak, Coffman, Li, Litson, & Chakraborti, 2021). This approach mirrors what has been used in prior research where substance use rates are estimated as a function of time for a single predictor (i.e., race/ethnicity; Lanza, Vasilenko, & Russell, 2016). A subset of data was chosen for analysis based on model assumptions of constant coverage of the time axis and large sample sizes (Lanza & Linden-Carmichael, 2020; Tan et al., 2012). The TVEM package for R (Dziak et al., 2021) was used to analyze the years ranging from 2001-2005 and 2015-2019 for all lifetime prevalence variables as well as past-year and past-month alcohol and cannabis use frequency. Since frequency of cigarette use was not collected for 2015 and 2016, the trend for this variable was only modeled from 2001-2005. For all lifetime prevalence outcome variables, models were specified using the binomial class of generalized linear models because of their dichotomous response options. All remaining substance use frequency variables were specified as Poisson, to account for the count distributions.

RESULTS

Comparisons of substance use by race/ethnicity and other key demographic variables (i.e., grade group, sex, region) are primarily reported as figures in Appendices A-L. Aims 1 and 2 are both composed of two types of figures: 1) separate annual substance use estimates for AI and White youth and 2) comparison figures for average substance use estimates stratified by race/ethnicity and other demographic variables as indicated.

For annual lifetime prevalence figures, estimates for each year are reported as proportions, with a grand proportion (i.e., mean of all annual proportions) and 95% CI used to represent the most accurate and precise estimate possible using these data. For all other substance use variables, estimates for each year are reported as means with 95% CIs in addition to the grand mean (i.e., mean of all annual means) and 95% CI. The y-axis of each figure has two components: 1) a left-justified year identifier, and 2) a right-justified value for the point estimate shown on the figure. The x-axis provides the scale, which is a proportion (i.e., 0-1) for lifetime prevalence variables and a natural scale of 0-20 representing number of times used for all other substance use variables (i.e., past-year, past-month, and frequency of use). A natural scale was created by centering each of the response options on the mean of possible values (i.e., "*None*" was coded "*0 times*", "*1-2 times*" became "*1.5 times*", "*3-9 times*" became "*6 times*", "*10-19 times*" became "*14.5 times*", and "*20+ times*" was coded "*20 times*"). If data were unavailable for a given year, a single strikethrough was used for the left-justified year label in addition to "not available" for the associated right-justified value label.

Aim one

Representativeness of both AI and White youth had considerable variability across the 22 years of available data. Among AI youth, sample sizes ranged from n=254 (lifetime prevalence of cigarettes in 1995) to n=2,100 (lifetime prevalence of cigarettes in 2016). For White youth, sample sizes ranged from n=4 (past-year and past-month alcohol use in 1998) to n=1,277 (past-year cannabis use in 2002).

On average, AI youth endorsed nearly twice the lifetime prevalence of cannabis use than their White peers (AI: $M_{proportions}$ = 0.59; White: $M_{proportions}$ = 0.31). For example, the estimate ($M_{proportions}$ = 0.59) indicates that 59% of the AI youth sample endorsed lifetime prevalence of cannabis compared to 31% among their White peers ($M_{proportions}$ = 0.31). Similar differences were found in comparisons of average past-year (AI: M_{Means} = 5.31; White: M_{Means} = 2.49) and past-month cannabis use (AI: M_{Means} = 3.26; White: M_{Means} = 1.25). Since these values were obtained using a natural scale, they reflect an estimated number of times using each substance for the identified length of time (i.e., past-year, past-month). For instance, the estimate (M_{Means} = 5.31) indicates that AI youth reported using cannabis an average of 5.31 times in the past-year compared to 2.49 times reported by White youth (M_{Means} = 2.49).

Average lifetime prevalence of cigarettes was also higher among AI youth ($M_{proportions}$ = 0.59) compared to White youth ($M_{proportions}$ = 0.43); however frequency of cigarette use did not differ across groups (AI: M_{Means} = 1.22; White: M_{Means} = 1.15). Frequency of cigarette use values represent the average reported number of cigarettes smoked per day at the time of assessment. Thus, the estimates (AI: M_{Means} = 1.22; White: M_{Means} = 1.15) indicate that both AI and White youth reported smoking between 1 to 2 cigarettes per day on average. There were no significant differences found for average lifetime prevalence, past-year, or past-month alcohol use in comparisons of race/ethnicity. All comparisons for race/ethnicity are summarized with 95% CIs in Table 1.

Aim two

Race/Ethnicity by Grade Group

For comparisons of race/ethnicity within the same grade group, nearly half of AI middle school youth endorsed lifetime prevalence of cannabis ($M_{Proportions}$ = 0.49), compared to roughly one-in-five of their White peers ($M_{Proportions}$ = 0.20), averaged across all years of available data. AI middle school youth also differed significantly from White youth for average past-year (AI M_{Means} = 3.99; White M_{Means} = 1.42) and past-month cannabis use (AI M_{Means} = 2.28; White M_{Means} = 0.70). Average lifetime prevalence of cigarettes was also significantly higher among AI middle school youth ($M_{Proportions}$ = 0.52) compared to White youth ($M_{Proportions}$ = 0.33).

Among high school youth, average lifetime prevalence of cannabis was higher for AI ($M_{Proportions}$ = 0.66) than for White youth ($M_{Proportions}$ = 0.39). AI youth also showed higher average past-year (AI M_{Means} = 6.24; White M_{Means} = 3.03) and past-month cannabis use (AI M_{Means} = 3.95; White M_{Means} = 1.46) than White youth in the same grade group. Average lifetime prevalence of cigarettes also showed a significant difference by race/ethnicity (AI $M_{Proportions}$ = 0.65; White $M_{Proportions}$ = 0.49).

No significant differences were found for averages of lifetime prevalence of alcohol use, past-year and past-month alcohol use, or frequency of cigarette use for comparisons of race/ethnicity within the same grade group. While high school youth tended to report higher use rates than middle school youth regardless of race/ethnicity, notable exceptions were seen for cannabis and cigarettes. Specifically, AI middle school youth and White high school youth were comparable in average lifetime prevalence of cannabis and cigarettes, as well as past-year cannabis use. However, AI middle school youth displayed significantly higher average past-month cannabis use compared to White high school youth. Table 2 provides a summary of all comparisons with 95% CIs for stratification by race/ethnicity and grade group.

Race/Ethnicity by Sex

For average lifetime prevalence of cannabis use, comparable rates were reported for AI females ($M_{Proportions}$ = 0.61) and males ($M_{Proportions}$ = 0.58) as well as for White females ($M_{Proportions}$ = 0.30) and males ($M_{Proportions}$ = 0.30). This pattern was also reflected in average past-year cannabis use (AI female M_{Means} = 5.25; AI male M_{Means} = 5.37; White female M_{Means} = 2.37; White male M_{Means} = 2.40), and average past-month cannabis use (AI female M_{Means} = 3.01; AI male M_{Means} = 3.51; White female M_{Means} = 0.97; White male: M_{Means} = 1.43).

Unlike cannabis, sparse and inconsistent differences were found for comparisons of race/ethnicity and sex for cigarettes and alcohol use. Average lifetime prevalence of cigarettes only differed between AI females ($M_{Proportions}$ = 0.64) and both White females ($M_{Proportions}$ = 0.42) and males ($M_{Proportions}$ = 0.44). AI males did not significantly differ from either AI females or White youth of either sex on average lifetime prevalence of cigarettes. Regarding average past-month alcohol use, White males reported the highest use (M_{Means} = 1.78), which was significantly more than females of either race/ethnicity (AI females M_{Means} = 1.31; White females M_{Means} = 1.19). AI males did not differ significantly from White males or females of either race/ethnicity on average past-month alcohol use. Further, no significant differences were present for average lifetime prevalence of alcohol, past-year alcohol use, or frequency of cigarette use after stratifying the sample by race/ethnicity and sex. All comparisons for stratification by race/ethnicity and sex are shown with 95% CIs in Table 3.

Race/Ethnicity by Region

After stratification by race/ethnicity and region, comparisons of average lifetime prevalence of cannabis showed significantly more use for AI youth compared to their White peers only in the NP, UGL, SW, and SP regions. Differences for lifetime prevalence of cannabis were largest for UGL youth (AI $M_{Proportions}$ = 0.64; White $M_{Proportions}$ = 0.28), followed by NP (AI $M_{Proportions}$ = 0.69; White $M_{Proportions}$ = 0.36), SW (AI $M_{Proportions}$ = 0.62; White $M_{Proportions}$ = 0.33), and SP (AI $M_{Proportions}$ = 0.38; White $M_{Proportions}$ = 0.26). Differences in average past-year cannabis use remained significant for adolescents residing in the UGL (AI M_{Means} = 6.97; White M_{Means} = 2.21), NP (AI M_{Means} = 6.44; White M_{Means} = 3.44), and SW (AI M_{Means} = 5.08; White M_{Means} = 2.91) regions, but not for SP youth. Average past-month cannabis use showed fewer differences across groups, with only the UGL (AI M_{Means} = 4.50; White M_{Means} = 1.03) and SW (AI M_{Means} = 3.12; White M_{Means} = 1.75) reaching significance. Finally, only the NP region showed a significant difference in average lifetime prevalence of cigarettes (AI $M_{Proportions}$ = 0.68; White $M_{Proportions}$ = 0.42). There was no evidence of race/ethnicity differences for average lifetime prevalence, past-year use, and past-month use of alcohol or frequency of cigarette use for youth residing in the same region. Further, the NE, SE, and NW regions did not show any significant race/ethnicity differences in average use for any substance.

Regional comparisons for youth of the same race/ethnicity revealed substantial variability in cannabis use rates for AI youth. Average lifetime prevalence of cannabis was highest for AI youth in the NP ($M_{Proportions}$ = 0.69), followed by UGL ($M_{Proportions}$ = 0.64), and SW ($M_{Proportions}$ = 0.62), and significantly lower in the SP ($M_{Proportions}$ = 0.38) and SE ($M_{Proportions}$ = 0.28). Average past-year cannabis use comparisons for AI youth were similar, with the greatest number of times reported in the UGL (M_{Means} = 6.97) and NP (M_{Means} = 6.44), and significantly fewer times used in the SP (M_{Means} = 2.65) and SE (M_{Means} = 2.22). Average past-month cannabis use among AI youth was also highest in the UGL (M_{Means} = 4.50), and lowest in the SE (M_{Means} = 1.33) and SP (M_{Means} = 1.28). There were no significant regional differences for White youth for any cannabis use variable.

Regional comparisons for youth of the same race/ethnicity for cigarettes showed comparable variability for AI and White youth. Among AI youth, average lifetime prevalence of cigarettes only differed between youth in the SE ($M_{Proportions}$ = 0.46) and the NP ($M_{Proportions}$ = 0.68). Average frequency of cigarette use for AI youth was significantly lower in the SW (M_{Means} = 0.61) than for AI youth in the SP (M_{Means} = 1.45) and UGL (M_{Means} = 1.53). For White youth, average lifetime prevalence of cigarettes only differed between those in the NW ($M_{Proportions}$ = 0.24) and SP ($M_{Proportions}$ = 0.49). Average frequency of cigarette use for White youth was significantly lower in the NW (M_{Means} = 0.11) than for those in the SW (M_{Means} = 0.86), NP (M_{Means} = 1.16), SP (M_{Means} = 1.26), and NE (M_{Means} = 7.16).

Finally, estimates for average lifetime prevalence of alcohol among AI youth were lowest in the NW ($M_{Proportions}$ = 0.51) and highest in the NE ($M_{Proportions}$ = 0.68), though no regions differed significantly. There were also no significant regional differences found for average past-year or past-month alcohol use for AI youth. For White youth, average lifetime prevalence of alcohol was significantly lower for those in the SE ($M_{Proportions}$ = 0.43) than their SP ($M_{Proportions}$ = 0.70) peers. There were no other significant differences in average lifetime prevalence, past-year, or past-month use of alcohol in regional comparisons of White youth. Table 4 provides a summary of all comparisons and associated 95% CIs for stratification by race/ethnicity and region.

Aim three

Perceived Availability

Perceived availability consistently and significantly predicted lower rates of substance use for both AI and White youth across all years of available data. For lifetime prevalence of alcohol, cannabis, and cigarettes, lower perceived availability predicted comparable decreases for AI and White youth in their likelihood of use for each substance. For example, on average, a one-unit increase for perceived availability of alcohol (e.g., going from "*Fairly Easy*" to "*Hard*" to obtain the substance) predicted 44% lower odds of lifetime prevalence of alcohol for both AI and White youth.

While perceived availability significantly predicted lower rates of use for AI and White youth across all substance use variables, several significant differences were found for the magnitude of these effects. In descending order of magnitude, these effects are presented below as percent changes in predicted use for every one-unit increase in perceived availability of each substance. A one-unit increase in perceived availability predicted an average of 63% fewer times using cannabis per month among White youth compared to 45% for AI youth. For instance, a one-unit increase in perceived availability for a White adolescent who reported using cannabis 10 times in the past month would predict a decrease to 3.7 times per month, on average across all years of data. In comparison, a one-unit increase in perceived availability for an AI adolescent reporting the same cannabis use (i.e., 10 times in the past month) would predict a decrease to 5.5 times per month, on average.

A significant difference was also seen for past-year cannabis use, such that a one-unit increase in perceived availability predicted an average of 58% fewer times using for White youth compared to 41% fewer among AI youth. A similar pattern was present for frequency of cigarette use, in that a one-unit increase in perceived availability predicted an average of 47% fewer cigarettes used per day among White youth compared to 30% fewer among their AI peers. A smaller, yet significant difference was also found for past-month alcohol use, wherein each one-unit increase in perceived availability predicted 43% and 37% fewer times using alcohol for White and AI youth, respectively. Each significant difference for the effects of perceived availability by race/ethnicity and accompanying 95% CI is available in Table 5.

Perceived Harm

There were consistent and significant differences between AI and White youth for comparisons of the average effects of perceived harm on all lifetime prevalence variables. Effects differed most for lifetime prevalence of alcohol, in which a one-unit increase in perceived harm (e.g., going from "*Very little harm*" to "*Some harm*" for regular use) predicted an average of 4% lower odds of use among AI youth compared to 36% among White youth. This effect was nonsignificant for AI youth but was significant for their White peers. For lifetime prevalence of cannabis, a one-unit increase in perceived harmfulness of regular use predicted an average of 41% lower odds of use among AI youth and 59% for White youth. This effect was significant for both AI and White youth. Each one-unit increase in perceived harm of regular tobacco use predicted 11% lower odds of lifetime prevalence of cigarettes for AI youth compared with 37% among White youth, which was significant for both groups.

Similar to lifetime prevalence, a pattern of consistent and significant differences was found for the effects of perceived harm on past-year and past-month use of alcohol and cannabis, as well as frequency of cigarette use. These effects are reported as the average percent change in use for a one-unit increase in perceived harmfulness of the substance. For alcohol, a one-unit increase in perceived harm of regular use predicted an average of 28% fewer times using in the past year among White youth compared to 6% among AI youth. For example, if an adolescent reported using alcohol 10 times in the past year, increasing perceived harm from "*No harm*" to "*Very little harm*" (i.e., a one-unit increase) predicted 2.8 fewer times using alcohol for White youth and 0.6 for AI youth, on average. While this effect was significant in predicting fewer times using for both AI and White youth, the magnitude of the effect was significantly higher among White youth compared to AI peers (see Table 6). The magnitude of perceived harm's effect for alcohol use was also significant for past-month use (AI: 15%; White: 36%), however it remained significantly higher for White youth than for AI youth.

Regarding cannabis, each one-unit increase in perceived harm of regular use predicted an average of 51% fewer times using among White youth compared to 28% for AI youth in the past year. Similarly, a one-unit increase in perceived harm of regular cannabis use predicted 58% fewer times using for White youth and 35% among AI peers. The effects of perceived harm on past-year and past-month cannabis use were significant for both AI and White youth, and significantly higher among White youth than their AI peers. Finally, a one-unit increase in perceived harm for regular tobacco use predicted an average of 32% fewer cigarettes used in the past 30 days among White youth compared to 13% among their AI peers. Increases in the average effect of perceived harm of regular tobacco use on frequency of cigarette use were significant for both AI and White youth, and significantly higher for White youth relative to AI peers. All comparisons of effects for perceived harm by race/ethnicity are shown in Table 6.

Exploratory Aim

Figures 1-8 show intercept-only TVEMs used to model trends in substance use comparing AI and White youth from 2001-2005 and 2015-2019. In each lifetime prevalence figure (Figures 1-3), the heavily weighted solid line represents the estimated odds ratio (OR) of substance use as a function of time in years. For past-year and past-month alcohol and cannabis, as well as frequency of cigarettes (Figures 4-8), the heavily weighted solid line represents the estimated risk ratio (RR) of substance use as a function of time in years. The less weighted lines around the time-varying estimates represent the 95% CI for the OR or RR. The horizontal dashed line in each figure represents an OR=1 or RR=1, used to indicate no difference by race/ethnicity for that substance and year. Since AI youth were used as the reference group (i.e., coded as 0), estimated ORs and RRs significantly below 1 indicate significantly higher odds of use among AI youth, while values significantly above 1 correspond with significantly higher odds of use among White youth for the associated year(s).

Alcohol

Figure 1 shows the trend in odds of lifetime prevalence of alcohol for AI and White youth from 2001-2005 and 2015-2019. From 2001-2005, the race/ethnicity comparison of odds of lifetime prevalence of alcohol fluctuated from 1.5 times higher among AI youth in 2001, to 1.5 times higher among White youth in 2003, to comparable prevalence rates for AI and White youth in 2005. The odds of lifetime prevalence of alcohol were similar for AI and White youth from 2015-2018. However, findings indicated approximately 2 times higher odds of lifetime prevalence of alcohol in 2019 for White youth compared to AI peers.

Past-year (Figure 4) and past-month (Figure 5) alcohol use TVEMs closely resembled that of lifetime prevalence. In 2001, AI youth reported approximately 20% more times using alcohol than White youth for both past-year and past-month, however this difference was only significant for past-year use. By 2003, White youth reported 20% more past-year and 10% more past-month times using alcohol than AI youth, again showing significant past-year and nonsignificant past-month differences. In 2005, White youth reported approximately 10% more past-year and 20% more past-month times using alcohol than AI youth, which were both significant. From 2015 to 2018, number of times using alcohol in the past-year and past-month were comparable for AI and White youth, with one exception in 2016 where White youth reported approximately 20% more times using in the past-year than AI youth. By 2019, White youth reported 100% more past-year and past-month times using alcohol than AI peers, mirroring the trend observed for lifetime prevalence.

Cannabis

The trend in odds of lifetime prevalence of cannabis (Figure 2) shows that AI youth had significantly higher odds of use than their White peers for 2001-2005 and 2015-2019. AI youth were approximately 1.8 times more likely than White youth to report a lifetime prevalence of cannabis in 2001, with a gradual trend toward 1.6 times higher odds for AI youth in 2004, and a return to 1.8 times higher odds among AI youth in 2005 compared to White peers. Odds of lifetime prevalence of cannabis for AI youth were 1.4 times higher than their white peers in 2015, followed by a trend toward 2 times higher for AI youth in 2017, and a decrease in odds to 1.4 times higher among AI compared to White youth in 2019.

Trends in past-year (Figure 6) and past-month (Figure 7) number of times using cannabis showed significantly more use among AI youth compared to White peers for 2001-2005 and 2015-2019. In 2001, AI youth reported approximately 60% more past-year and 70% more past-month times using cannabis than their White peers. For both past-year and past-month number of times using cannabis, there was a gradual trend toward 40% more use among AI youth than their White peers in 2004, followed by a spike toward approximately 80% more times using cannabis in 2005. From 2015-2019, AI youth reported approximately 40% more times using cannabis in

2015 than White peers, trending toward 80% in 2017, and returning to 40% in 2019 for both past-year and past-month.

Cigarettes

As shown in Figure 3, AI youth were approximately 1.7 times more likely than White youth to report a lifetime prevalence of cigarette use in 2001. This was followed by a gradual decline, such that AI youth were 1.3 times more likely than their White peers to report lifetime cigarette use in 2004, and a return to 1.7 times higher odds among AI youth in 2005 compared to White peers. Odds of lifetime prevalence of cigarettes for AI youth were approximately 1.6 times higher than their White peers from 2015-2017, followed by a trend toward equal odds of lifetime prevalence between AI and White youth by 2019.

For frequency of cigarette use (Figure 8), AI youth reported significantly more (approximately 50%) cigarettes used than White peers in 2001, followed by a trend toward nonsignificant difference from 2003-2004. However, AI youth showed a trend toward 50% more cigarettes used than White peers in 2005. The trend in frequency of cigarette use was not examined for 2015-2019 since these data were not collected for 2016-2017.

DISCUSSION

The purpose of this study was to examine the accuracy and precision of estimates for substance use as well as for identified risk/protective factors (i.e., perceived harm and availability) for Indigenous youth in the United States from 1993-2019. While the results of this study provide the most accurate substance use estimates possible with the given data, precision (i.e., CI width) of estimates varied considerably. The findings of the present study illustrate the benefit of using both estimation thinking (i.e., point and CI estimation) and dichotomous thinking (i.e., significance testing; Cumming, 2012) in epidemiology research. As previously noted, dichotomous thinking allows for useful claims regarding the presence or absence of a significant difference between groups, however present study findings demonstrate why such differences are not necessarily indications of where prevention and intervention resources would be best allocated. Incorporation of CI and point estimation alongside significance testing provides prevention and intervention scientists with important details often overlooked with significant testing alone, thereby reducing the potential for misallocation of resources. Specific examples of benefits to combined estimation and dichotomous thinking are evident in findings from primary study aims, each of which are discussed in turn and followed by the one exploratory aim.

The first aim provides a summary of alcohol, cannabis, and cigarette use comparing AI and White youth, averaged across 22 years of data (Appendices A-C). In contrast to prior research which found significantly higher lifetime prevalence of alcohol and past 30-day alcohol use when comparing AI youth to a national sample (i.e., MTF; Swaim & Stanley, 2018), current study findings indicated that all alcohol use variables (i.e., lifetime prevalence, past-year, and past-month use) were nearly identical for AI youth and their White peers. One explanation for this discrepancy is the difference in samples from which comparisons were drawn. Specifically, the samples of White youth in the present study were co-located with the samples of AI youth for each year, whereas MTF data are drawn from a much broader sampling frame (Johnston et al., 2020). This may have biased current study findings to reflect a greater degree of similarity for AI and White youth relative to comparisons between AI youth and a national sample of their White peers. Further, the co-location of AI and White youth in present study data may reflect similarities in social influences (e.g., norms, living on/off reservation) likely related to alcohol use that could not be accounted for in the present study. Alternatively, this discrepancy in findings may indicate a closing gap between AI youth and their non-AI peers for alcohol use.

Regarding race/ethnicity comparisons for cannabis, present study findings aligned with prior research and provided additional novel detail. Specifically, past research found that AI youth showed more than twice the risk of lifetime prevalence and past 30-day cannabis use than non-AI peers (Swaim & Stanley, 2018). The present study expands upon those previously highlighted risks by showing that nearly twice as many AI youth reported any lifetime cannabis use compared to White peers (i.e., 59% vs 31%), and more than twice as many times using cannabis in the past 30-days (AI: 3.26, White: 1.25). These findings reflect continuity of evidence regarding the magnitude of differences across studies, further establishing the need for prevention and intervention programming specifically for cannabis with Indigenous youth.

Finally, the finding that lifetime prevalence of cigarettes was significantly higher among AI youth than White peers, but frequency of cigarette use did not differ by race/ethnicity, may be an artifact of cultural differences regarding the spiritual and ceremonial use of tobacco products in some tribes. Since some tribes allow commercial tobacco as a substitute for traditional tobacco

(Hodge, 2006; Unger et al., 2006; Margalit et al., 2013; Wilson et al., 2019; Denny et al., 2020), it is likely for many Indigenous youths to have engaged exclusively in culturally sanctioned cigarette use (i.e., no recreational use). This interpretation is consistent with recent evidence that found no association between previous ceremonial tobacco use with any recreational substance use (Unger et al., 2020). Thus, it is likely the case that the comparable rates found for frequency of cigarette use among AI and White youth in the present study are a more accurate representation of recreational cigarette use comparisons, while lifetime prevalence is skewed toward higher estimates among AI youth due to the lack of differentiation between recreational and ceremonial use.

The second study aim was to characterize relationships between race/ethnicity and grade group, sex, and region for alcohol, cannabis, and cigarettes. When stratifying by race/ethnicity and grade group, a similar pattern of differences emerged for all three cannabis use variables as well as lifetime prevalence of cigarettes. That is, AI youth endorsed significantly higher average lifetime prevalence, past-year, and past-month cannabis use and lifetime prevalence of cigarettes, compared to White peers within the same grade group. Further, average past-month cannabis use among AI middle school youth was significantly higher than for White high school youth. As with Aim 1 comparisons, there were also no differences for any alcohol variable or frequency of cigarette use for race/ethnicity by grade group. The present findings broadly reflect a similar pattern of elevated substance use rates for AI youth compared to non-AI peers when matched according to grade (Stanley et al., 2014; Stanley & Swaim, 2015; Swaim & Stanley, 2018). This is of particular concern due to the well documented association between early age of initiation for substance use with development of a substance use disorder with AI samples (Stanley, Miller, Beauvais, Walker, & Walker, 2014; O’Connell et al., 2011; Whitesell et al., 2006).

For race/ethnicity by sex, AI females and males had an average of approximately twice the lifetime prevalence, and number of times using cannabis in the past-year and past-month than their White counterparts. Further, females and males of the same race/ethnicity displayed nearly identical average use rates for all three cannabis use variables. These findings are convergent with prior trend data that indicates significantly higher cannabis use for AI females and males compared to White females and males, in addition to a closing gender gap for cannabis use among high schoolers (Johnson et al., 2015).

Regarding alcohol and cigarettes, three findings stood out across all comparisons when stratified by race/ethnicity and sex: 1) AI females had significantly higher average lifetime prevalence of cigarettes than White youth of either sex, 2) White males had slightly, yet significantly, higher average past-month alcohol use than females of either race/ethnicity, and 3) AI males did not differ from AI females or White youth of either sex for alcohol or cigarette comparisons. These findings are partially consistent with prior research, in that Spillane and colleagues (2020) found AI females to have significantly higher odds of ever smoking tobacco than non-AI females and that this was the largest disparity for race/ethnicity by sex comparisons of smoking. However, since there was no distinction between cigarettes and other forms of smoked tobacco (Spillane et al., 2020), it is unclear how much of this may be attributed to cigarette use, specifically. The finding that White males showed the only significantly elevation in alcohol use comparisons for race/ethnicity by sex coincides with prior research indicating that males have historically shown higher rates of alcohol use, and that sex differences in alcohol use are diminishing in recent years (Slade et al., 2016). Finally, the finding that AI males did not differ from AI females or White youth of either sex for alcohol and cigarette comparisons builds upon evidence from past research. For example, Spear and colleagues (2005) found 58.4% of AI males in 7th grade reported lifetime prevalence of alcohol use, compared to 59% for all AI males in the present study. While prior data also indicated significantly higher lifetime prevalence of alcohol and cigarettes for AI females compared to males (Spear et al., 2005), the present study aligns with more recent evidence with non-AI samples that the gender gap for substance use is closing (Johnston et al., 2020; Slade et al., 2016; Colell et al., 2013).

Regional comparisons of substance use revealed several important findings that build upon other demographic comparisons. First, AI youth that reported higher average cannabis use than White peers in the same region also tended to have higher average cannabis use than AI youth residing in different regions. For example, AI youth in the NP, UGL, and SW generally had higher levels of cannabis use compared to White youth in the same region, as well as compared to AI peers in the SP and SE. These findings are consistent with those of Miller and colleagues (2012), in that AI youth in the NP and UGL had higher odds of cannabis use than AI youth in Oklahoma. While the findings by Miller and colleagues (2012) were based on data also used in the present study analyses (i.e., 1993-2005), the current findings contain subsequent additional years of data for NP (i.e., 2009-2012, 2015-2018) and UGL (i.e., 2009, 2012, 2015-2018). Thus, the present study findings suggest sustained elevations in cannabis use among AI youth in the NP and UGL.

For regional comparisons of cigarette use, only AI youth in the NP were found to have significantly higher average lifetime prevalence of cigarettes than White NP peers, despite point estimate differences of similar magnitude among youth in the NW, UGL, and SW. Although research has previously shown AI youth to have higher risk of lifetime prevalence for cigarette use than non-AI peers (Swaim & Stanley, 2018; Nez Henderson, Jacobsen, Beals, & Ai-Superpfp Team, 2005), the present study provides additional insight into where those differences exist. Findings also indicated that AI youth in the NP endorsed higher average lifetime prevalence of cigarettes than AI peers in the SE. Additionally, frequency of cigarette use was significantly higher for AI youth in the UGL and SP compared to AI youth in the SW. While these findings contrast with recent evidence that showed no regional differences in odds of lifetime or current smoked tobacco use (Spillane et al., 2020), most cigarette comparisons in the present study revealed congruent evidence of no significant regional differences among AI youth.

Finally, there were no significant differences in average alcohol use for AI youth compared to White youth in the same region or AI peers in different regions. The absence of differences for average alcohol use contradicts prior research comparing both AI and White youth (Swaim & Stanley, 2018; Johnson et al., 2019) and AI youth of different regions (Miller et al., 2014). One explanation for this stark contrast in findings is the use of convenience sampling used prior to 2015 (i.e., when random sampling was implemented), which may artificially create or inflate differences for individual years of data. However, stratification by region in the present study also created considerably lower precision of estimates, potentially masking the existence of differences noted in prior research. Thus, it is likely the true difference in substance use between AI and non-AI youth lies somewhere between these two explanations.

One substantive contributor to the differences observed in substance use rates between AI and White youth is the presence of historical trauma (HT). Historical trauma is defined as massive and cumulative emotional and psychological wounding transferred across generations (Brave Heart, 2003, 1998). Researchers have theorized that intergenerational transmission of HT is the source of disproportionate substance use rates for AI youth relative to their non-AI peers (Nutton & Fast, 2015). This theory was supported in a recent comprehensive review which found

19 of the 22 studies included support a significant and positive link between HT and substance use with Indigenous samples in North America (c.f., Spillane et al., 2022). Further, some tribes may have been, or continue to be, exposed to higher degrees of HT and oppression than others, creating regional variability in the magnitude of HT across tribes (Brave Heart, Chase, Elkins, & Altschul, 2011). This spectrum in magnitude of HT across tribes and regions would likely manifest as a range in prevalence rates for substance use, such as those found in the present study. For example, tribes in the modern-day NP region were subject to the "largest Indian wars in the West" including battles such as the Wounded Knee Massacre (Michno, 2003, p. 359). In the present study, AI youth in the NP consistently reported higher substance use than White peers and were frequently among the highest rates reported among AI youth of any region. Importantly, this suggests that addressing substance use with AI youth would require prevention and intervention programs that address HT, (e.g., incorporating anti-colonial initiatives into mainstream psychological interventions; Hartmann, Wendt, Burrage, Pomerville, & Gone, 2019) in addition to typical prevention and intervention components (e.g., psychoeducation, personalized feedback strategies).

In a review of trauma-informed interventions for substance use with Indigenous populations, Pride and colleagues (2021) found a consistent recommendation for programs to concurrently address trauma and substance use by bolstering ethnic identity. Despite this support for strengthening identification with Indigenous culture as a conduit for lowering substance use, there is mixed support for this with AI youth samples, specifically. For instance, Swaim and Stanley (2019) found no evidence of protective effects for AI identification against substance use among either middle or high schoolers. Conversely, other research has shown strong ethnic identity to protect against past-month alcohol, cannabis, and cigarette use among Indigenous youth (Unger et al., 2020). A possible explanation for this discrepancy is that stronger identification with AI culture may share an association with a more salient experience of HT (Gameon & Skewes, 2021). Thus, the buffering effect of strengthening ethnic identity could be attenuated by a commensurate increase in the negative impact of HT when youth do not receive strategies for coping. Recent evidence suggests that enhancing cultural knowledge (i.e., ethnic identity) should be accompanied by skills development (i.e., drug refusal skills), substance use education, and community involvement in how effective programs are developed for AI youth (Snijder et al., 2020). Incorporating coping skill development for trauma alongside drug refusal skills may offset negative impacts of HT (i.e., substance use for coping) and enhance the effectiveness of substance use prevention and intervention programming designed for Indigenous youth.

Findings for the average effects of perceived harm and availability on substance use largely supported study hypotheses. Consistent with past research which found greater perceived risk for substance use to predict lower likelihood of alcohol, cannabis, and cigarette use among non-AI youth (Villagrana & Lee, 2018), present findings supported the association between greater risk of harm perception and large percentage decreases in substance use among White youth. Further, the notably weaker association between greater perceived harm and average percent decreases in substance use among AI youth relative to their White peers supports the hypothesis that perceived harm is a less powerful protective factor for AI youth. This replicated prior research showing lower perceived risk and higher rates of use for cannabis among AI youth relative to White peers (Lee et al., 2021) and extends it to alcohol and cigarettes. While perceived harm still emerged as a meaningful protective factor for AI youth, its influence on alcohol was notably weaker than for cannabis and cigarettes, as evidenced by the influence of perceived harm diminishing to nonsignificance for lifetime prevalence of alcohol. In a qualitative examination of alcohol use perceptions among AI communities, Yuan and colleagues (2010) found that alcohol was compared to a "common cold" and jokingly described as "family tradition" among some tribal elders. If these and similar perceptions reflect those of the broader Indigenous communities, it is likely that AI youth would adopt a low-harm perception of alcohol from an early age. In turn, this may account for the difference in the protective influence of perceived harm against alcohol use among AI youth relative to White peers shown in the present study.

For both AI and White youth, greater perceived difficulty (i.e., lack of availability) in obtaining a substance was associated with large percent decreases in use for the associated substance. Contrary to study hypotheses, the magnitude of effects for perceived availability did not differ by race/ethnicity for lifetime prevalence of any substance or past-year alcohol use. In fact, the influence of perceived availability was nearly identical for AI and White youth lifetime prevalence and past-year alcohol use, and highly similar for lifetime prevalence of cannabis and cigarettes. While prior research has established low levels of perceived availability as a protective factor against substance use for AI (Spillane et al., 2021; Morrell et al., 2020) and White youth (Johnston et al., 2020), the present study builds on this by showing little distinction between AI and White youth for the magnitude of effects for perceived availability on lifetime prevalence of alcohol, cannabis, and cigarettes and past-year alcohol use. This evidence for a comparable influence of perceived availability between AI and White youth underscores the importance of including drug refusal skills in prevention and intervention efforts, such as those found in effective prevention programs for AI youth (Snijder et al., 2020). Similarly, fostering awareness among parents and caregivers of the importance of inhibiting youth access to substances, and the extent of potential benefits, would provide community members with agency in contributing meaningfully to adolescent substance use prevention in the community.

One potential source of variability in the magnitude of effects for perceived availability and harm found between AI and White youth may be traced back to the literature regarding spiritual and ceremonial practices involving substances. Although causal inferences cannot be drawn, the present findings lend intuitive support to evidence that participation in many spiritual and ceremonial practices increases availability of cigarettes for many AI youth (Unger et al., 2006; Kulis et al., 2012). There is specific evidence for commercial tobacco (i.e., cigarettes) being substituted for traditional tobacco for ceremonial purposes in multiple regions, including the NE (Gryczynski et al., 2010), NP (Margalit et al., 2013; Hodge, 2006), UGL (Nadeau, Blake, Poupart, Rhodes, & Forster, 2012; Brokenleg & Tornes, 2013), and SW (Greenfield et al., 2018; Sanderson et al., 2018). Of note, the present study found lifetime prevalence of cigarettes to be highest among AI youth in the NP and NE, followed by the UGL, SP, and SW, demonstrating a high degree of overlap among regions where cigarette use is culturally sanctioned. Further, multiple studies have indicated that ceremonial or spiritual use of cigarettes may lessen the perception of risk that AI adolescents have toward smoking (Hodge, 2006; Margalit et al., 2013; Wilson et al., 2019; Denny et al., 2020). In sum, the present findings appear to support an association between culturally sanctioned tobacco use, and that this association may be stronger among tribes which permit the use of commercial tobacco for ceremonial and spiritual purposes.

The support for ceremonial and spiritual use as contributors to altered perceptions of availability and harm for cigarettes underscores an important consideration for prevention and intervention researchers. Brokenleg and Tornes (2013) identified a lack of knowledge and understanding about the differences between commercial and traditional tobacco as a common contributor to the use of cigarettes for ceremonial practices. The use of cigarettes in lieu of traditional tobacco has been traced back as early as 1947 in some tribes, with ease of access (i.e., availability) being cited as a primary reason for this substitution (Wilson et al., 2019). Such longstanding precedent for substitution of commercial tobacco in place of traditional tobacco has raised concern among some tribal leaders that implementation of policy would not be sufficient to change this practice among many healers (Wilson et al., 2019). Given that there are a wide range of reasons why some tribes permit commercial tobacco use, a necessary component of programming for AI youth is education about commercial and traditional tobacco, with particular attention given to how they differ in potential harm to health (Brokenleg & Tornes, 2013). Thus, it may be most appropriate for programs developed for AI youth to adopt a harm reduction model that clearly distinguishes the relative risks and benefits of commercial and traditional tobacco.

While some race/ethnicity differences for perceived harm and availability of cigarettes may reasonably be attributed to culturally sanctioned practices in many Indigenous communities, there is not a similar basis of evidence for alcohol and cannabis. Adolescent research has found a slight association between spirituality and higher levels of cannabis use; however, these findings are based on a predominantly White sample with no explicit AI youth representation (Yeterian, Bursik, & Kelly, 2018). Given that research is mixed regarding the possible presence of a predictive relationship between spirituality and use of alcohol, cannabis, and cigarettes for AI youth (Unger et al., 2020; Kulis et al., 2012), disentangling the associations between perceived harm, perceived availability, and substance use will first require research to adequately distinguish between recreational substance use and culturally sanctioned (i.e., ceremonial, spiritual) use with AI samples.

In addition to the primary aims, this study included an exploratory aim to examine the comparison in trends of alcohol, cannabis, and cigarette use between AI youth and their White peers using TVEM. Although TVEM has been used to model substance use trends for adolescents within the United States (Lanza et al., 2016; Lanza, Vasilenko, Dziak, & Butera, 2015), the present study is the first to apply TVEM to a predominantly AI youth sample. The intercept-only TVEM models provide race/ethnicity comparison data for individual years of data in two waves (i.e., 2001-2005; 2015-2019). While these comparisons reflect the full samples for AI and White youth for each year (i.e., Appendices A & B), the shift from convenience to random sampling in 2015 exerted considerable influence over the output. In turn, the interpretability of the exploratory aim findings was confounded by sample composition for individual years included in the trend analysis. Despite the low interpretability, findings from this exploratory aim highlighted key considerations for researchers when conducting TVEM with AI samples.

Evaluation of TVEM output in relation to findings from primary study aims (i.e., aims 1 & 2) revealed that only subsets of regions are represented when comparing individual years in the present study data. In fact, individual years often include data from three or fewer regions, commonly with notable differences in representativeness (i.e., sample size). For example, the TVEM figure for lifetime prevalence of alcohol suggests a reversal in race/ethnicity trend comparisons from 2001 to 2003, such that AI youth had higher odds of use in 2001 and White youth had higher odds in 2003 (Figure 1). However, the regional composition of samples in 2001 and 2003 show important differences between AI and White youth. Specifically, AI representativeness in 2001 (n = 390) is predominantly from the SP (n = 215), followed by SW (n = 125), and NP (n = 50), with no NW, UGL, NE, or SE youth included. For White youth in 2001 (*n* = 615), most the sample was from the SW (*n* = 438), followed by SP (*n* = 177), and no youth from the NW, NP, UGL, NE, or SE. When the trend in lifetime prevalence of alcohol appeared to reverse in 2003, sample composition of AI youth (*n* = 1450) was largely from the SW (*n* = 981), followed by SP (*n* = 407), and NP (*n* = 62). For White youth in 2003 (*n* = 611), the bulk of the sample was from the SP (*n* = 590), with considerably fewer from the SW (*n* = 21). Regions included in 2003 were the same as in 2001 for both AI and White youth, suggesting that the shift in trend is most likely attributable to regional differences in substance use as detailed in aim 2 of the present study.

This study identified important data considerations that should be assessed prior to conducting TVEM with Indigenous youth. To satisfy sample size recommendations for the model, data from multiple regions were aggregated for both AI and White youth. However, the variability in regional representation for youth of the same race/ethnicity introduced bias which was not accounted for in the model. This resulted in misleading information regarding the presence or absence of differences in substance use rates between AI and White youth. Researchers should be cautious when conducting and interpreting TVEMs with Indigenous samples, due to the potential for underlying heterogeneity across demographic variables that may be overlooked when preparing data. Key demographic variables, such as region, should be thoroughly examined first to ensure that differences seen in TVEM output are a reflection of true differences and not an artifact of the sampling frame.

Study significance

The present study benefits epidemiology research in several ways. First, it provides a comprehensive description of substance use rates with Indigenous youth which approximates a nationally representative sample. This study provides a crucial step in improving the accuracy of representation for AI youth in substance use epidemiology research by aggregating data across nearly three decades and providing a reference group (i.e., White youth) to contextualize the findings. The comparisons made after stratifying the sample according to either grade group, sex, or region illustrate the nuance that exists within the heterogenous population of Indigenous youth. Moreover, the present study provides a standardization of comparisons across substance use outcomes which was not achievable when comparing studies that employed a variety of sampling strategies and substance use outcomes (i.e., Spillane et al., 2020; Tragesser et al., 2010; Spear et al., 2005).

Second, this study is the first to consolidate comprehensive substance use estimates for Indigenous youth alongside commonly studied risk/protective factors (i.e., perceived harm and availability). An important benefit of this is in the ability for substance use prevention and intervention scientists to gain insight into similarities and differences between AI and White youth for program development. For example, AI and White youth were similar in average alcohol use despite the protective effects of perceived harmfulness being considerably weaker for AI than White youth. Taken together, these findings suggest that increasing harm perceptions may be of limited relevance for AI youth compared to their White counterparts. This also lends support to previous calls for programming to be designed based on the unique needs of Indigenous populations and incorporate community-level strengths and resources that support tribal self-determination (Stanley et al., 2020; Substance Abuse and Mental Health Services Administration, 2022). One approach taken by several tribes in the UGL region incorporates teachings about traditional uses of tobacco with practical guidance showing how to cultivate it for ceremonial use (Brokenleg & Tornes, 2013). While this may include education about the harms of cigarettes, it places greater emphasis on the spiritual significance of traditional tobacco use and respect for cultural traditions.

Third, this study was the first to apply an emergent statistical methodology (i.e., TVEM) to a sample predominantly consisting of AI youth. Following past research conducted with nationally representative data (Lanza et al., 2016), this study fit intercept-only models with one time-invariant covariate (i.e., race/ethnicity) for each of the eight substance use outcomes. While the data characteristics required for TVEM (c.f., Lanza & Linden-Carmichael, 2020) appeared to be met in select years of present study data, the heterogeneity of regional representation embedded within those years of data precluded full application of the model. Continued improvements to sampling methods are likely to generate data that are less influenced by demographic confounds. In turn, future studies will be better positioned for more sophisticated applications of TVEM.

Limitations and Future Directions

The present study had several limitations that should be taken into account when contextualizing findings. First, perceived harm for cigarettes was assessed as “tobacco” in the surveys used. Given the evidence for spiritual and ceremonial practices to influence Indigenous youth’s perceptions of harm for tobacco, whether traditional or non-traditional (i.e., cigarettes; Wilson et al., 2019; Denny et al., 2020), this likely created measurement error in present analyses. Further, the modifications to wording of survey response options for perceived harm from 2015-2019 shifted focus from “harm” to “risk of harm” to align with other epidemiology research (i.e., MTF; Johnston et al., 2020). This survey revision may have contributed to measurement error for all substances and compounded error for cigarettes. Despite the potential confounds for the present study, future research should continue efforts to standardize surveys for adolescent substance use and incorporate ways to allow differentiation of recreational substance use from use resulting from culturally sanctioned practices. Doing so would not only yield improved accuracy in estimates but ensure that research is being appropriately adapted to cultural contexts.

Second, the precision of substance use estimates for many demographic comparisons was greatly reduced by the variability in representativeness (i.e., sample sizes) of both AI and White youth across the years of available data, with the representativeness being less precise in the early cohorts (1993-2013) due to convenience sampling and non-random selection of schools. This was most notable in regional comparisons, where the inability to obtain a precise estimate potentially masked the presence of differences in substance use rates between AI and White youth. While research has illustrated the importance of examining regional comparisons of substance use (Spillane et al., 2020; Johnston et al., 2020), an ongoing challenge for epidemiology research with Indigenous youth is equitable representation that can assist in identifying areas of greatest need for prevention and intervention programming without stigmatizing the tribes native to those regions.

Third, present study findings are based on school survey data and are not inclusive of school dropouts. Research has identified the tendency for school-based surveys to underestimate population levels of substance use and cautioned against generalizing findings to non-school populations (Johnson, 2014; Swaim, Beauvais, Chavez, & Oetting, 1997). While evidence suggests that dropout rates among AI youth have decreased in recent years, these rates remain considerably higher among AI youth relative to White peers (McFarland, Cui, Rathbun, & Holmes, 2018). These disparate rates in school dropout may have may have masked or skewed differences in substance use rates and the influence of perceived harm and availability between

AI and White youth, as well as for other demographic comparisons. In turn, the allocation of resources for prevention and intervention programming with AI youth should consider the possibility of greater need than is indicated by school-based survey measures.

Finally, a limitation of the statistical software used to conduct TVEM (i.e., “tvem” package in R; Dziak et al., 2021) required all models to be specified as Poisson instead of QuasiPoisson (QP). Although Poisson models can accommodate small amounts of overdispersion in count data, an assumption of the model is that the mean is equal to the variance (Gardner, Mulvey, & Shaw, 1995). When Poisson modeling is used for overdispersed count data, the result is an increased number of false positives (i.e., Type I error; Sturman, 1999). However, the purpose of TVEM in the present study was merely to demonstrate the utility of TVEM for modeling the trend comparing substance use between AI and White youth for use in epidemiology research. Moreover, visual inspection of Aim 1 findings for the associated TVEM output provides confirmatory evidence of the findings for the TVEM models. While the present TVEM output may indicate more significant differences between AI and White youth than are truly present, the trend itself appears to be an accurate depiction of variability for the years included in each TVEM figure.

Current best practices in substance use research support the use of QP rather than Poisson modeling for count data when comparing two groups, as it allows for greater control over Type I error (Baggio, Iglesias, & Rousson, 2018). As advancements continue to be made for TVEM software, future research should seek to model trends in substance use rates for Indigenous youth in a manner consistent with best practices for epidemiology and substance use (i.e., conducting analysis with QP distribution).

Conclusions

The data presented herein represent decades of historical and ongoing efforts to represent Indigenous youth in epidemiology research. A novel strength of presenting aggregated substance use estimates is in the accuracy and often accompanying precision made possible with the volume of available data. However, there remains potential for such methods to mask heterogeneity, as illustrated by the demographic comparisons reported. The inability to differentiate ceremonial and spiritual use of tobacco from recreational use among Indigenous youth presents an additional unaccounted-for source of variability and an incomplete picture of substance use for AI youth. Further, the relatively meager influence of perceived harm on alcohol use with AI youth, in conjunction with the nearly identical alcohol use rates found in race/ethnicity comparisons, underscores the need for continued efforts to conduct culturally responsive research in support of prevention and intervention. A challenge for creating such programming for AI youth will be development of parsimonious programs flexible enough to be modified at the Tribal and community level.

Table 1

Substance use comparisons by race/ethnicity

		Lifetime Prevalence			Past-Year Use			Past-Month Use		
Substance	Race/Ethnicity	$M_{Proportions}$	LLCI	ULCI	M_{Means}	LLCI	ULCI	M_{Means}	LLCI	ULCI
Alcohol	American Indian	0.63	0.58	0.68	3.76	3.29	4.23	1.36	1.23	1.49
	White	0.65	0.60	0.70	4.32	3.80	4.84	1.45	1.26	1.64
Cannabis	American Indian	**0.59**	0.54	0.64	**5.31**	4.72	5.90	**3.26**	2.85	3.67
	White	**0.31**	0.26	0.36	**2.49**	1.89	3.09	**1.25**	0.94	1.56
					Frequency of Use					
					M_{Means}	LLCI	ULCI			
Cigarettes	American Indian	**0.59**	0.51	0.67	1.22	0.94	1.50			
	White	**0.43**	0.36	0.50	1.15	0.81	1.49			

Note: $M_{Proportions}$ = Mean of Proportions; M_{Means} = Mean of Means; LLCI = Lower-Level 95% Confidence Interval; ULCI = Upper-Level 95% Confidence Interval. Lifetime Prevalence estimates are proportions. Past-Year Use, Past-Month Use, and Frequency of Use estimates are number of times used on a scale of 0-20. Significant differences are indicated in bold.

Table 2

Substance use comparisons by race/ethnicity and grade group

Substance	Grade Group	Race/Ethnicity	Lifetime Prevalence			Past-Year Use			Past-Month Use		
			$M_{Proportions}$	LLCI	ULCI	M_{Means}	LLCI	ULCI	M_{Means}	LLCI	ULCI
Alcohol	Middle School	American Indian	0.51	0.45	0.57	2.29	1.88	2.70	0.87	0.73	1.01
		White	0.46	0.39	0.53	1.98	1.38	2.58	0.62	0.50	0.74
	High School	American Indian	0.72	0.67	0.77	4.82	4.26	5.38	1.71	1.55	1.87
		White	0.75	0.70	0.80	5.27	4.58	5.96	1.80	1.49	2.11
Cannabis	Middle School	American Indian	**0.49**	0.43	0.55	**3.99**	3.37	4.61	**2.28**	1.89	2.67
		White	**0.20**	0.14	0.26	**1.42**	0.77	2.07	**0.70**	0.33	1.07
	High School	American Indian	**0.66**	0.61	0.71	**6.24**	5.58	6.90	**3.95**	3.47	4.43
		White	**0.39**	0.32	0.46	**3.03**	2.42	3.64	**1.46**	1.17	1.75
						Frequency of Use					
						M_{Means}	LLCI	ULCI			
Cigarettes	Middle School	American Indian	**0.52**	0.44	0.60	0.96	0.73	1.19			
		White	**0.33**	0.24	0.42	0.69	0.34	1.04			
	High School	American Indian	**0.65**	0.58	0.72	1.40	1.06	1.74			
		White	**0.49**	0.41	0.57	1.38	0.99	1.77			

Note: $M_{Proportions}$ = Mean of Proportions; M_{Means} = Mean of Means; LLCI = Lower-Level 95% Confidence Interval; ULCI = Upper-Level 95% Confidence Interval. Lifetime Prevalence estimates are proportions. Past-Year Use, Past-Month Use, and Frequency of Use estimates are number of times used on a scale of 0-20. Significant differences are indicated in bold.

Table 3

Substance use comparisons by race/ethnicity and sex

Substance	Sex	Race/Ethnicity	Lifetime Prevalence			Past-Year Use			Past-Month Use		
			$M_{Proportions}$	LLCI	ULCI	M_{Means}	LLCI	ULCI	M_{Means}	LLCI	ULCI
Alcohol	Female	American Indian	0.67	0.62	0.72	3.92	3.41	4.43	1.31	1.18	1.44
		White	0.65	0.60	0.70	4.11	3.49	4.73	1.19	0.99	1.39
	Male	American Indian	0.59	0.54	0.64	3.58	3.11	4.05	1.40	1.25	1.55
		White	0.66	0.60	0.72	4.51	3.81	5.21	1.78	1.45	2.11
Cannabis	Female	American Indian	**0.61**	0.56	0.66	**5.25**	4.51	5.99	**3.01**	2.54	3.48
		White	**0.30**	0.24	0.36	**2.37**	1.63	3.11	**0.97**	0.57	1.37
	Male	American Indian	**0.58**	0.53	0.63	**5.37**	4.88	5.86	**3.51**	3.11	3.91
		White	**0.30**	0.25	0.35	**2.40**	1.84	2.96	**1.43**	1.04	1.82
						Frequency of Use					
						M_{Means}	LLCI	ULCI			
Cigarettes	Female	American Indian	**0.64**	0.56	0.72	1.27	0.93	1.61			
		White	**0.42**	0.34	0.50	1.13	0.72	1.54			
	Male	American Indian	0.55	0.48	0.62	1.14	0.91	1.37			
		White	0.44	0.36	0.52	1.18	0.87	1.49			

Note: $M_{Proportions}$ = Mean of Proportions; M_{Means} = Mean of Means; LLCI = Lower-Level 95% Confidence Interval; ULCI = Upper-Level 95% Confidence Interval. Lifetime Prevalence estimates are proportions. Past-Year Use, Past-Month Use, and Frequency of Use estimates are number of times used on a scale of 0-20. Significant differences are indicated in bold.

Table 4

Substance use comparisons by race/ethnicity and region

Substance	Region	Race/Ethnicity	Lifetime Prevalence			Past-Year Use			Past-Month Use		
			$M_{Proportions}$	LLCI	ULCI	M_{Means}	LLCI	ULCI	M_{Means}	LLCI	ULCI
Alcohol	Northwest	American Indian	0.51	0.40	0.62	2.84	1.75	3.93	1.22	0.76	1.68
		White	0.41	0.17	0.65	2.40	0.61	4.19	1.27	-0.03	2.57
	Northern Plains	American Indian	0.67	0.61	0.73	3.90	3.35	4.45	1.32	1.10	1.54
		White	0.65	0.57	0.73	3.53	2.78	4.28	1.15	0.70	1.60
	Upper Great Lakes	American Indian	0.66	0.56	0.76	4.56	3.32	5.80	1.62	1.18	2.06
		White	0.63	0.43	0.83	3.70	2.04	5.36	1.14	0.57	1.71
	Northeast	American Indian	0.68	0.47	0.89	4.68	2.74	6.62	1.32	0.91	1.73
		White	0.82	0.55	1.09	7.58	-0.77	15.93	1.06	0.29	1.83
	Southeast	American Indian	0.58	0.48	0.68	3.89	2.77	5.01	1.62	1.09	2.15
		White	0.43	0.24	0.62	3.17	1.29	5.05	1.26	0.50	2.02
	Southern Plains	American Indian	0.67	0.58	0.76	4.14	3.45	4.83	1.48	1.29	1.67
		White	0.70	0.66	0.74	4.45	3.91	4.99	1.61	1.47	1.75
	Southwest	American Indian	0.59	0.52	0.66	3.29	2.70	3.88	1.45	1.08	1.82
		White	0.53	0.39	0.67	3.66	2.30	5.02	1.33	0.56	2.10

Note: $M_{Proportions}$ = Mean of Proportions; M_{Means} = Mean of Means; LLCI = Lower-Level 95% Confidence Interval; ULCI = Upper-Level 95% Confidence Interval. Lifetime Prevalence estimates are proportions. Past-Year Use, Past-Month Use, and Frequency of Use estimates are number of times used on a scale of 0-20. Significant differences are indicated in bold.

Table 4 (cont.)

Substance use comparisons by race/ethnicity and region

Substance	Region	Race/Ethnicity	Lifetime Prevalence			Past-Year Use			Past-Month Use		
			$M_{Proportions}$	LLCI	ULCI	M_{Means}	LLCI	ULCI	M_{Means}	LLCI	ULCI
Cannabis	Northwest	American Indian	0.51	0.39	0.63	4.25	3.47	5.03	2.32	1.63	3.01
		White	0.31	0.12	0.50	2.28	0.92	3.64	1.32	0.10	2.54
	Northern Plains	American Indian	**0.69**	0.65	0.73	**6.44**	5.97	6.91	3.88	3.39	4.37
		White	**0.36**	0.24	0.48	**3.44**	1.70	5.18	2.20	0.87	3.53
	Upper Great Lakes	American Indian	**0.64**	0.54	0.74	**6.97**	5.82	8.12	**4.50**	3.60	5.40
		White	**0.28**	0.19	0.37	**2.21**	1.50	2.92	**1.03**	0.68	1.38
	Northeast	American Indian	0.51	0.30	0.72	5.05	2.95	7.15	3.02	1.82	4.22
		White	0.63	0.22	1.04	6.54	-2.26	15.34	2.46	0.14	4.78
	Southeast	American Indian	0.28	0.20	0.36	2.22	1.40	3.04	1.33	0.69	1.97
		White	0.41	0.13	0.69	2.94	0.99	4.89	1.32	0.55	2.09
	Southern Plains	American Indian	**0.38**	0.33	0.43	2.65	1.86	3.44	1.28	0.81	1.75
		White	**0.26**	0.20	0.32	1.86	1.19	2.53	0.82	0.50	1.14
	Southwest	American Indian	**0.62**	0.57	0.67	**5.08**	4.54	5.62	**3.12**	2.77	3.47
		White	**0.33**	0.20	0.46	**2.91**	1.42	4.40	**1.75**	0.82	2.68

Note: $M_{Proportions}$ = Mean of Proportions; M_{Means} = Mean of Means; LLCI = Lower-Level 95% Confidence Interval; ULCI = Upper-Level 95% Confidence Interval. Lifetime Prevalence estimates are proportions. Past-Year Use, Past-Month Use, and Frequency of Use estimates are number of times used on a scale of 0-20. Significant differences are indicated in bold.

Table 4 (cont.)

Substance use comparisons by race/ethnicity and region

Substance	Region	Race/Ethnicity	Lifetime Prevalence			Frequency of Use		
			$M_{Proportions}$	LLCI	ULCI	M_{Means}	LLCI	ULCI
Cigarettes	Northwest	American Indian	0.48	0.30	0.66	0.64	0.00	1.28
		White	0.24	0.06	0.42	0.11	-0.03	0.25
	Northern Plains	American Indian	**0.68**	0.60	0.76	1.53	1.17	1.89
		White	**0.42**	0.33	0.51	1.16	0.66	1.66
	Upper Great Lakes	American Indian	0.60	0.45	0.75	2.05	1.31	2.79
		White	0.35	0.16	0.54	0.99	0.21	1.77
	Northeast	American Indian	0.67	0.43	0.91	2.73	0.40	5.06
		White	0.72	0.34	1.10	7.16	1.59	12.73
	Southeast	American Indian	0.46	0.33	0.59	0.98	0.44	1.52
		White	0.40	0.18	0.62	0.51	0.01	1.01
	Southern Plains	American Indian	0.60	0.53	0.67	1.45	1.08	1.82
		White	0.49	0.42	0.56	1.26	0.81	1.71
	Southwest	American Indian	0.55	0.47	0.63	0.61	0.43	0.79
		White	0.37	0.22	0.52	0.86	0.32	1.40

Note: $M_{Proportions}$ = Mean of Proportions; M_{Means} = Mean of Means; LLCI = Lower-Level 95% Confidence Interval; ULCI = Upper-Level 95% Confidence Interval. Lifetime Prevalence estimates are proportions. Past-Year Use, Past-Month Use, and Frequency of Use estimates are number of times used on a scale of 0-20. Significant differences are indicated in bold.

Table 5

Comparison of effects for perceived availability by race/ethnicity

		Lifetime Prevalence			Past-Year Use			Past-Month Use		
Substance	Race/Ethnicity	Pct Chg	LLCI	ULCI	Pct Chg	LLCI	ULCI	Pct Chg	LLCI	ULCI
Alcohol	American Indian	44%	42%	46%	34%	32%	36%	**37%**	35%	39%
	White	44%	40%	48%	36%	33%	39%	**43%**	39%	47%
Cannabis	American Indian	53%	52%	54%	**41%**	39%	43%	**45%**	42%	48%
	White	57%	53%	61%	**58%**	54%	61%	**63%**	58%	68%
					Frequency of Use					
					Pct Chg	LLCI	ULCI			
Cigarettes	American Indian	39%	36%	42%	**30%**	27%	33%			
	White	43%	37%	49%	**47%**	40%	54%			

Note: Pct Chg = Average percent decrease in substance use for a one-unit increase in perceived difficulty of obtaining said substance; LLCI = Lower-level 95% confidence interval; ULCI = Upper-level 95% confidence interval. Significant differences are indicated in bold.

Table 6

Comparison of effects for perceived harm by race/ethnicity

		Lifetime Prevalence			Past-Year Use			Past-Month Use		
Substance	Race/Ethnicity	Pct Chg	LLCI	ULCI	Pct Chg	LLCI	ULCI	Pct Chg	LLCI	ULCI
Alcohol	American Indian	**4%**	-3%	11%	**6%**	2%	10%	**15%**	11%	19%
	White	**36%**	31%	41%	**28%**	25%	31%	**36%**	33%	39%
Cannabis	American Indian	**41%**	36%	46%	**28%**	25%	31%	**35%**	32%	38%
	White	**59%**	55%	63%	**51%**	48%	54%	**58%**	54%	62%
					Frequency of Use					
					Pct Chg	LLCI	ULCI			
Cigarettes	American Indian	**11%**	6%	16%	**13%**	9%	17%			
	White	**37%**	31%	43%	**32%**	28%	36%			

Note: Pct Chg = Average percent decrease in substance use for a one-unit increase in perceived harm for regular use of said substance; LLCI = Lower-level 95% confidence interval; ULCI = Upper-level 95% confidence interval. Significant differences are indicated in bold.

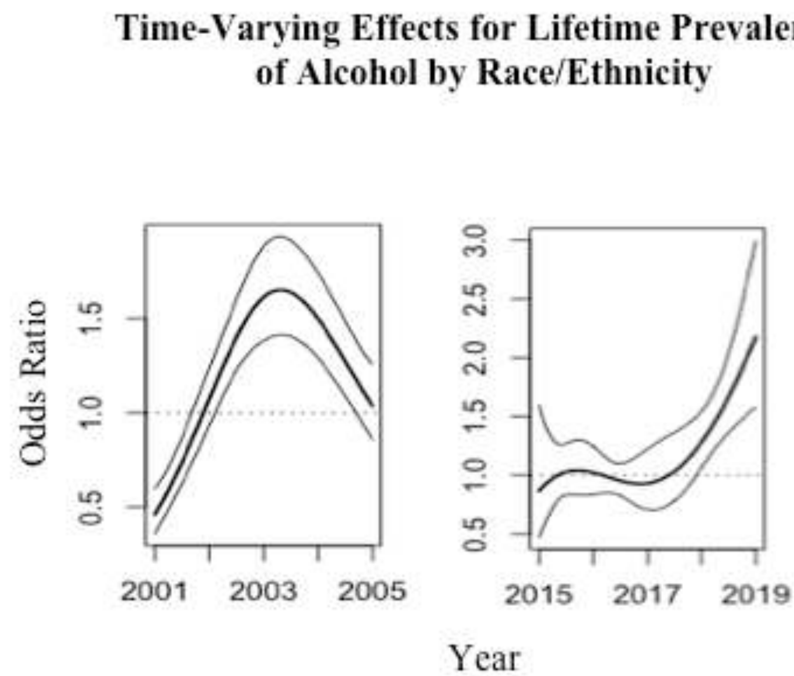

Figure 1: *Time-varying effects model for lifetime prevalence of alcohol*
Note: Two panels of data are shown in the figure, one for each range of years (i.e., 2001-2005 & 2015-2019) as indicated on the x-axis. The odds ratio (OR) values on the y-axis differ across panels within the figure because they were modeled separately. The heavily weighted solid line and lesser-weighted solid lines represent the estimated OR and 95% CI, respectively. The horizontal dashed line in each panel represents an OR=1. In each panel, AI youth are the reference group (i.e., coded 0) and White youth are the comparison group (i.e., coded 1). Thus, when all solid lines (i.e., the estimated OR and 95% CI) are below 1, the model indicated significantly higher use for AI youth for the associated year(s) compared to White peers. When the solid lines are all above 1, the model indicated significantly higher use for White youth compared to AI peers for the associated year(s). When confidence bands include the dashed line (i.e., OR=1), the model indicated no difference between groups for the associated year(s).

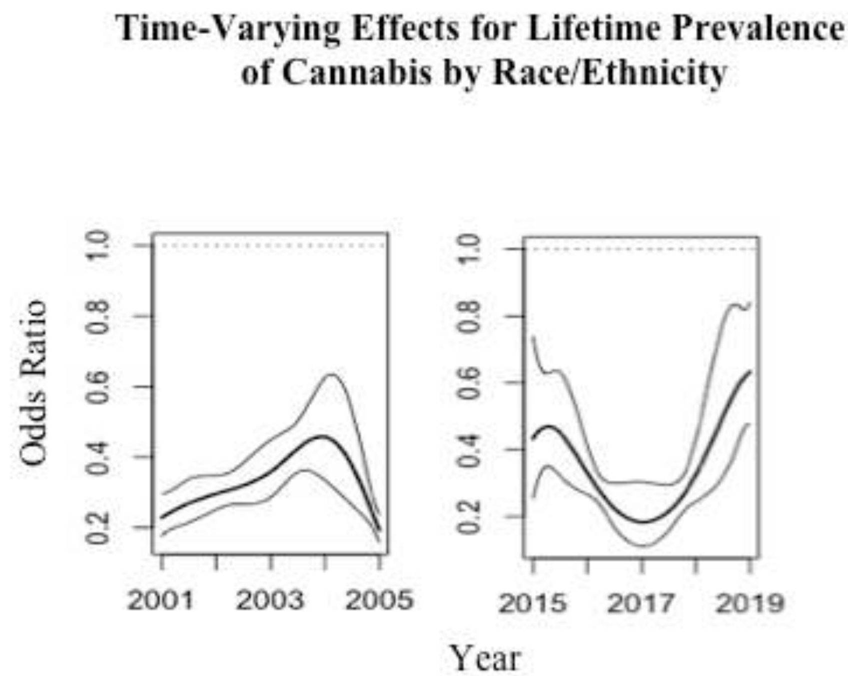

Figure 2: *Time-varying effects model for lifetime prevalence of cannabis*
Note: Two panels of data are shown in the figure, one for each range of years (i.e., 2001-2005 & 2015-2019) as indicated on the x-axis. The odds ratio (OR) values on the y-axis differ across panels within the figure because they were modeled separately. The heavily weighted solid line and lesser-weighted solid lines represent the estimated OR and 95% CI, respectively. The horizontal dashed line in each panel represents an OR=1. In each panel, AI youth are the reference group (i.e., coded 0) and White youth are the comparison group (i.e., coded 1). Thus, when all solid lines (i.e., the estimated OR and 95% CI) are below 1, the model indicated significantly higher use for AI youth for the associated year(s) compared to White peers. When the solid lines are all above 1, the model indicated significantly higher use for White youth compared to AI peers for the associated year(s). When confidence bands include the dashed line (i.e., OR=1), the model indicated no difference between groups for the associated year(s).

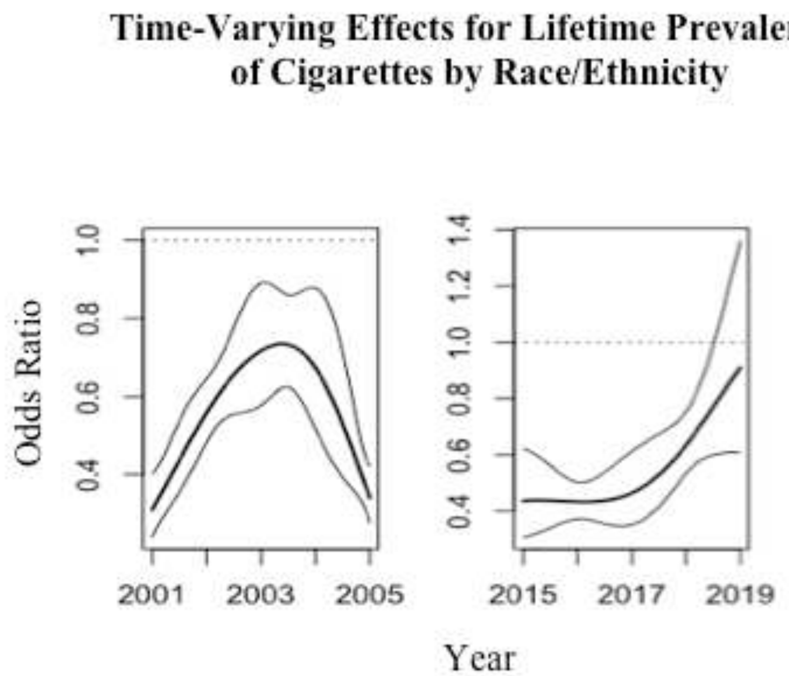

Figure 3: *Time-varying effects model for lifetime prevalence of cigarettes*
Note: Two panels of data are shown in the figure, one for each range of years (i.e., 2001-2005 & 2015-2019) as indicated on the x-axis. The odds ratio (OR) values on the y-axis differ across panels within the figure because they were modeled separately. The heavily weighted solid line and lesser-weighted solid lines represent the estimated OR and 95% CI, respectively. The horizontal dashed line in each panel represents an OR=1. In each panel, AI youth are the reference group (i.e., coded 0) and White youth are the comparison group (i.e., coded 1). Thus, when all solid lines (i.e., the estimated OR and 95% CI) are below 1, the model indicated significantly higher use for AI youth for the associated year(s) compared to White peers. When the solid lines are all above 1, the model indicated significantly higher use for White youth compared to AI peers for the associated year(s). When confidence bands include the dashed line (i.e., OR=1), the model indicated no difference between groups for the associated year(s).

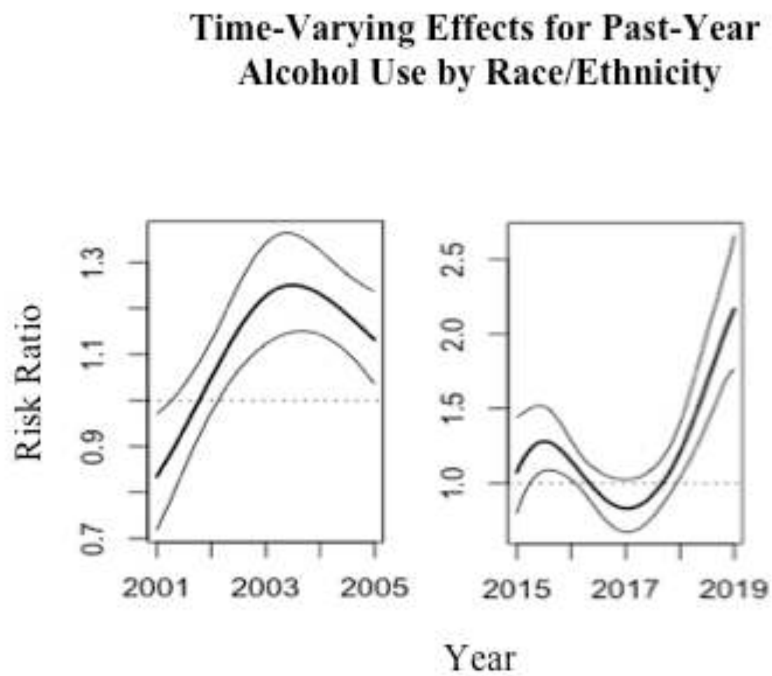

Figure 4: *Time-varying effects model for past-year alcohol use*
Note: Two panels of data are shown in the figure, one for each range of years (i.e., 2001-2005 & 2015-2019) as indicated on the x-axis. The risk ratio (RR) values on the y-axis differ across panels within the figure because they were modeled separately. The heavily weighted solid line and lesser-weighted solid lines represent the estimated RR and 95% CI, respectively. The horizontal dashed line in each panel represents a RR=1. In each panel, AI youth are the reference group (i.e., coded 0) and White youth are the comparison group (i.e., coded 1). Thus, when all solid lines (i.e., the estimated RR and 95% CI) are below 1, the model indicated significantly higher use for AI youth for the associated year(s) compared to White peers. When the solid lines are all above 1, the model indicated significantly higher use for White youth compared to AI peers for the associated year(s). When confidence bands include the dashed line (i.e., RR=1), the model indicated no difference between groups for the associated year(s).

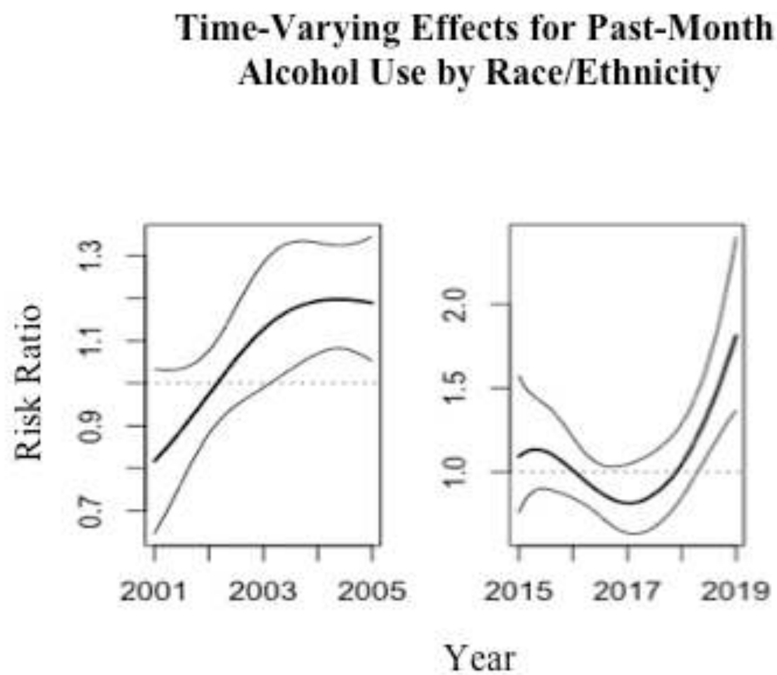

Figure 5: *Time-varying effects model for past-month alcohol use*
Note: Two panels of data are shown in the figure, one for each range of years (i.e., 2001-2005 & 2015-2019) as indicated on the x-axis. The risk ratio (RR) values on the y-axis differ across panels within the figure because they were modeled separately. The heavily weighted solid line and lesser-weighted solid lines represent the estimated RR and 95% CI, respectively. The horizontal dashed line in each panel represents a RR=1. In each panel, AI youth are the reference group (i.e., coded 0) and White youth are the comparison group (i.e., coded 1). Thus, when all solid lines (i.e., the estimated RR and 95% CI) are below 1, the model indicated significantly higher use for AI youth for the associated year(s) compared to White peers. When the solid lines are all above 1, the model indicated significantly higher use for White youth compared to AI peers for the associated year(s). When confidence bands include the dashed line (i.e., RR=1), the model indicated no difference between groups for the associated year(s).

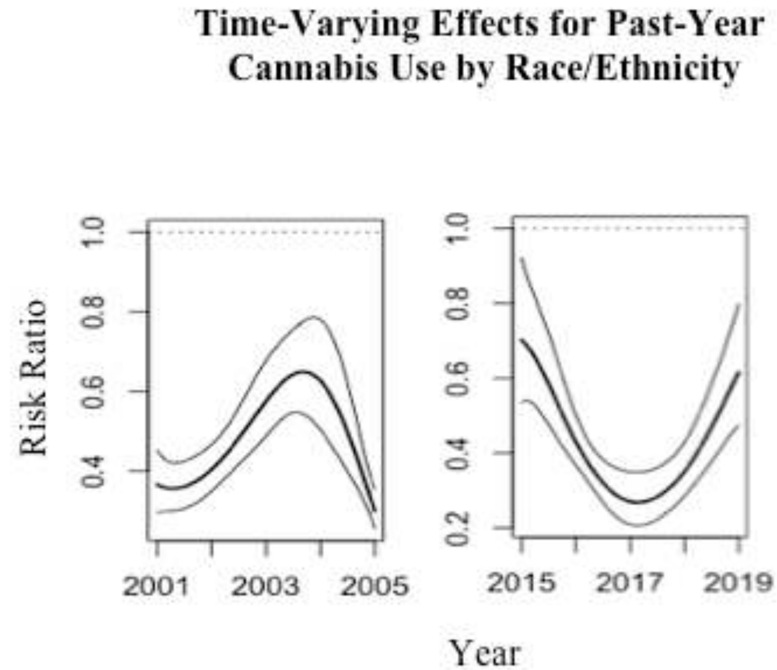

Figure 6: *Time-varying effects model for past-year cannabis use*
Note: Two panels of data are shown in the figure, one for each range of years (i.e., 2001-2005 & 2015-2019) as indicated on the x-axis. The risk ratio (RR) values on the y-axis differ across panels within the figure because they were modeled separately. The heavily weighted solid line and lesser-weighted solid lines represent the estimated RR and 95% CI, respectively. The horizontal dashed line in each panel represents a RR=1. In each panel, AI youth are the reference group (i.e., coded 0) and White youth are the comparison group (i.e., coded 1). Thus, when all solid lines (i.e., the estimated RR and 95% CI) are below 1, the model indicated significantly higher use for AI youth for the associated year(s) compared to White peers. When the solid lines are all above 1, the model indicated significantly higher use for White youth compared to AI peers for the associated year(s). When confidence bands include the dashed line (i.e., RR=1), the model indicated no difference between groups for the associated year(s).

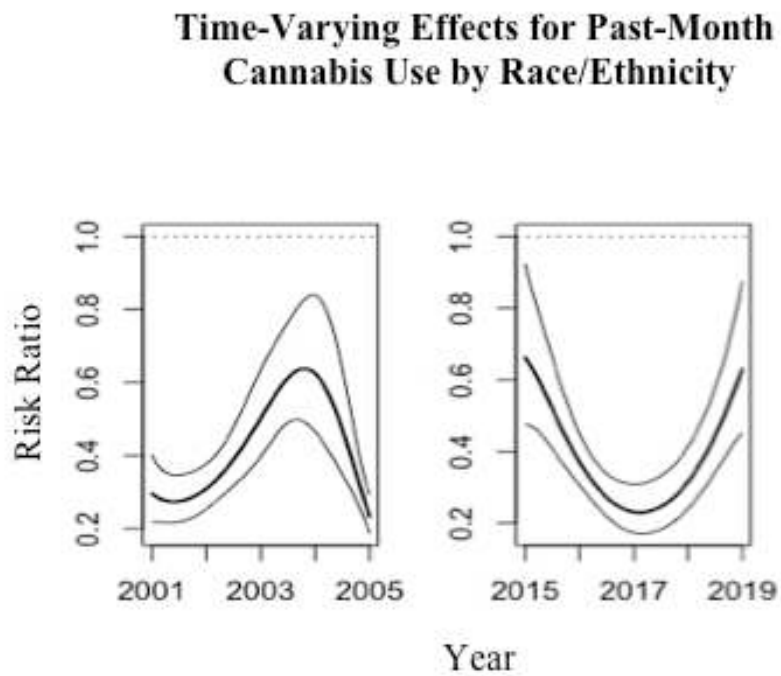

Figure 7: *Time-varying effects model for past-month cannabis use*
Note: Two panels of data are shown in the figure, one for each range of years (i.e., 2001-2005 & 2015-2019) as indicated on the x-axis. The risk ratio (RR) values on the y-axis differ across panels within the figure because they were modeled separately. The heavily weighted solid line and lesser-weighted solid lines represent the estimated RR and 95% CI, respectively. The horizontal dashed line in each panel represents a RR=1. In each panel, AI youth are the reference group (i.e., coded 0) and White youth are the comparison group (i.e., coded 1). Thus, when all solid lines (i.e., the estimated RR and 95% CI) are below 1, the model indicated significantly higher use for AI youth for the associated year(s) compared to White peers. When the solid lines are all above 1, the model indicated significantly higher use for White youth compared to AI peers for the associated year(s). When confidence bands include the dashed line (i.e., RR=1), the model indicated no difference between groups for the associated year(s).

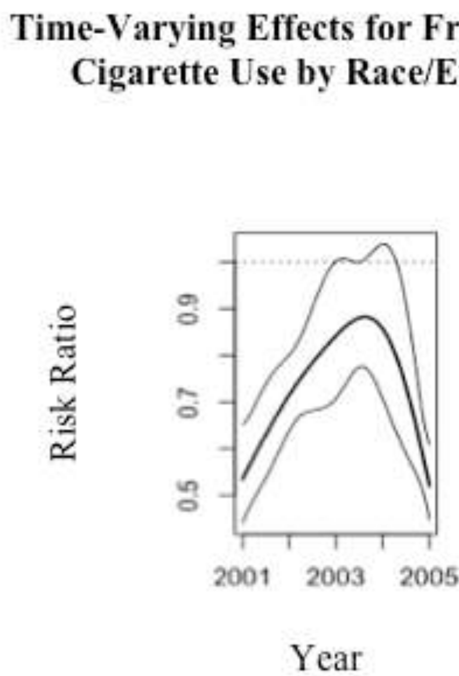

Figure 8: *Time-varying effects model for frequency of cigarette use*
Note: The x-axis represents the range of years from 2001-2005. The y-axis values are the risk ratio (RR) used to model the trend comparing frequency of cigarette use between AI and White youth from 2001-2005. The heavily weighted solid line and lesser-weighted solid lines represent the estimated RR and 95% CI, respectively. The horizontal dashed line represents a RR=1. AI youth are the reference group (i.e., coded 0) and White youth are the comparison group (i.e., coded 1). Thus, when all solid lines (i.e., the estimated RR and 95% CI) are below 1, the model indicated significantly higher use for AI youth for the associated year(s) compared to White peers. When the solid lines are all above 1, the model indicated significantly higher use for White youth compared to AI peers for the associated year(s). When confidence bands include the dashed line (i.e., RR=1), the model indicated no difference between groups for the associated year(s).

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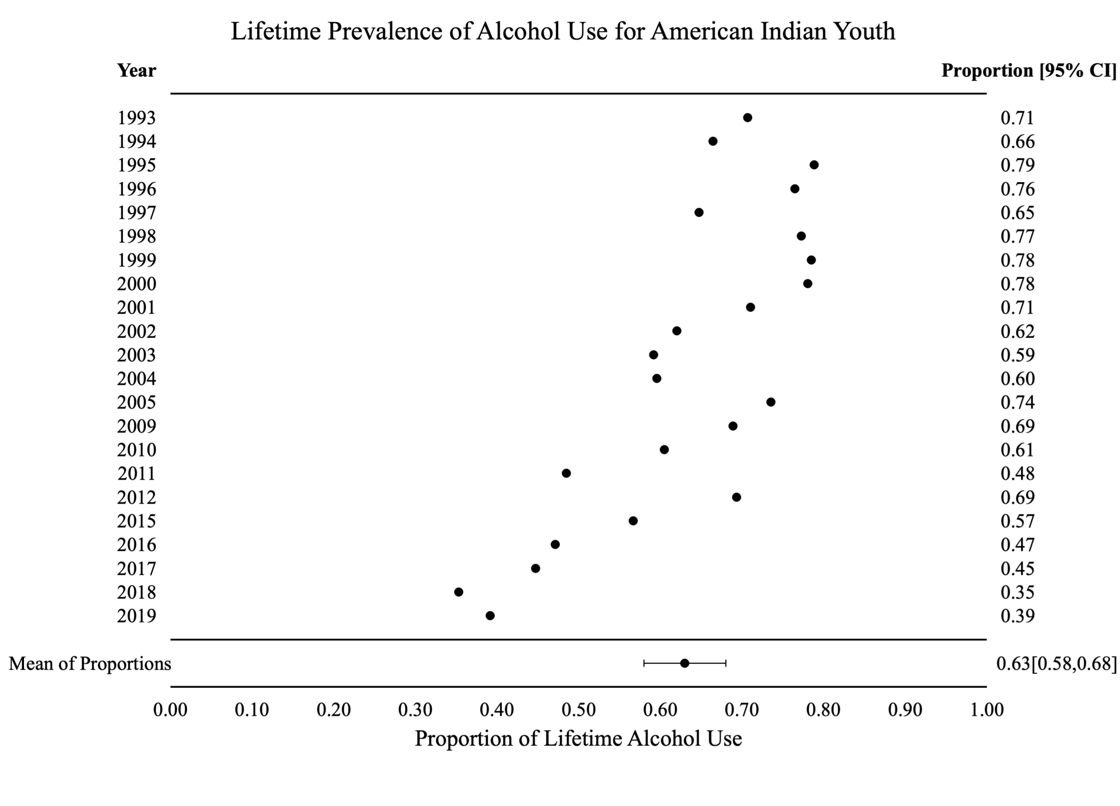
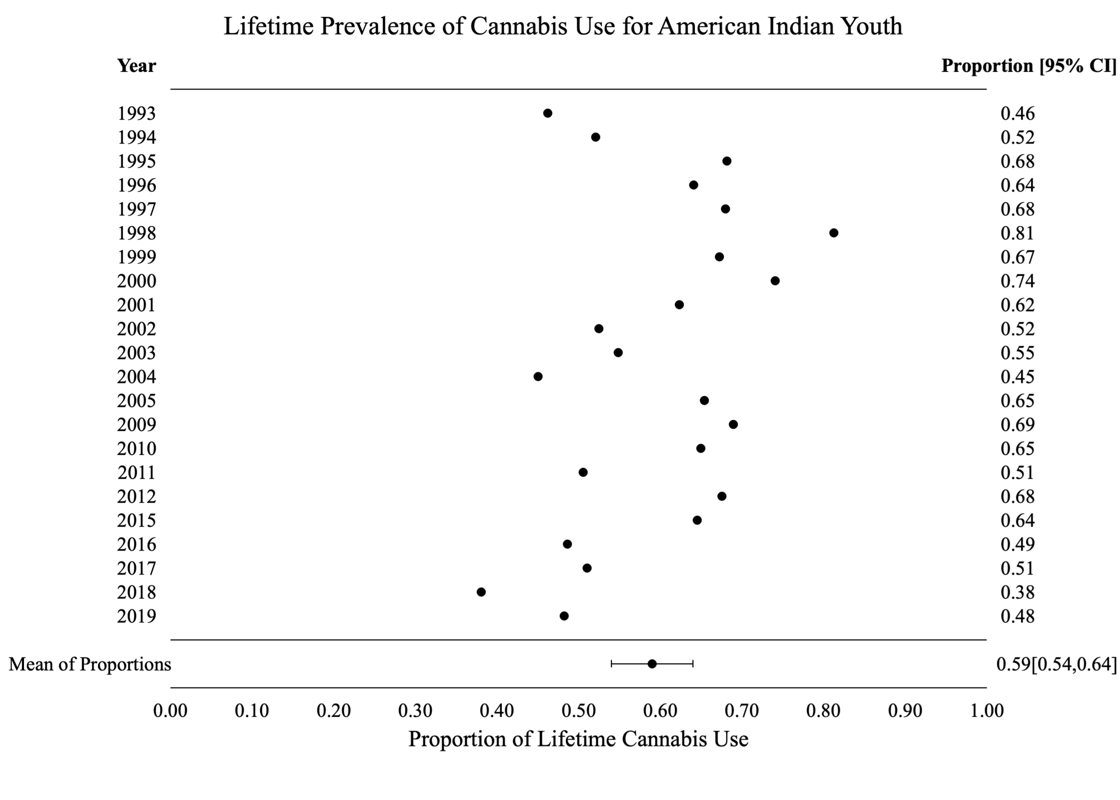
APPENDIX A

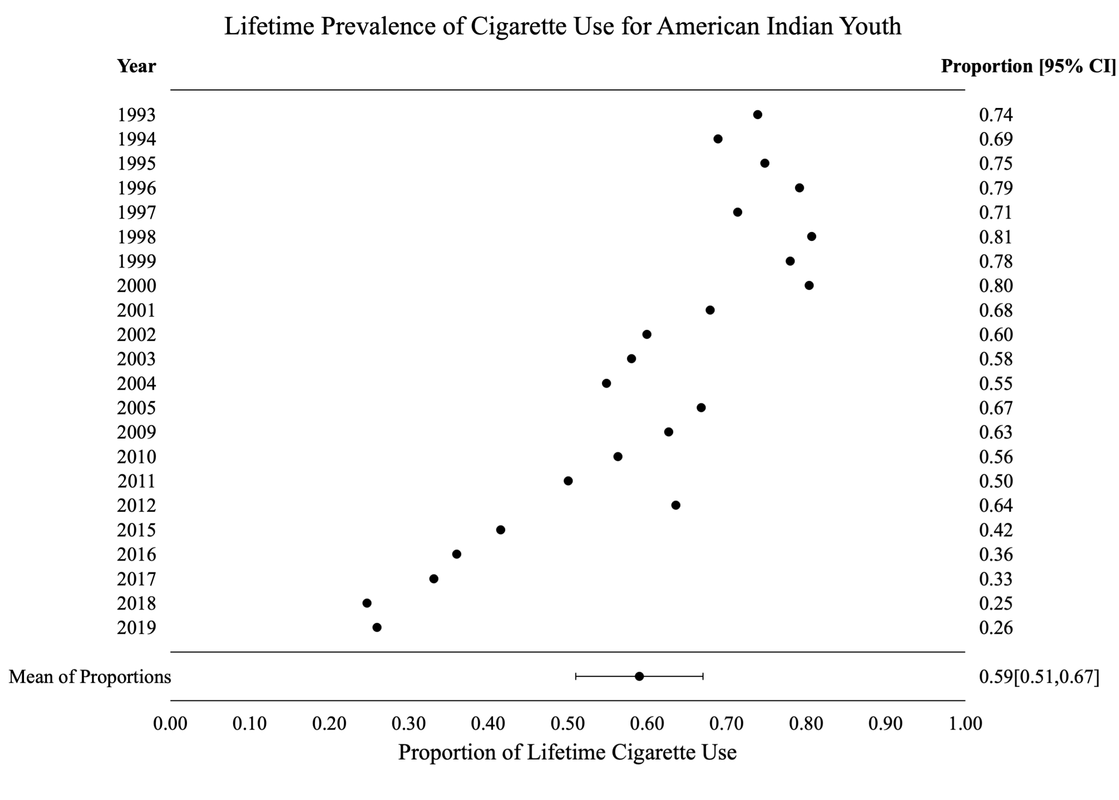
Aim 1: Substance Use for American Indian Youth by Year



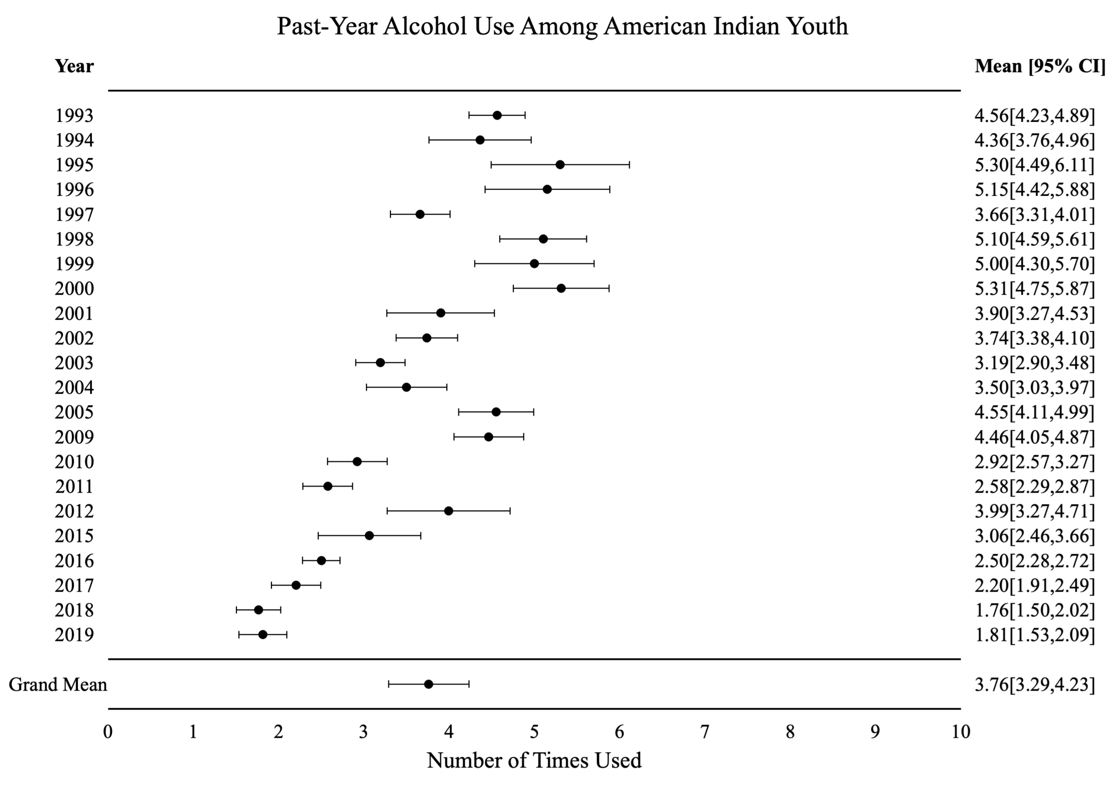
Note: Sample sizes for each year: 1993, n = 1484; 1994, n = 429; 1995, n = 288; 1996, n = 344; 1997, n = 1132; 1998, n = 655; 1999, n = 344; 2000, n = 606; 2001, n = 390; 2002, n = 1142; 2003, n = 1450; 2004, n = 633; 2005, n = 839; 2009, n = 951; 2010, n = 876; 2011, n = 1145; 2012, n = 274; 2015, n = 307; 2016, n = 2093; 2017, n = 1035; 2018, n = 1076; 2019, n = 902



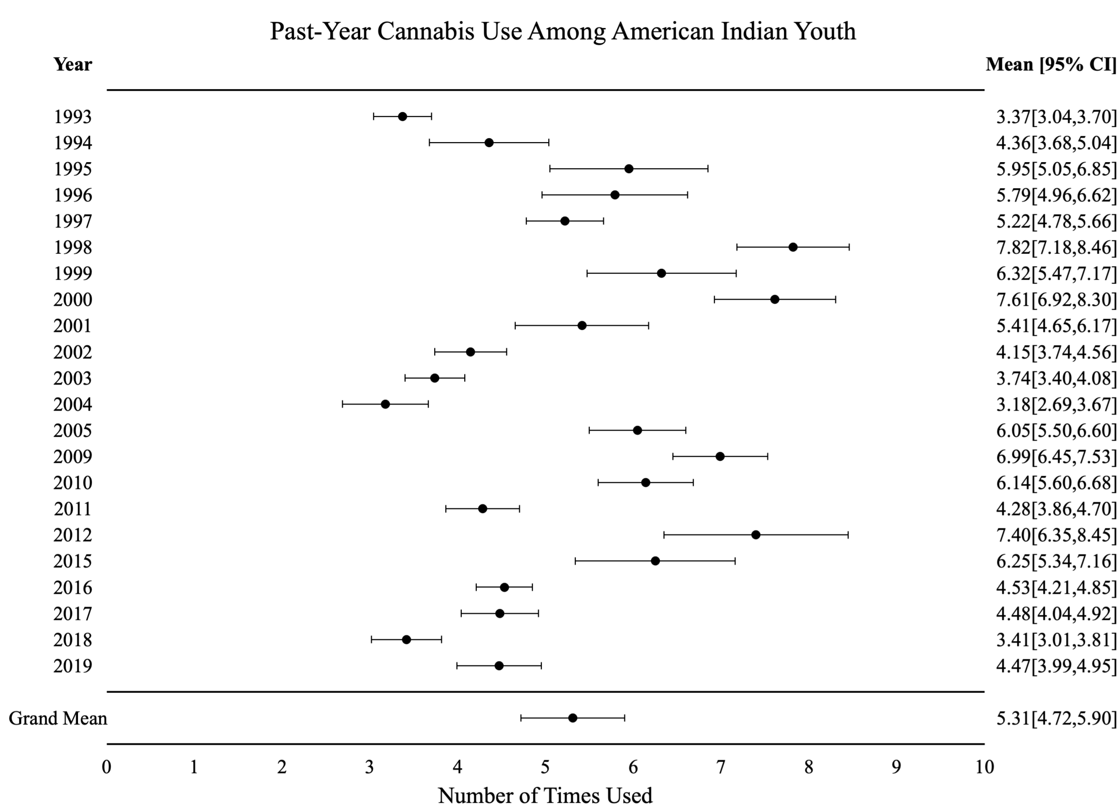
Note: Sample sizes for each year: 1993, n = 1485; 1994, n = 430; 1995, n = 289; 1996, n = 348; 1997, n = 1134; 1998, n = 651; 1999, n = 345; 2000, n = 605; 2001, n = 390; 2002, n = 1142; 2003, n = 1446; 2004, n = 633; 2005, n = 838; 2009, n = 933; 2010, n = 864; 2011, n = 1136; 2012, n = 274; 2015, n = 307; 2016, n = 2088; 2017, n = 1031; 2018, n = 1069; 2019, n = 898



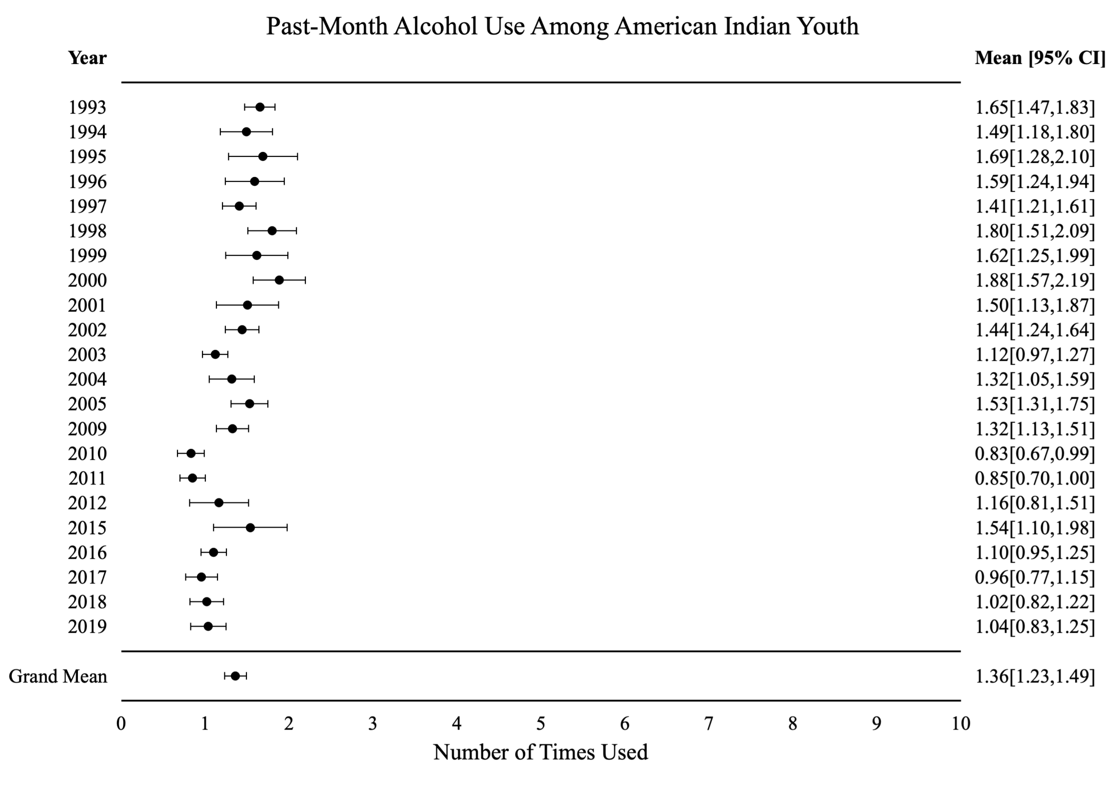
Note: Sample sizes for each year: 1993, n = 1324; 1994, n = 360; 1995, n = 254; 1996, n = 307; 1997, n = 1003; 1998, n = 554; 1999, n = 295; 2000, n = 519; 2001, n = 349; 2002, n = 984; 2003, n = 1236; 2004, n = 545; 2005, n = 716; 2009, n = 900; 2010, n = 835; 2011, n = 1105; 2012, n = 269; 2015, n = 308; 2016, n = 2100; 2017, n = 1035; 2018, n = 1076; 2019, n = 908



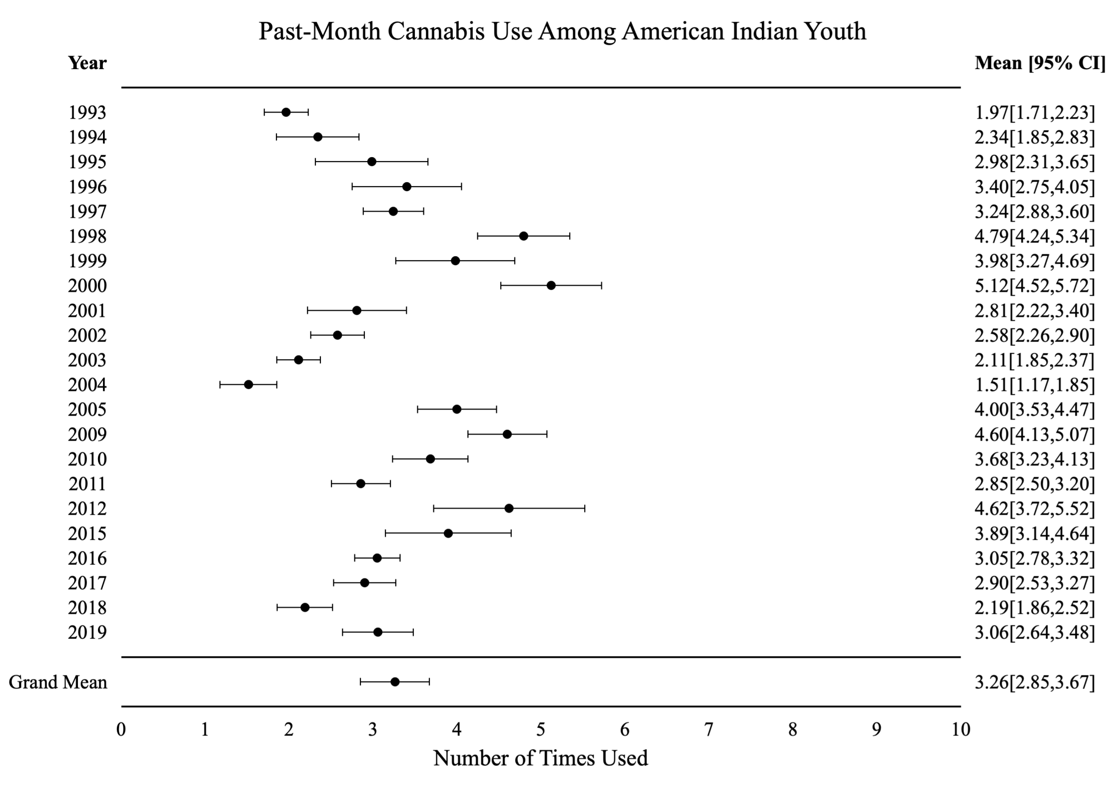
Note: Sample sizes for each year: 1993, n = 1451; 1994, n = 421; 1995, n = 275; 1996, n = 332; 1997, n = 1103; 1998, n = 630; 1999, n = 334; 2000, n = 579; 2001, n = 375; 2002, n = 1115; 2003, n = 1417; 2004, n = 620; 2005, n = 820; 2009, n = 940; 2010, n = 852; 2011, n = 1133; 2012, n = 272; 2015, n = 307; 2016, n = 2092; 2017, n = 1034; 2018, n = 1074; 2019, n = 902



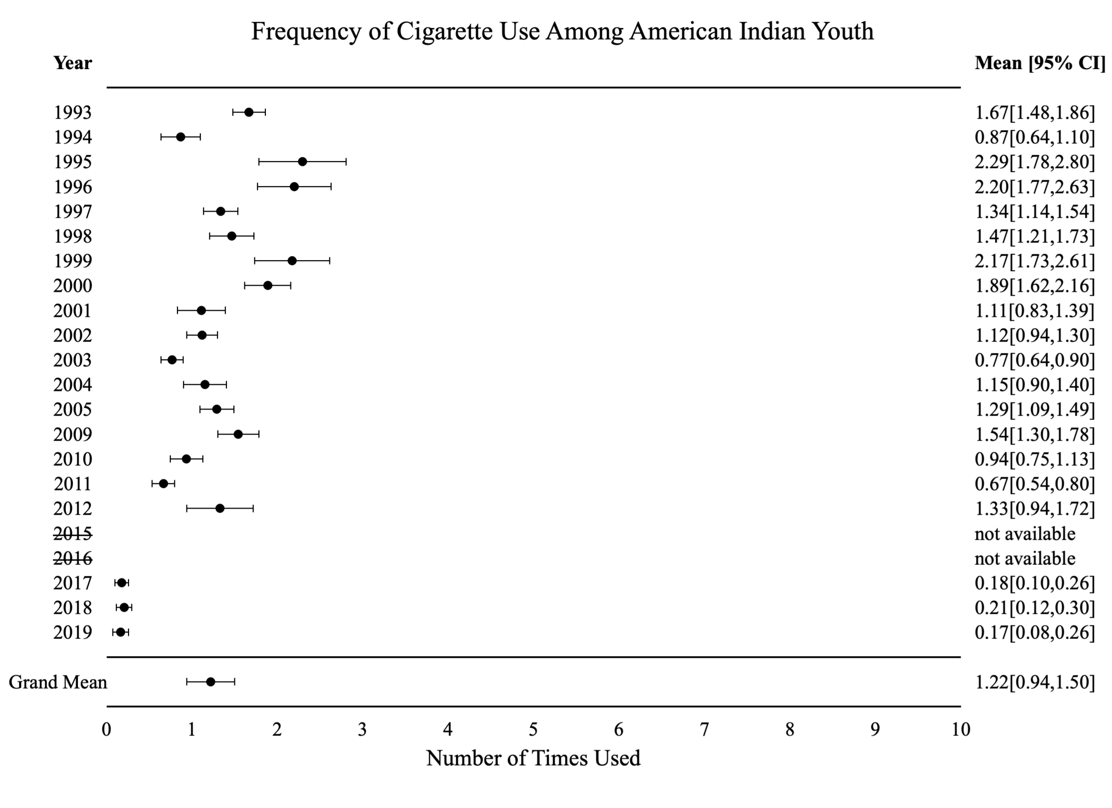
Note: Sample sizes for each year: 1993, n = 1480; 1994, n = 427; 1995, n = 287; 1996, n = 346; 1997, n = 1133; 1998, n = 650; 1999, n = 345; 2000, n = 602; 2001, n = 389; 2002, n = 1141; 2003, n = 1448; 2004, n = 632; 2005, n = 838; 2009, n = 931; 2010, n = 863; 2011, n = 1133; 2012, n = 273; 2015, n = 307; 2016, n = 2088; 2017, n = 1032; 2018, n = 1068; 2019, n = 898



Note: Sample sizes for each year: 1993, n = 1463; 1994, n = 419; 1995, n = 276; 1996, n = 329; 1997, n = 1104; 1998, n = 626; 1999, n = 336; 2000, n = 586; 2001, n = 373; 2002, n = 1111; 2003, n = 1424; 2004, n = 621; 2005, n = 826; 2009, n = 939; 2010, n = 847; 2011, n = 1129; 2012, n = 272; 2015, n = 307; 2016, n = 2091; 2017, n = 1034; 2018, n = 1075; 2019, n = 902



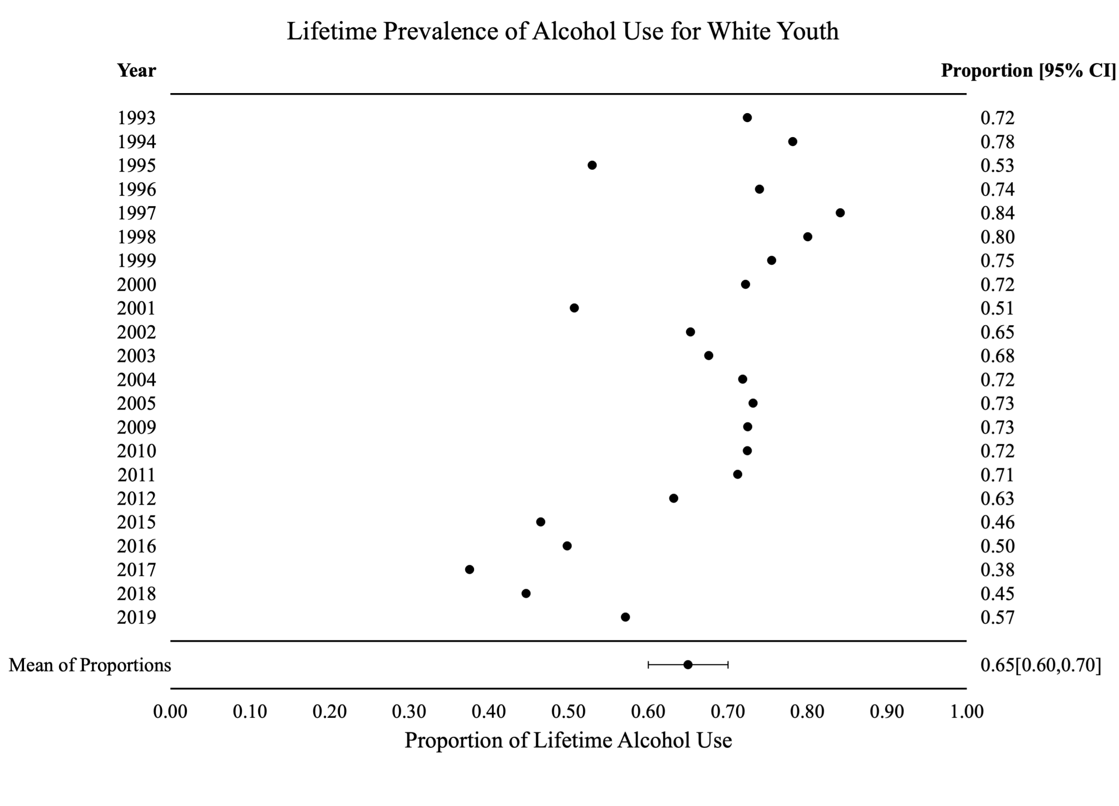
Note: Sample sizes for each year: 1993, n = 1483; 1994, n = 429; 1995, n = 290; 1996, n = 348; 1997, n = 1133; 1998, n = 653; 1999, n = 345; 2000, n = 604; 2001, n = 389; 2002, n = 1142; 2003, n = 1452; 2004, n = 633; 2005, n = 839; 2009, n = 934; 2010, n = 865; 2011, n = 1134; 2012, n = 273; 2015, n = 307; 2016, n = 2088; 2017, n = 1032; 2018, n = 1068; 2019, n = 898



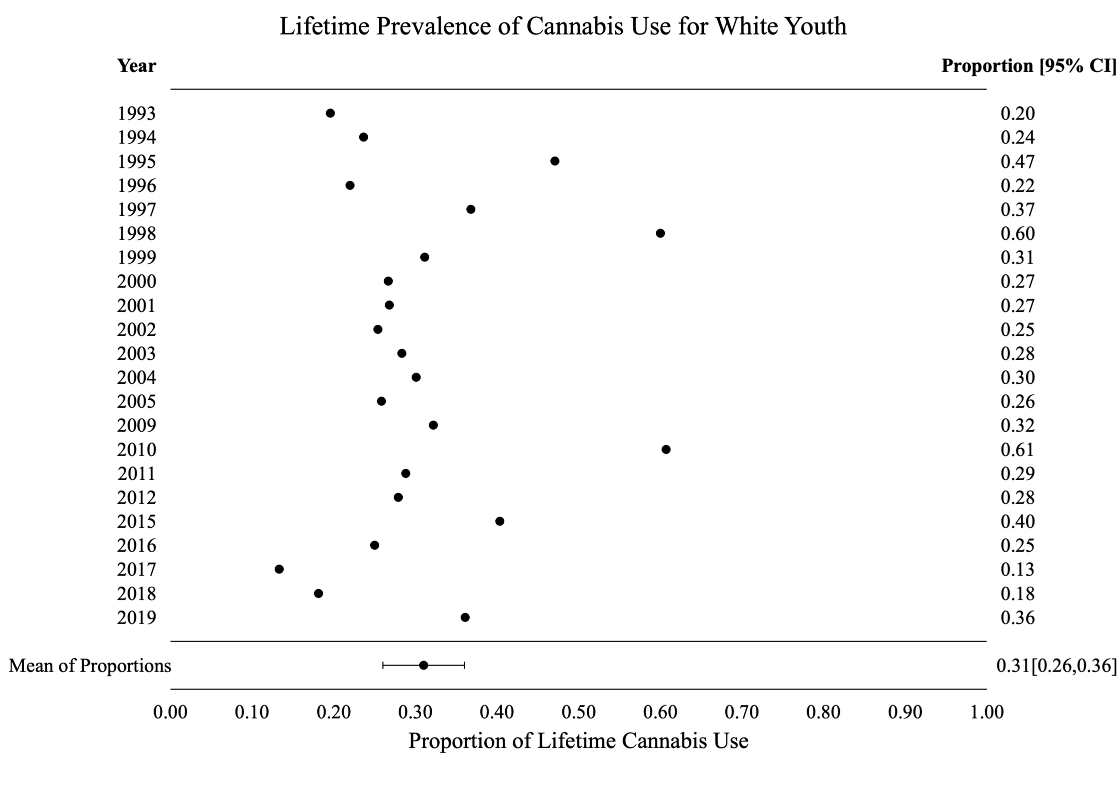
Note: Sample sizes for each year: 1993, n = 1475; 1994, n = 423; 1995, n = 288; 1996, n = 347; 1997, n = 1129; 1998, n = 649; 1999, n = 342; 2000, n = 604; 2001, n = 388; 2002, n = 1137; 2003, n = 1442; 2004, n = 634; 2005, n = 835; 2009, n = 921; 2010, n = 857; 2011, n = 1128; 2012, n = 271; 2017, n = 1035; 2018, n = 1076; 2019, n = 908

APPENDIX B

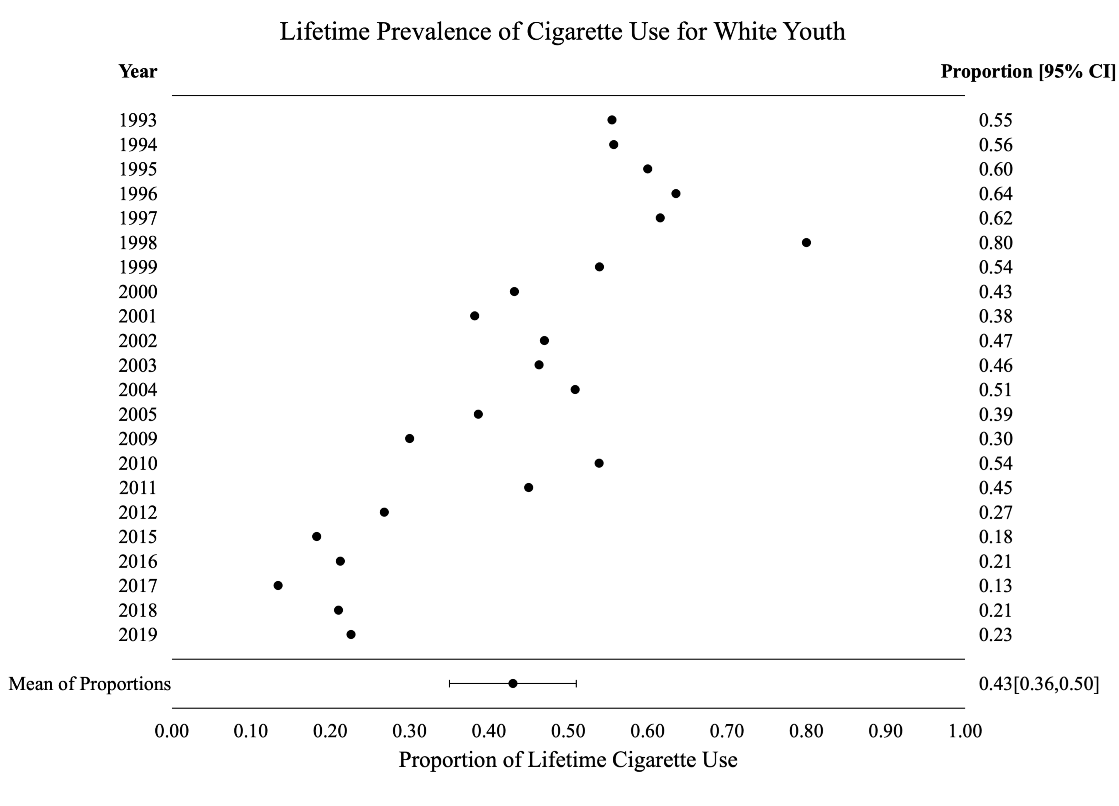
Aim 1: Substance Use for White Youth by Year



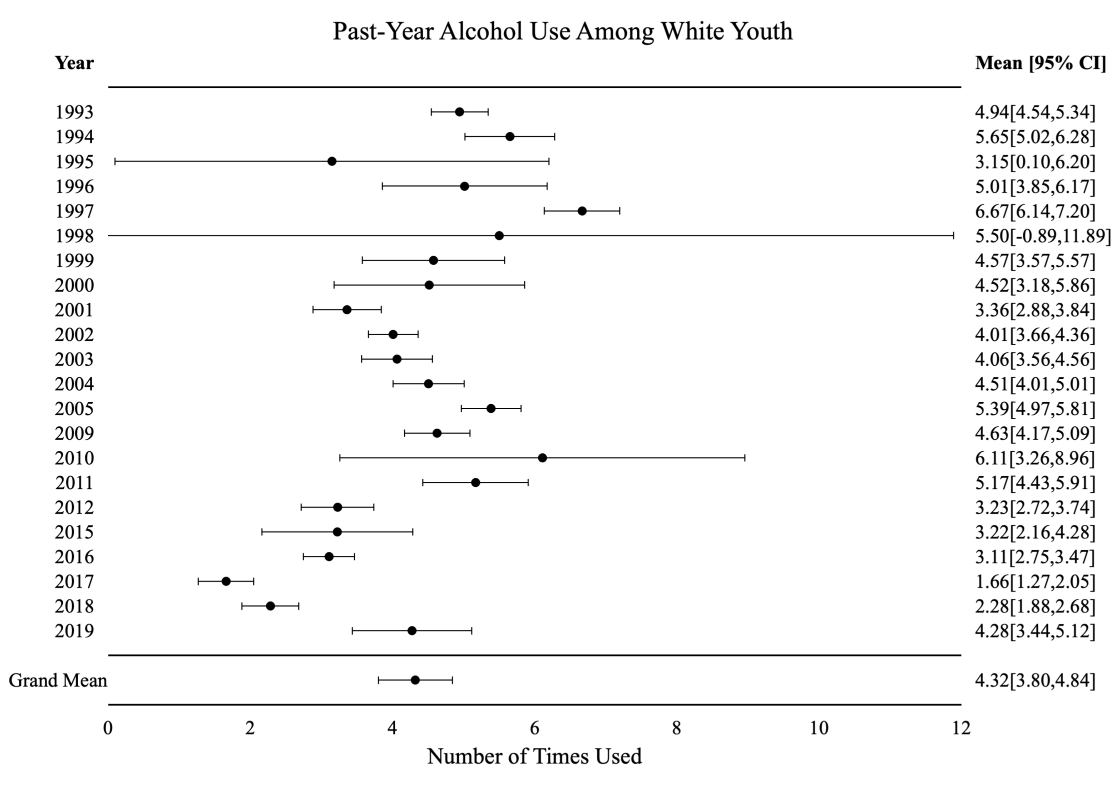
Note: Sample sizes for each year: 1993, n = 1147; 1994, n = 494; 1995, n = 17; 1996, n = 142; 1997, n = 724; 1998, n = 5; 1999, n = 151; 2000, n = 90; 2001, n = 615; 2002, n = 1274; 2003, n = 611; 2004, n = 668; 2005, n = 1107; 2009, n = 760; 2010, n = 29; 2011, n = 358; 2012, n = 451; 2015, n = 114; 2016, n = 996; 2017, n = 455; 2018, n = 578; 2019, n = 238



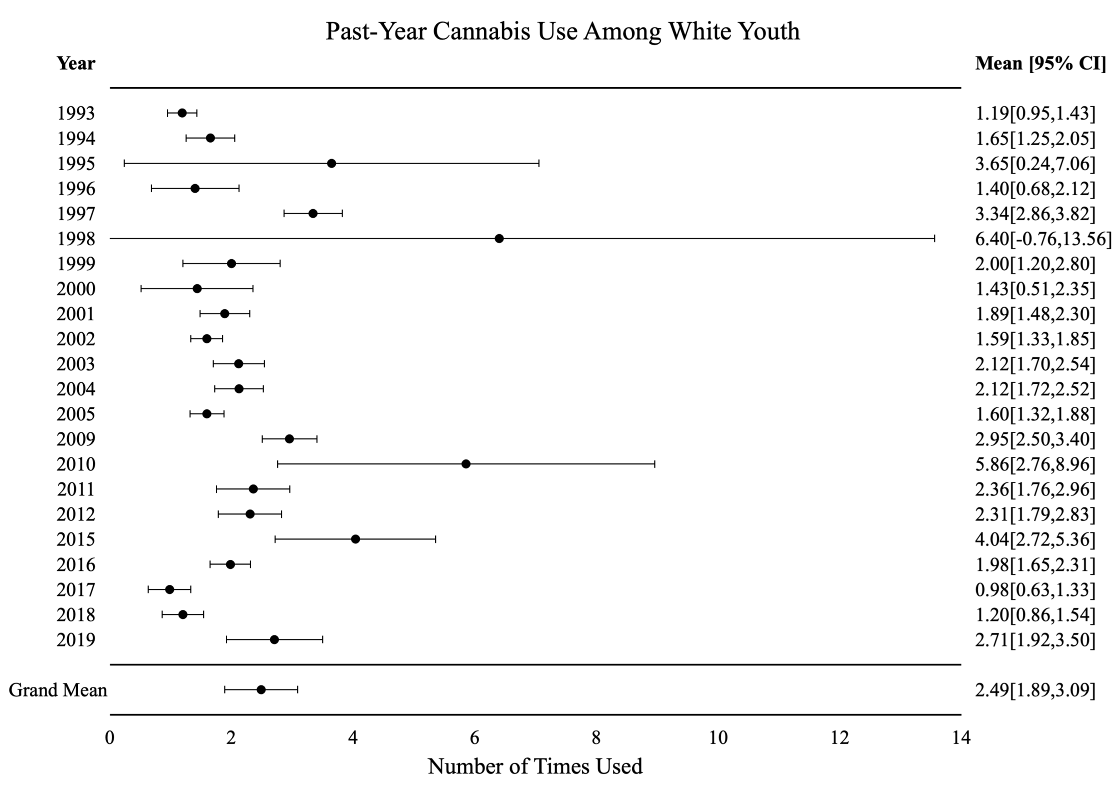
Note: Sample sizes for each year: 1993, n = 1145; 1994, n = 495; 1995, n = 17; 1996, n = 141; 1997, n = 723; 1998, n = 5; 1999, n = 151; 2000, n = 90; 2001, n = 616; 2002, n = 1276; 2003, n = 614; 2004, n = 668; 2005, n = 1106; 2009, n = 755; 2010, n = 28; 2011, n = 354; 2012, n = 441; 2015, n = 114; 2016, n = 991; 2017, n = 451; 2018, n = 574; 2019, n = 230



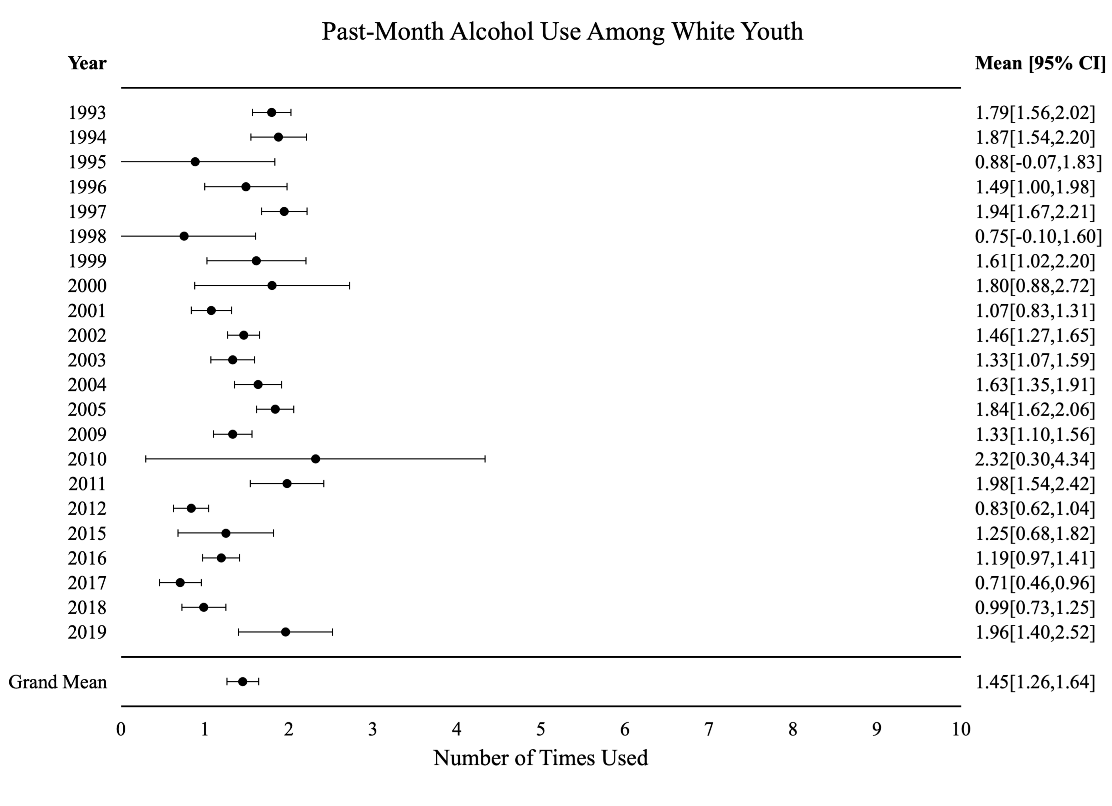
Note: Sample sizes for each year: 1993, n = 1024; 1994, n = 429; 1995, n = 15; 1996, n = 129; 1997, n = 664; 1998, n = 5; 1999, n = 141; 2000, n = 81; 2001, n = 545; 2002, n = 1122; 2003, n = 540; 2004, n = 576; 2005, n = 971; 2009, n = 747; 2010, n = 26; 2011, n = 340; 2012, n = 433; 2015, n = 115; 2016, n = 998; 2017, n = 456; 2018, n = 580; 2019, n = 239



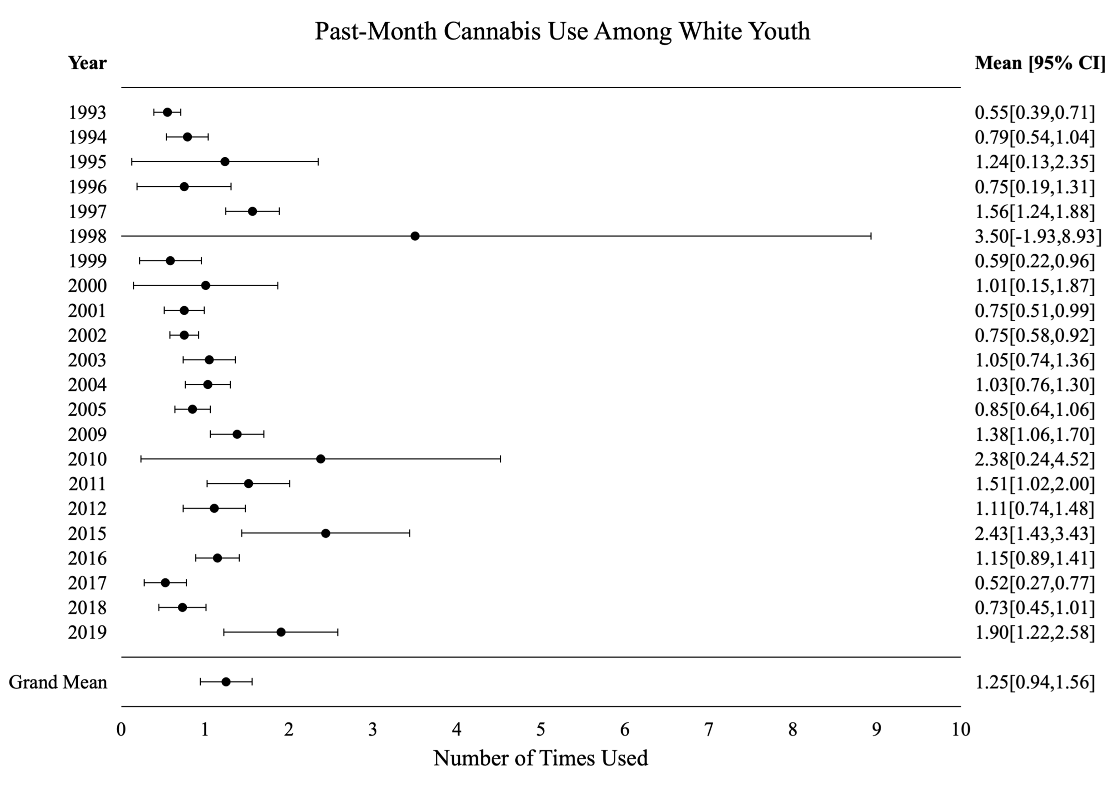
Note: Sample sizes for each year: 1993, n = 1126; 1994, n = 485; 1995, n = 17; 1996, n = 139; 1997, n = 715; 1998, n = 4; 1999, n = 149; 2000, n = 89; 2001, n = 609; 2002, n = 1259; 2003, n = 600; 2004, n = 658; 2005, n = 1092; 2009, n = 748; 2010, n = 28; 2011, n = 355; 2012, n = 442; 2015, n = 114; 2016, n = 994; 2017, n = 455; 2018, n = 577; 2019, n = 238



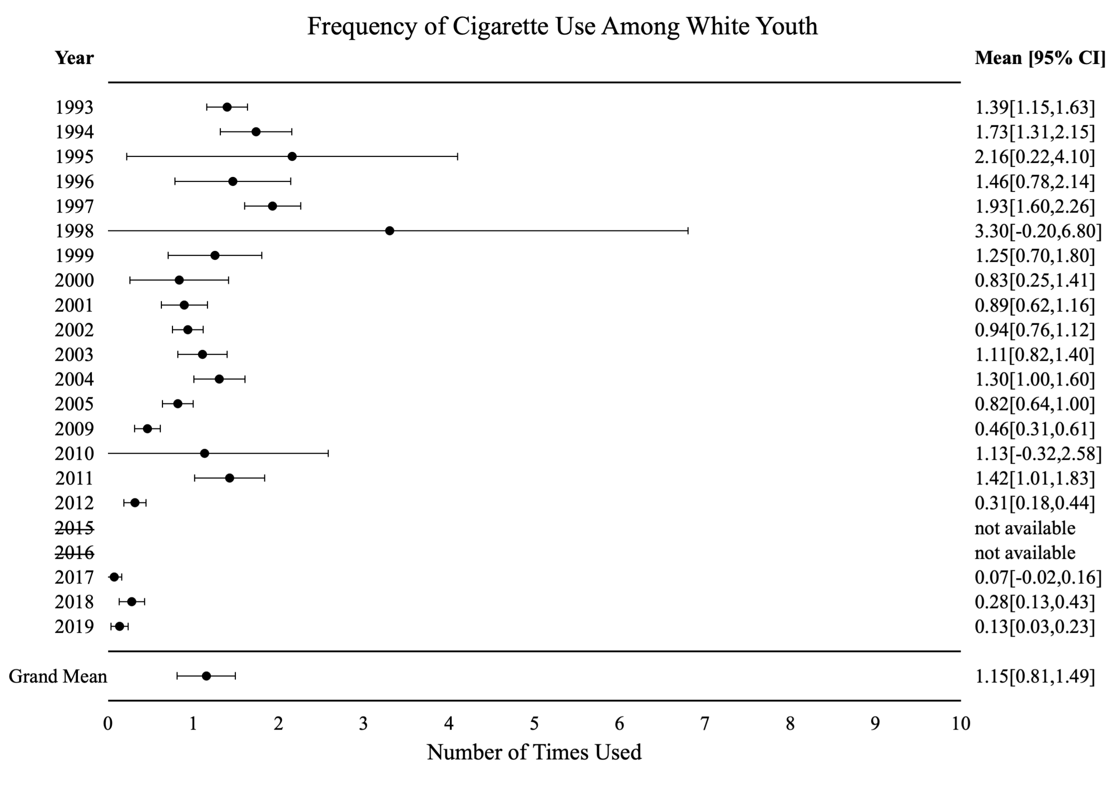
Note: Sample sizes for each year: 1993, n = 1144; 1994, n = 492; 1995, n = 17; 1996, n = 141; 1997, n = 725; 1998, n = 5; 1999, n = 151; 2000, n = 90; 2001, n = 616; 2002, n = 1277; 2003, n = 614; 2004, n = 668; 2005, n = 1102; 2009, n = 755; 2010, n = 28; 2011, n = 353; 2012, n = 440; 2015, n = 114; 2016, n = 990; 2017, n = 451; 2018, n = 574; 2019, n = 230



Note: Sample sizes for each year: 1993, n = 1129; 1994, n = 489; 1995, n = 17; 1996, n = 139; 1997, n = 713; 1998, n = 4; 1999, n = 149; 2000, n = 87; 2001, n = 610; 2002, n = 1258; 2003, n = 606; 2004, n = 655; 2005, n = 1091; 2009, n = 753; 2010, n = 27; 2011, n = 356; 2012, n = 441; 2015, n = 114; 2016, n = 993; 2017, n = 455; 2018, n = 577; 2019, n = 238



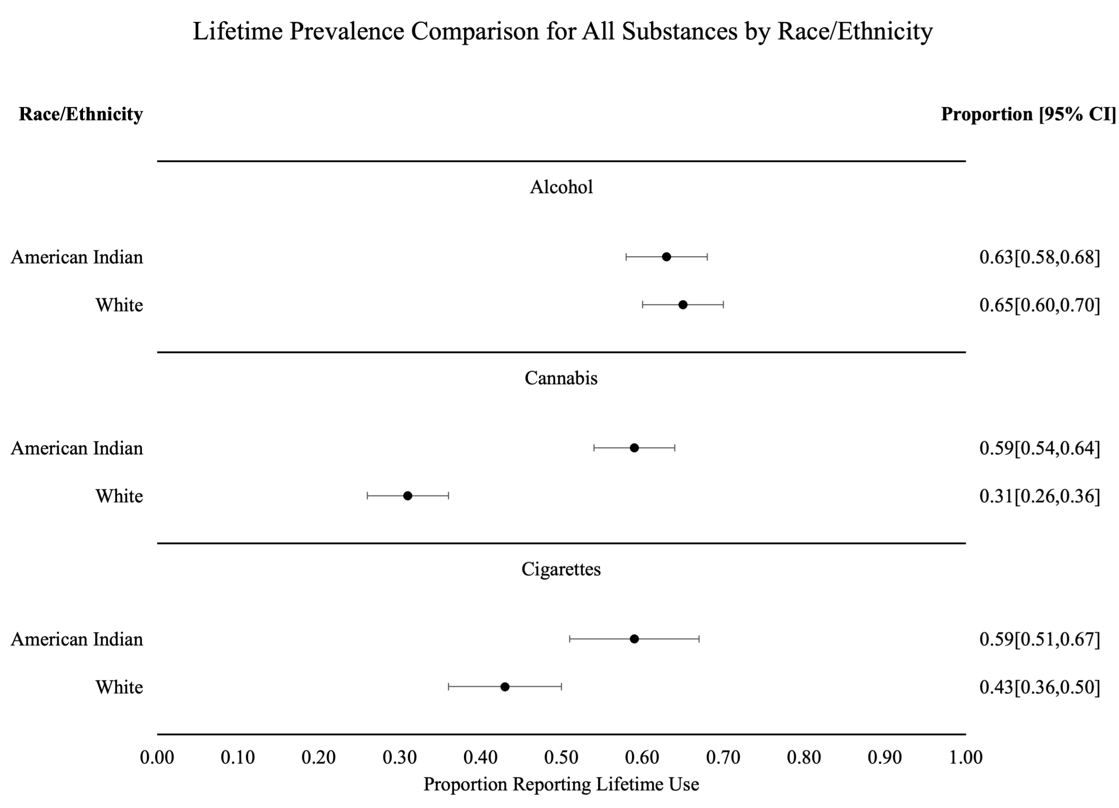
Note: Sample sizes for each year: 1993, n = 1145; 1994, n = 495; 1995, n = 17; 1996, n = 141; 1997, n = 723; 1998, n = 5; 1999, n = 151; 2000, n = 90; 2001, n = 614; 2002, n = 1276; 2003, n = 613; 2004, n = 667; 2005, n = 1106; 2009, n = 754; 2010, n = 28; 2011, n = 354; 2012, n = 440; 2015, n = 114; 2016, n = 991; 2017, n = 451; 2018, n = 575; 2019, n = 230

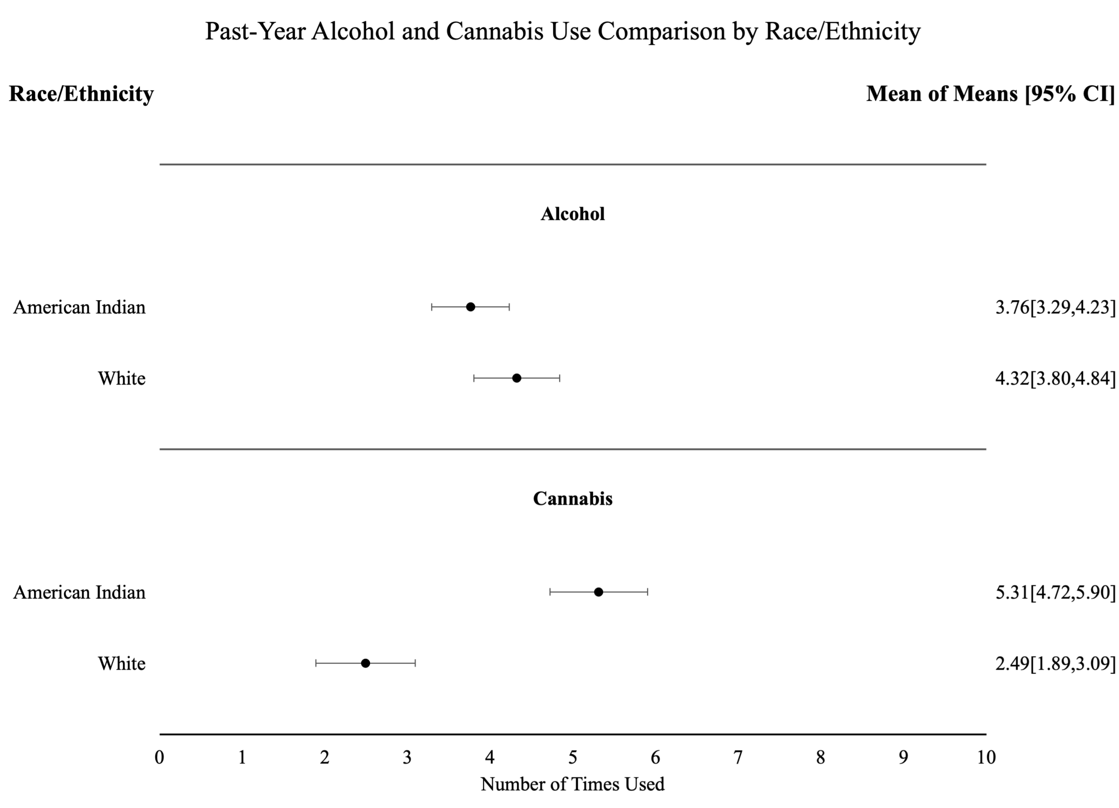


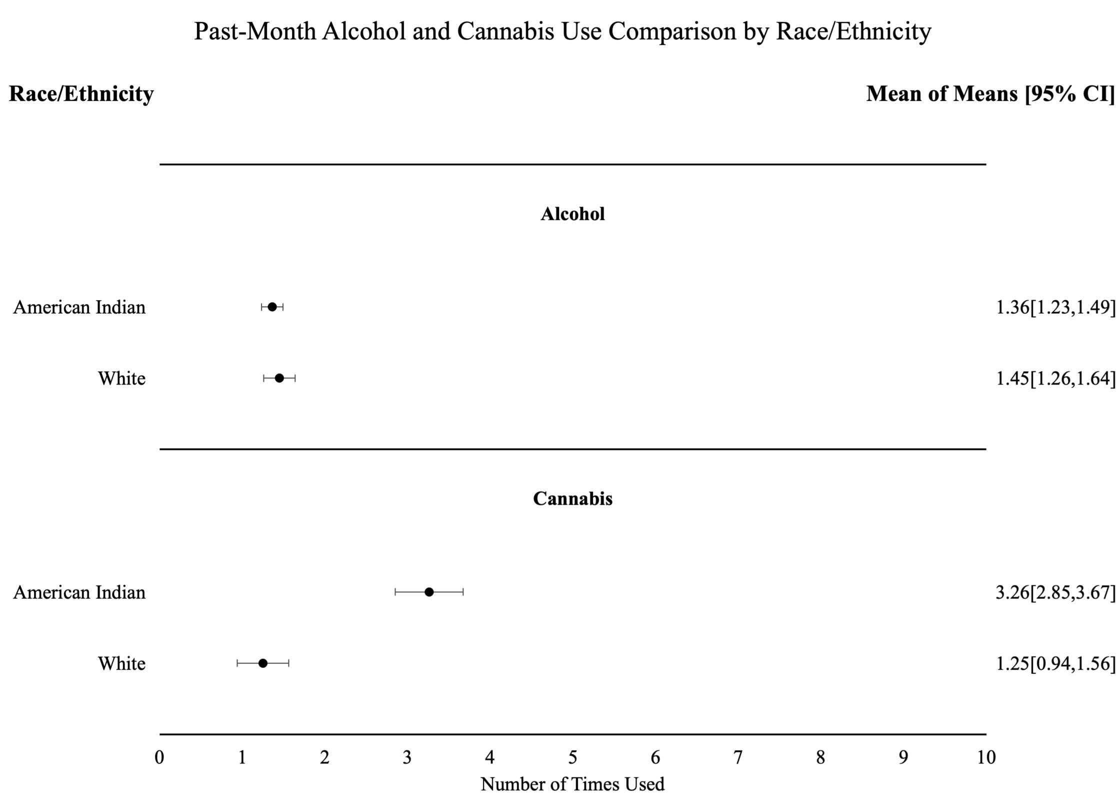
Note: Sample sizes for each year: 1993, n = 1141; 1994, n = 491; 1995, n = 16; 1996, n = 140; 1997, n = 722; 1998, n = 5; 1999, n = 150; 2000, n = 90; 2001, n = 611; 2002, n = 1274; 2003, n = 613; 2004, n = 662; 2005, n = 1105; 2009, n = 750; 2010, n = 27; 2011, n = 349; 2012, n = 439; 2017, n = 456; 2018, n = 580; 2019, n = 239

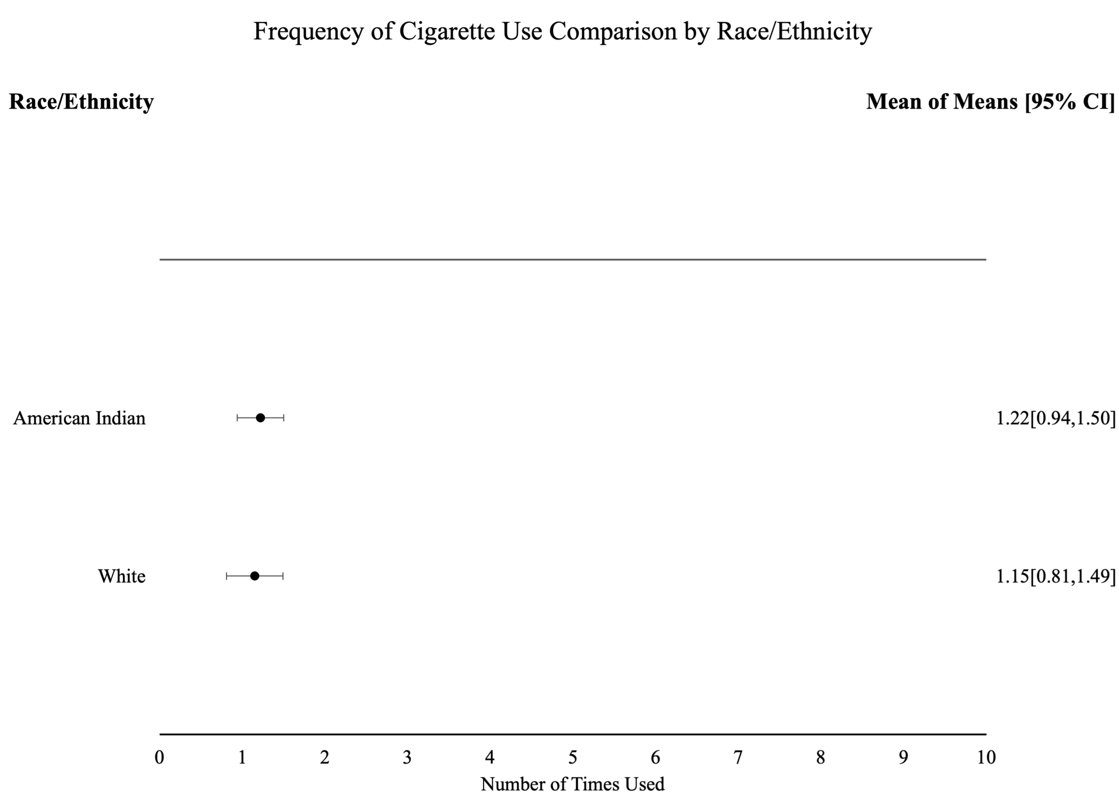
APPENDIX C

Aim 1: Substance Use Comparisons by Race/Ethnicity


Lifetime Prevalence Comparison for All Substances by Race/Ethnicity
Race/Ethnicity
Proportion [95% CI]
Alcohol
American Indian
0.63[0.58,0.68]
White
0.65[0.60,0.70]
Cannabis
American Indian
0.59[0.54,0.64]
White
0.31[0.26,0.36]
Cigarettes
American Indian
0.59[0.51,0.67]
White
0.43[0.36,0.50]
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00
Proportion Reporting Lifetime Use

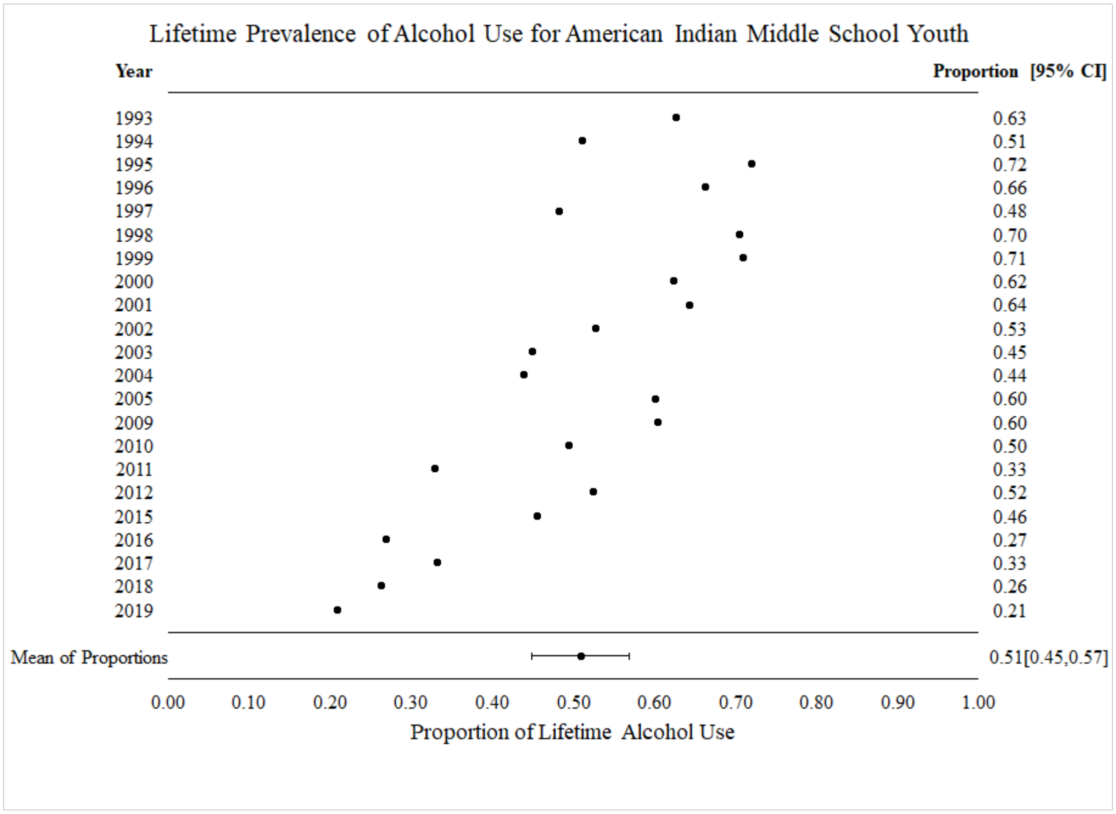

Past-Year Alcohol and Cannabis Use Comparison by Race/Ethnicity
Race/Ethnicity
Mean of Means [95% CI]
Alcohol
American Indian
3.76[3.29,4.23]
White
4.32[3.80,4.84]
Cannabis
American Indian
5.31[4.72,5.90]
White
2.49[1.89,3.09]
0 1 2 3 4 5 6 7 8 9 10
Number of Times Used


Past-Month Alcohol and Cannabis Use Comparison by Race/Ethnicity
Race/Ethnicity
Mean of Means [95% CI]
Alcohol
American Indian
1.36[1.23,1.49]
White
1.45[1.26,1.64]
Cannabis
American Indian
3.26[2.85,3.67]
White
1.25[0.94,1.56]
0
1
2
3
4
5
6
7
8
9
10
Number of Times Used

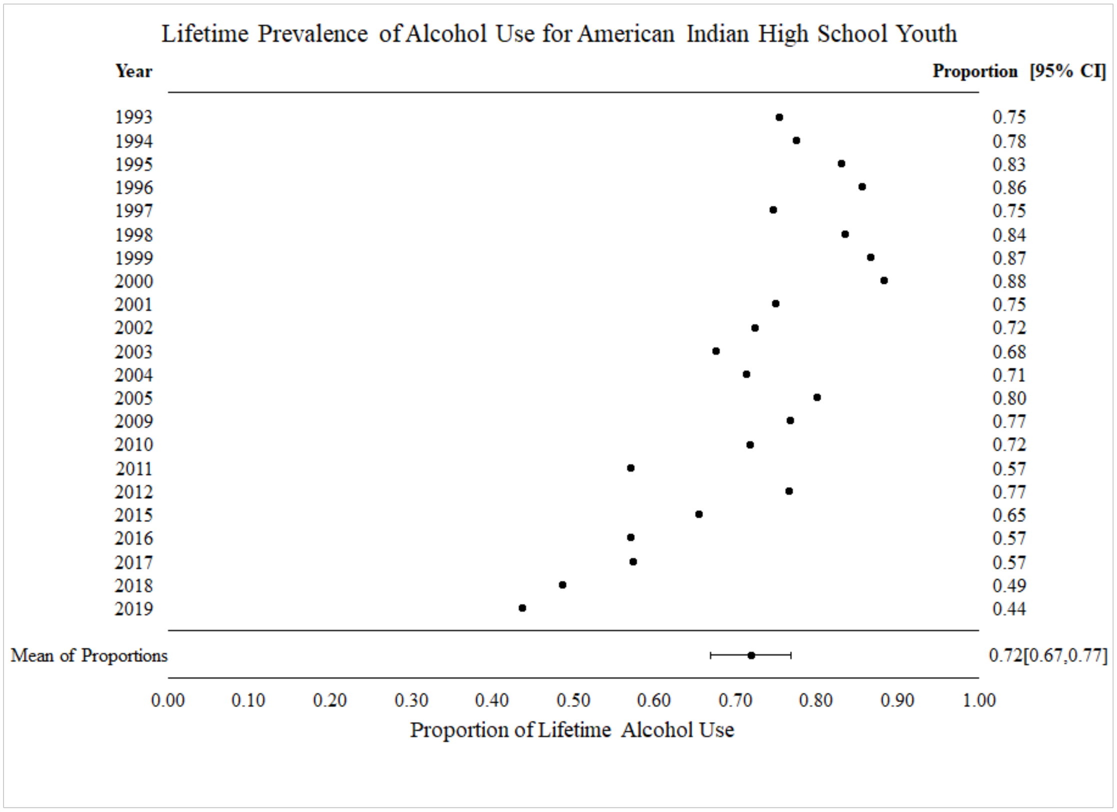

Frequency of Cigarette Use Comparison by Race/Ethnicity
Race/Ethnicity
Mean of Means [95% CI]
American Indian
1.22[0.94,1.50]
White
1.15[0.81,1.49]
0
1
2
3
4
5
6
7
8
9
10
Number of Times Used

APPENDIX D

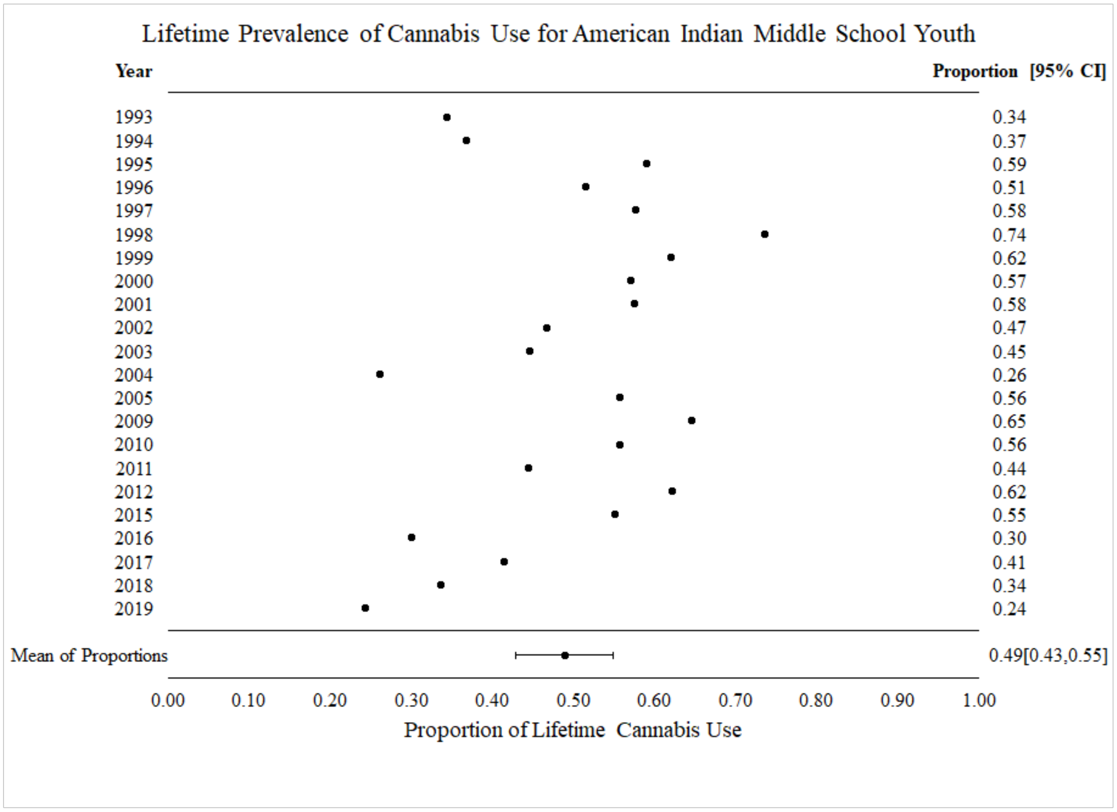
Aim 2: Substance Use for American Indian Youth by Year and Grade Group



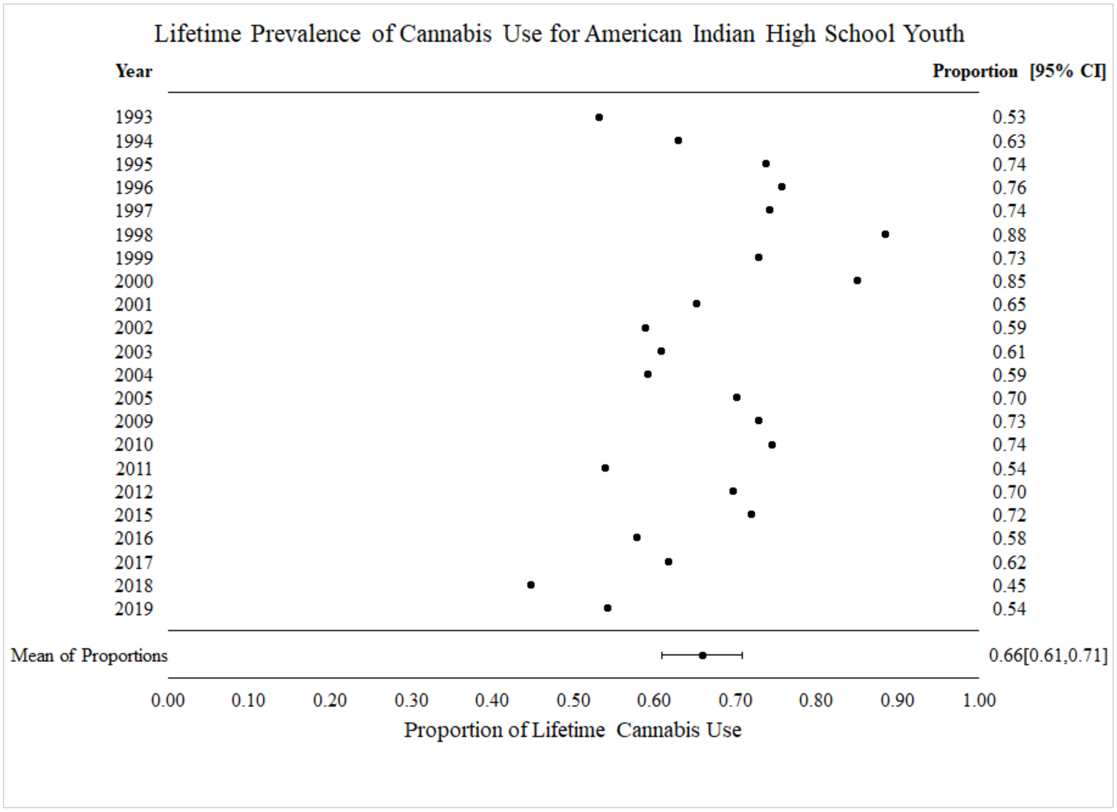
Note: Sample sizes for each year: 1993, n = 556; 1994, n = 180; 1995, n = 111; 1996, n = 163; 1997, n = 423; 1998, n = 315; 1999, n = 179; 2000, n = 239; 2001, n = 146; 2002, n = 606; 2003, n = 542; 2004, n = 273; 2005, n = 276; 2009, n = 463; 2010, n = 446; 2011, n = 412; 2012, n = 82; 2015, n = 136; 2016, n = 692; 2017, n = 529; 2018, n = 646; 2019, n = 182



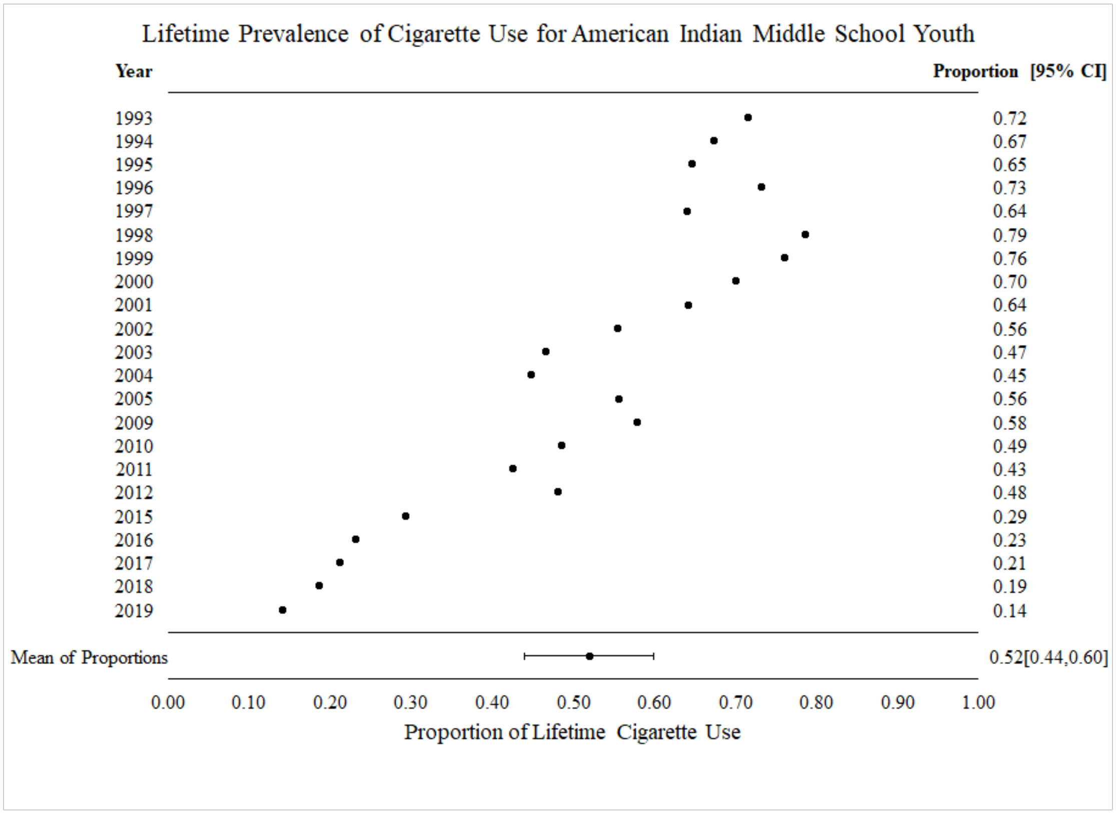
Note: Sample sizes for each year: 1993, n = 928; 1994, n = 249; 1995, n = 177; 1996, n = 181; 1997, n = 709; 1998, n = 340; 1999, n = 165; 2000, n = 367; 2001, n = 244; 2002, n = 536; 2003, n = 908; 2004, n = 360; 2005, n = 563; 2009, n = 488; 2010, n = 430; 2011, n = 733; 2012, n = 192; 2015, n = 171; 2016, n = 1400; 2017, n = 500; 2018, n = 429; 2019, n = 720



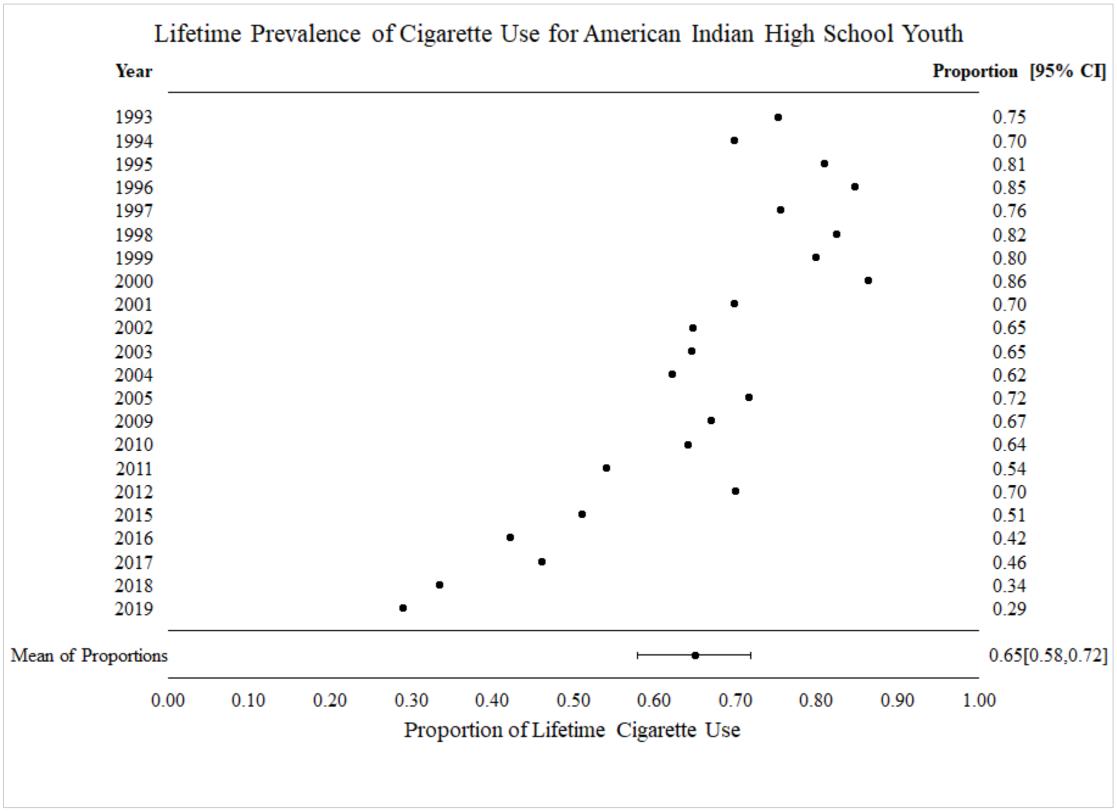
Note: Sample sizes for each year: 1993, n = 554; 1994, n = 179; 1995, n = 110; 1996, n = 167; 1997, n = 425; 1998, n = 314; 1999, n = 179; 2000, n = 238; 2001, n = 146; 2002, n = 606; 2003, n = 537; 2004, n = 272; 2005, n = 276; 2009, n = 453; 2010, n = 441; 2011, n = 405; 2012, n = 82; 2015, n = 136; 2016, n = 693; 2017, n = 528; 2018, n = 642; 2019, n = 181



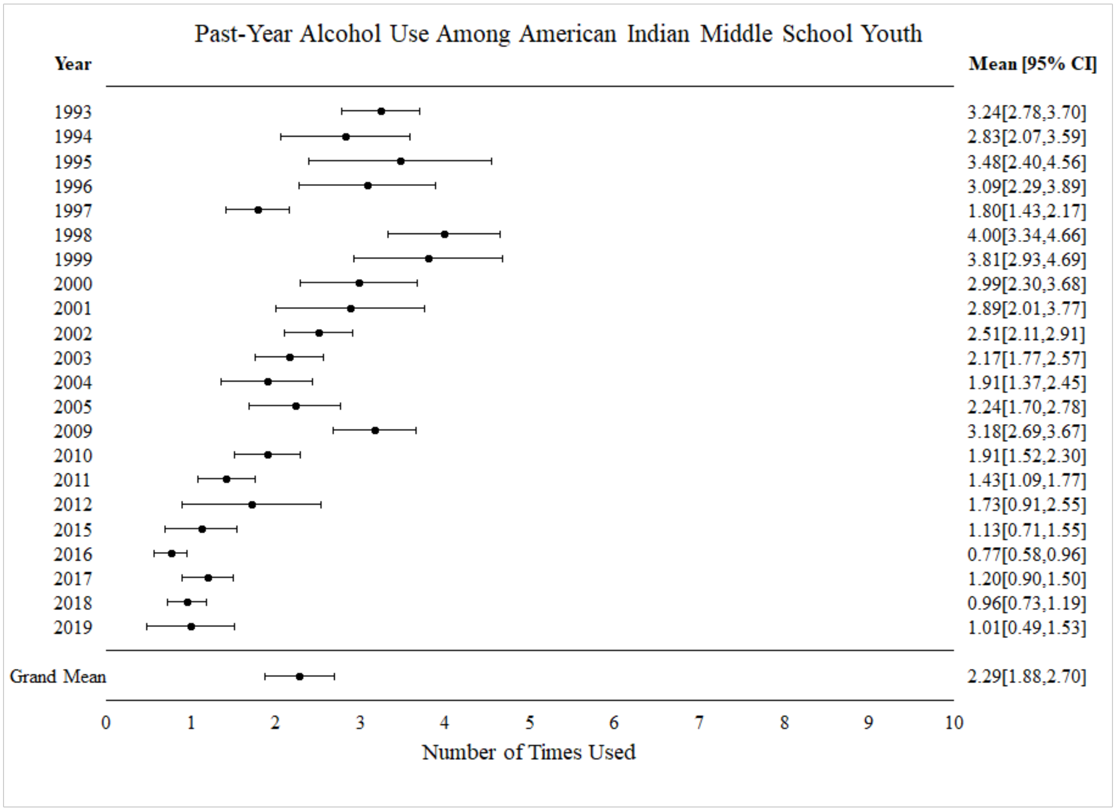
Note: Sample sizes for each year: 1993, n = 931; 1994, n = 251; 1995, n = 179; 1996, n = 181; 1997, n = 709; 1998, n = 337; 1999, n = 166; 2000, n = 367; 2001, n = 244; 2002, n = 536; 2003, n = 909; 2004, n = 361; 2005, n = 562; 2009, n = 480; 2010, n = 423; 2011, n = 731; 2012, n = 192; 2015, n = 171; 2016, n = 1394; 2017, n = 497; 2018, n = 427; 2019, n = 717



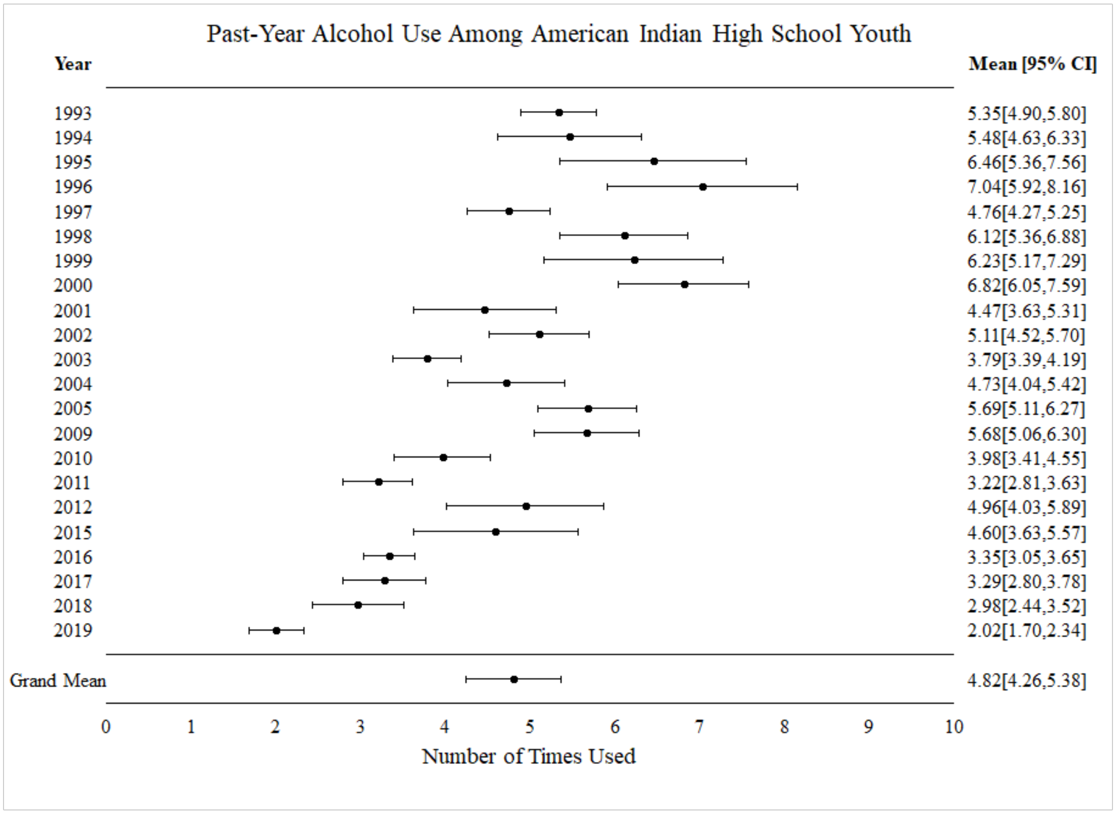
Note: Sample sizes for each year: 1993, n = 496; 1994, n = 144; 1995, n = 96; 1996, n = 149; 1997, n = 367; 1998, n = 258; 1999, n = 146; 2000, n = 190; 2001, n = 120; 2002, n = 513; 2003, n = 454; 2004, n = 230; 2005, n = 219; 2009, n = 432; 2010, n = 422; 2011, n = 388; 2012, n = 79; 2015, n = 136; 2016, n = 695; 2017, n = 529; 2018, n = 646; 2019, n = 184



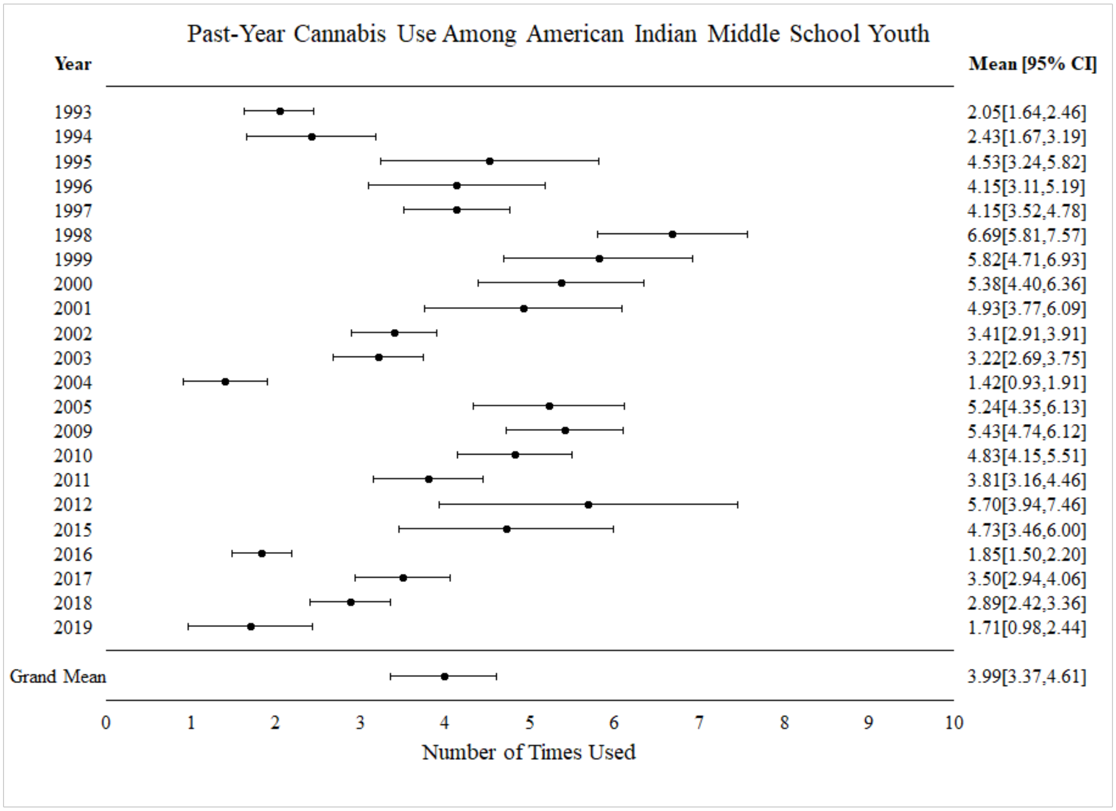
Note: Sample sizes for each year: 1993, n = 828; 1994, n = 216; 1995, n = 158; 1996, n = 158; 1997, n = 636; 1998, n = 296; 1999, n = 149; 2000, n = 329; 2001, n = 229; 2002, n = 471; 2003, n = 782; 2004, n = 315; 2005, n = 497; 2009, n = 468; 2010, n = 413; 2011, n = 717; 2012, n = 190; 2015, n = 172; 2016, n = 1404; 2017, n = 500; 2018, n = 429; 2019, n = 724



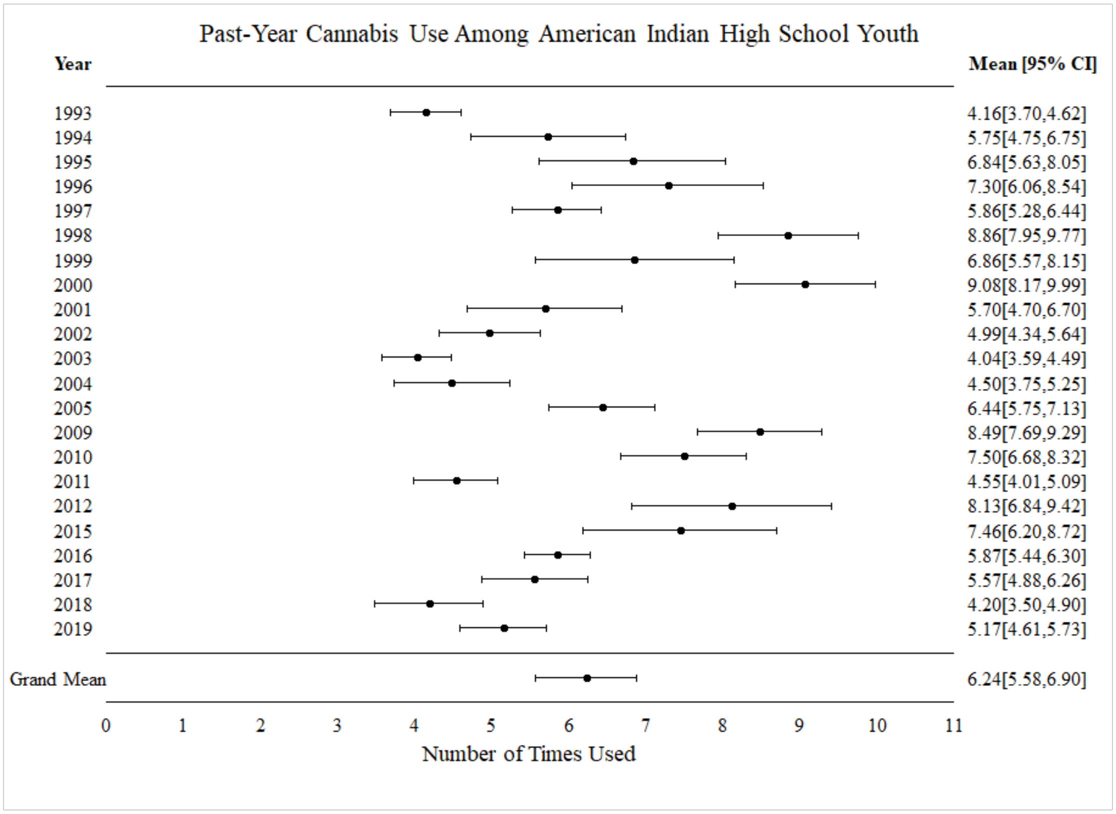
Note: Sample sizes for each year: 1993, n = 542; 1994, n = 178; 1995, n = 107; 1996, n = 159; 1997, n = 411; 1998, n = 302; 1999, n = 170; 2000, n = 228; 2001, n = 136; 2002, n = 589; 2003, n = 525; 2004, n = 270; 2005, n = 270; 2009, n = 457; 2010, n = 436; 2011, n = 406; 2012, n = 81; 2015, n = 136; 2016, n = 692; 2017, n = 529; 2018, n = 645; 2019, n = 182



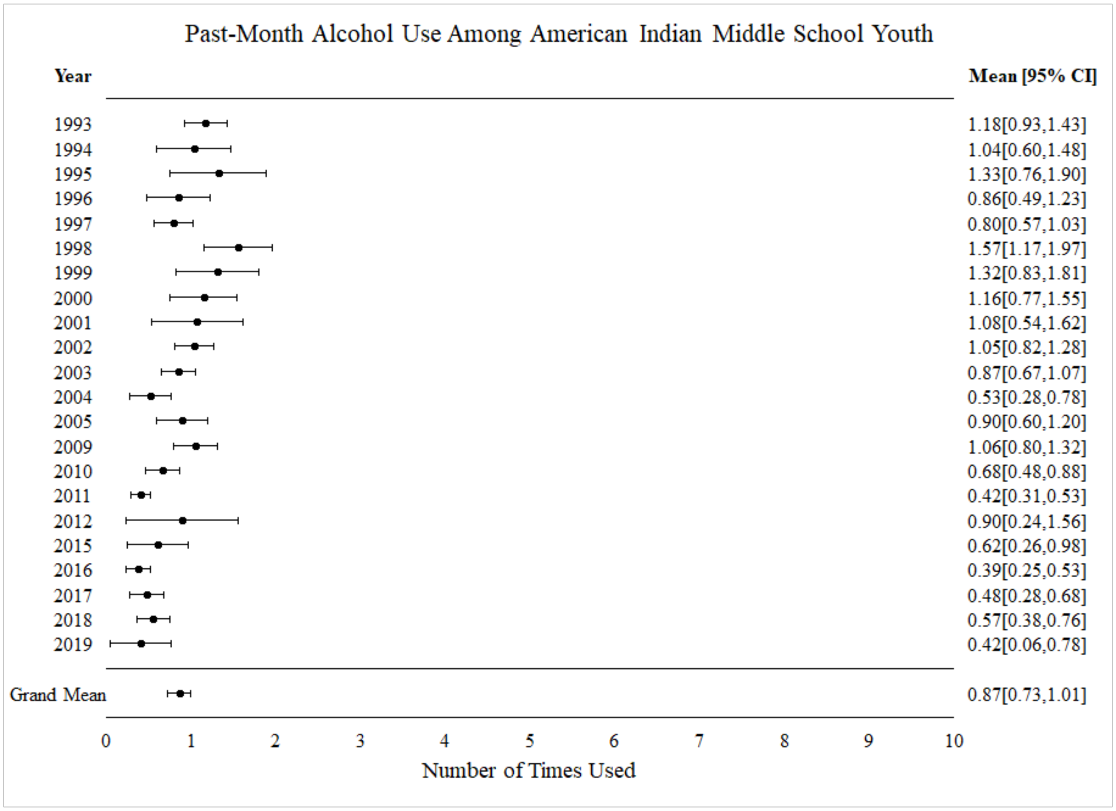
Note: Sample sizes for each year: 1993, n = 909; 1994, n = 243; 1995, n = 168; 1996, n = 173; 1997, n = 692; 1998, n = 328; 1999, n = 164; 2000, n = 351; 2001, n = 239; 2002, n = 526; 2003, n = 892; 2004, n = 350; 2005, n = 550; 2009, n = 483; 2010, n = 416; 2011, n = 727; 2012, n = 191; 2015, n = 171; 2016, n = 1399; 2017, n = 499; 2018, n = 428; 2019, n = 720



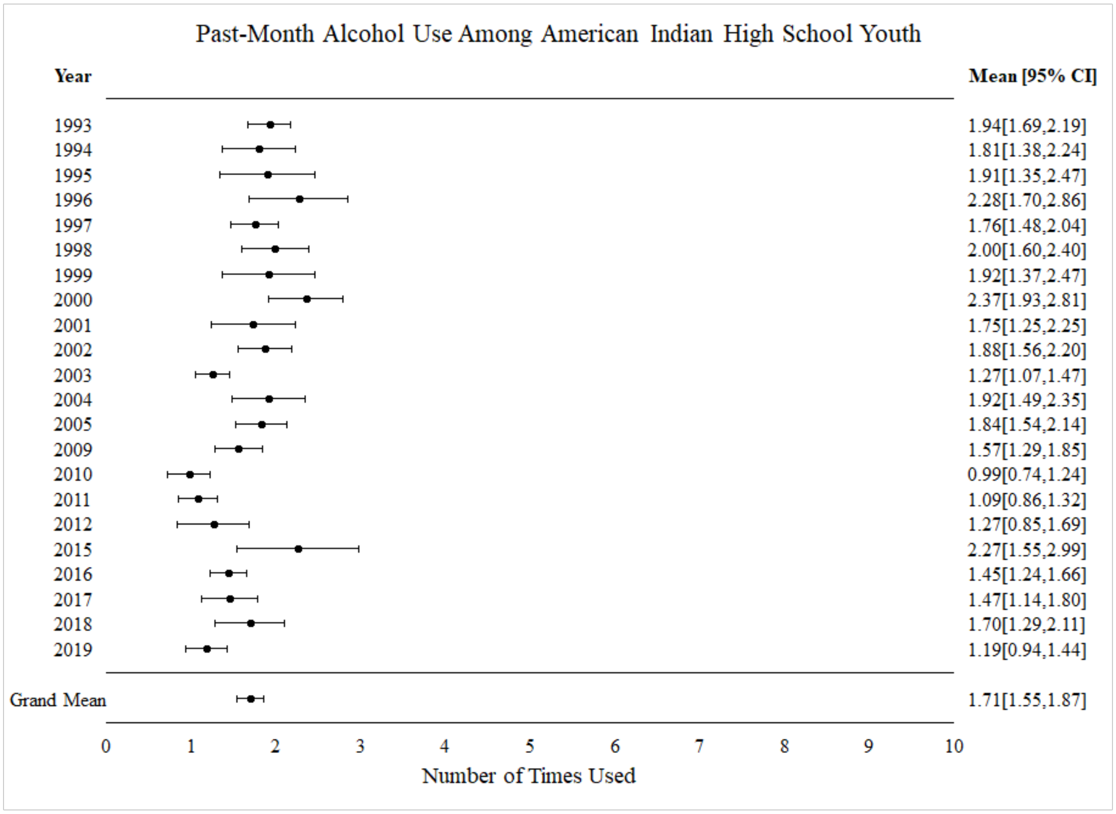
Note: Sample sizes for each year: 1993, n = 554; 1994, n = 179; 1995, n = 111; 1996, n = 166; 1997, n = 425; 1998, n = 312; 1999, n = 179; 2000, n = 239; 2001, n = 145; 2002, n = 608; 2003, n = 539; 2004, n = 271; 2005, n = 275; 2009, n = 456; 2010, n = 440; 2011, n = 405; 2012, n = 82; 2015, n = 136; 2016, n = 693; 2017, n = 529; 2018, n = 641; 2019, n = 181



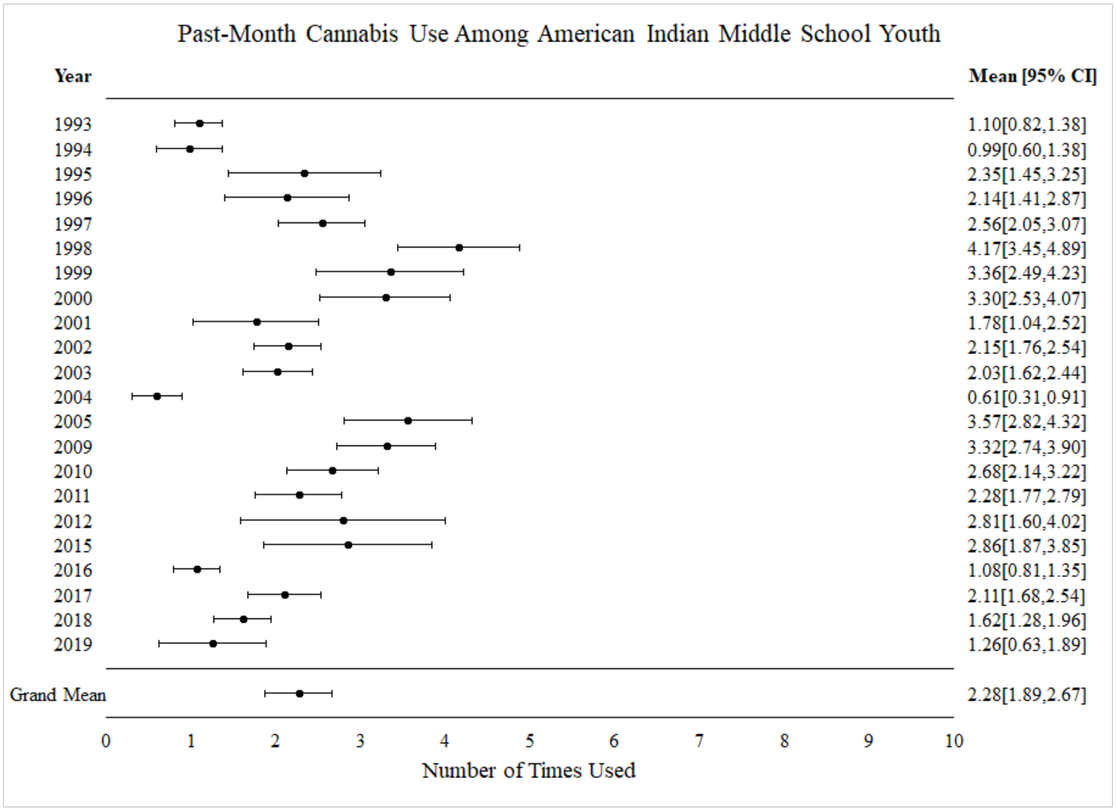
Note: Sample sizes for each year: 1993, n = 926; 1994, n = 248; 1995, n = 176; 1996, n = 180; 1997, n = 708; 1998, n = 338; 1999, n = 166; 2000, n = 363; 2001, n = 244; 2002, n = 533; 2003, n = 909; 2004, n = 361; 2005, n = 563; 2009, n = 475; 2010, n = 423; 2011, n = 728; 2012, n = 191; 2015, n = 171; 2016, n = 1394; 2017, n = 497; 2018, n = 427; 2019, n = 717



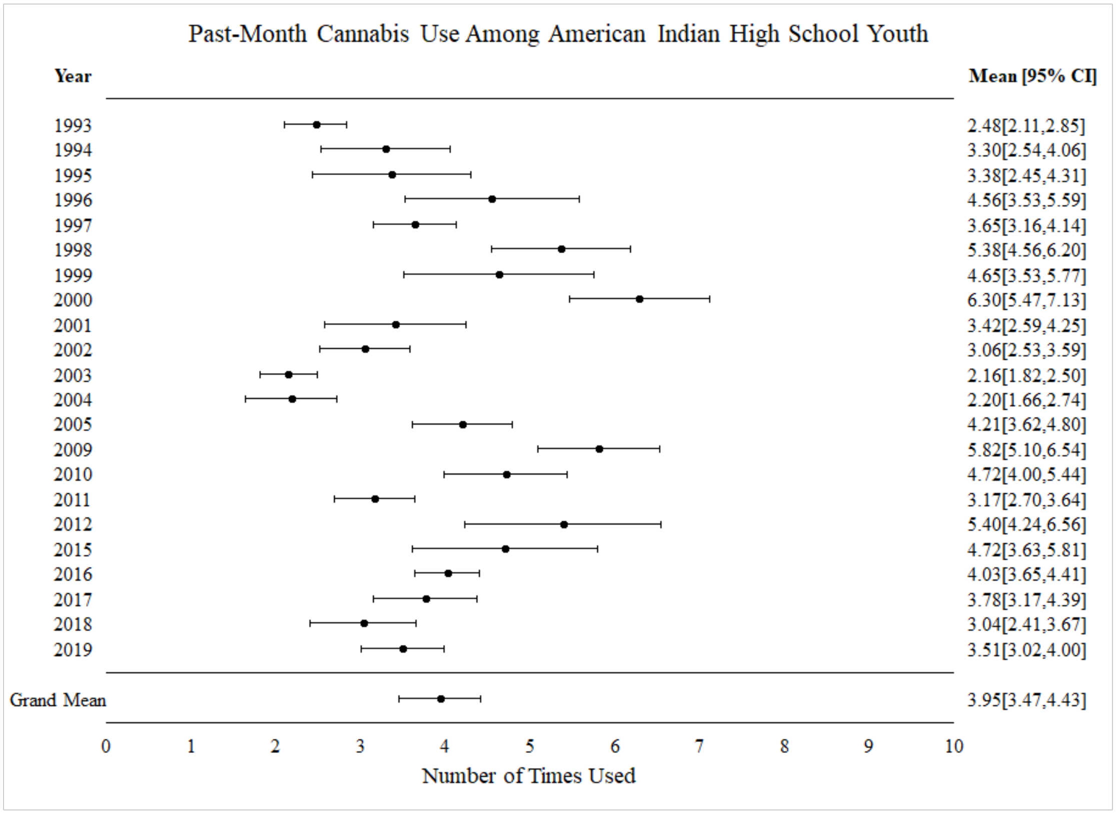
Note: Sample sizes for each year: 1993, n = 550; 1994, n = 174; 1995, n = 106; 1996, n = 160; 1997, n = 408; 1998, n = 299; 1999, n = 172; 2000, n = 236; 2001, n = 136; 2002, n = 587; 2003, n = 524; 2004, n = 270; 2005, n = 273; 2009, n = 454; 2010, n = 432; 2011, n = 404; 2012, n = 80; 2015, n = 136; 2016, n = 692; 2017, n = 529; 2018, n = 646; 2019, n = 182



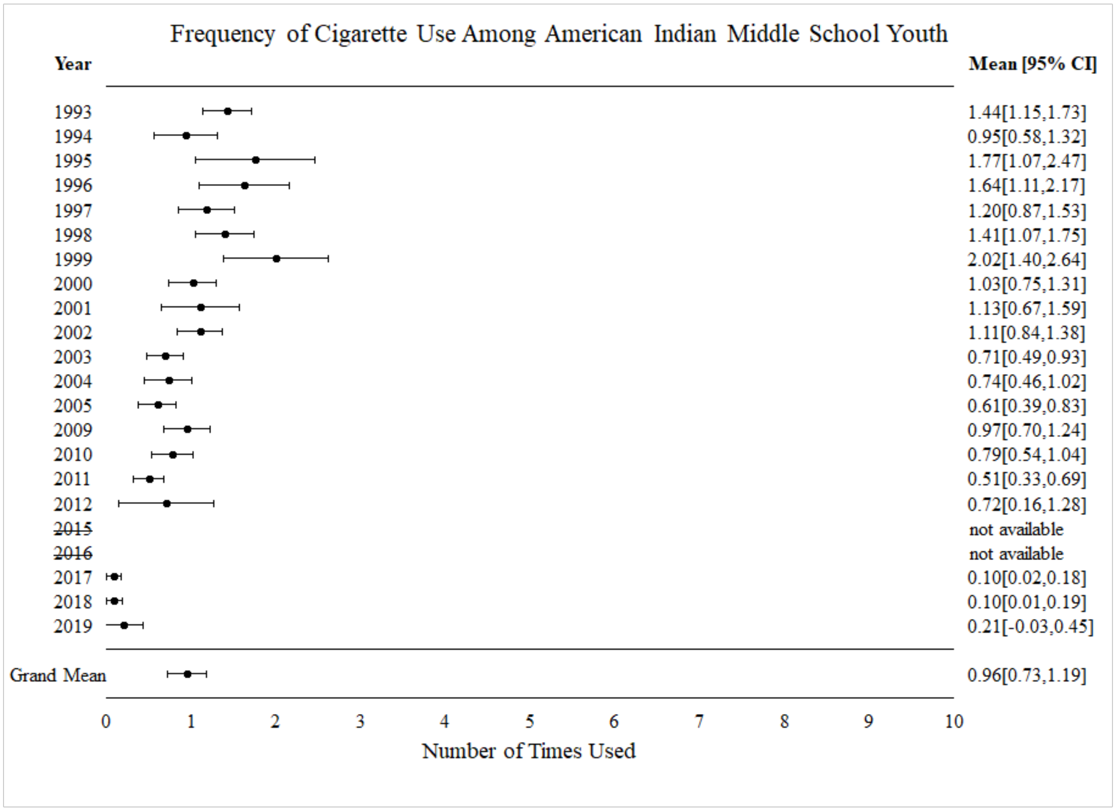
Note: Sample sizes for each year: 1993, n = 913; 1994, n = 245; 1995, n = 170; 1996, n = 169; 1997, n = 696; 1998, n = 327; 1999, n = 164; 2000, n = 350; 2001, n = 237; 2002, n = 524; 2003, n = 900; 2004, n = 351; 2005, n = 553; 2009, n = 485; 2010, n = 415; 2011, n = 725; 2012, n = 192; 2015, n = 171; 2016, n = 1398; 2017, n = 499; 2018, n = 428; 2019, n = 720



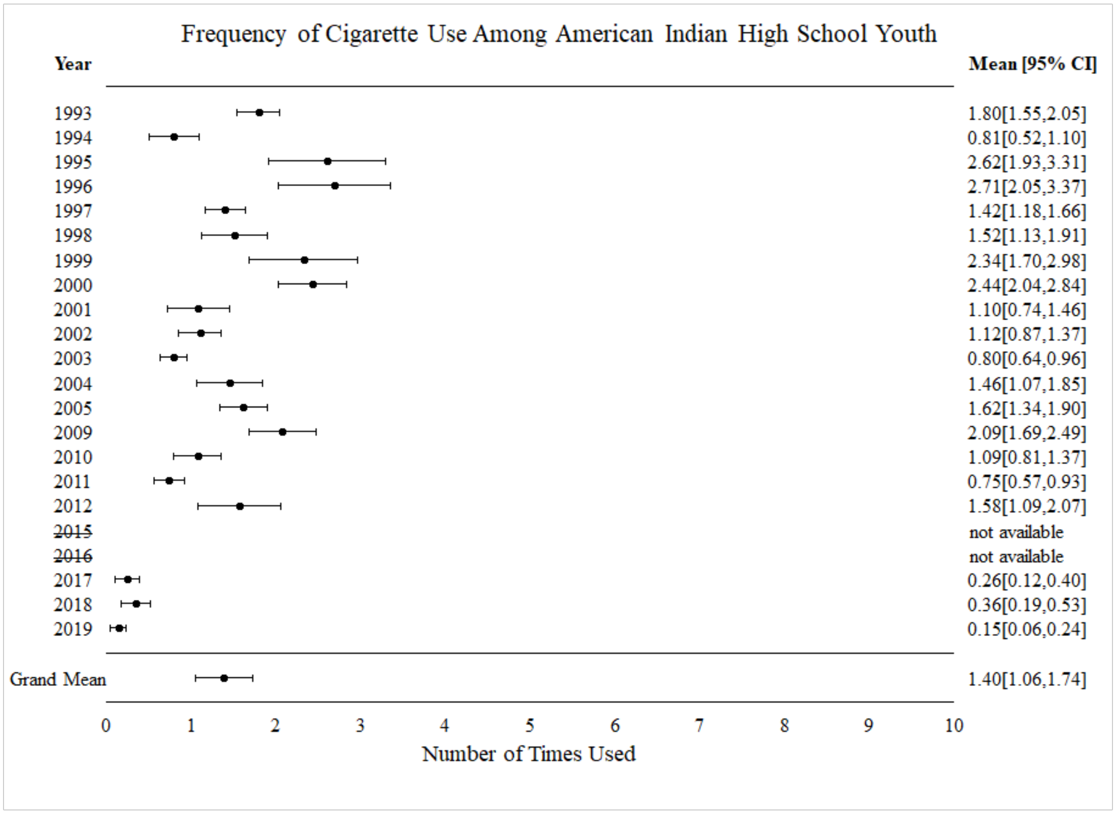
Note: Sample sizes for each year: 1993, n = 554; 1994, n = 179; 1995, n = 111; 1996, n = 167; 1997, n = 423; 1998, n = 315; 1999, n = 179; 2000, n = 238; 2001, n = 145; 2002, n = 607; 2003, n = 541; 2004, n = 272; 2005, n = 276; 2009, n = 455; 2010, n = 441; 2011, n = 406; 2012, n = 82; 2015, n = 136; 2016, n = 693; 2017, n = 529; 2018, n = 641; 2019, n = 181



Note: Sample sizes for each year: 1993, n = 929; 1994, n = 250; 1995, n = 179; 1996, n = 181; 1997, n = 710; 1998, n = 338; 1999, n = 166; 2000, n = 366; 2001, n = 244; 2002, n = 535; 2003, n = 911; 2004, n = 361; 2005, n = 563; 2009, n = 479; 2010, n = 424; 2011, n = 728; 2012, n = 191; 2015, n = 171; 2016, n = 1394; 2017, n = 497; 2018, n = 427; 2019, n = 717



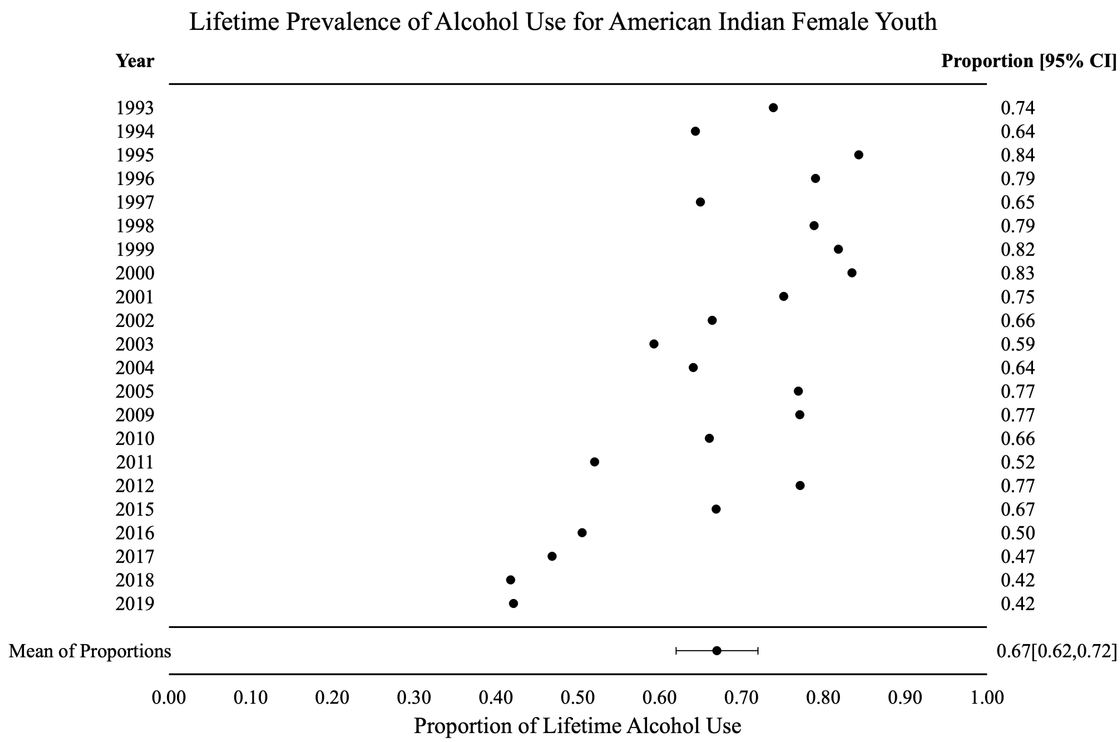
Note: Sample sizes for each year: 1993, n = 553; 1994, n = 178; 1995, n = 110; 1996, n = 166; 1997, n = 419; 1998, n = 312; 1999, n = 178; 2000, n = 238; 2001, n = 145; 2002, n = 604; 2003, n = 538; 2004, n = 273; 2005, n = 274; 2009, n = 447; 2010, n = 438; 2011, n = 405; 2012, n = 79; 2017, n = 529; 2018, n = 646; 2019, n = 184



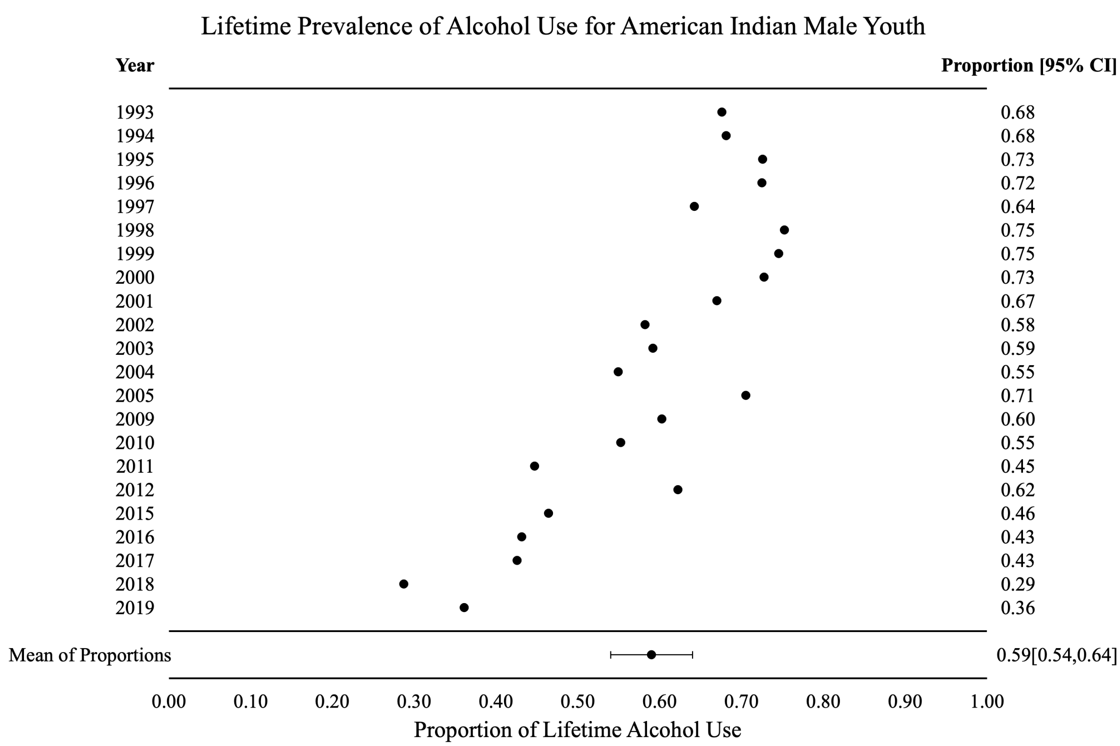
Note: Sample sizes for each year: 1993, n = 922; 1994, n = 245; 1995, n = 178; 1996, n = 181; 1997, n = 710; 1998, n = 337; 1999, n = 164; 2000, n = 366; 2001, n = 243; 2002, n = 533; 2003, n = 904; 2004, n = 361; 2005, n = 561; 2009, n = 474; 2010, n = 419; 2011, n = 723; 2012, n = 192; 2017, n = 500; 2018, n = 429; 2019, n = 724

APPENDIX E

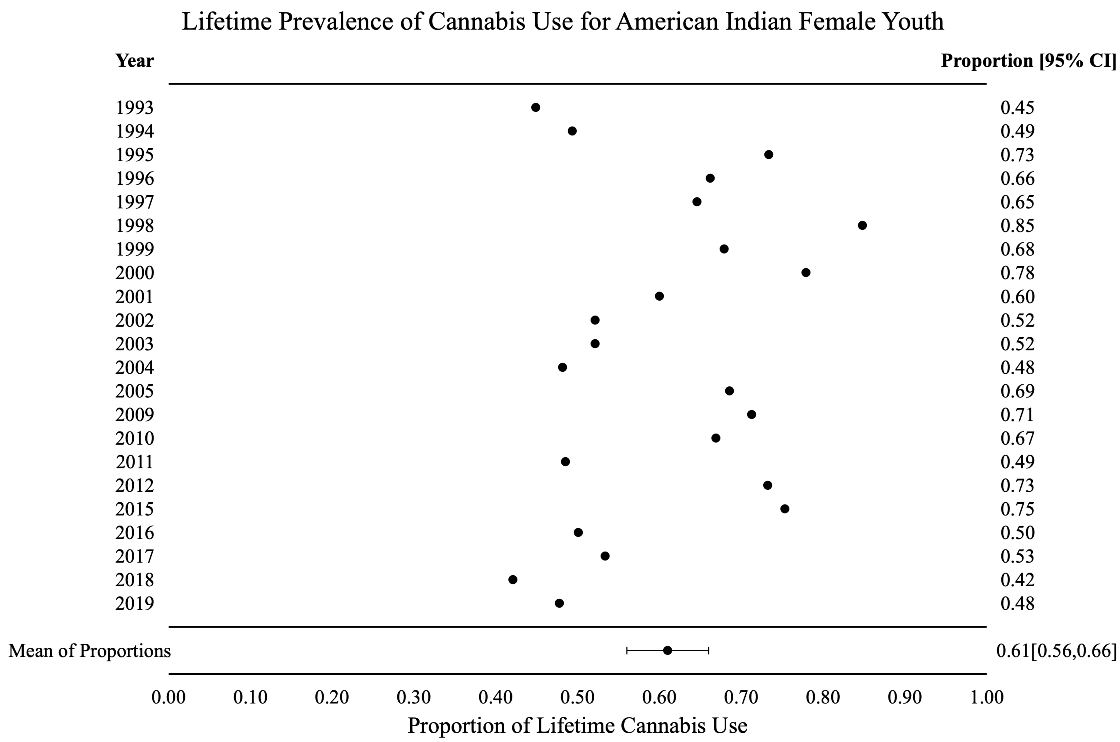
Aim 2: Substance Use for American Indian Youth by Year and Sex



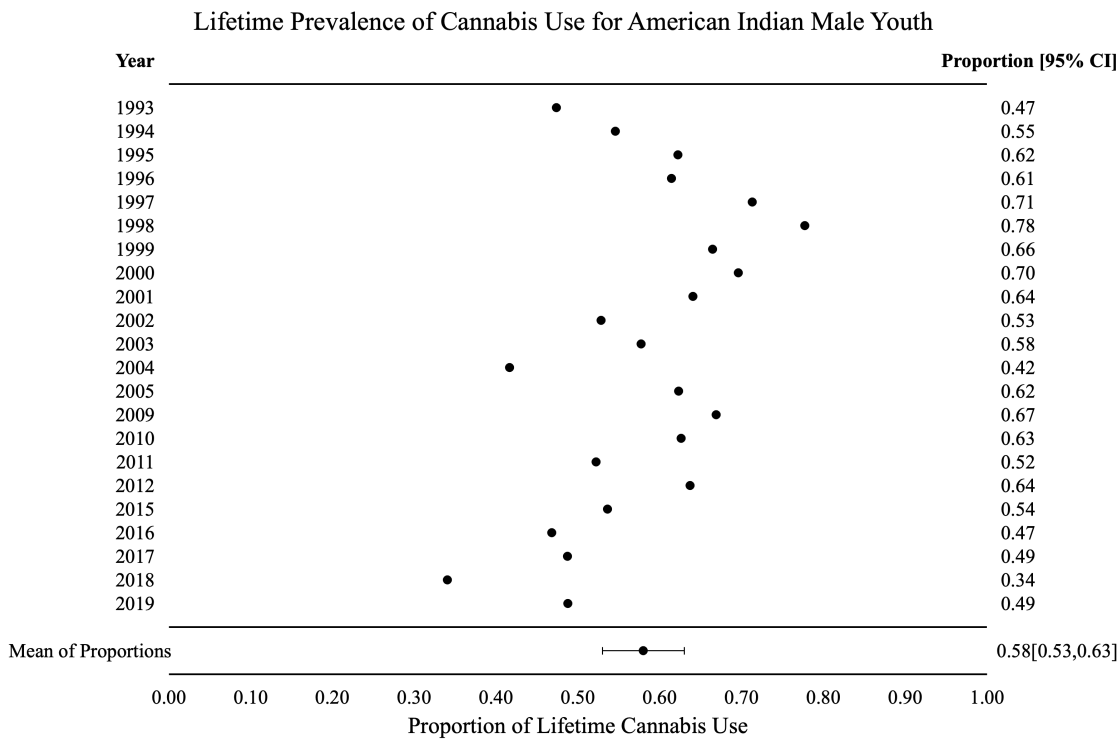
Note: Sample sizes for each year: 1993, n = 743; 1994, n = 216; 1995, n = 153; 1996, n = 205; 1997, n = 577; 1998, n = 322; 1999, n = 187; 2000, n = 303; 2001, n = 185; 2002, n = 536; 2003, n = 747; 2004, n = 323; 2005, n = 421; 2009, n = 450; 2010, n = 430; 2011, n = 538; 2012, n = 127; 2015, n = 154; 2016, n = 1109; 2017, n = 523; 2018, n = 546; 2019, n = 451



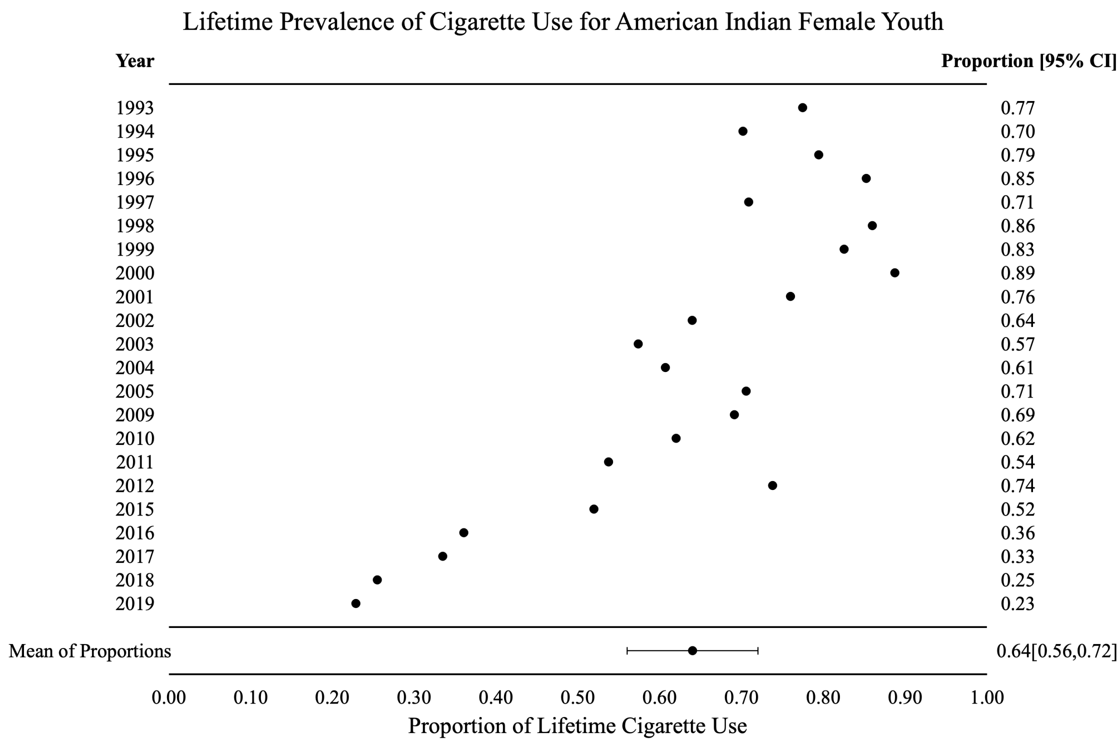
Note: Sample sizes for each year: 1993, n = 728; 1994, n = 207; 1995, n = 135; 1996, n = 138; 1997, n = 551; 1998, n = 327; 1999, n = 157; 2000, n = 297; 2001, n = 203; 2002, n = 603; 2003, n = 693; 2004, n = 304; 2005, n = 414; 2009, n = 473; 2010, n = 420; 2011, n = 566; 2012, n = 135; 2015, n = 153; 2016, n = 979; 2017, n = 503; 2018, n = 526; 2019, n = 446



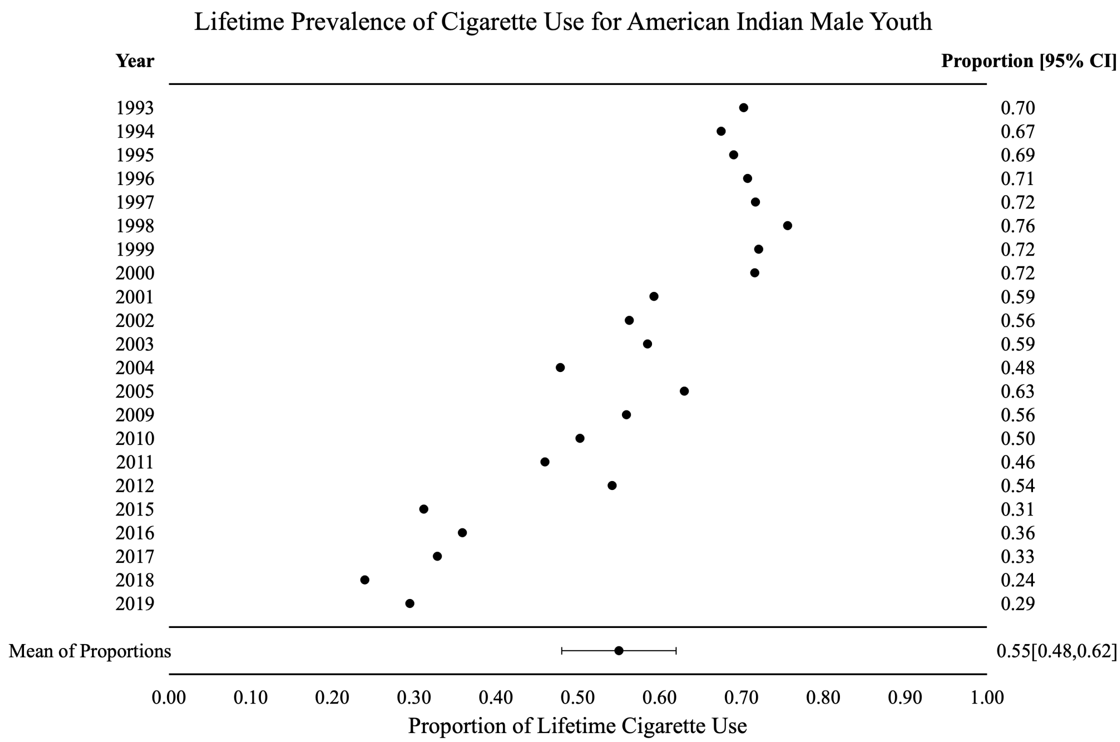
Note: Sample sizes for each year: 1993, n = 744; 1994, n = 217; 1995, n = 154; 1996, n = 207; 1997, n = 579; 1998, n = 322; 1999, n = 187; 2000, n = 303; 2001, n = 185; 2002, n = 537; 2003, n = 748; 2004, n = 322; 2005, n = 420; 2009, n = 442; 2010, n = 426; 2011, n = 534; 2012, n = 127; 2015, n = 154; 2016, n = 1106; 2017, n = 521; 2018, n = 542; 2019, n = 448



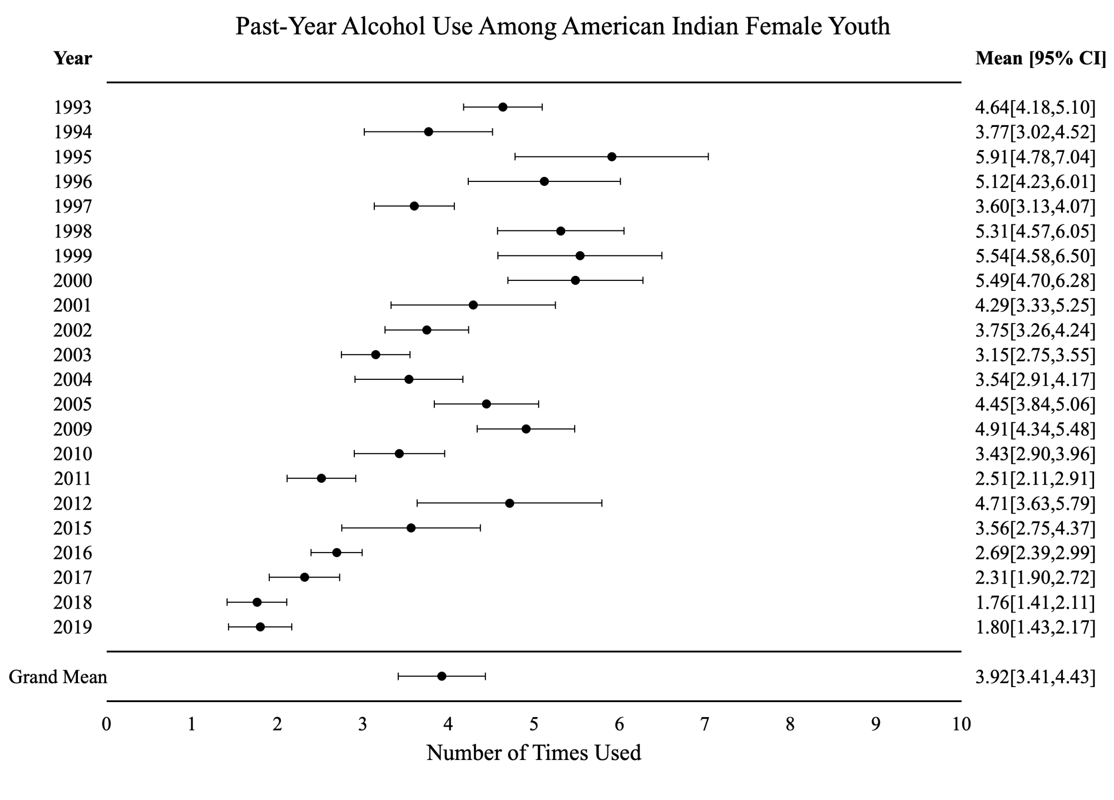
Note: Sample sizes for each year: 1993, n = 726; 1994, n = 207; 1995, n = 135; 1996, n = 140; 1997, n = 551; 1998, n = 323; 1999, n = 158; 2000, n = 296; 2001, n = 203; 2002, n = 602; 2003, n = 688; 2004, n = 305; 2005, n = 414; 2009, n = 465; 2010, n = 412; 2011, n = 561; 2012, n = 135; 2015, n = 153; 2016, n = 977; 2017, n = 501; 2018, n = 523; 2019, n = 445



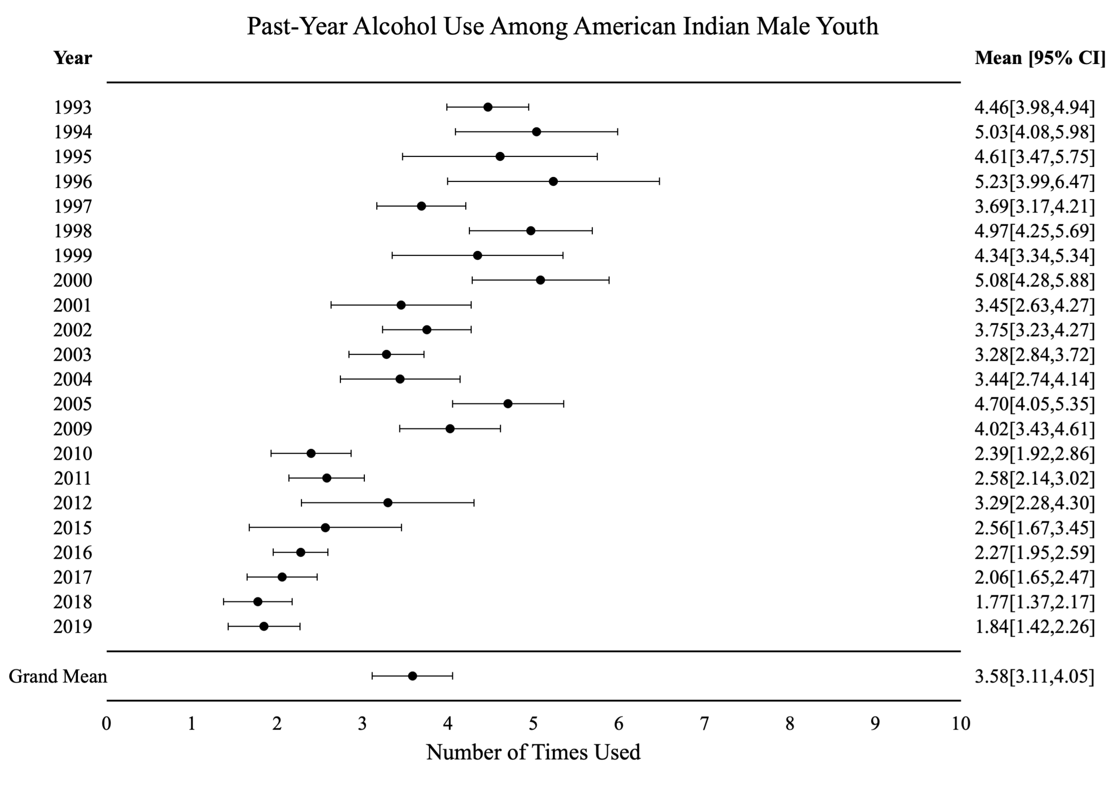
Note: Sample sizes for each year: 1993, n = 688; 1994, n = 191; 1995, n = 141; 1996, n = 183; 1997, n = 529; 1998, n = 271; 1999, n = 166; 2000, n = 257; 2001, n = 175; 2002, n = 480; 2003, n = 664; 2004, n = 285; 2005, n = 367; 2009, n = 437; 2010, n = 416; 2011, n = 521; 2012, n = 126; 2015, n = 154; 2016, n = 1110; 2017, n = 523; 2018, n = 546; 2019, n = 455



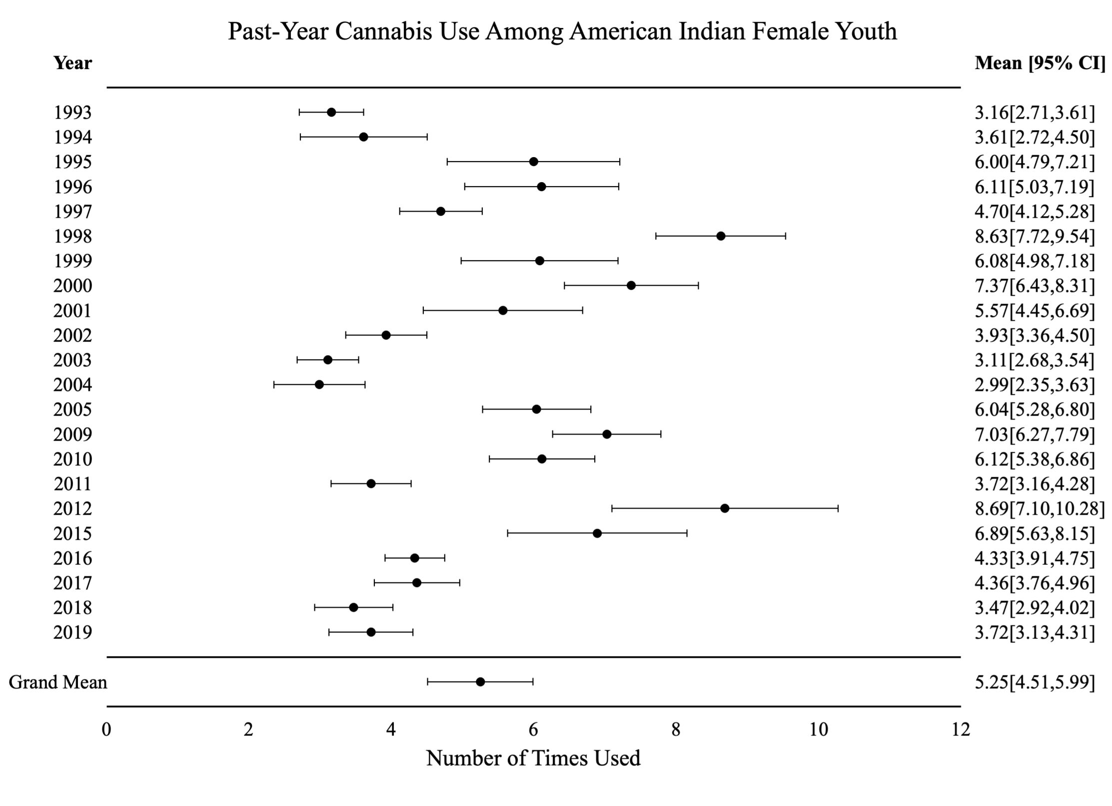
Note: Sample sizes for each year: 1993, n = 625; 1994, n = 163; 1995, n = 113; 1996, n = 123; 1997, n = 470; 1998, n = 279; 1999, n = 129; 2000, n = 257; 2001, n = 172; 2002, n = 501; 2003, n = 564; 2004, n = 255; 2005, n = 346; 2009, n = 440; 2010, n = 394; 2011, n = 546; 2012, n = 131; 2015, n = 154; 2016, n = 984; 2017, n = 503; 2018, n = 526; 2019, n = 448



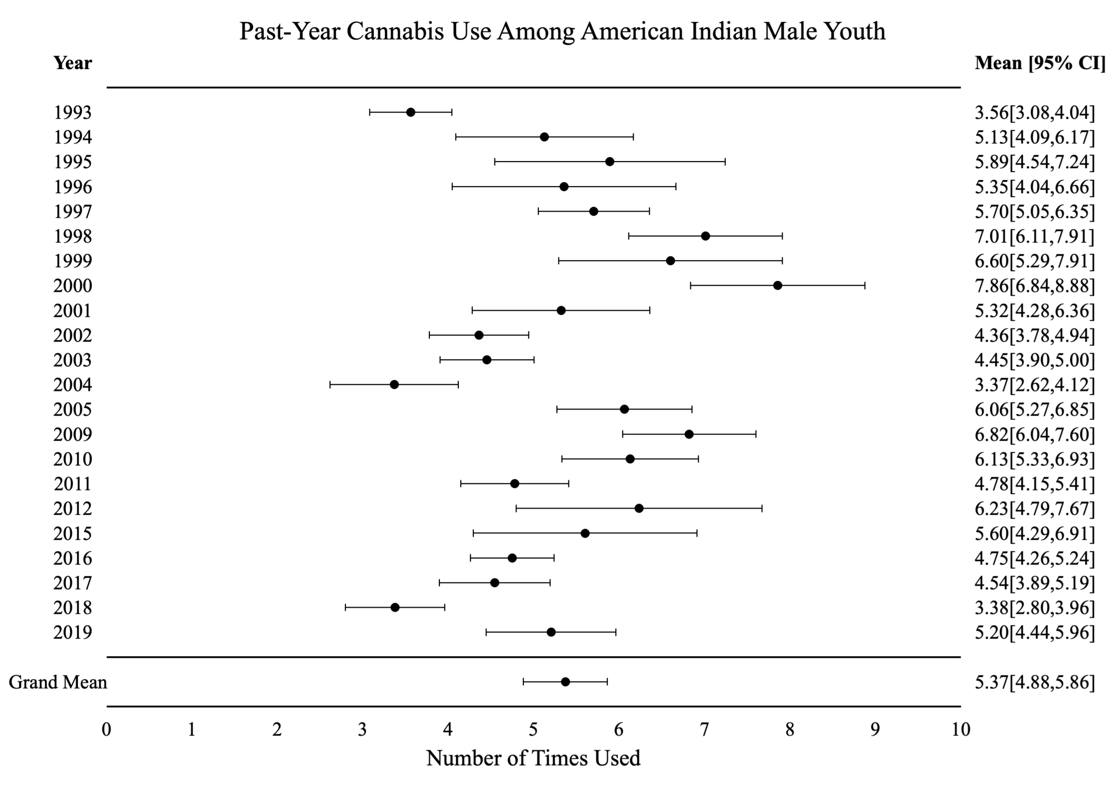
Note: Sample sizes for each year: 1993, n = 728; 1994, n = 215; 1995, n = 147; 1996, n = 197; 1997, n = 568; 1998, n = 306; 1999, n = 183; 2000, n = 292; 2001, n = 178; 2002, n = 530; 2003, n = 732; 2004, n = 322; 2005, n = 411; 2009, n = 447; 2010, n = 419; 2011, n = 532; 2012, n = 127; 2015, n = 154; 2016, n = 1108; 2017, n = 523; 2018, n = 545; 2019, n = 451



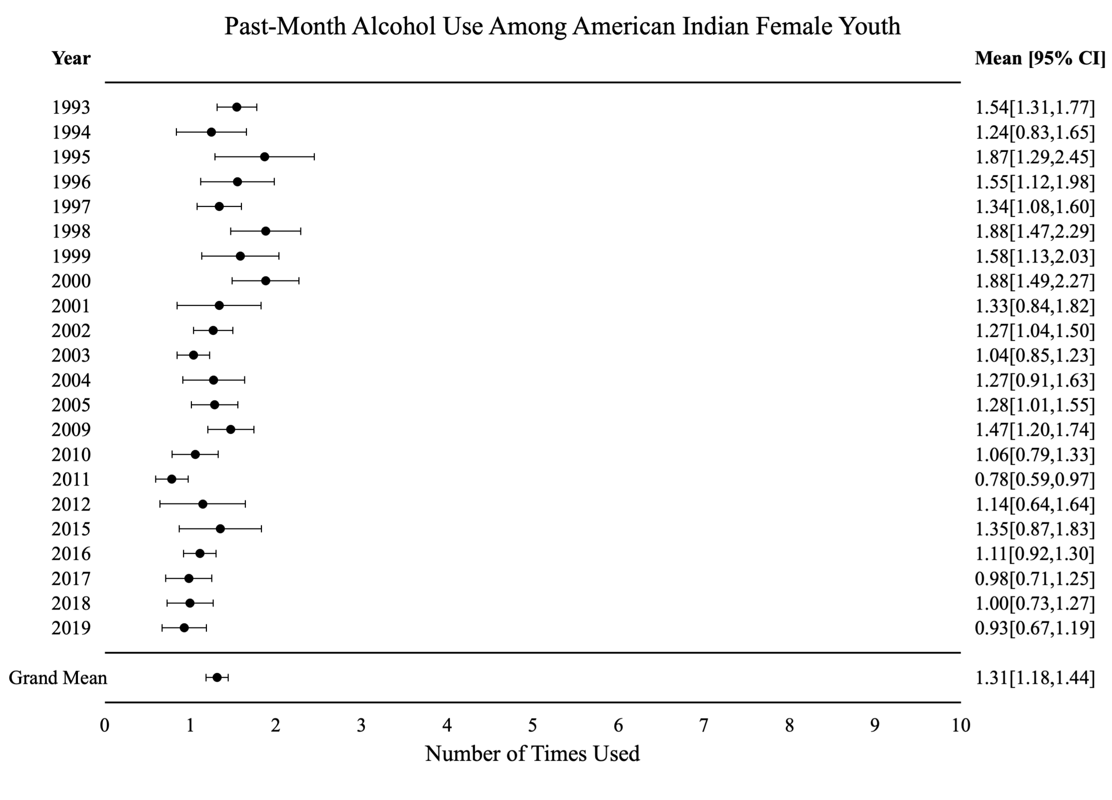
Note: Sample sizes for each year: 1993, n = 709; 1994, n = 201; 1995, n = 128; 1996, n = 134; 1997, n = 531; 1998, n = 319; 1999, n = 151; 2000, n = 281; 2001, n = 195; 2002, n = 582; 2003, n = 675; 2004, n = 292; 2005, n = 405; 2009, n = 466; 2010, n = 407; 2011, n = 559; 2012, n = 133; 2015, n = 153; 2016, n = 979; 2017, n = 502; 2018, n = 525; 2019, n = 446



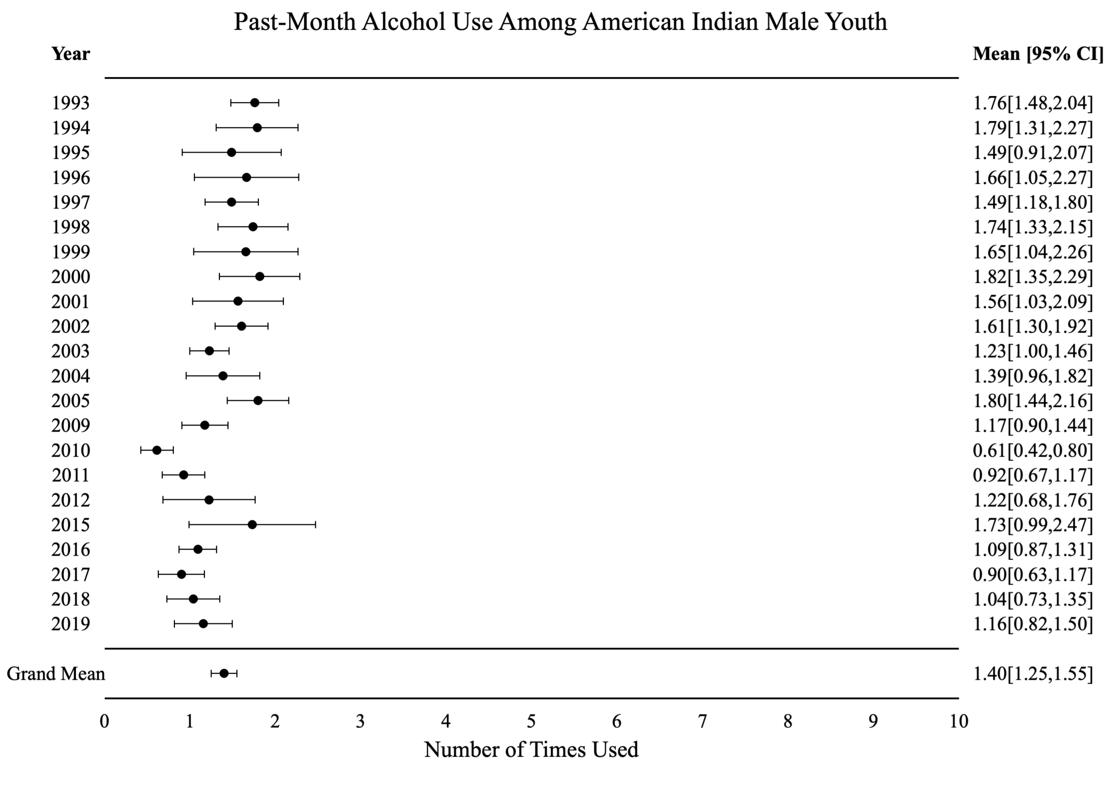
Note: Sample sizes for each year: 1993, n = 742; 1994, n = 217; 1995, n = 153; 1996, n = 205; 1997, n = 579; 1998, n = 321; 1999, n = 187; 2000, n = 302; 2001, n = 184; 2002, n = 539; 2003, n = 748; 2004, n = 322; 2005, n = 421; 2009, n = 443; 2010, n = 425; 2011, n = 534; 2012, n = 126; 2015, n = 154; 2016, n = 1106; 2017, n = 522; 2018, n = 542; 2019, n = 448



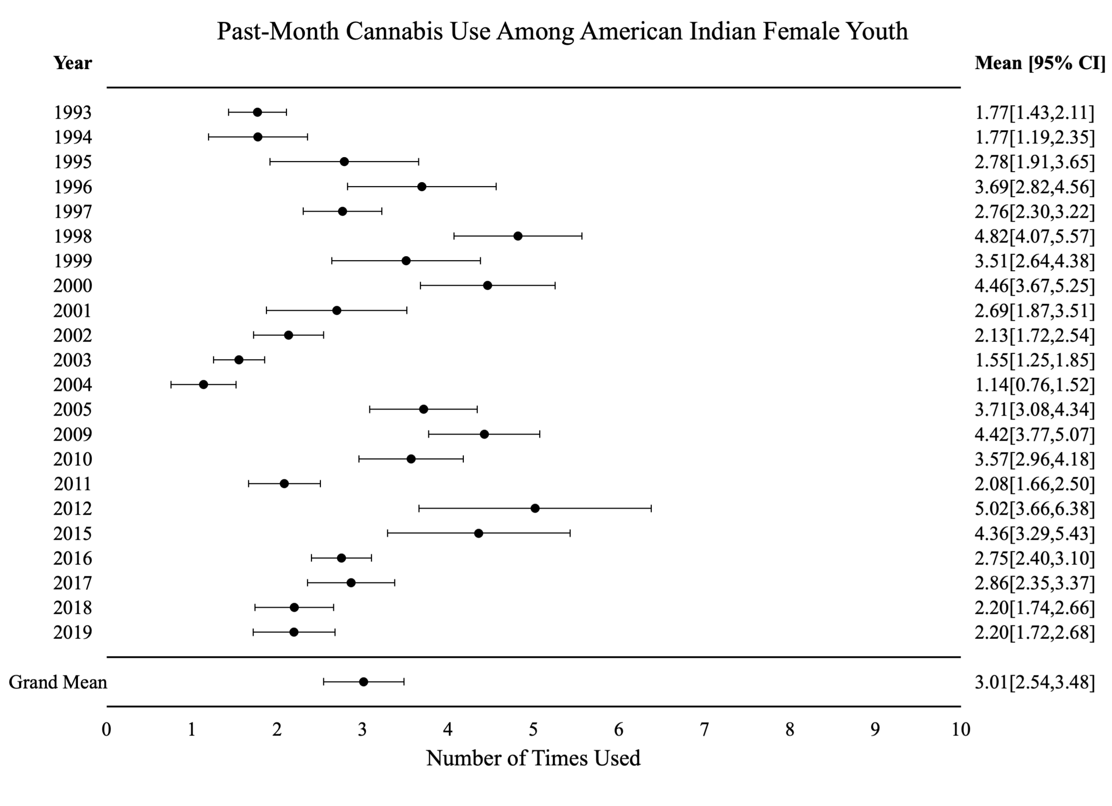
Note: Sample sizes for each year: 1993, n = 724; 1994, n = 204; 1995, n = 134; 1996, n = 140; 1997, n = 550; 1998, n = 323; 1999, n = 158; 2000, n = 294; 2001, n = 203; 2002, n = 599; 2003, n = 690; 2004, n = 304; 2005, n = 413; 2009, n = 462; 2010, n = 412; 2011, n = 558; 2012, n = 135; 2015, n = 153; 2016, n = 977; 2017, n = 501; 2018, n = 522; 2019, n = 445



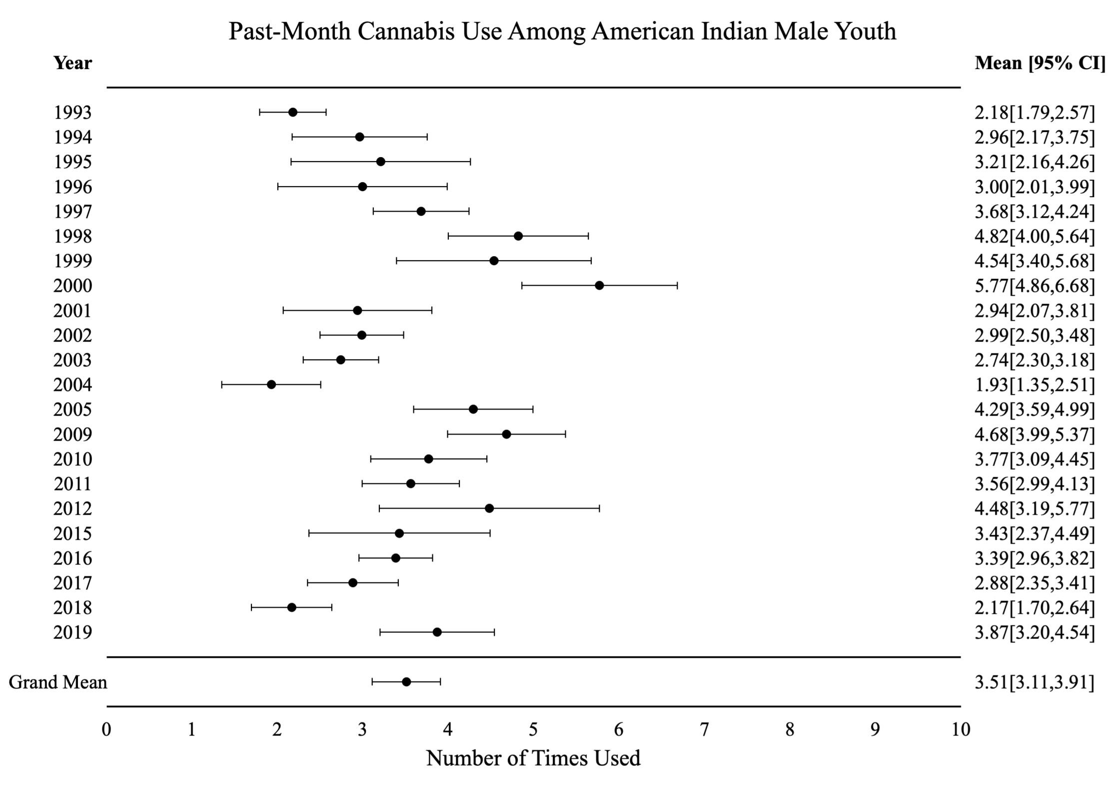
Note: Sample sizes for each year: 1993, n = 732; 1994, n = 214; 1995, n = 146; 1996, n = 199; 1997, n = 569; 1998, n = 307; 1999, n = 183; 2000, n = 296; 2001, n = 178; 2002, n = 524; 2003, n = 739; 2004, n = 318; 2005, n = 418; 2009, n = 444; 2010, n = 416; 2011, n = 531; 2012, n = 127; 2015, n = 154; 2016, n = 1107; 2017, n = 523; 2018, n = 546; 2019, n = 451



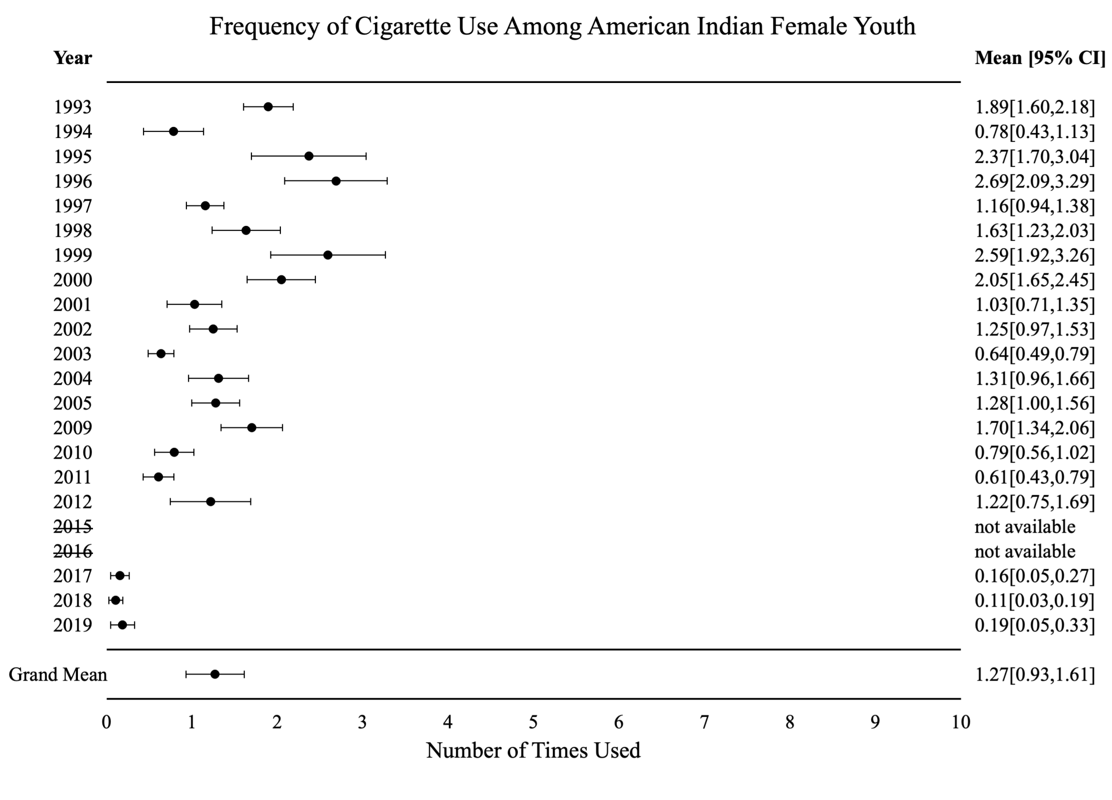
Note: Sample sizes for each year: 1993, n = 717; 1994, n = 199; 1995, n = 130; 1996, n = 129; 1997, n = 531; 1998, n = 314; 1999, n = 153; 2000, n = 284; 2001, n = 193; 2002, n = 584; 2003, n = 675; 2004, n = 297; 2005, n = 404; 2009, n = 468; 2010, n = 405; 2011, n = 558; 2012, n = 133; 2015, n = 153; 2016, n = 979; 2017, n = 502; 2018, n = 525; 2019, n = 446



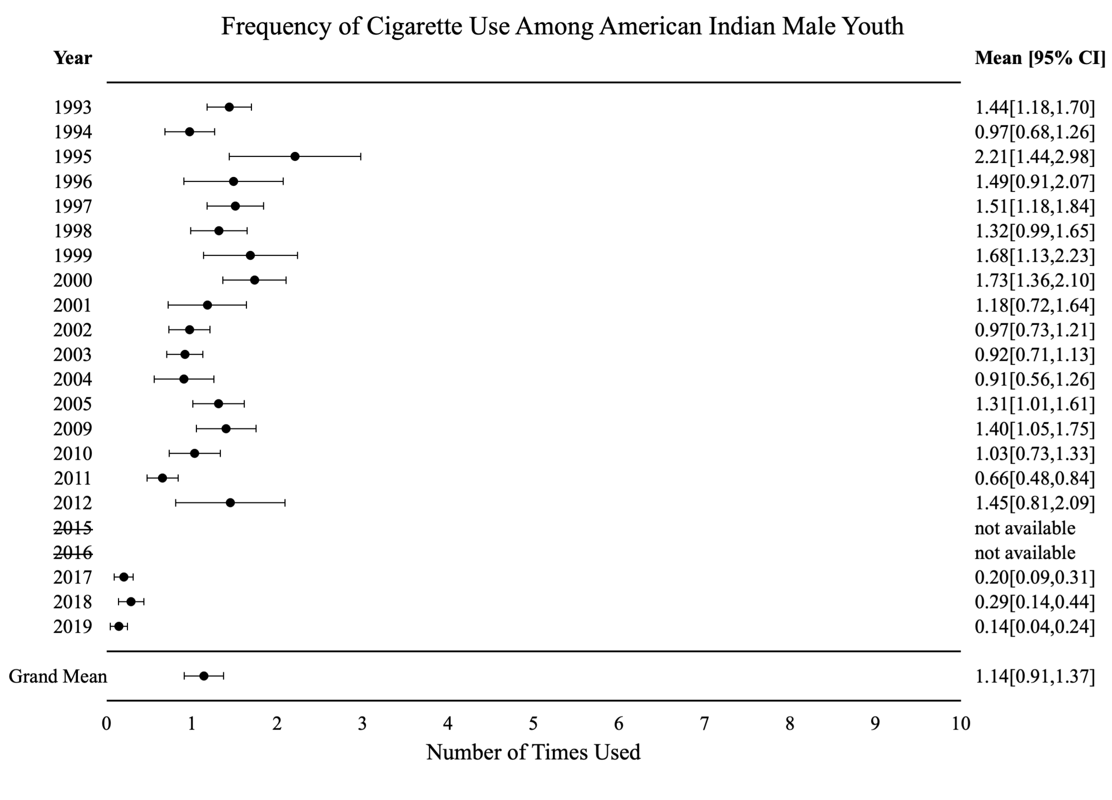
Note: Sample sizes for each year: 1993, n = 743; 1994, n = 217; 1995, n = 154; 1996, n = 207; 1997, n = 578; 1998, n = 321; 1999, n = 187; 2000, n = 303; 2001, n = 184; 2002, n = 539; 2003, n = 750; 2004, n = 323; 2005, n = 421; 2009, n = 444; 2010, n = 426; 2011, n = 535; 2012, n = 127; 2015, n = 154; 2016, n = 1106; 2017, n = 522; 2018, n = 542; 2019, n = 448



Note: Sample sizes for each year: 1993, n = 725; 1994, n = 206; 1995, n = 136; 1996, n = 140; 1997, n = 551; 1998, n = 326; 1999, n = 158; 2000, n = 295; 2001, n = 203; 2002, n = 600; 2003, n = 692; 2004, n = 304; 2005, n = 414; 2009, n = 464; 2010, n = 413; 2011, n = 560; 2012, n = 134; 2015, n = 153; 2016, n = 977; 2017, n = 501; 2018, n = 522; 2019, n = 445



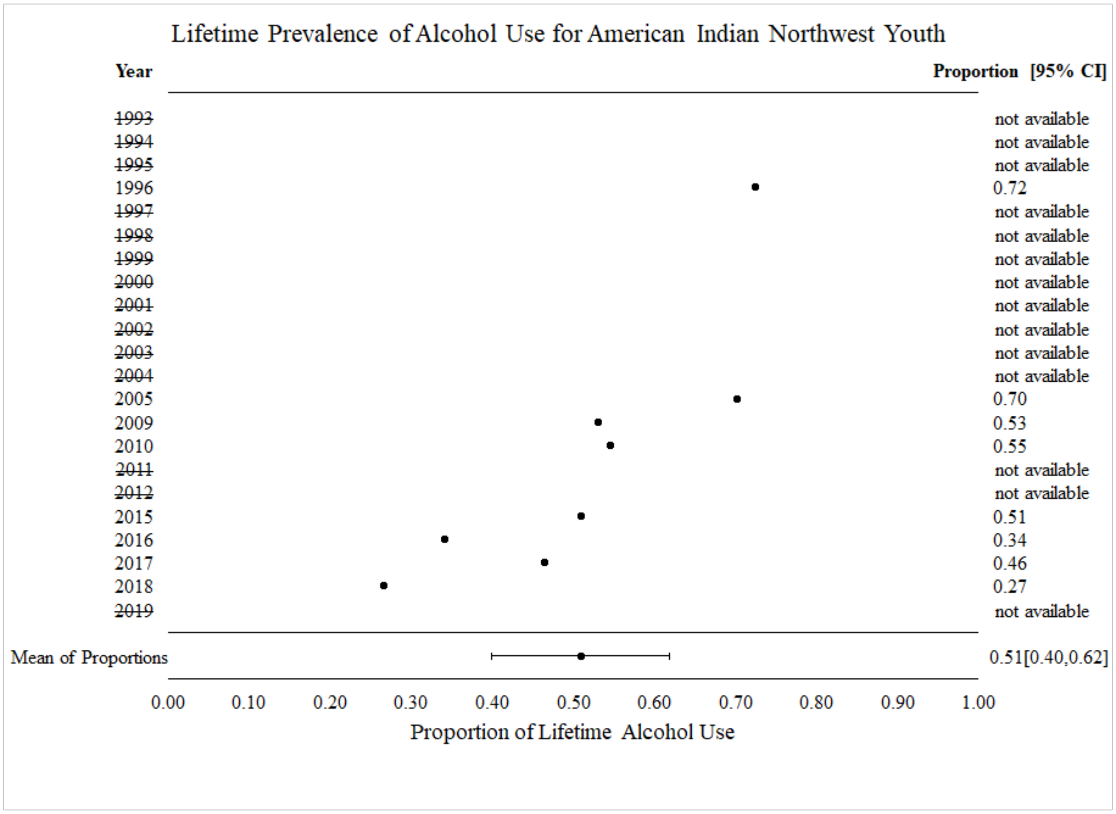
Note: Sample sizes for each year: 1993, n = 738; 1994, n = 214; 1995, n = 154; 1996, n = 207; 1997, n = 577; 1998, n = 320; 1999, n = 184; 2000, n = 302; 2001, n = 185; 2002, n = 534; 2003, n = 748; 2004, n = 323; 2005, n = 420; 2009, n = 438; 2010, n = 423; 2011, n = 531; 2012, n = 127; 2017, n = 523; 2018, n = 546; 2019, n = 455



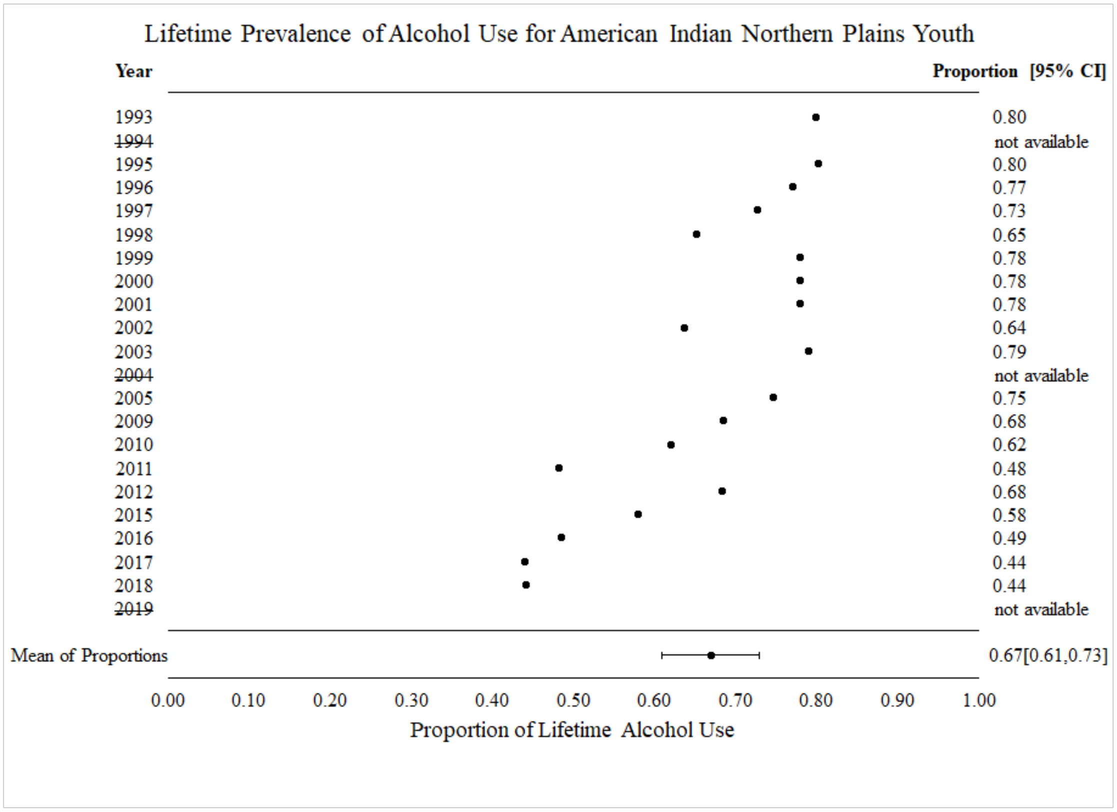
Note: Sample sizes for each year: 1993, n = 723; 1994, n = 203; 1995, n = 134; 1996, n = 139; 1997, n = 548; 1998, n = 323; 1999, n = 158; 2000, n = 297; 2001, n = 201; 2002, n = 600; 2003, n = 684; 2004, n = 305; 2005, n = 411; 2009, n = 458; 2010, n = 409; 2011, n = 556; 2012, n = 132; 2017, n = 503; 2018, n = 526; 2019, n = 448

APPENDIX F

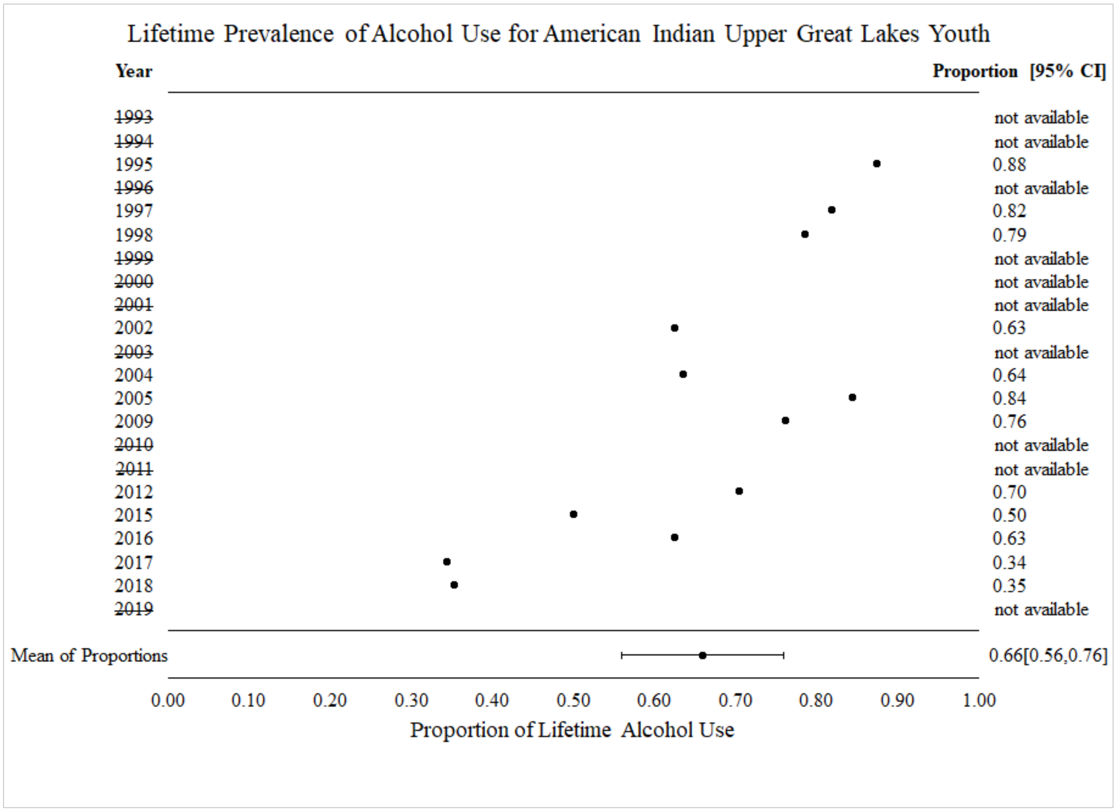
Aim 2: Substance Use for American Indian Youth by Year and Region



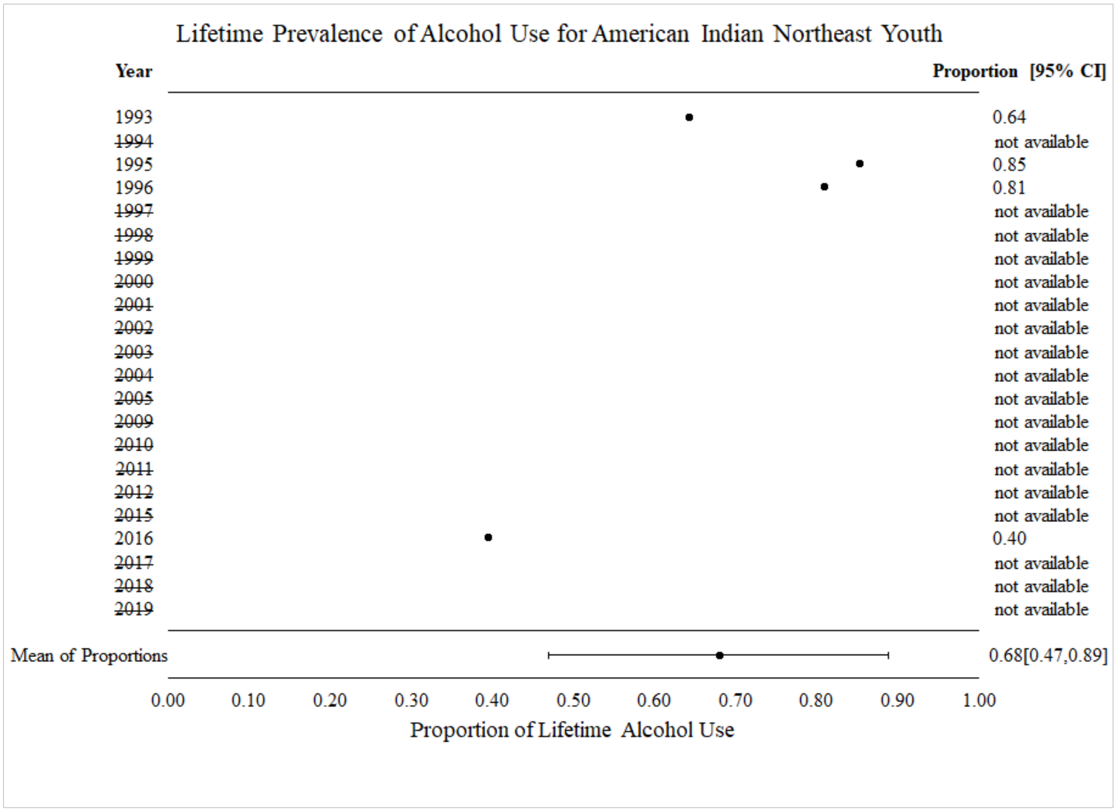
Note: Sample sizes for each year: 1996, n = 87; 2005, n = 94; 2009, n = 64; 2010, n = 11; 2015, n = 49; 2016, n = 44; 2017, n = 71; 2018, n = 15



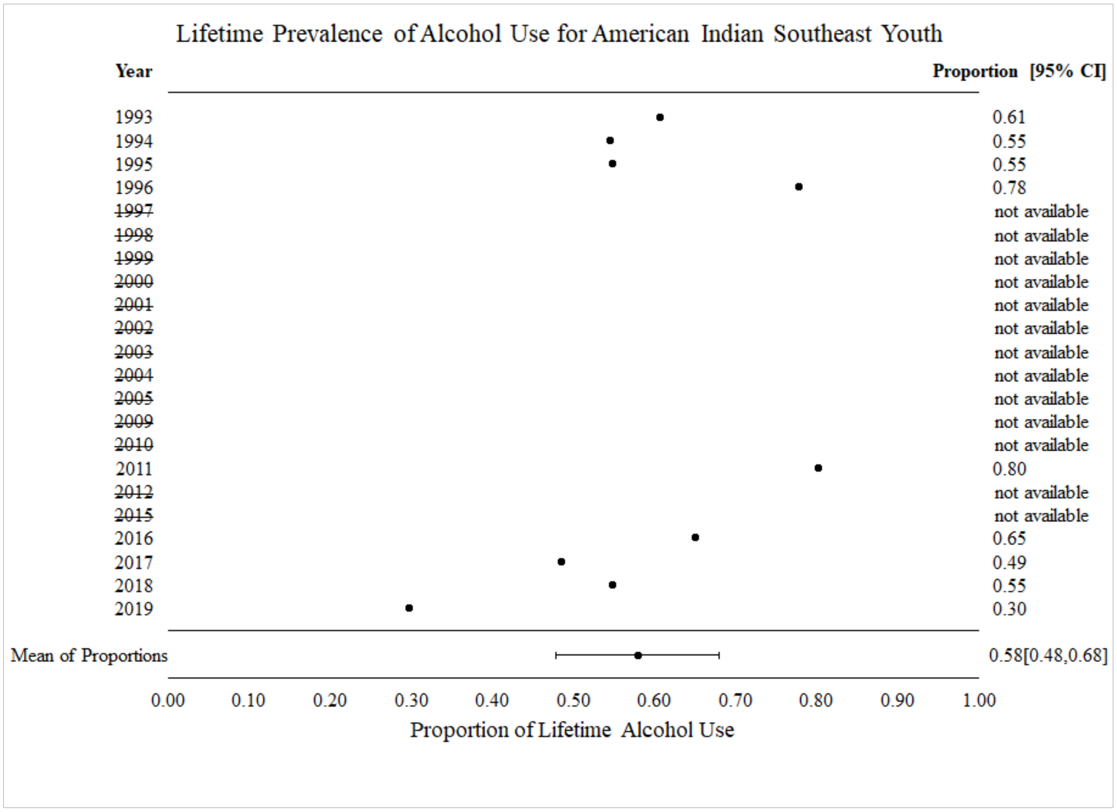
Note: Sample sizes for each year: 1993, n = 369; 1995, n = 193; 1996, n = 161; 1997, n = 99; 1998, n = 132; 1999, n = 250; 2000, n = 606; 2001, n = 50; 2002, n = 251; 2003, n = 62; 2005, n = 442; 2009, n = 514; 2010, n = 702; 2011, n = 332; 2012, n = 142; 2015, n = 198; 2016, n = 578; 2017, n = 220; 2018, n = 120



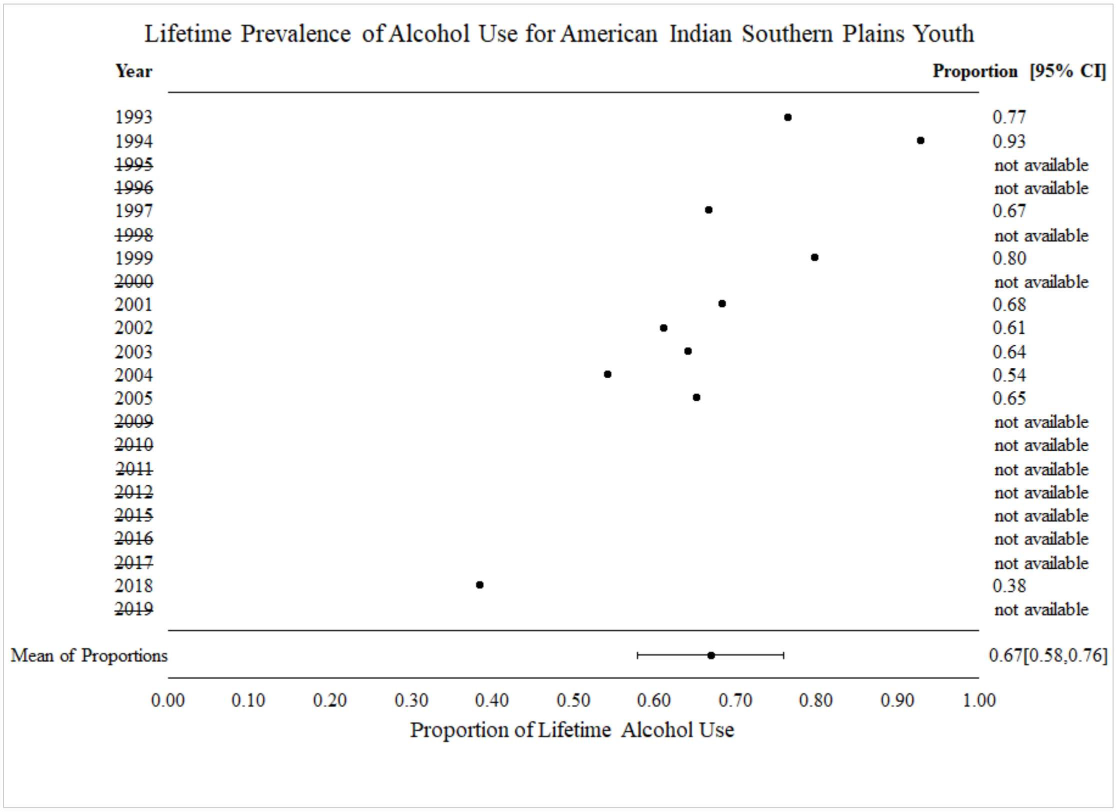
Note: Sample sizes for each year: 1995, n = 16; 1997, n = 127; 1998, n = 205; 2002, n = 64; 2004, n = 77; 2005, n = 122; 2009, n = 222; 2012, n = 132; 2015, n = 46; 2016, n = 64; 2017, n = 119; 2018, n = 68



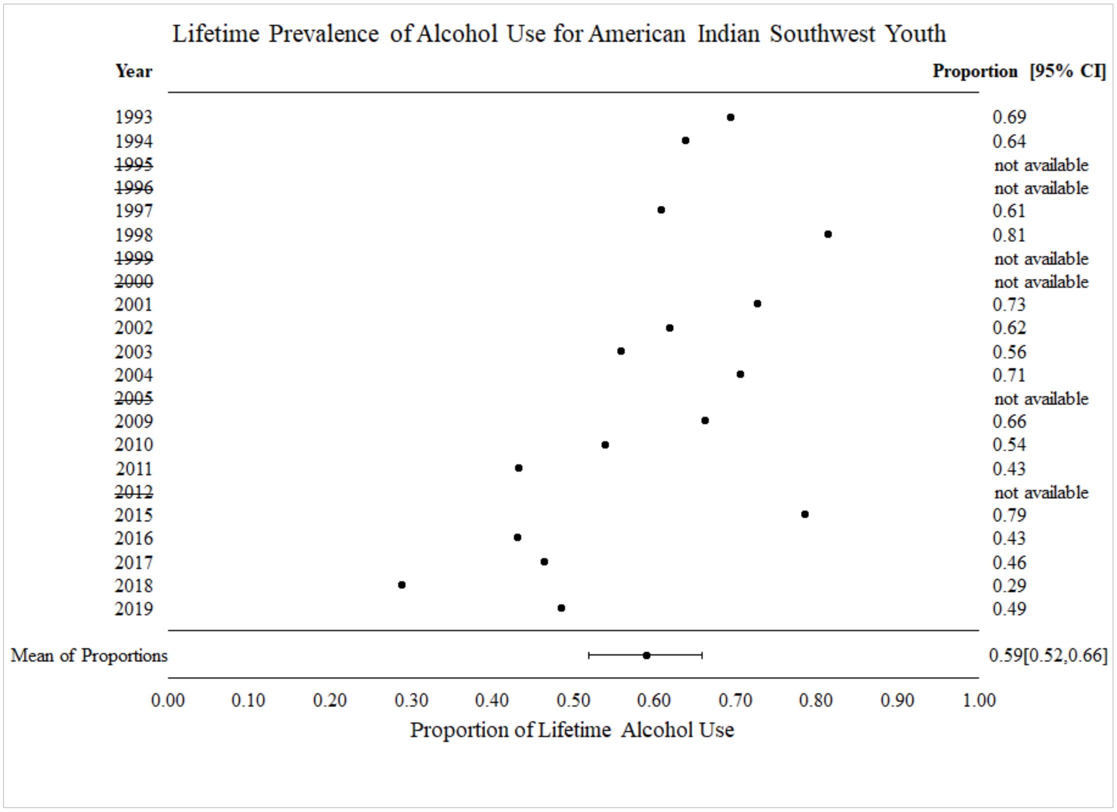
Note: Sample sizes for each year: 1993, n = 42; 1995, n = 48; 1996, n = 42; 2016, n = 86



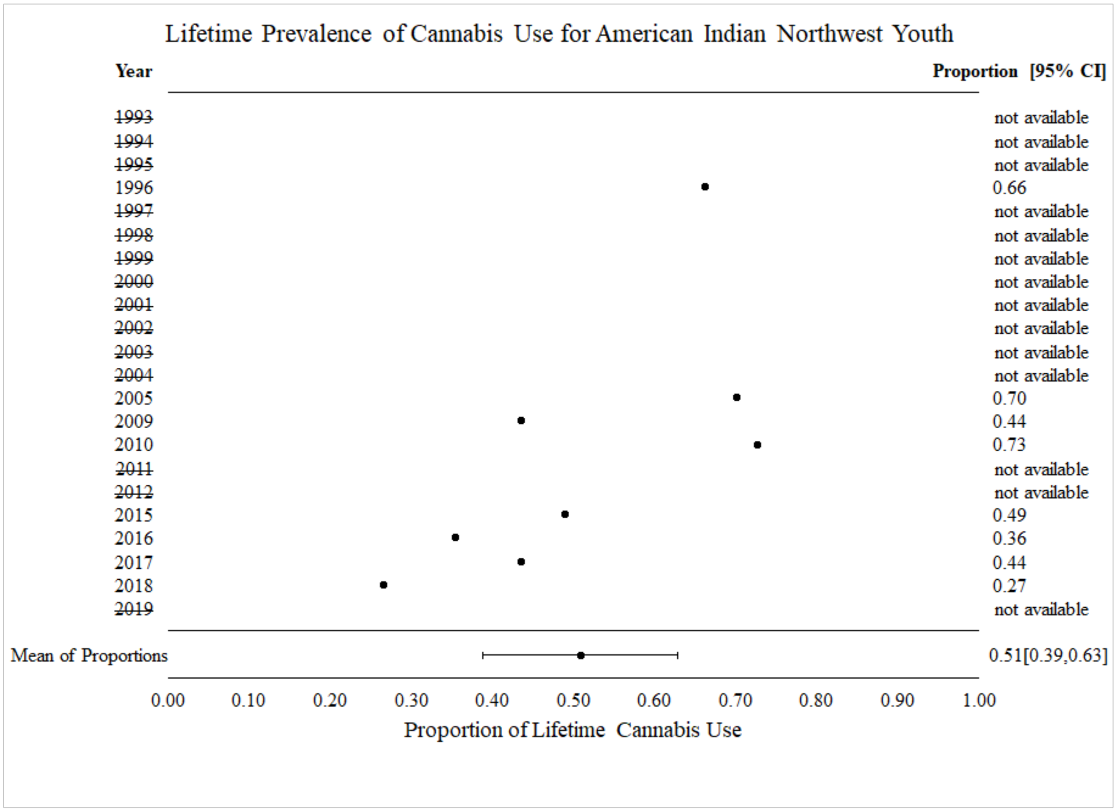
Note: Sample sizes for each year: 1993, n = 377; 1994, n = 11; 1995, n = 31; 1996, n = 54; 2011, n = 116; 2016, n = 209; 2017, n = 101; 2018, n = 177; 2019, n = 451



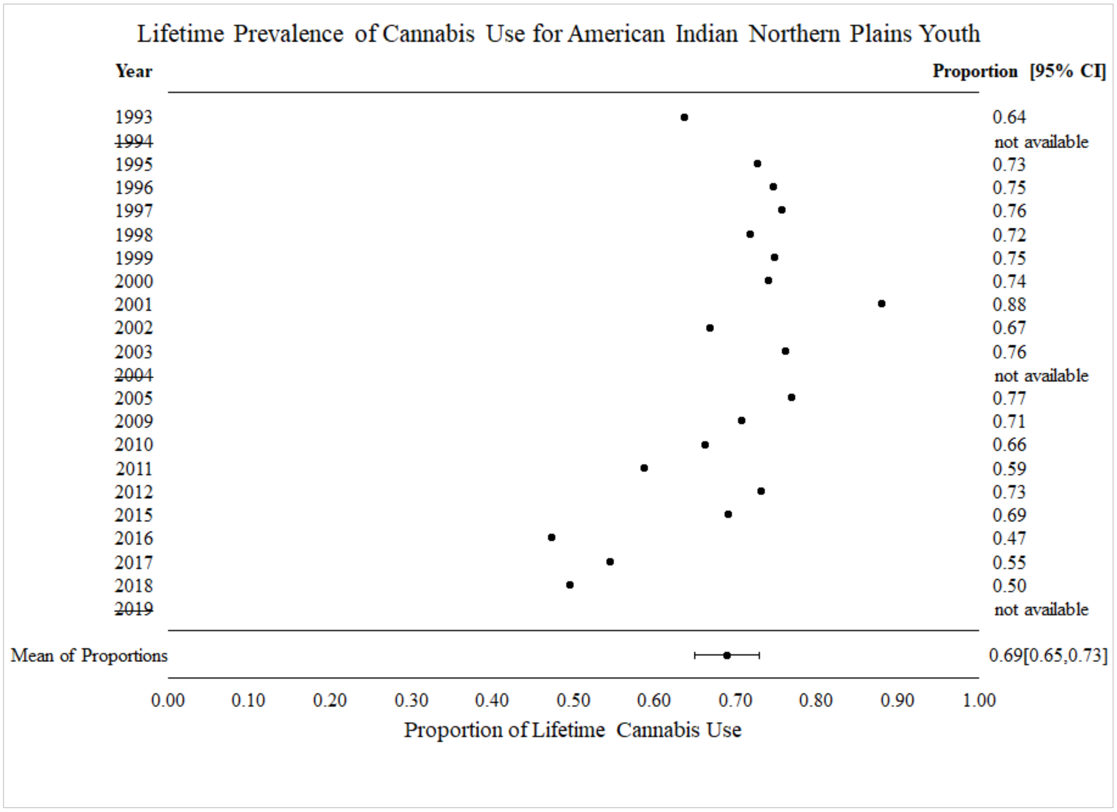
Note: Sample sizes for each year: 1993, n = 213; 1994, n = 42; 1997, n = 93; 1999, n = 94; 2001, n = 215; 2002, n = 530; 2003, n = 407; 2004, n = 393; 2005, n = 181; 2018, n = 13



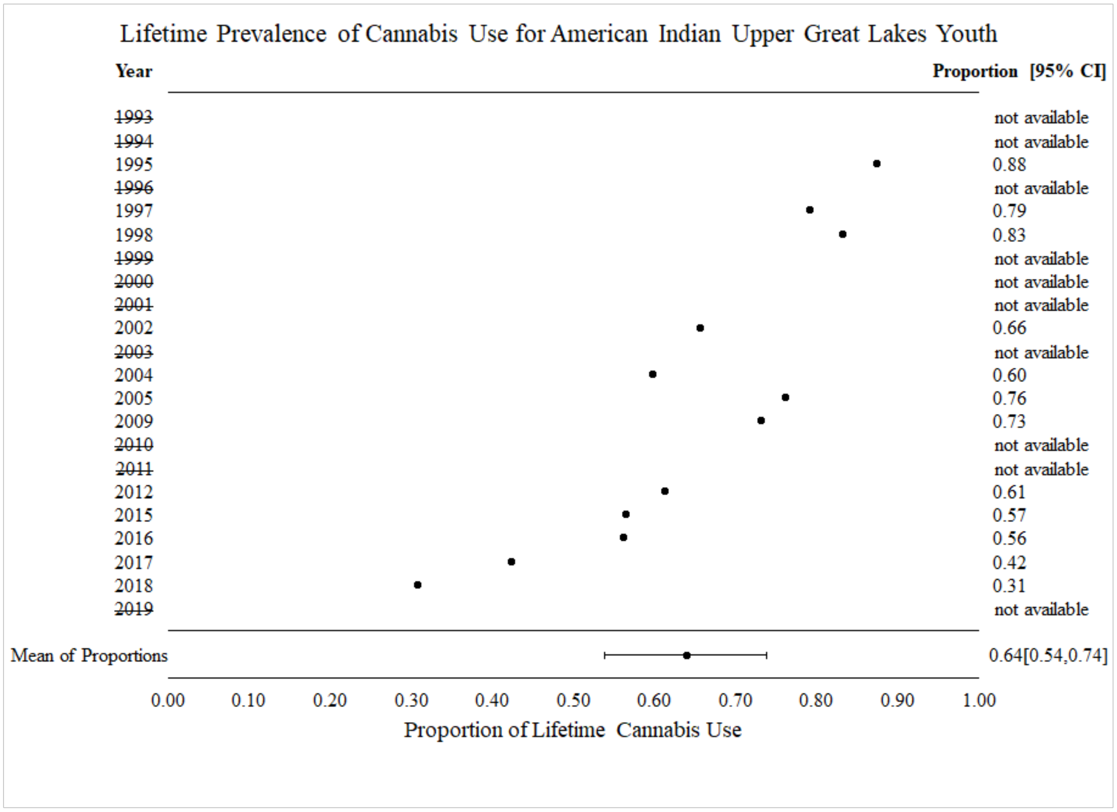
Note: Sample sizes for each year: 1993, n = 483; 1994, n = 376; 1997, n = 813; 1998, n = 318; 2001, n = 125; 2002, n = 297; 2003, n = 981; 2004, n = 163; 2009, n = 151; 2010, n = 163; 2011, n = 697; 2015, n = 14; 2016, n = 1112; 2017, n = 524; 2018, n = 683; 2019, n = 451



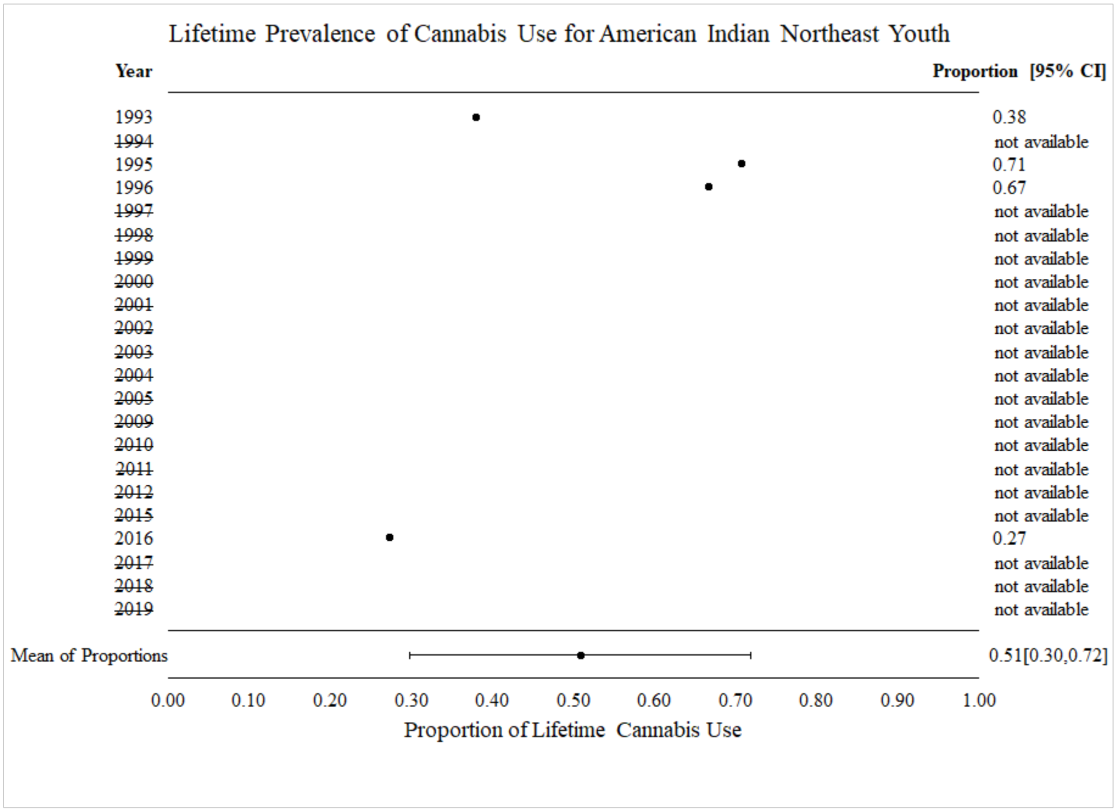
Note: Sample sizes for each year: 1996, n = 89; 2005, n = 94; 2009, n = 62; 2010, n = 11; 2015, n = 49; 2016, n = 45; 2017, n = 71; 2018, n = 15



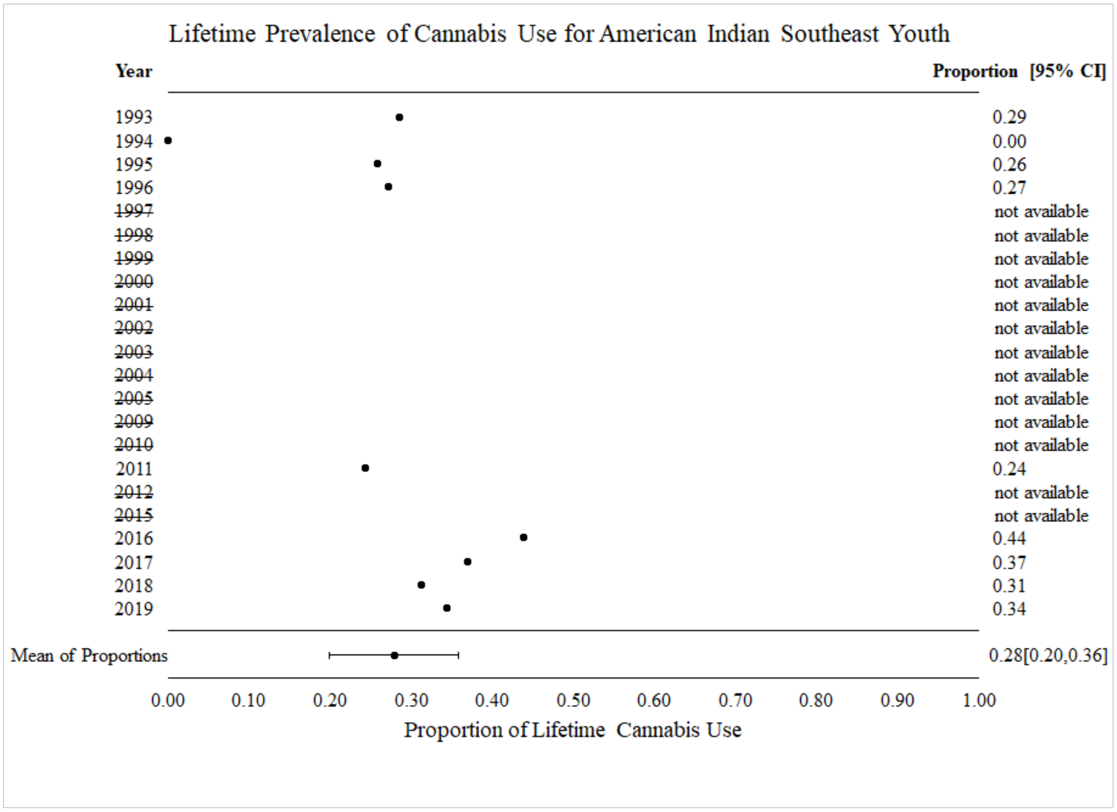
Note: Sample sizes for each year: 1993, n = 369; 1995, n = 194; 1996, n = 162; 1997, n = 99; 1998, n = 131; 1999, n = 251; 2000, n = 605; 2001, n = 50; 2002, n = 251; 2003, n = 63; 2005, n = 441; 2009, n = 502; 2010, n = 690; 2011, n = 325; 2012, n = 142; 2015, n = 198; 2016, n = 577; 2017, n = 220; 2018, n = 119



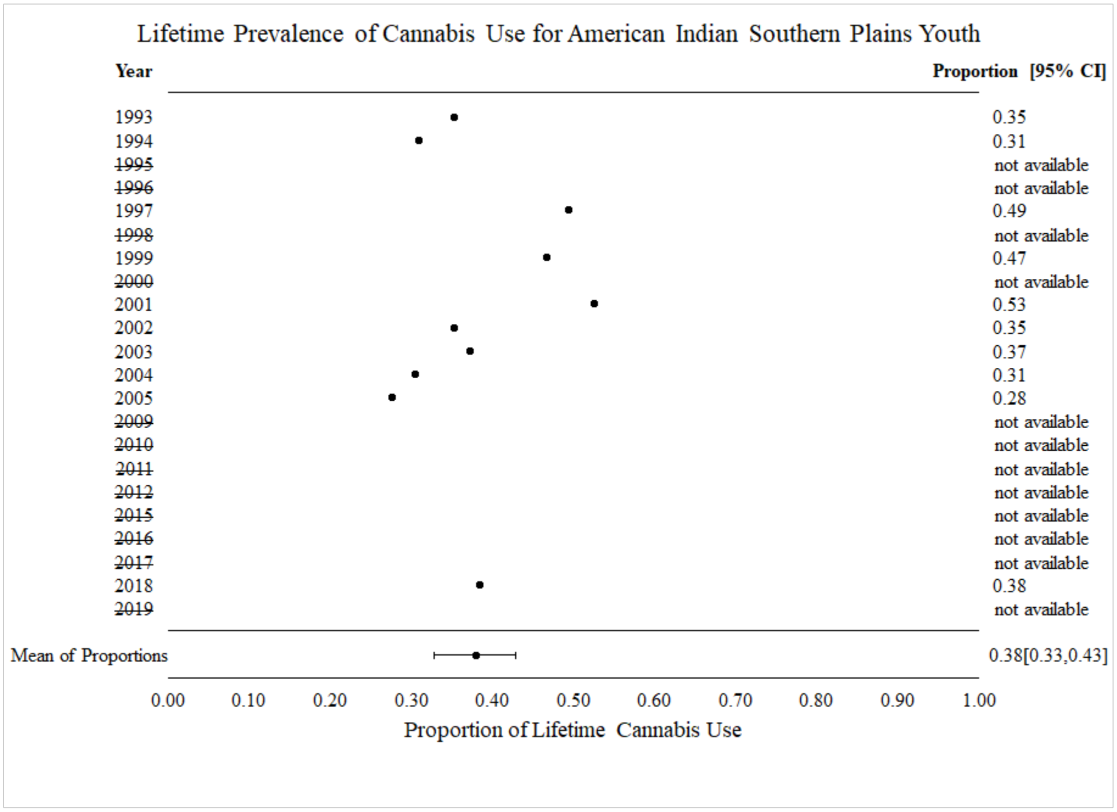
Note: Sample sizes for each year: 1995, n = 16; 1997, n = 125; 1998, n = 203; 2002, n = 64; 2004, n = 77; 2005, n = 122; 2009, n = 220; 2012, n = 132; 2015, n = 46; 2016, n = 64; 2017, n = 118; 2018, n = 68



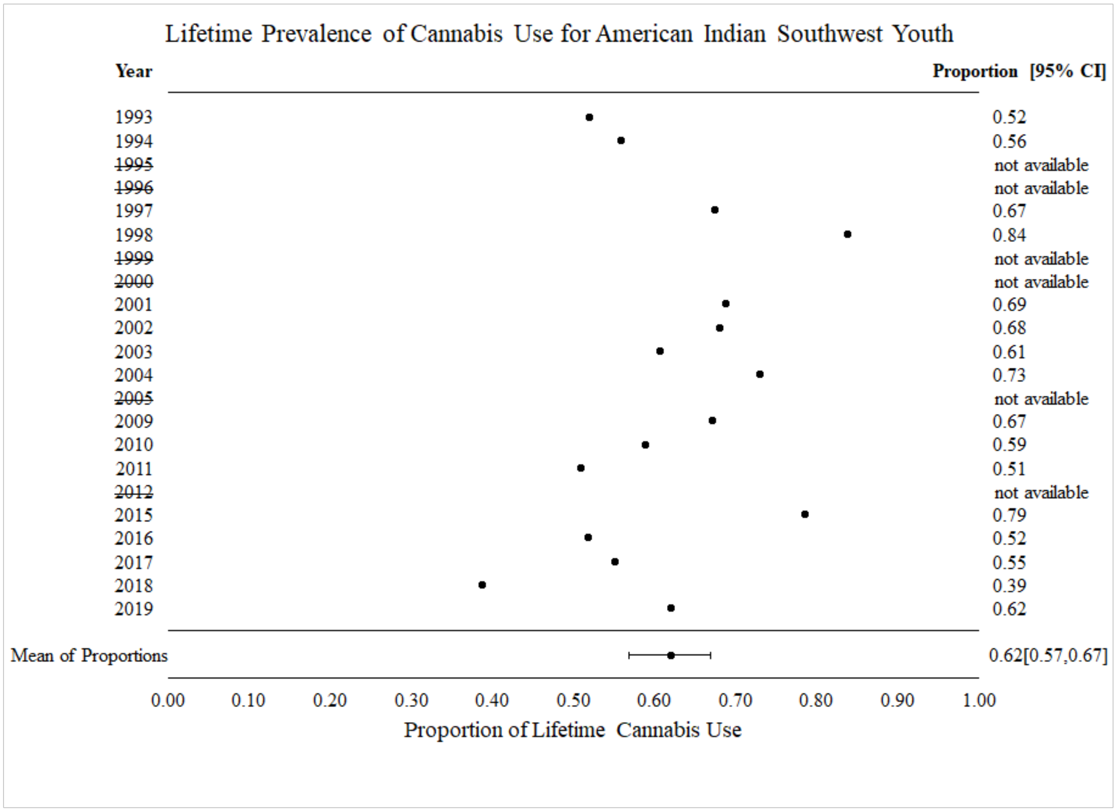
Note: Sample sizes for each year: 1993, n = 42; 1995, n = 48; 1996, n = 42; 2016, n = 84



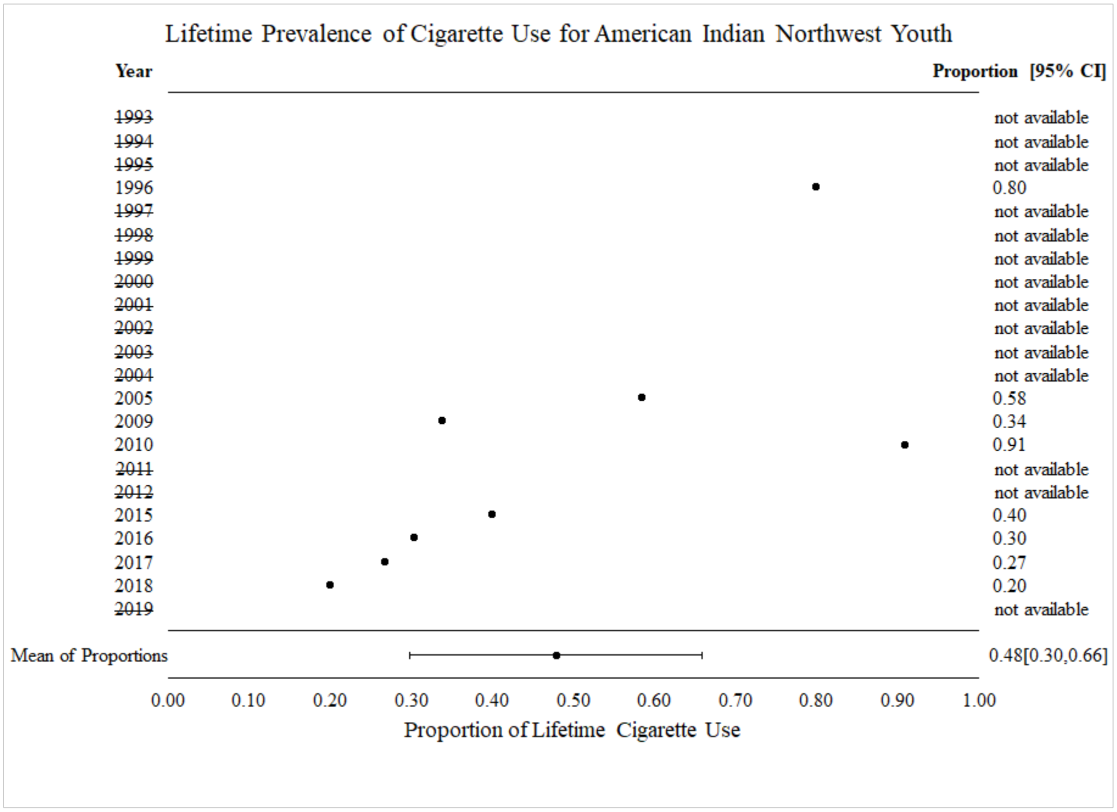
Note: Sample sizes for each year: 1993, n = 377; 1994, n = 11; 1995, n = 31; 1996, n = 55; 2011, n = 115; 2016, n = 207; 2017, n = 100; 2018, n = 176; 2019, n = 450



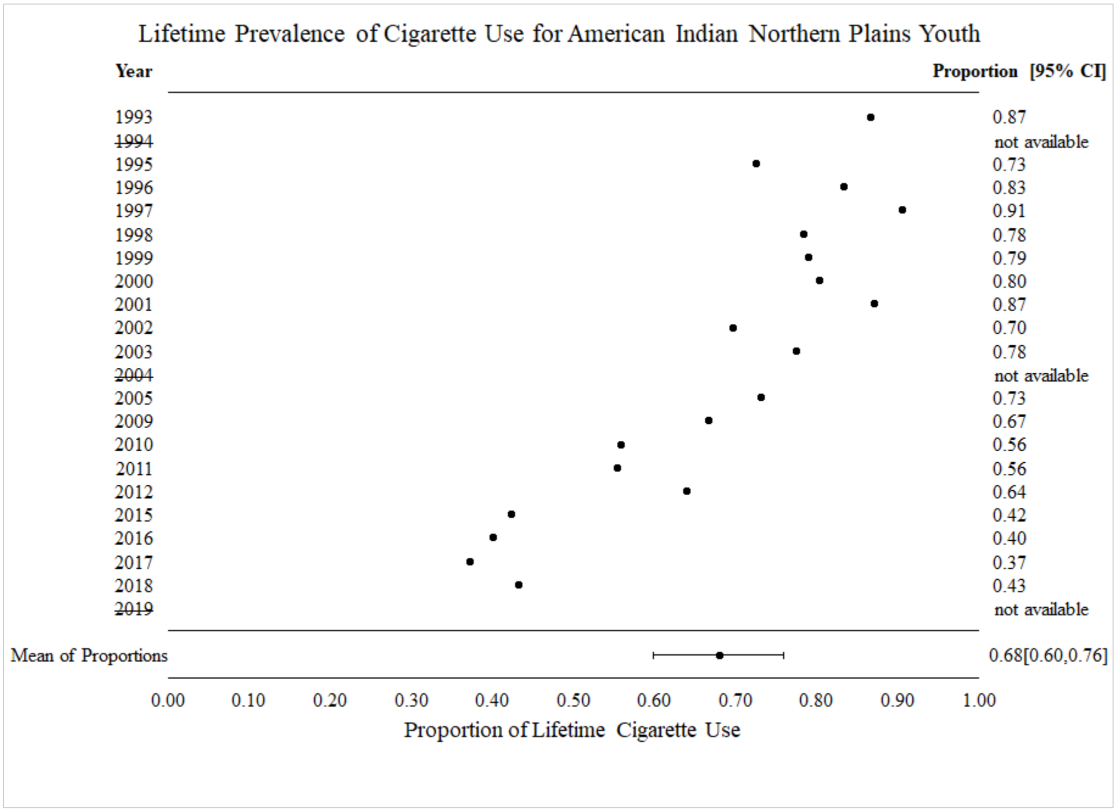
Note: Sample sizes for each year: 1993, n = 212; 1994, n = 42; 1997, n = 95; 1999, n = 94; 2001, n = 215; 2002, n = 530; 2003, n = 407; 2004, n = 393; 2005, n = 181; 2018, n = 13



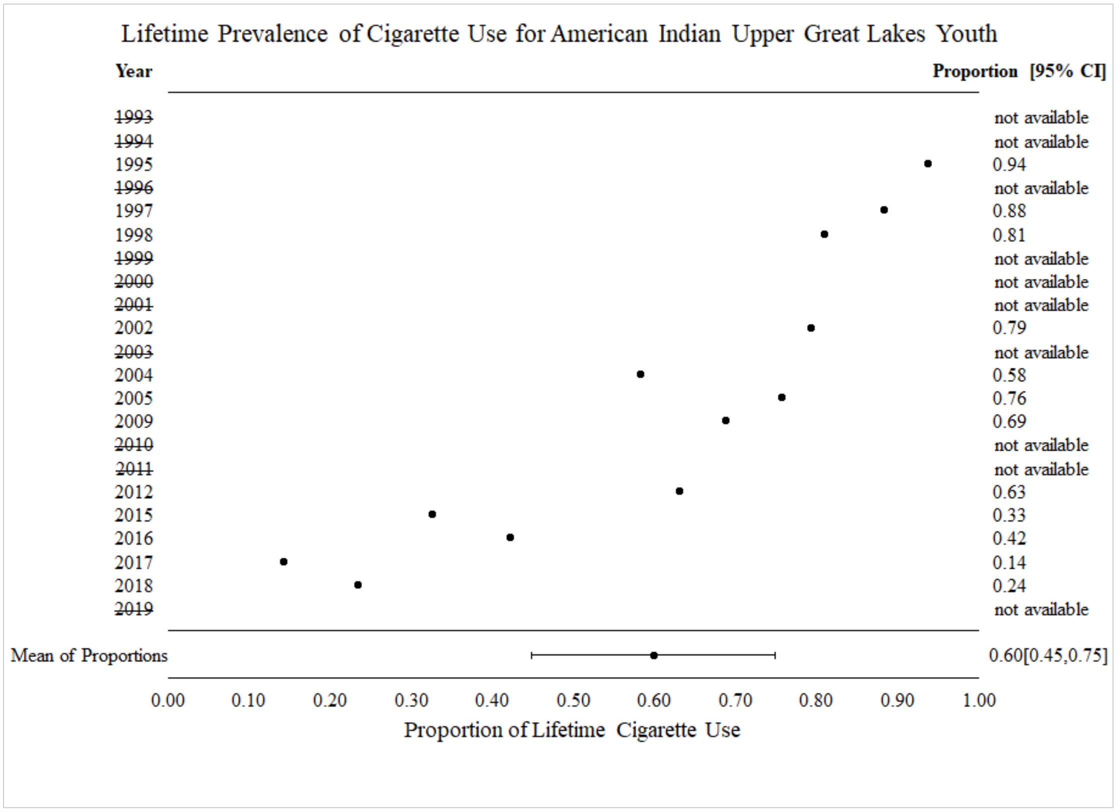
Note: Sample sizes for each year: 1993, n = 485; 1994, n = 377; 1997, n = 815; 1998, n = 317; 2001, n = 125; 2002, n = 297; 2003, n = 976; 2004, n = 163; 2009, n = 149; 2010, n = 163; 2011, n = 696; 2015, n = 14; 2016, n = 1111; 2017, n = 522; 2018, n = 678; 2019, n = 448



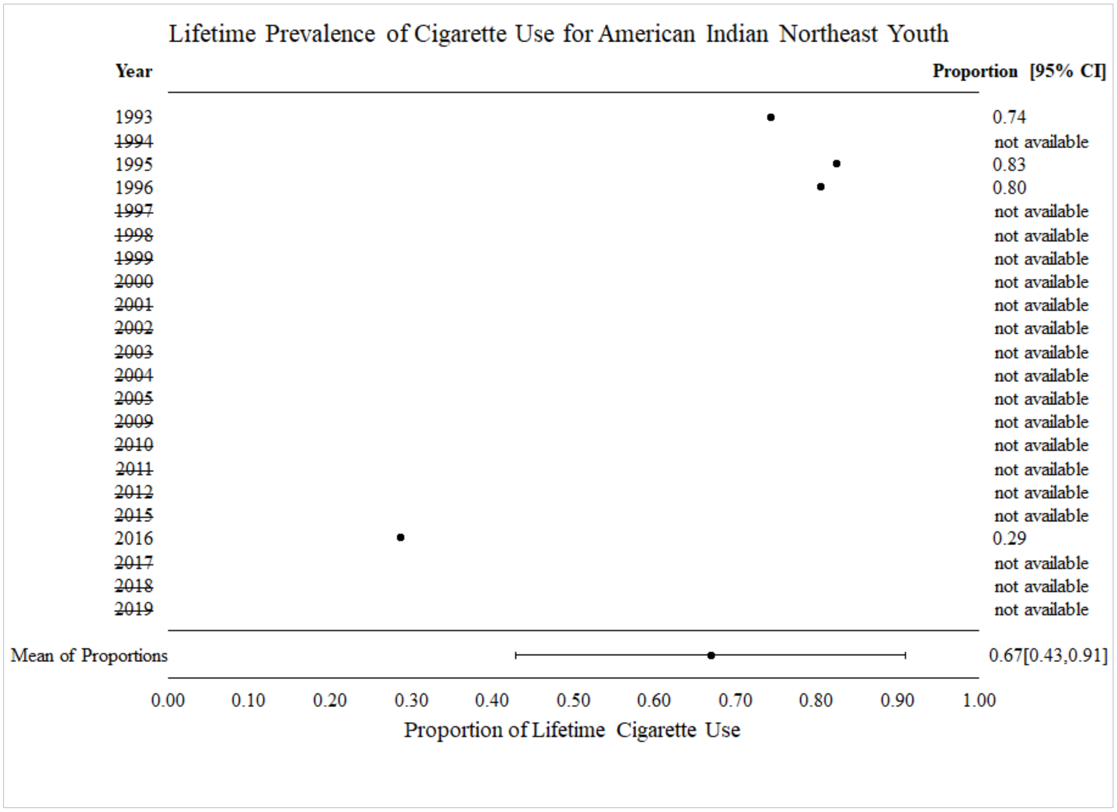
Note: Sample sizes for each year: 1996, n = 75; 2005, n = 77; 2009, n = 59; 2010, n = 11; 2015, n = 50; 2016, n = 46; 2017, n = 71; 2018, n = 15



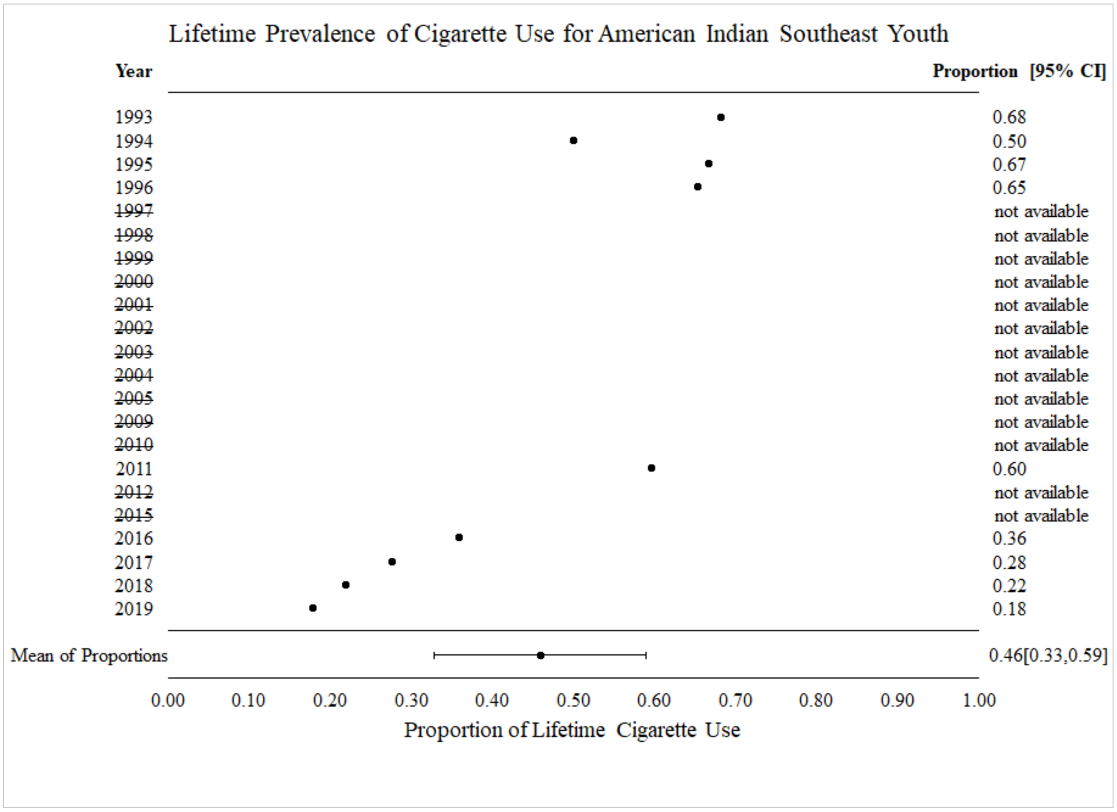
Note: Sample sizes for each year: 1993, n = 339; 1995, n = 171; 1996, n = 139; 1997, n = 75; 1998, n = 116; 1999, n = 210; 2000, n = 519; 2001, n = 39; 2002, n = 215; 2003, n = 58; 2005, n = 385; 2009, n = 487; 2010, n = 667; 2011, n = 317; 2012, n = 139; 2015, n = 198; 2016, n = 580; 2017, n = 220; 2018, n = 120



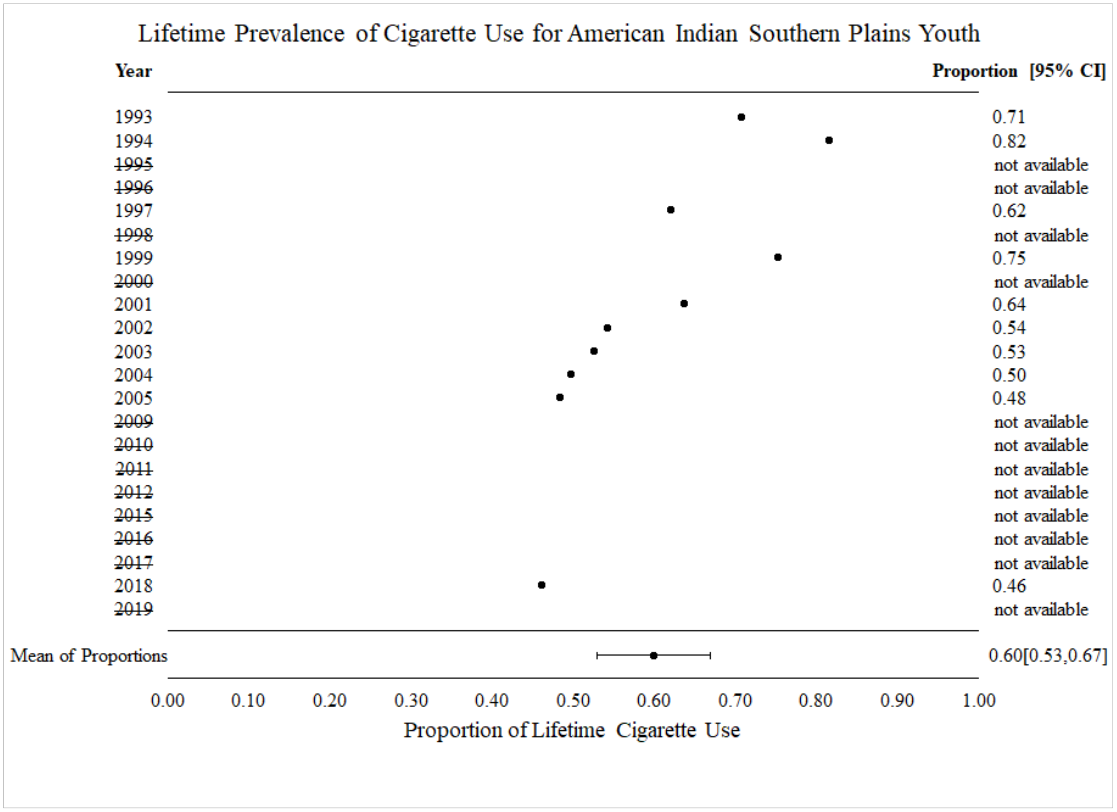
Note: Sample sizes for each year: 1995, n = 16; 1997, n = 111; 1998, n = 179; 2002, n = 58; 2004, n = 60; 2005, n = 103; 2009, n = 215; 2012, n = 130; 2015, n = 46; 2016, n = 64; 2017, n = 119; 2018, n = 68



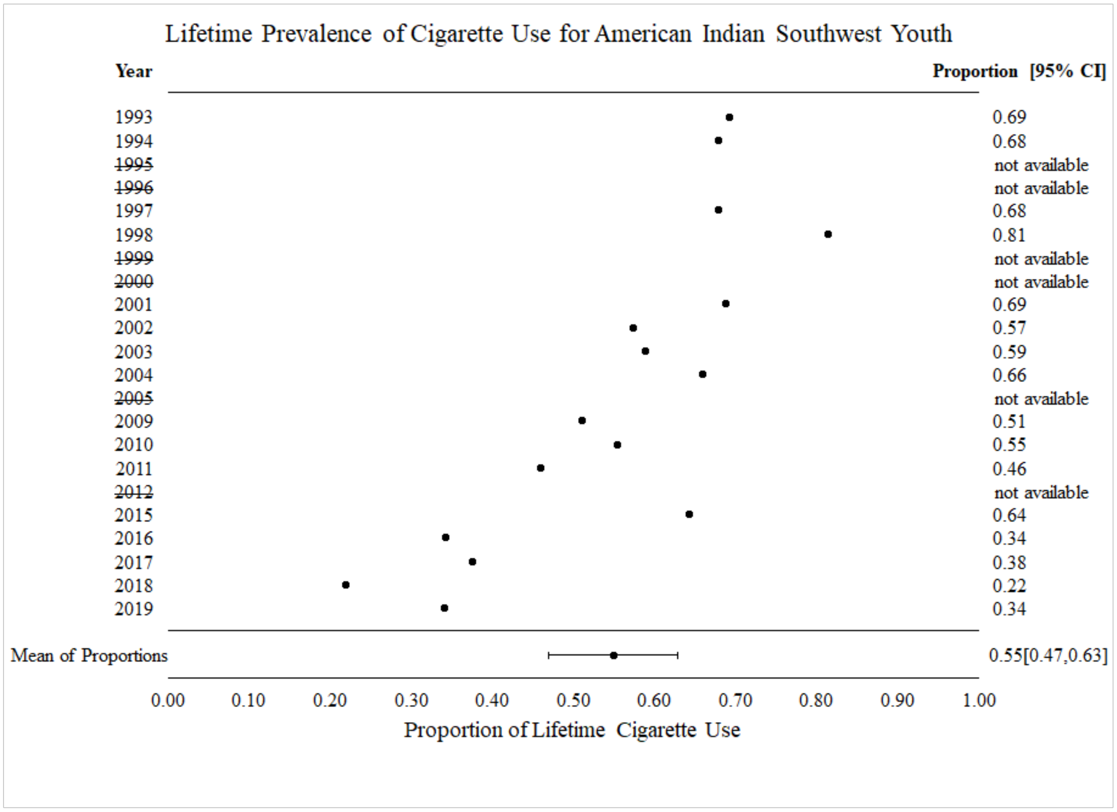
Note: Sample sizes for each year: 1993, n = 39; 1995, n = 40; 1996, n = 41; 2016, n = 87



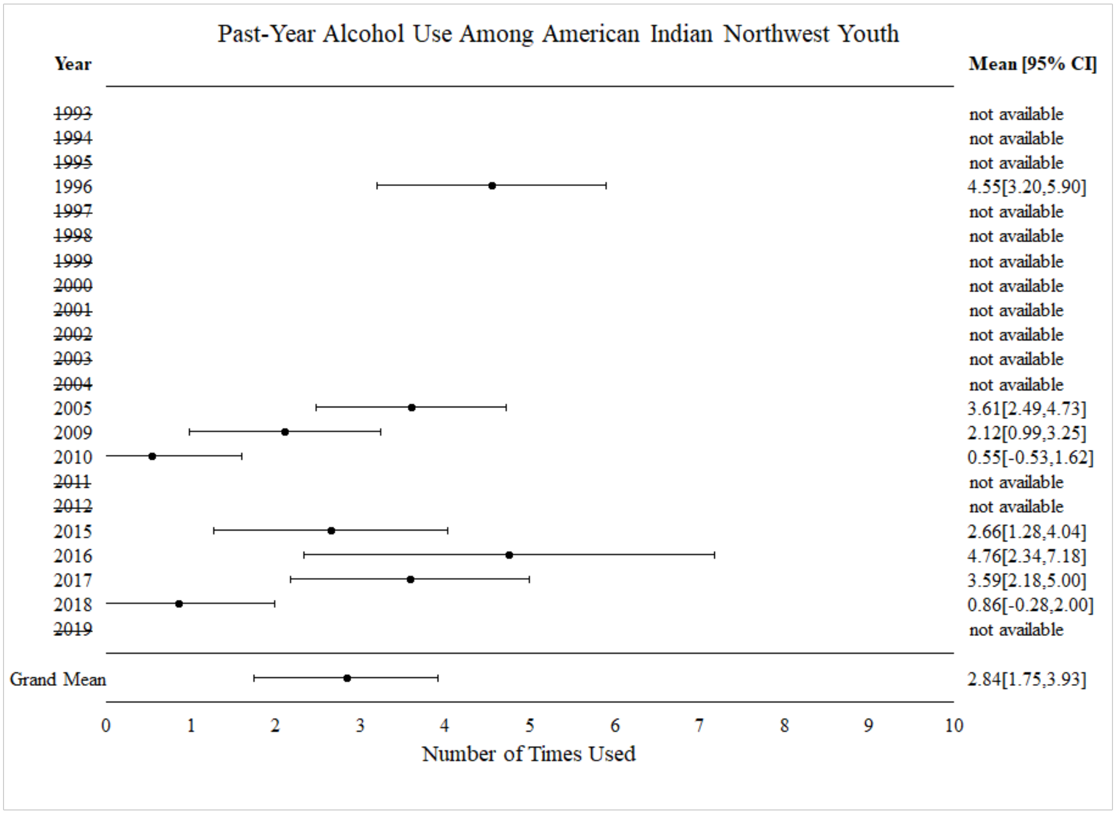
Note: Sample sizes for each year: 1993, n = 334; 1994, n = 10; 1995, n = 27; 1996, n = 52; 2011, n = 109; 2016, n = 209; 2017, n = 101; 2018, n = 177; 2019, n = 453



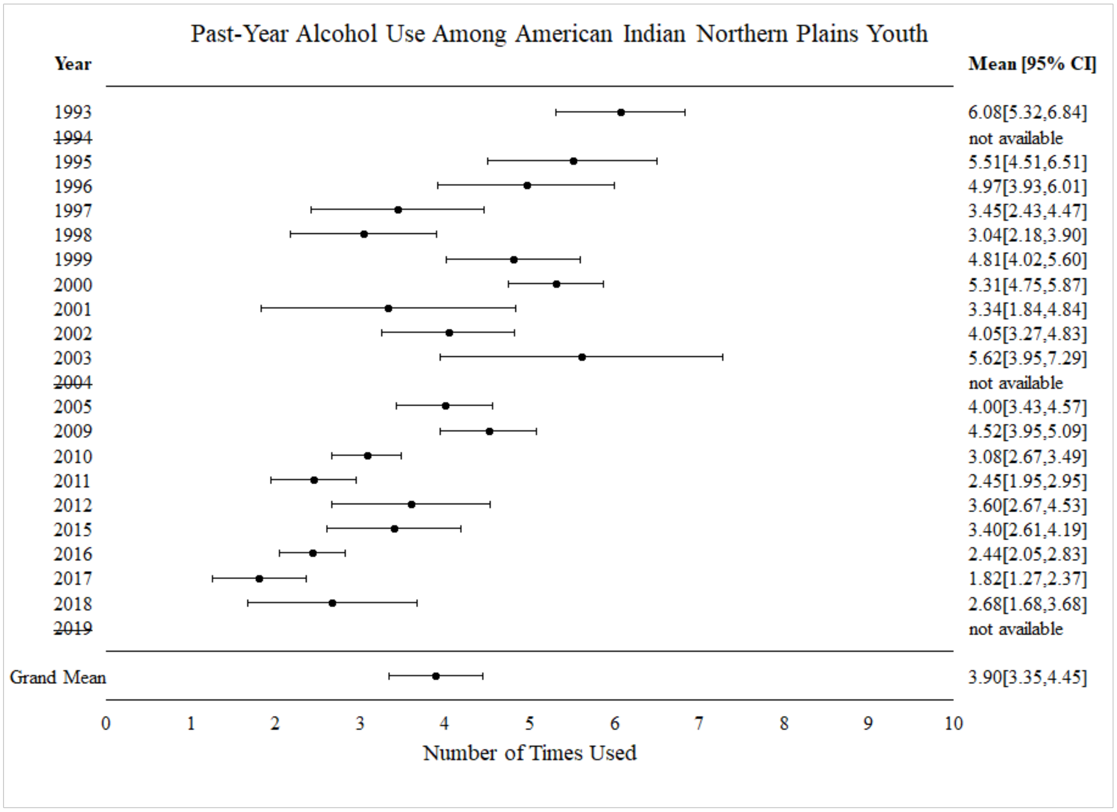
Note: Sample sizes for each year: 1993, n = 188; 1994, n = 38; 1997, n = 87; 1999, n = 85; 2001, n = 201; 2002, n = 455; 2003, n = 352; 2004, n = 344; 2005, n = 151; 2018, n = 13



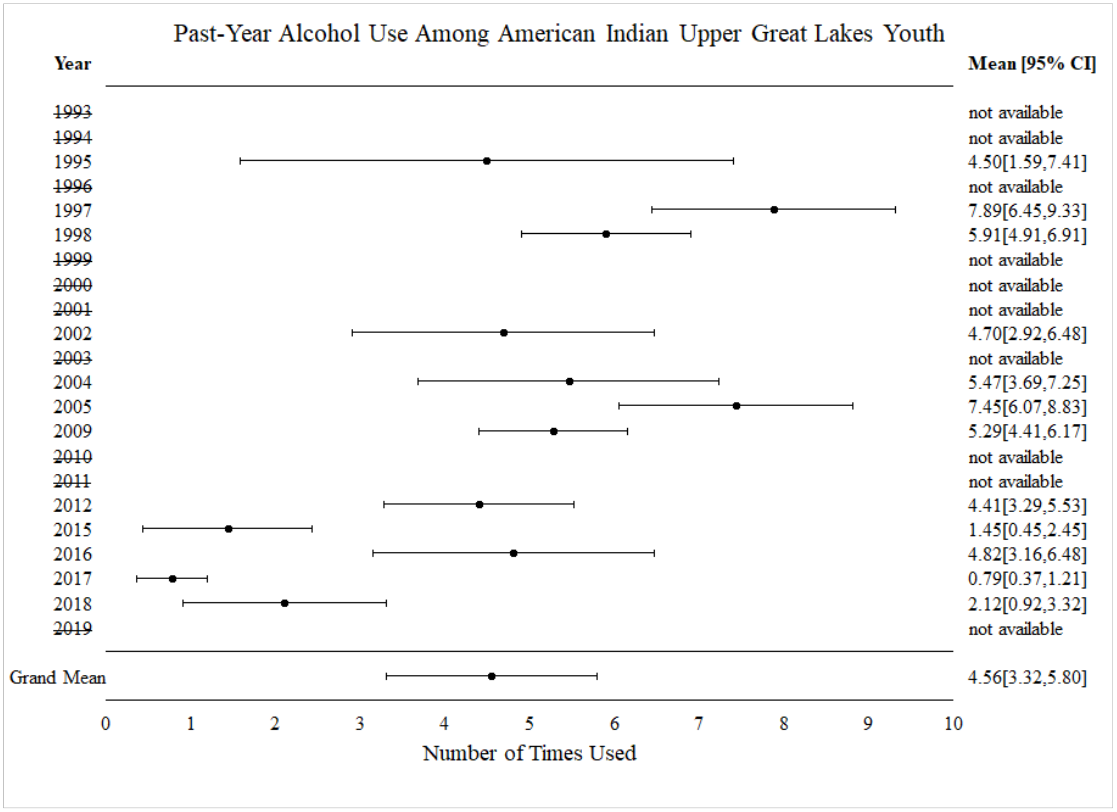
Note: Sample sizes for each year: 1993, n = 424; 1994, n = 312; 1997, n = 730; 1998, n = 259; 2001, n = 109; 2002, n = 256; 2003, n = 826; 2004, n = 141; 2009, n = 139; 2010, n = 157; 2011, n = 679; 2015, n = 14; 2016, n = 1114; 2017, n = 524; 2018, n = 683; 2019, n = 455



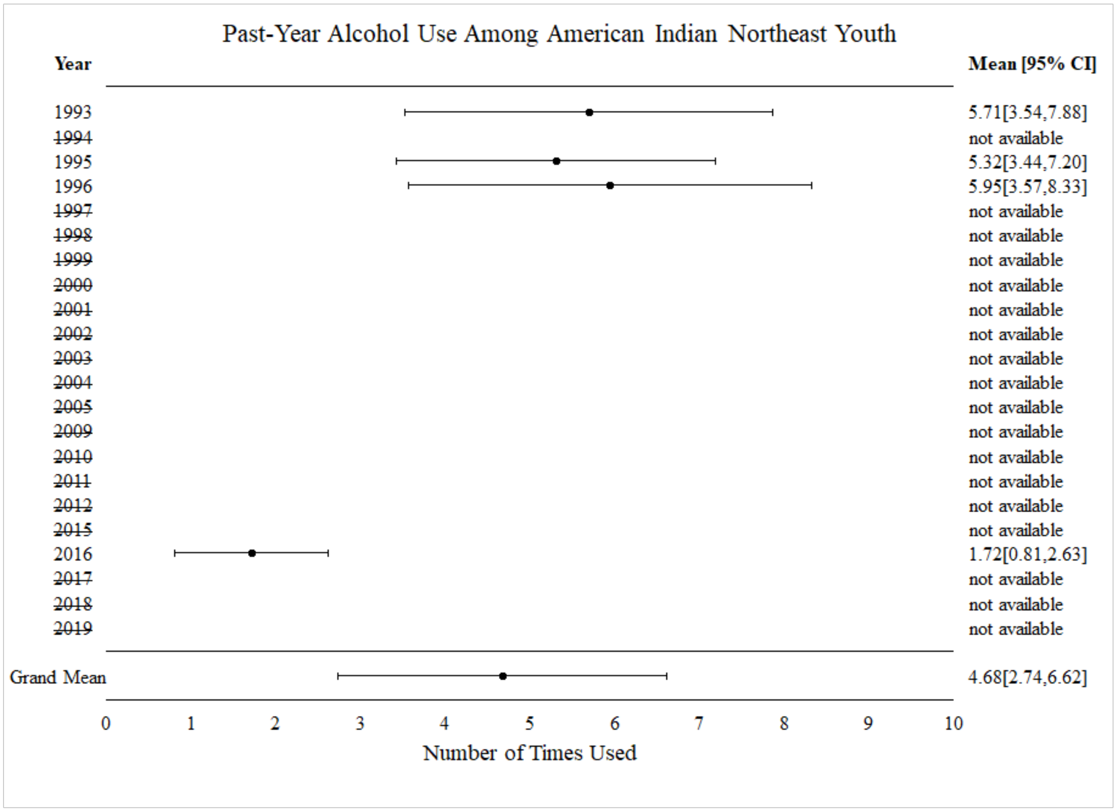
Note: Sample sizes for each year: 1996, n = 84; 2005, n = 89; 2009, n = 65; 2010, n = 11; 2015, n = 49; 2016, n = 44; 2017, n = 71; 2018, n = 14



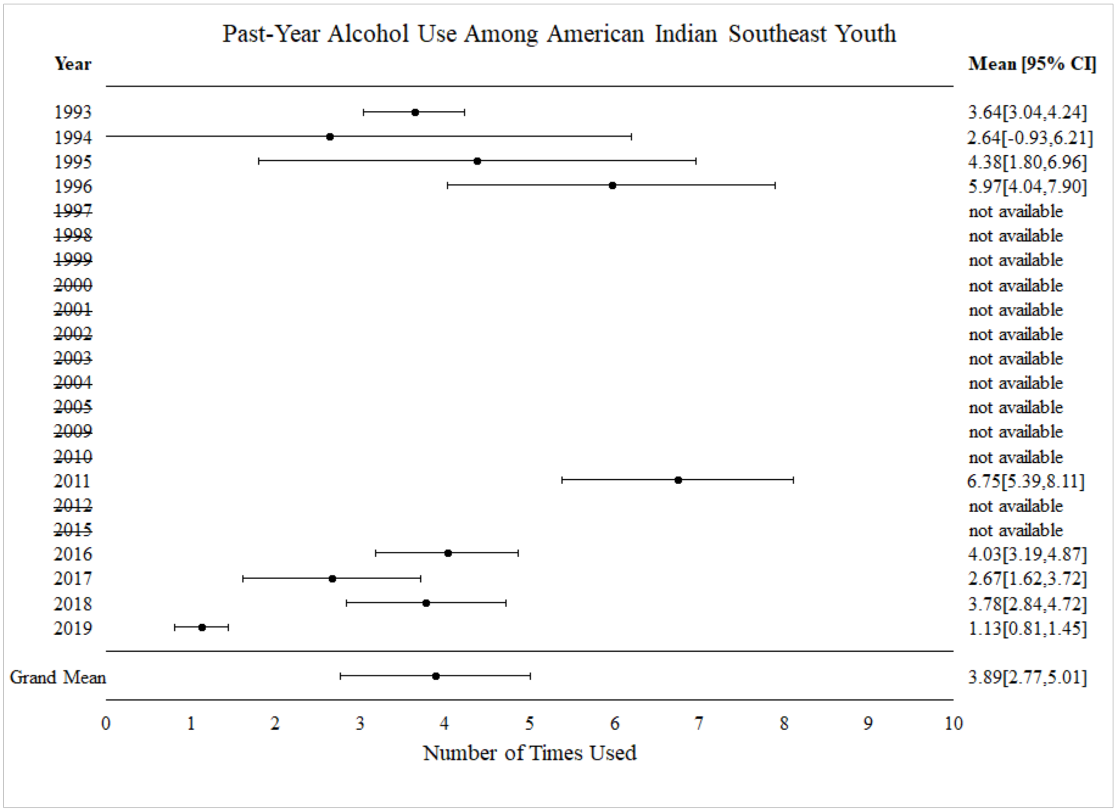
Note: Sample sizes for each year: 1993, n = 353; 1995, n = 186; 1996, n = 152; 1997, n = 93; 1998, n = 125; 1999, n = 242; 2000, n = 579; 2001, n = 47; 2002, n = 242; 2003, n = 61; 2005, n = 433; 2009, n = 506; 2010, n = 680; 2011, n = 331; 2012, n = 140; 2015, n = 198; 2016, n = 578; 2017, n = 220; 2018, n = 120



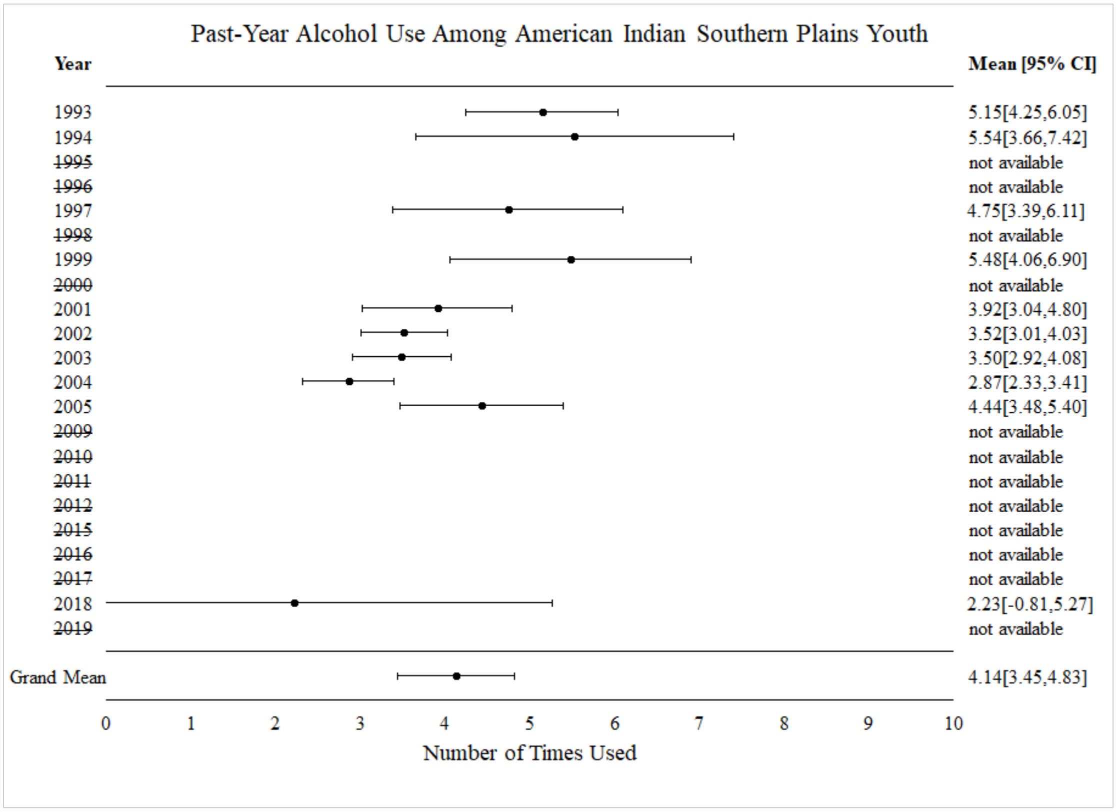
Note: Sample sizes for each year: 1995, n = 15; 1997, n = 122; 1998, n = 194; 2002, n = 59; 2004, n = 76; 2005, n = 118; 2009, n = 220; 2012, n = 132; 2015, n = 46; 2016, n = 64; 2017, n = 119; 2018, n = 68



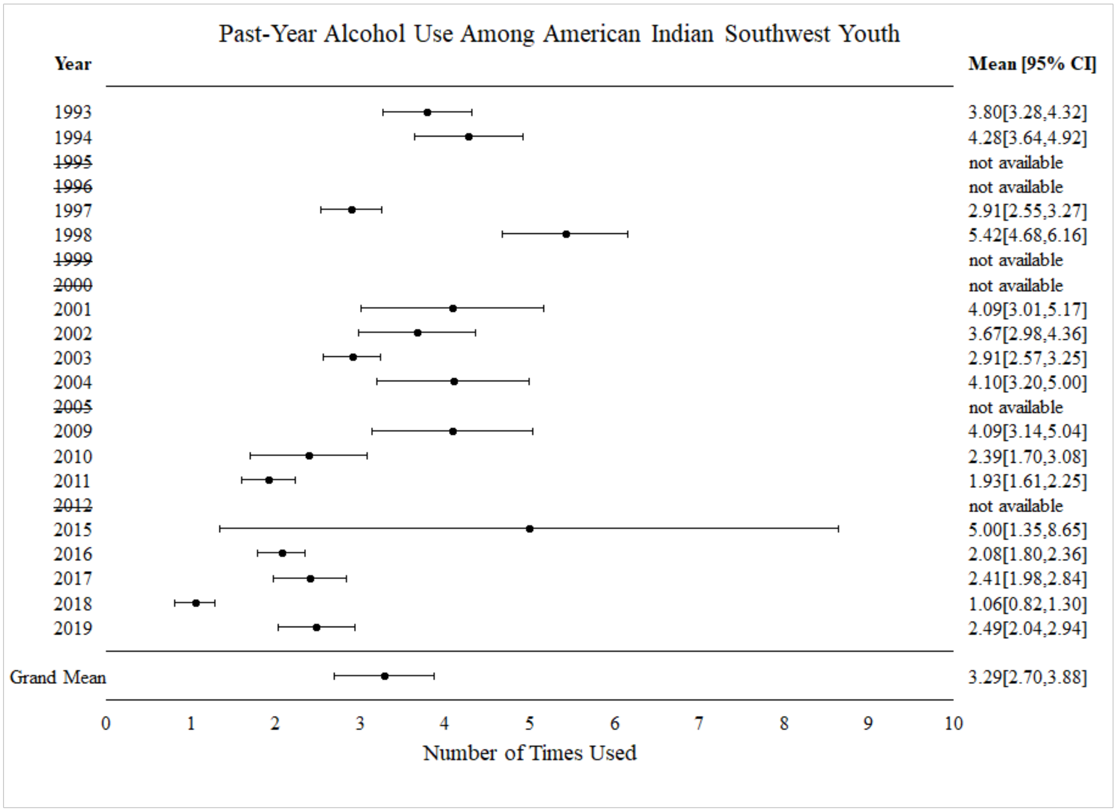
Note: Sample sizes for each year: 1993, n = 41; 1995, n = 44; 1996, n = 42; 2016, n = 85



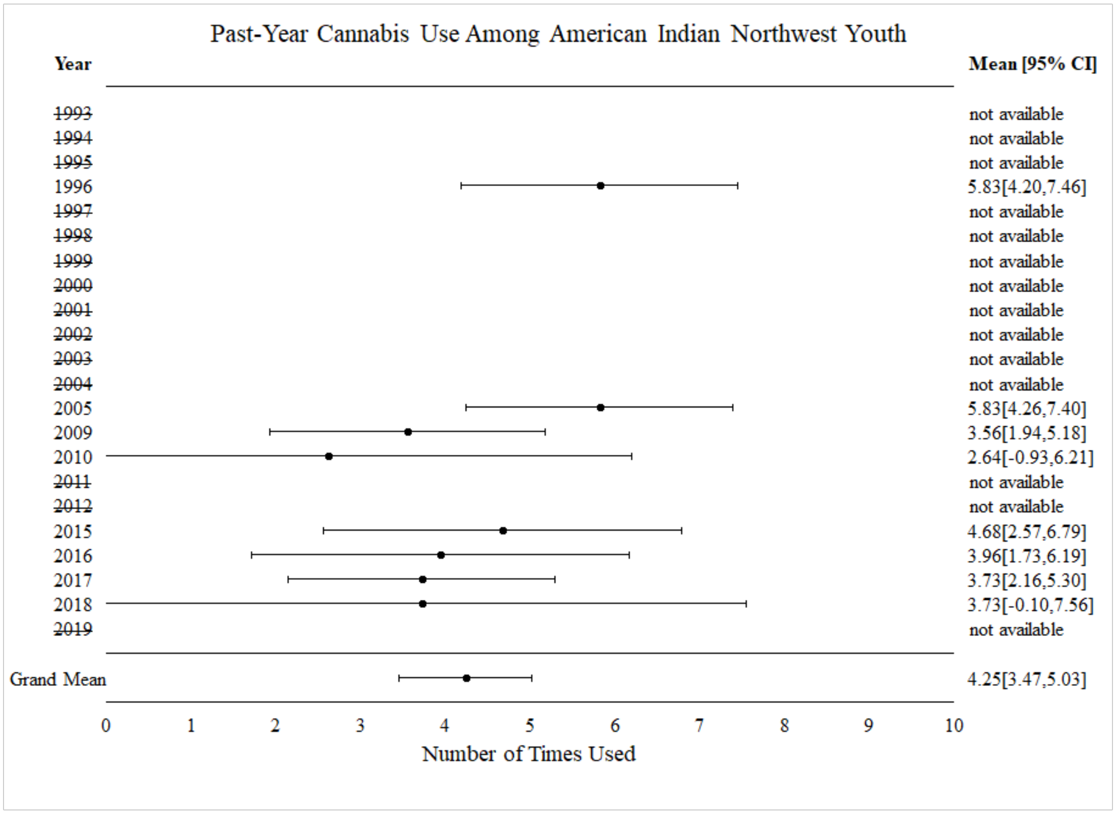
Note: Sample sizes for each year: 1993, n = 375; 1994, n = 11; 1995, n = 30; 1996, n = 54; 2011, n = 116; 2016, n = 209; 2017, n = 100; 2018, n = 176; 2019, n = 451



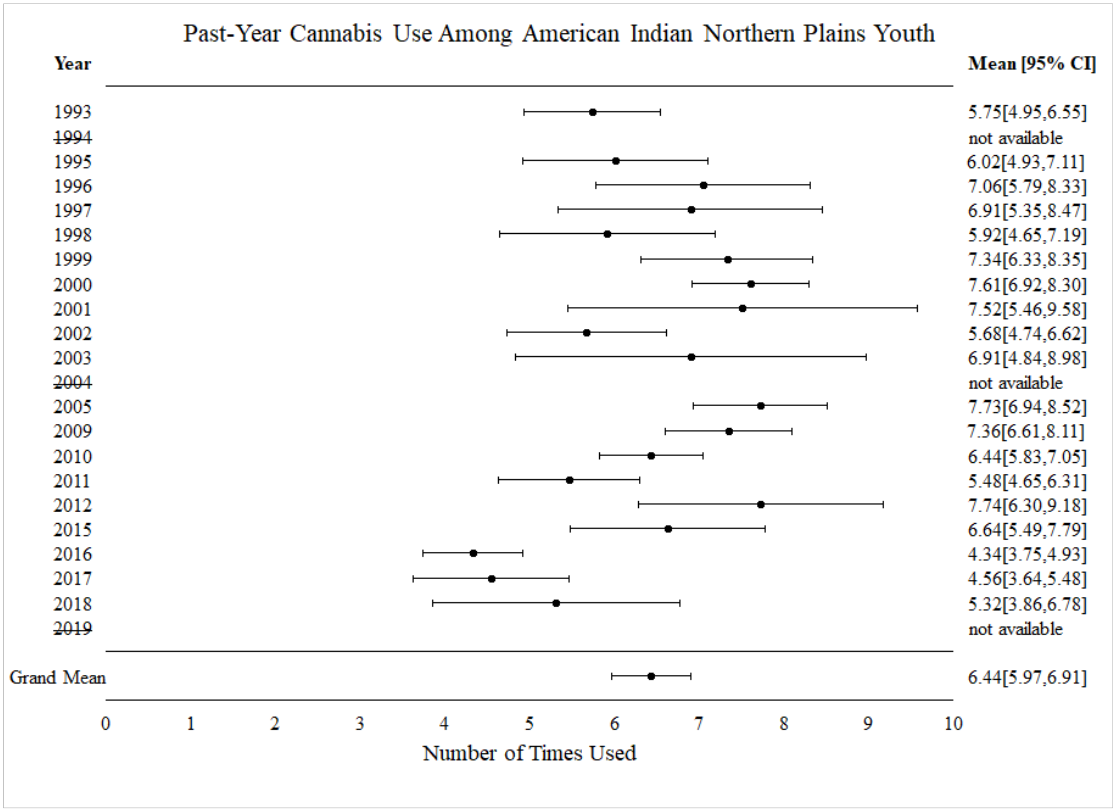
Note: Sample sizes for each year: 1993, n = 208; 1994, n = 41; 1997, n = 93; 1999, n = 92; 2001, n = 213; 2002, n = 524; 2003, n = 401; 2004, n = 387; 2005, n = 180; 2018, n = 13



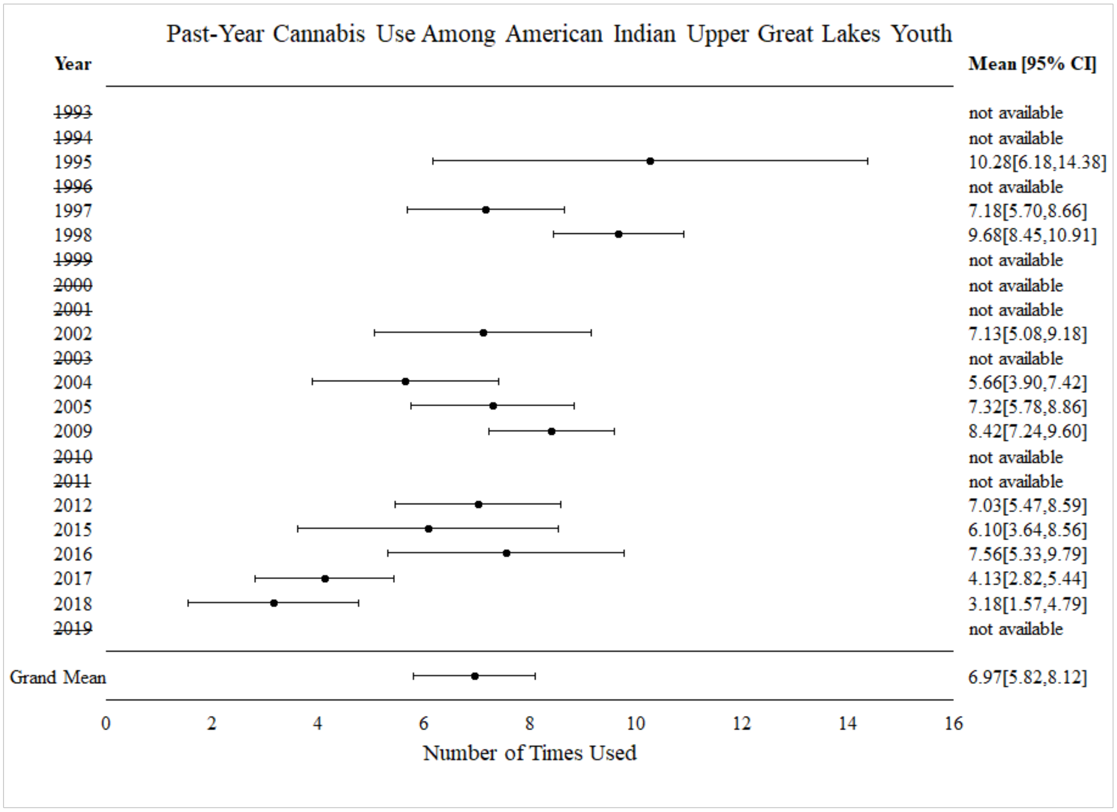
Note: Sample sizes for each year: 1993, n = 474; 1994, n = 369; 1997, n = 795; 1998, n = 311; 2001, n = 115; 2002, n = 290; 2003, n = 955; 2004, n = 157; 2009, n = 149; 2010, n = 161; 2011, n = 686; 2015, n = 14; 2016, n = 1112; 2017, n = 524; 2018, n = 683; 2019, n = 451



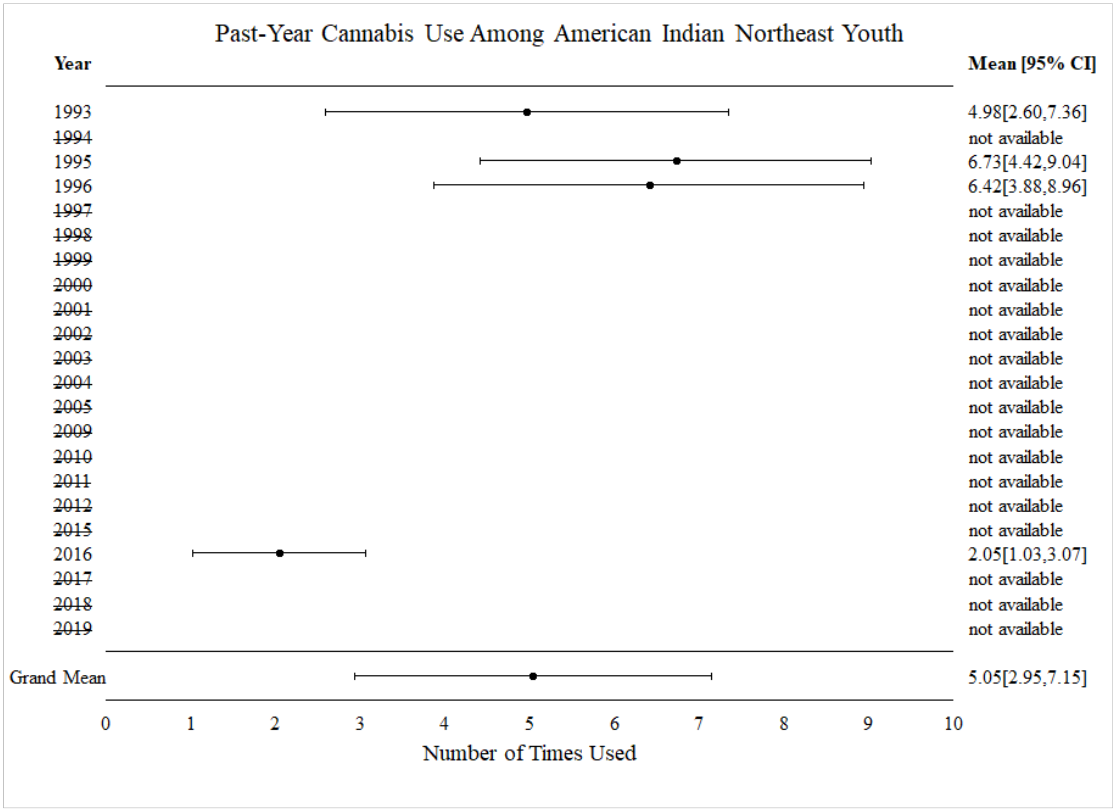
Note: Sample sizes for each year: 1996, n = 87; 2005, n = 94; 2009, n = 63; 2010, n = 11; 2015, n = 49; 2016, n = 45; 2017, n = 71; 2018, n = 15



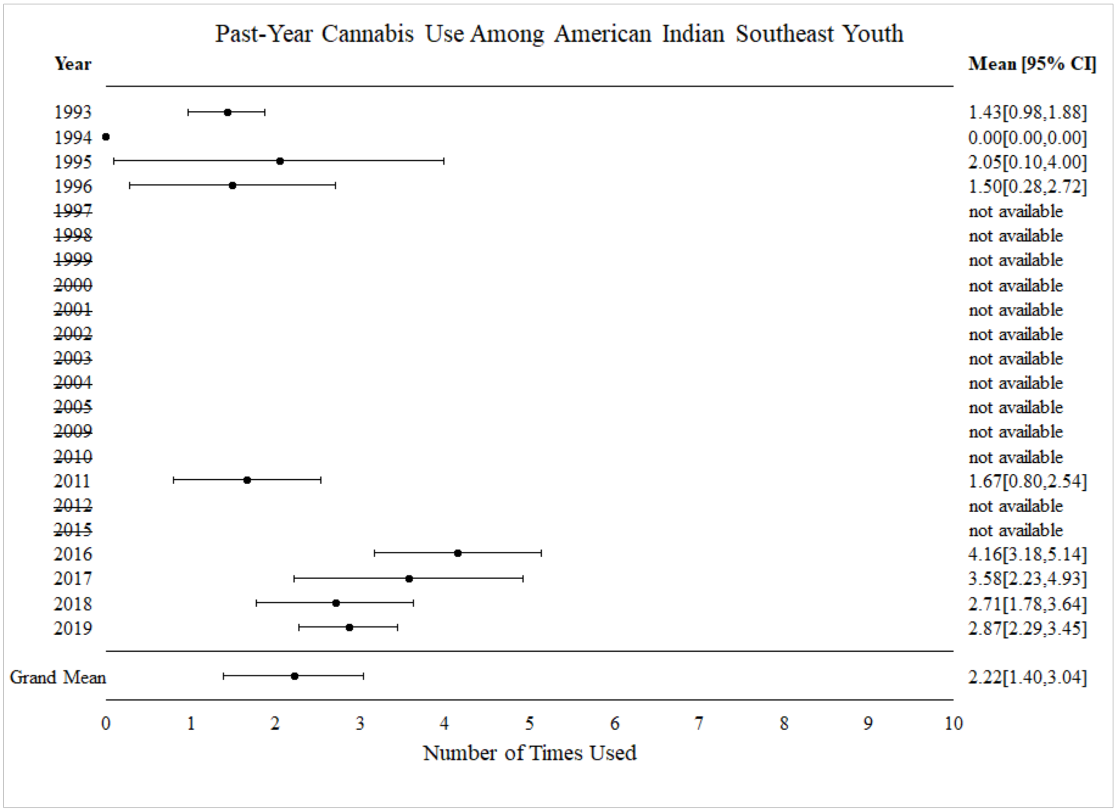
Note: Sample sizes for each year: 1993, n = 369; 1995, n = 193; 1996, n = 162; 1997, n = 99; 1998, n = 130; 1999, n = 251; 2000, n = 602; 2001, n = 50; 2002, n = 251; 2003, n = 63; 2005, n = 441; 2009, n = 500; 2010, n = 690; 2011, n = 325; 2012, n = 142; 2015, n = 198; 2016, n = 577; 2017, n = 220; 2018, n = 119



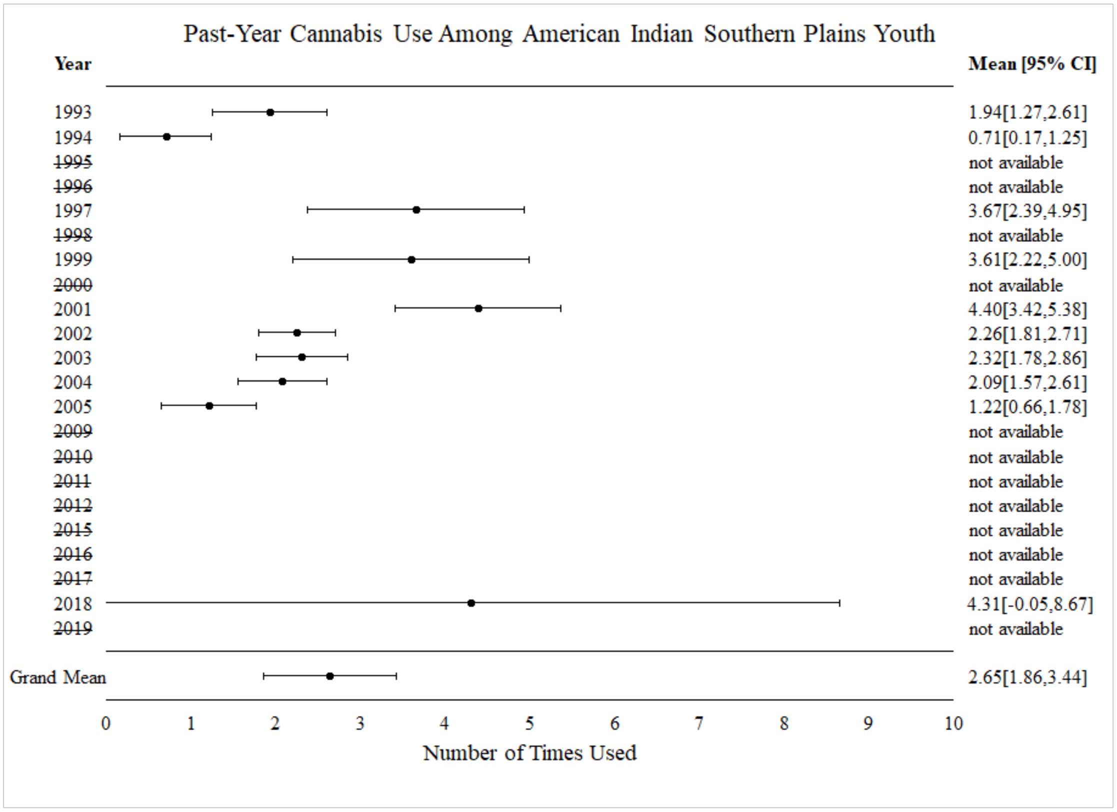
Note: Sample sizes for each year: 1995, n = 16; 1997, n = 126; 1998, n = 204; 2002, n = 64; 2004, n = 77; 2005, n = 122; 2009, n = 219; 2012, n = 131; 2015, n = 46; 2016, n = 64; 2017, n = 119; 2018, n = 68



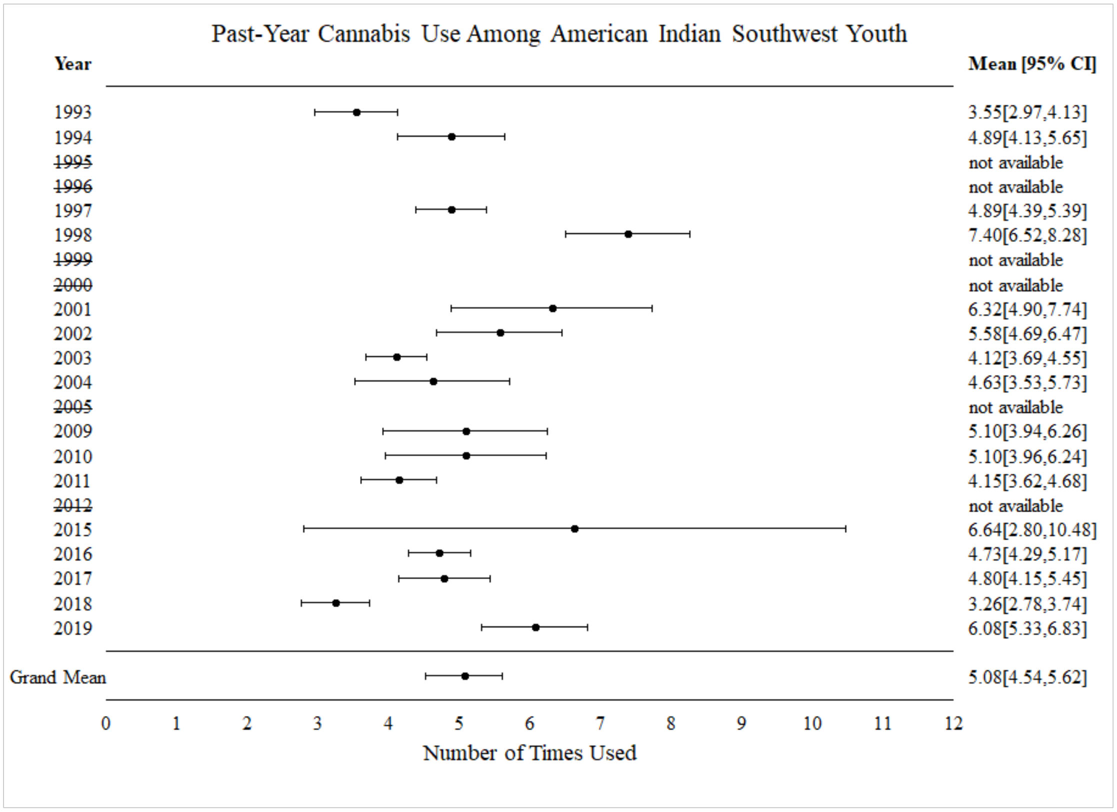
Note: Sample sizes for each year: 1993, n = 42; 1995, n = 47; 1996, n = 42; 2016, n = 84



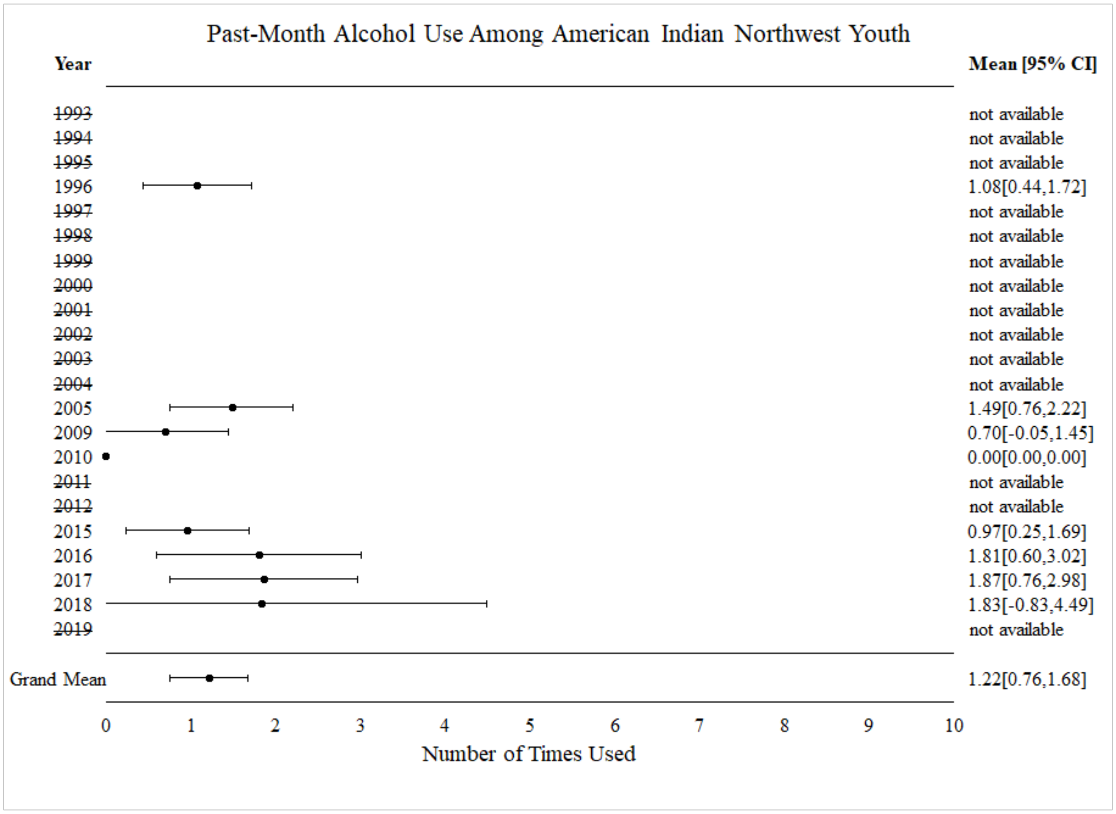
Note: Sample sizes for each year: 1993, n = 376; 1994, n = 11; 1995, n = 31; 1996, n = 55; 2011, n = 114; 2016, n = 207; 2017, n = 100; 2018, n = 176; 2019, n = 450



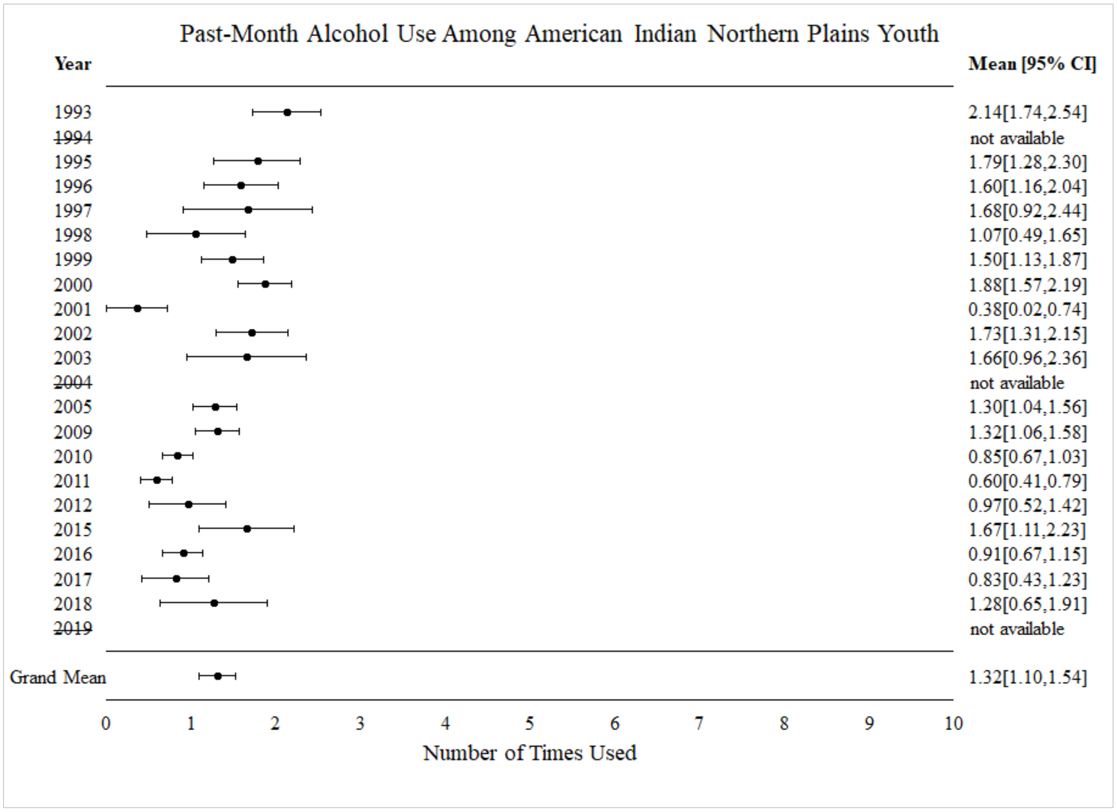
Note: Sample sizes for each year: 1993, n = 210; 1994, n = 42; 1997, n = 95; 1999, n = 94; 2001, n = 215; 2002, n = 530; 2003, n = 407; 2004, n = 393; 2005, n = 181; 2018, n = 13



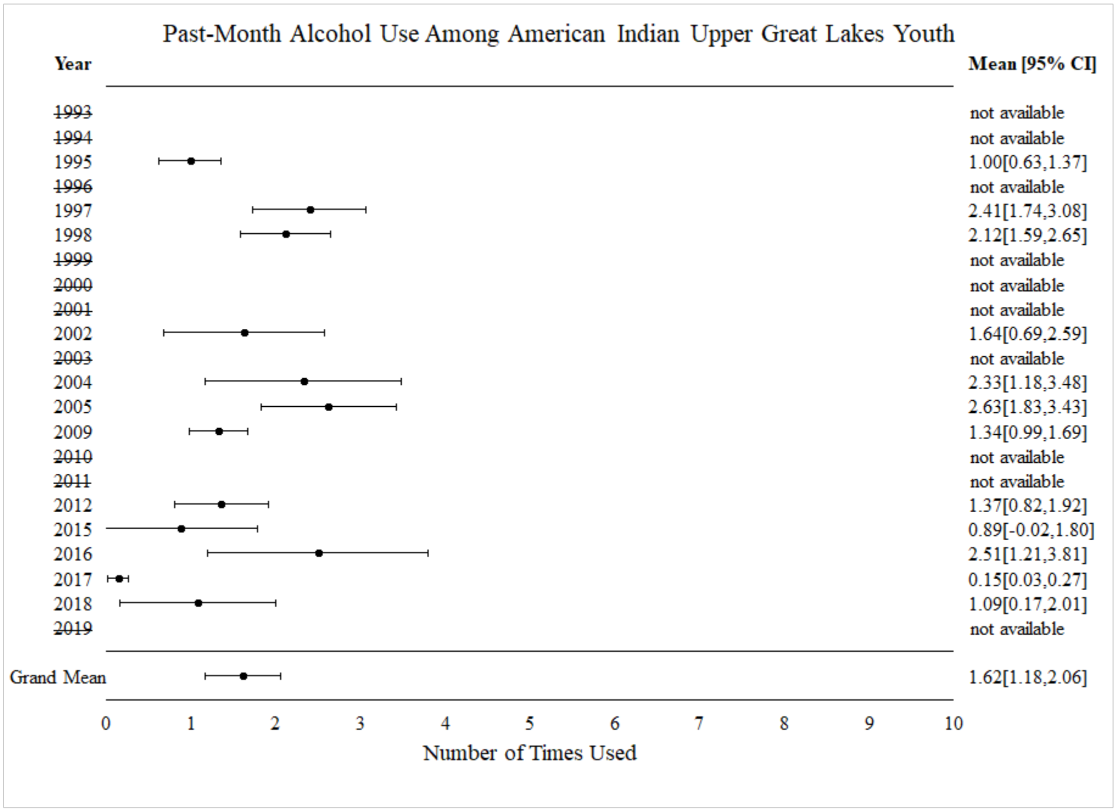
Note: Sample sizes for each year: 1993, n = 483; 1994, n = 374; 1997, n = 813; 1998, n = 316; 2001, n = 124; 2002, n = 296; 2003, n = 978; 2004, n = 162; 2009, n = 149; 2010, n = 162; 2011, n = 694; 2015, n = 14; 2016, n = 1111; 2017, n = 522; 2018, n = 677; 2019, n = 448



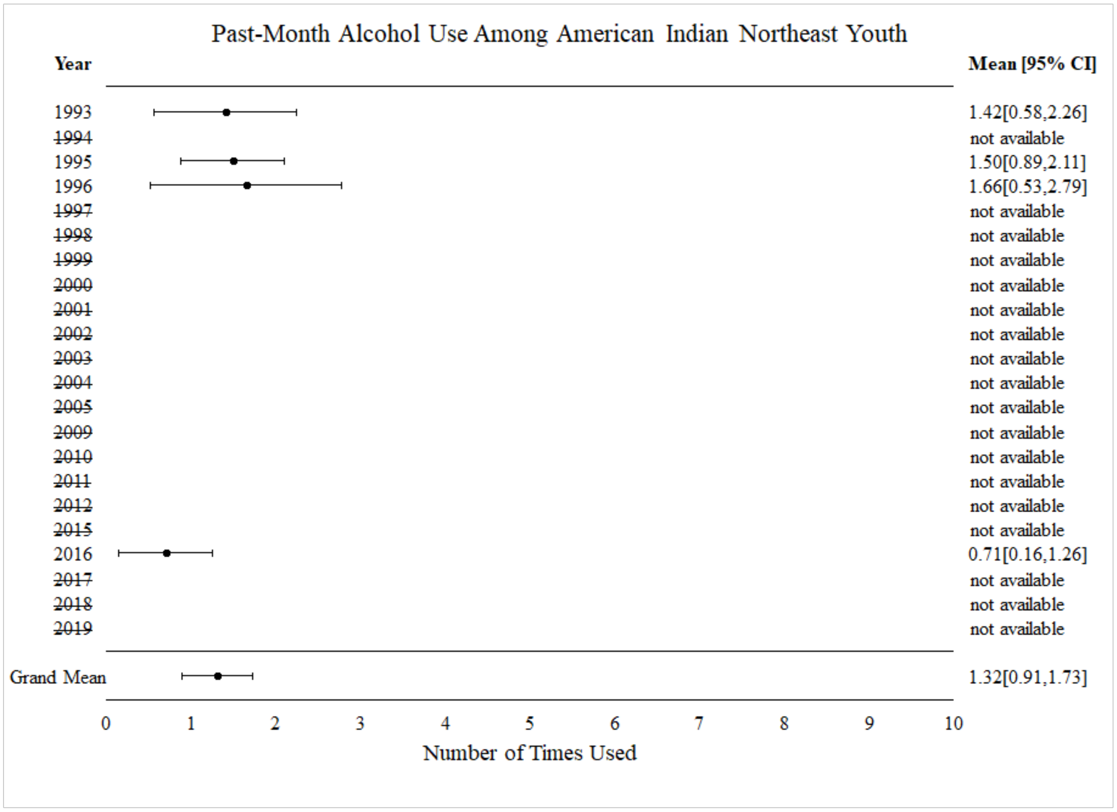
Note: Sample sizes for each year: 1996, n = 83; 2005, n = 92; 2009, n = 64; 2010, n = 11; 2015, n = 49; 2016, n = 44; 2017, n = 71; 2018, n = 15



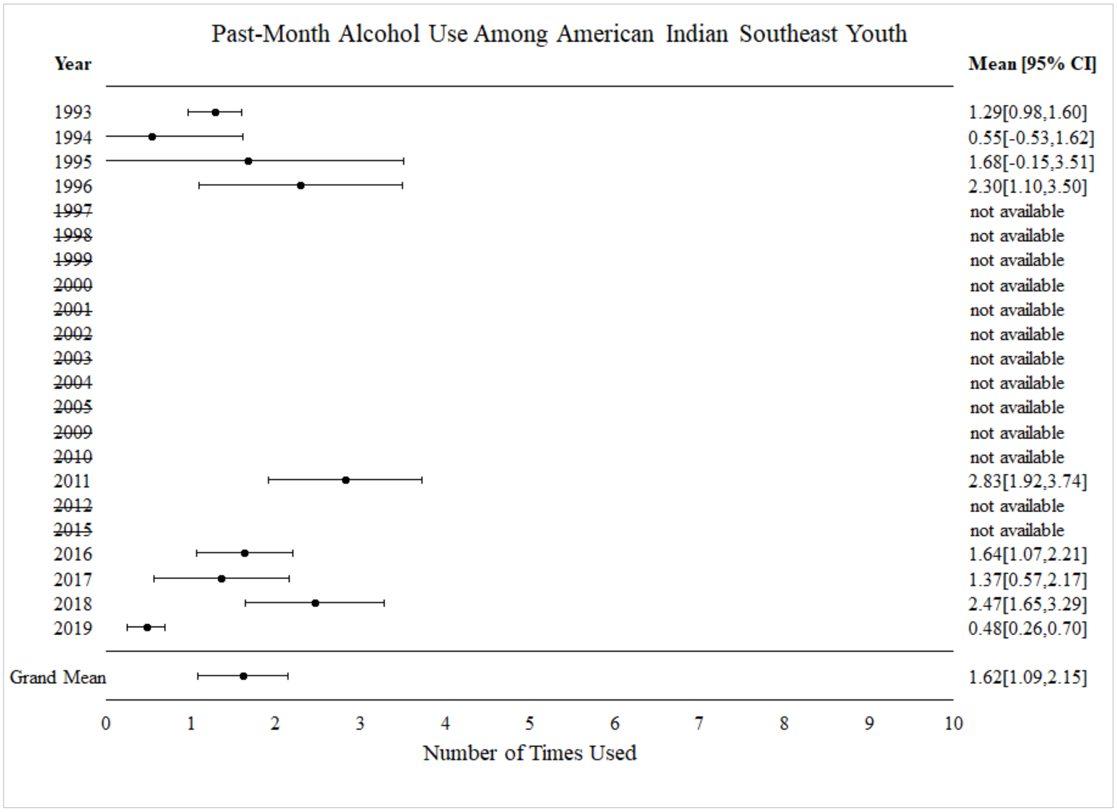
Note: Sample sizes for each year: 1993, n = 357; 1995, n = 186; 1996, n = 152; 1997, n = 94; 1998, n = 121; 1999, n = 243; 2000, n = 586; 2001, n = 48; 2002, n = 240; 2003, n = 61; 2005, n = 438; 2009, n = 506; 2010, n = 679; 2011, n = 330; 2012, n = 140; 2015, n = 198; 2016, n = 578; 2017, n = 220; 2018, n = 120



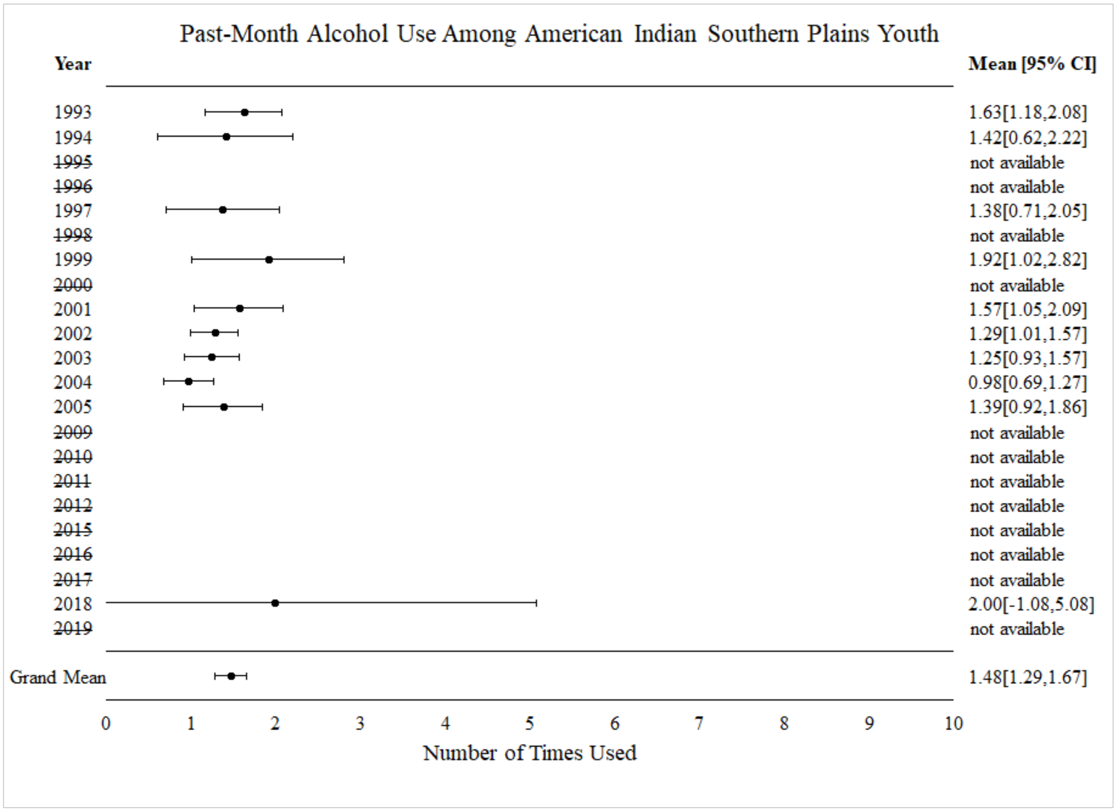
Note: Sample sizes for each year: 1995, n = 15; 1997, n = 123; 1998, n = 193; 2002, n = 61; 2004, n = 75; 2005, n = 117; 2009, n = 222; 2012, n = 132; 2015, n = 46; 2016, n = 64; 2017, n = 119; 2018, n = 68



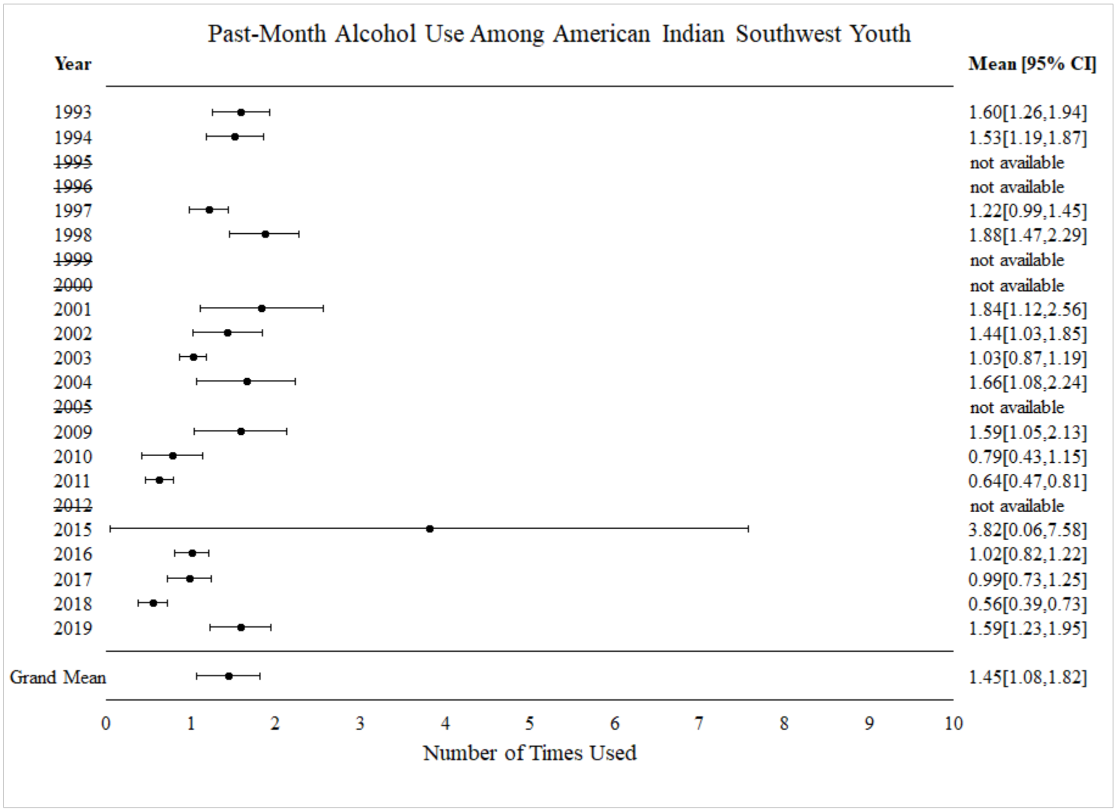
Note: Sample sizes for each year: 1993, n = 41; 1995, n = 45; 1996, n = 41; 2016, n = 85



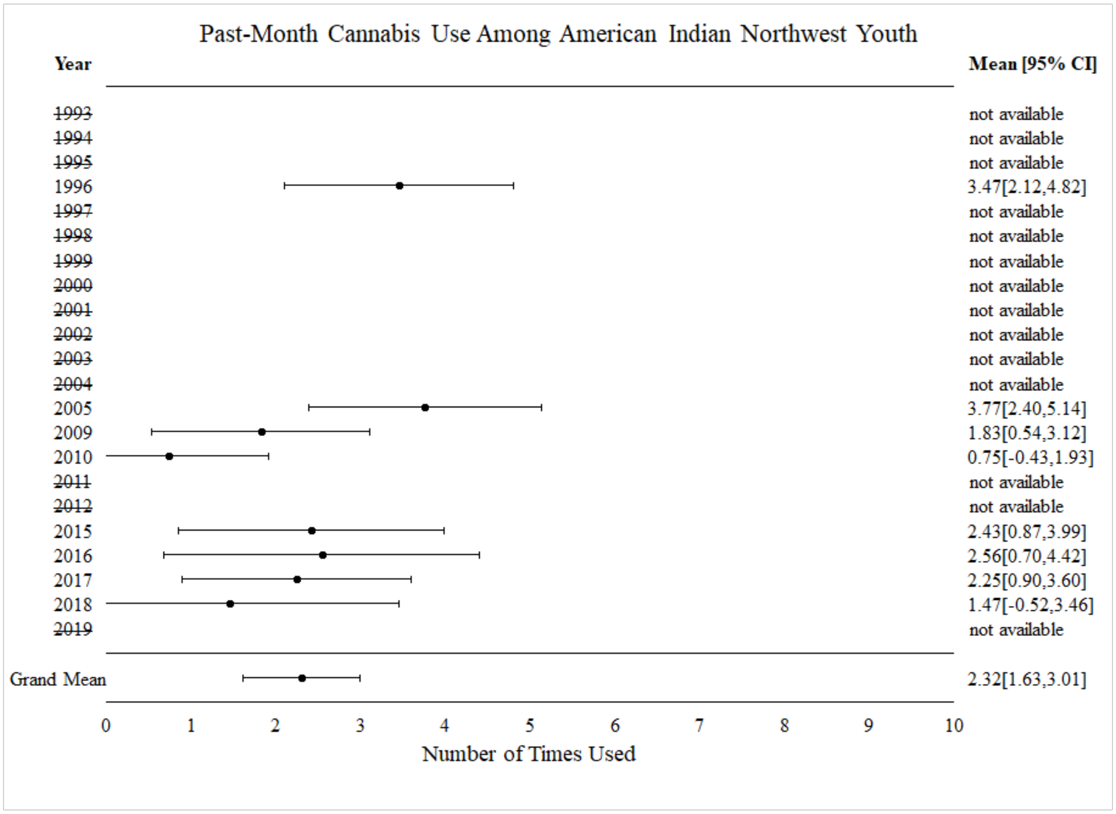
Note: Sample sizes for each year: 1993, n = 378; 1994, n = 11; 1995, n = 30; 1996, n = 53; 2011, n = 115; 2016, n = 208; 2017, n = 100; 2018, n = 176; 2019, n = 451



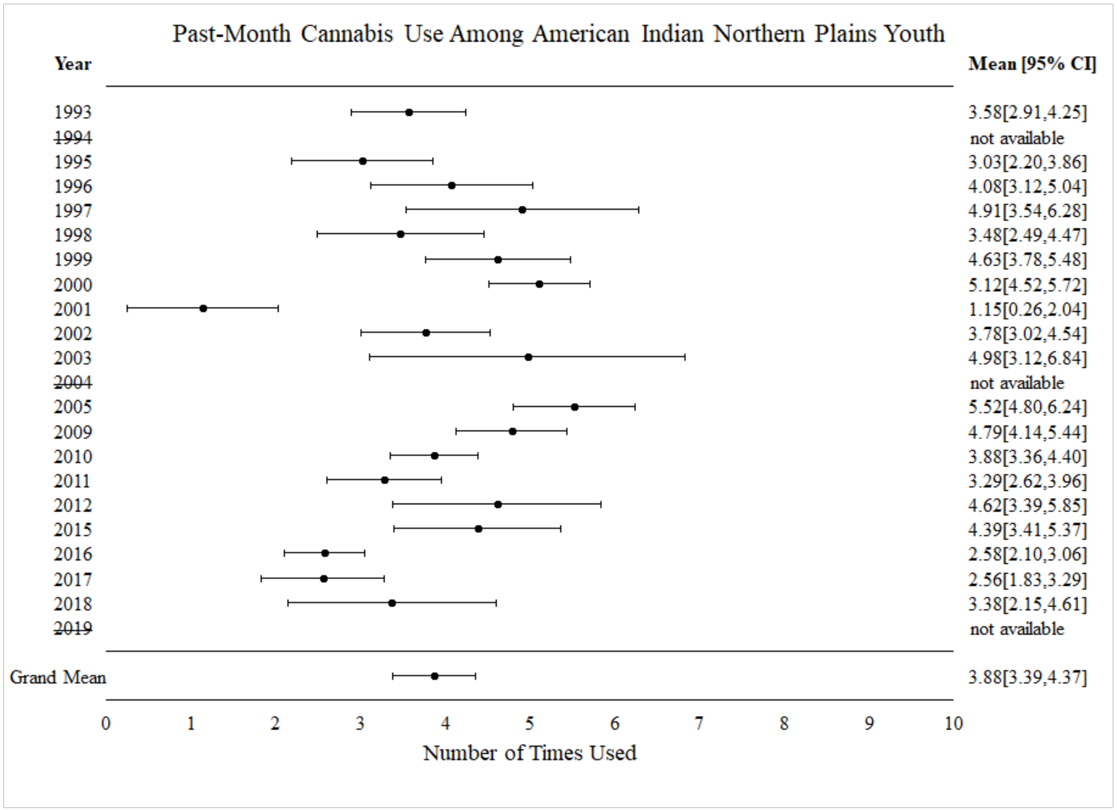
Note: Sample sizes for each year: 1993, n = 207; 1994, n = 41; 1997, n = 93; 1999, n = 93; 2001, n = 210; 2002, n = 520; 2003, n = 403; 2004, n = 388; 2005, n = 179; 2018, n = 13



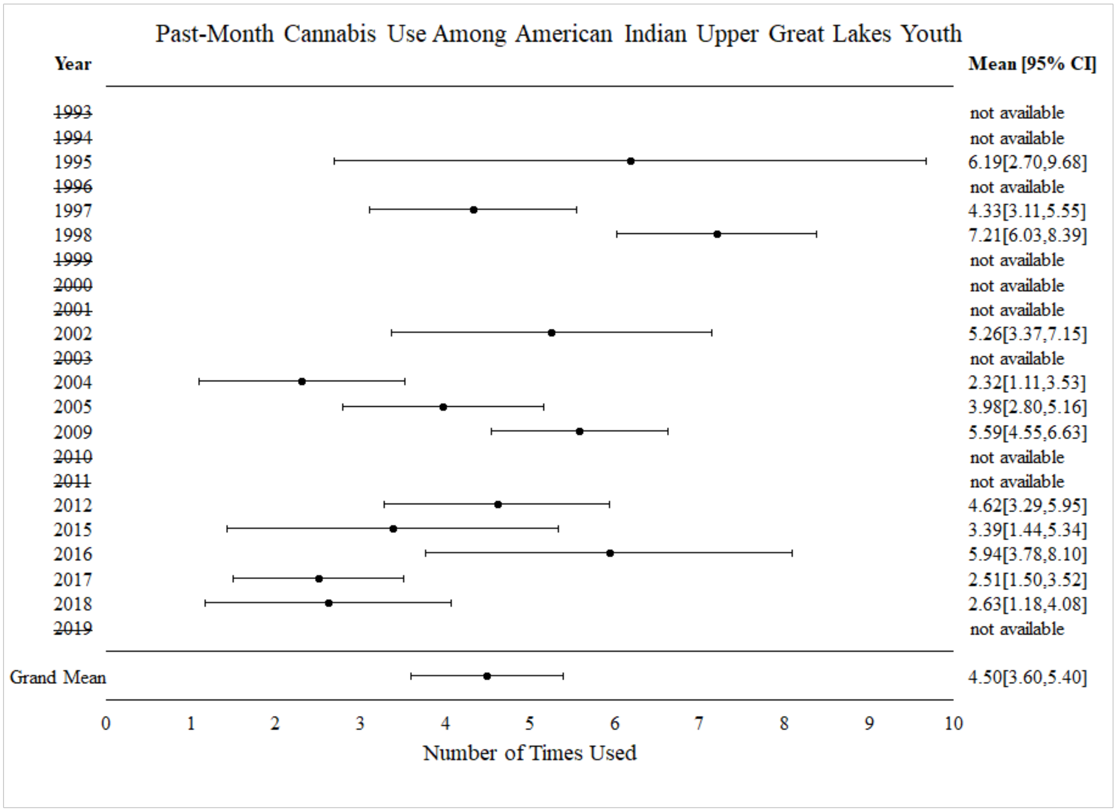
Note: Sample sizes for each year: 1993, n = 480; 1994, n = 367; 1997, n = 794; 1998, n = 312; 2001, n = 115; 2002, n = 290; 2003, n = 960; 2004, n = 158; 2009, n = 147; 2010, n = 157; 2011, n = 684; 2015, n = 14; 2016, n = 1112; 2017, n = 524; 2018, n = 683; 2019, n = 451



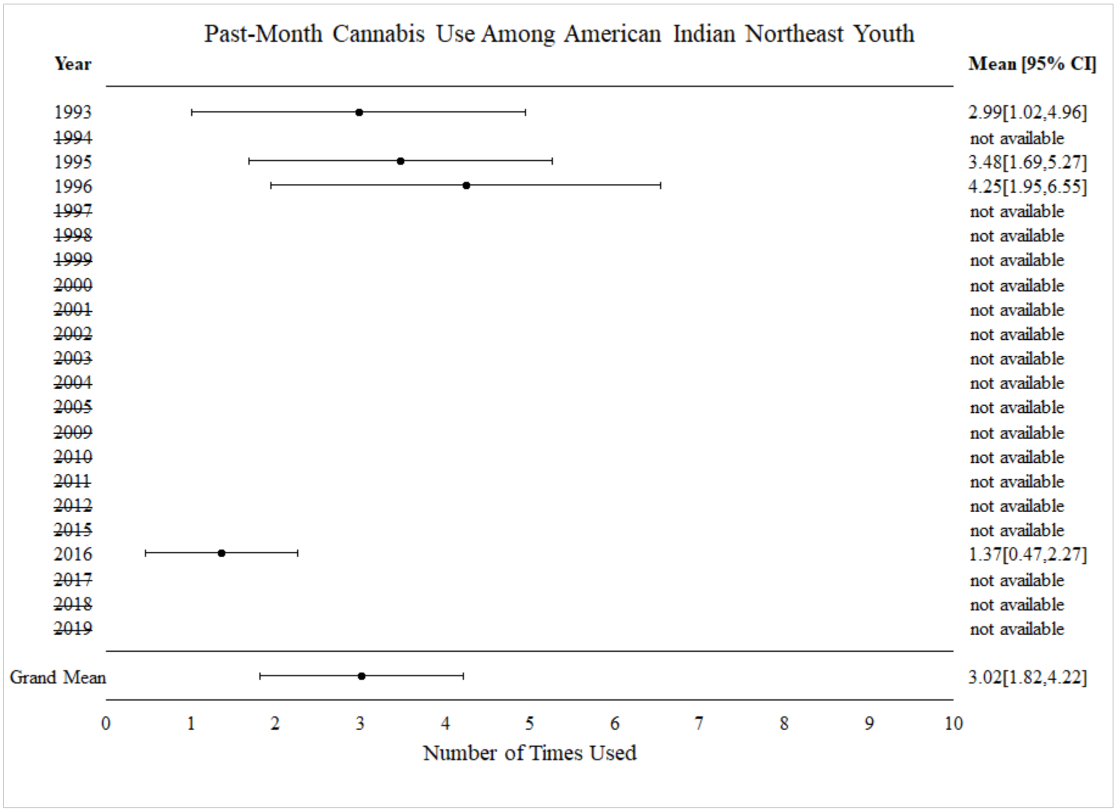
Note: Sample sizes for each year: 1996, n = 89; 2005, n = 94; 2009, n = 63; 2010, n = 10; 2015, n = 49; 2016, n = 45; 2017, n = 71; 2018, n = 15



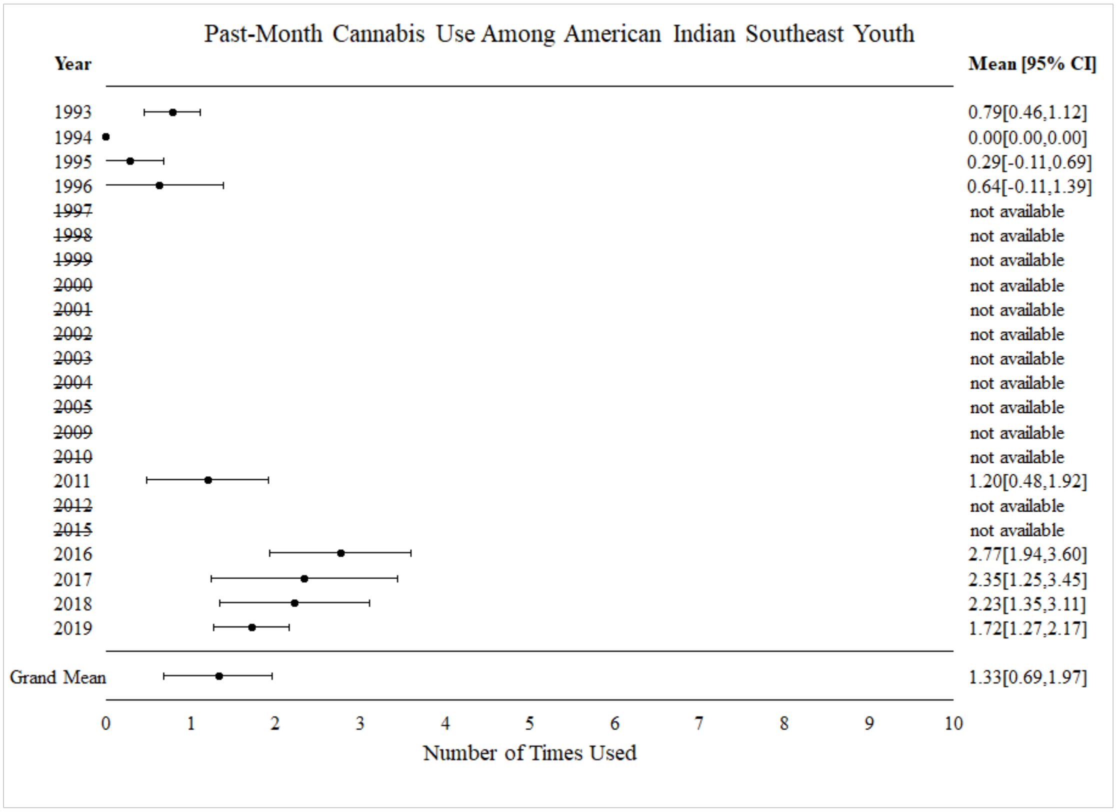
Note: Sample sizes for each year: 1993, n = 369; 1995, n = 195; 1996, n = 162; 1997, n = 99; 1998, n = 132; 1999, n = 251; 2000, n = 604; 2001, n = 50; 2002, n = 250; 2003, n = 63; 2005, n = 442; 2009, n = 502; 2010, n = 692; 2011, n = 325; 2012, n = 141; 2015, n = 198; 2016, n = 577; 2017, n = 220; 2018, n = 119



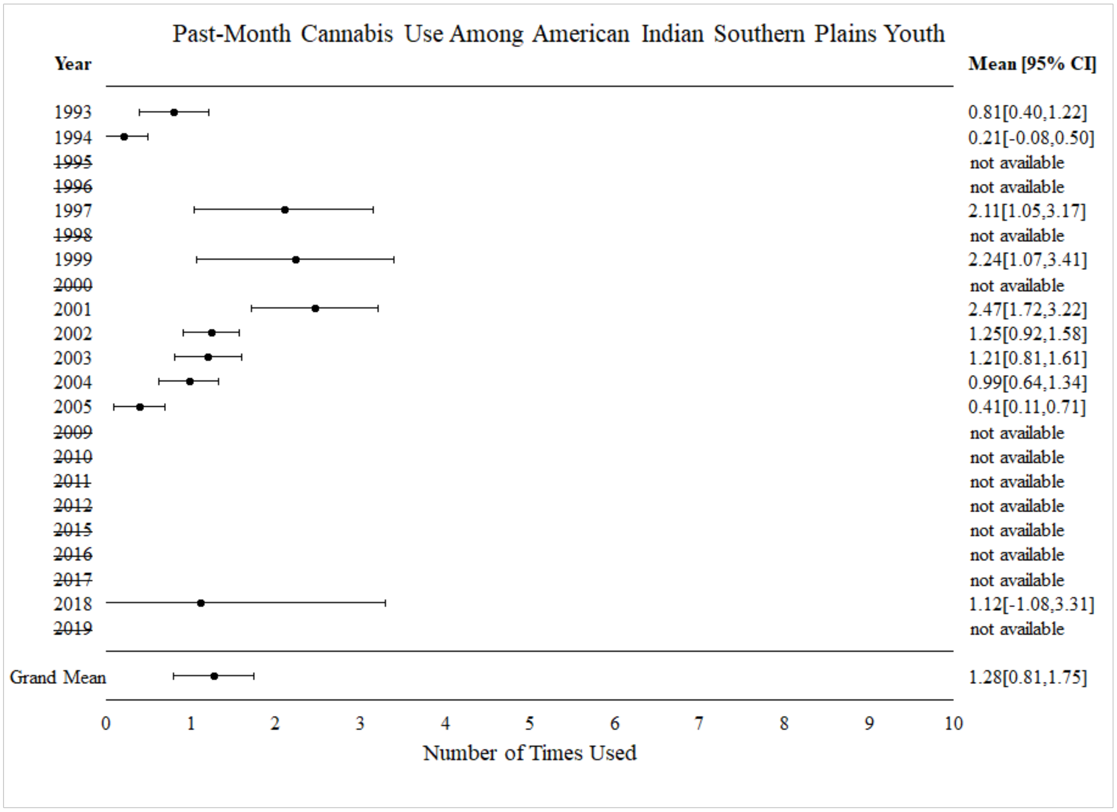
Note: Sample sizes for each year: 1995, n = 16; 1997, n = 127; 1998, n = 203; 2002, n = 64; 2004, n = 77; 2005, n = 122; 2009, n = 220; 2012, n = 132; 2015, n = 46; 2016, n = 64; 2017, n = 119; 2018, n = 68



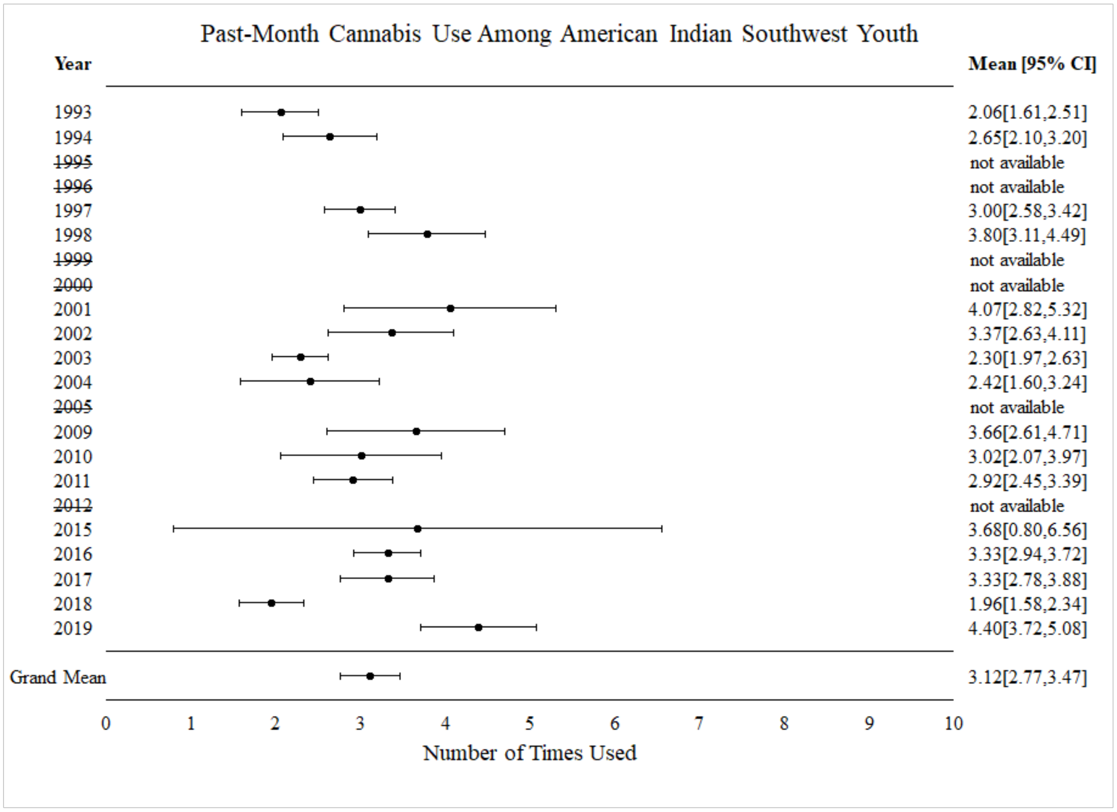
Note: Sample sizes for each year: 1993, n = 42; 1995, n = 48; 1996, n = 42; 2016, n = 84



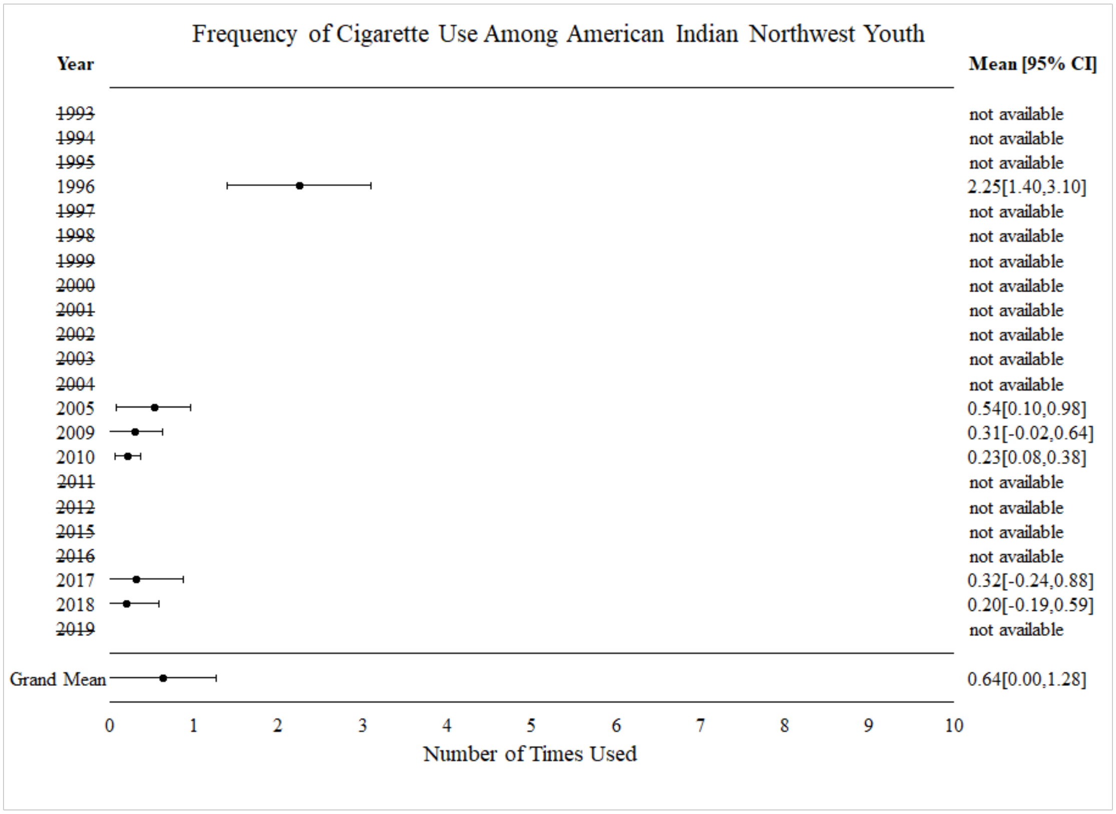
Note: Sample sizes for each year: 1993, n = 377; 1994, n = 11; 1995, n = 31; 1996, n = 55; 2011, n = 114; 2016, n = 207; 2017, n = 100; 2018, n = 176; 2019, n = 450



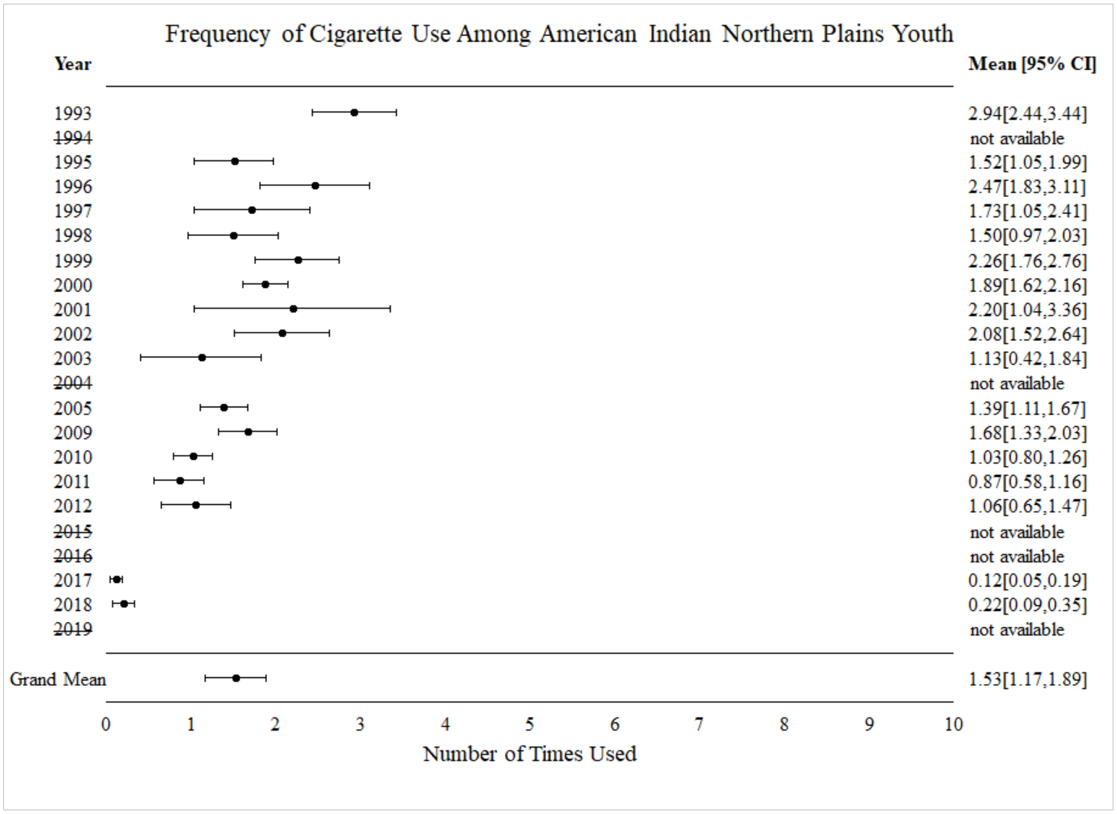
Note: Sample sizes for each year: 1993, n = 211; 1994, n = 42; 1997, n = 95; 1999, n = 94; 2001, n = 215; 2002, n = 532; 2003, n = 408; 2004, n = 394; 2005, n = 181; 2018, n = 13



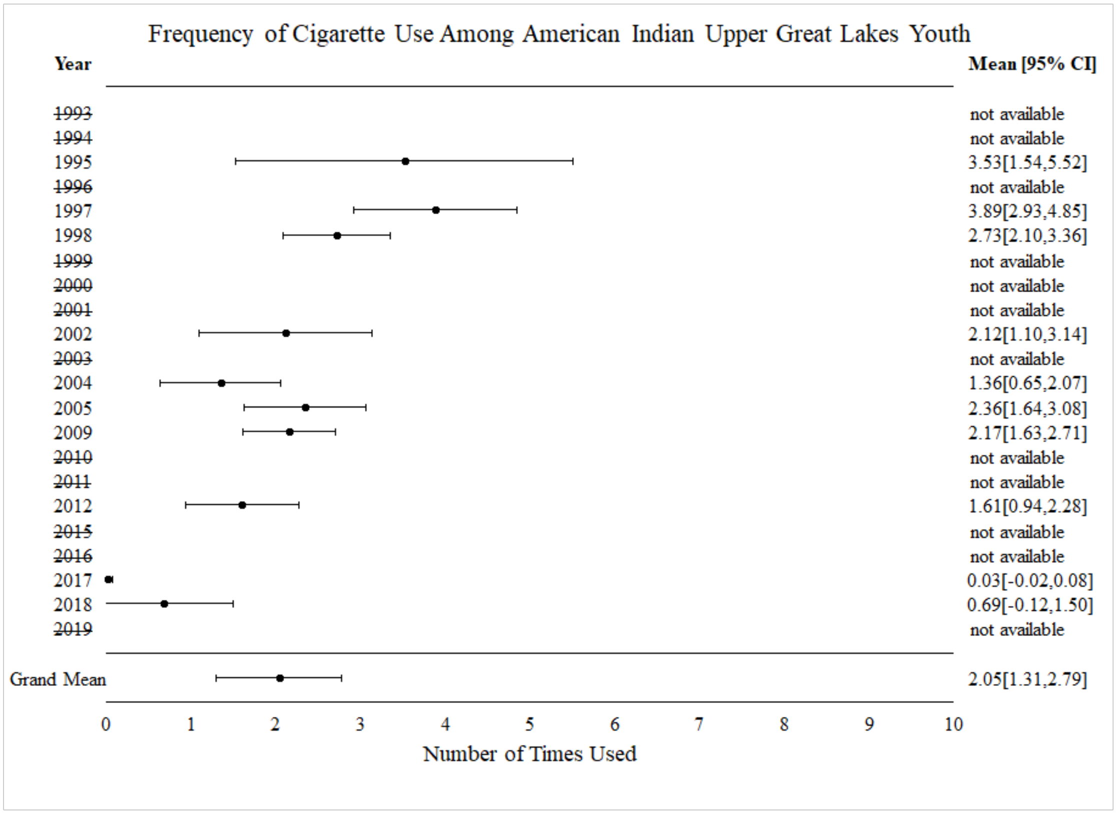
Note: Sample sizes for each year: 1993, n = 484; 1994, n = 376; 1997, n = 812; 1998, n = 318; 2001, n = 124; 2002, n = 296; 2003, n = 981; 2004, n = 162; 2009, n = 149; 2010, n = 163; 2011, n = 695; 2015, n = 14; 2016, n = 1111; 2017, n = 522; 2018, n = 677; 2019, n = 448



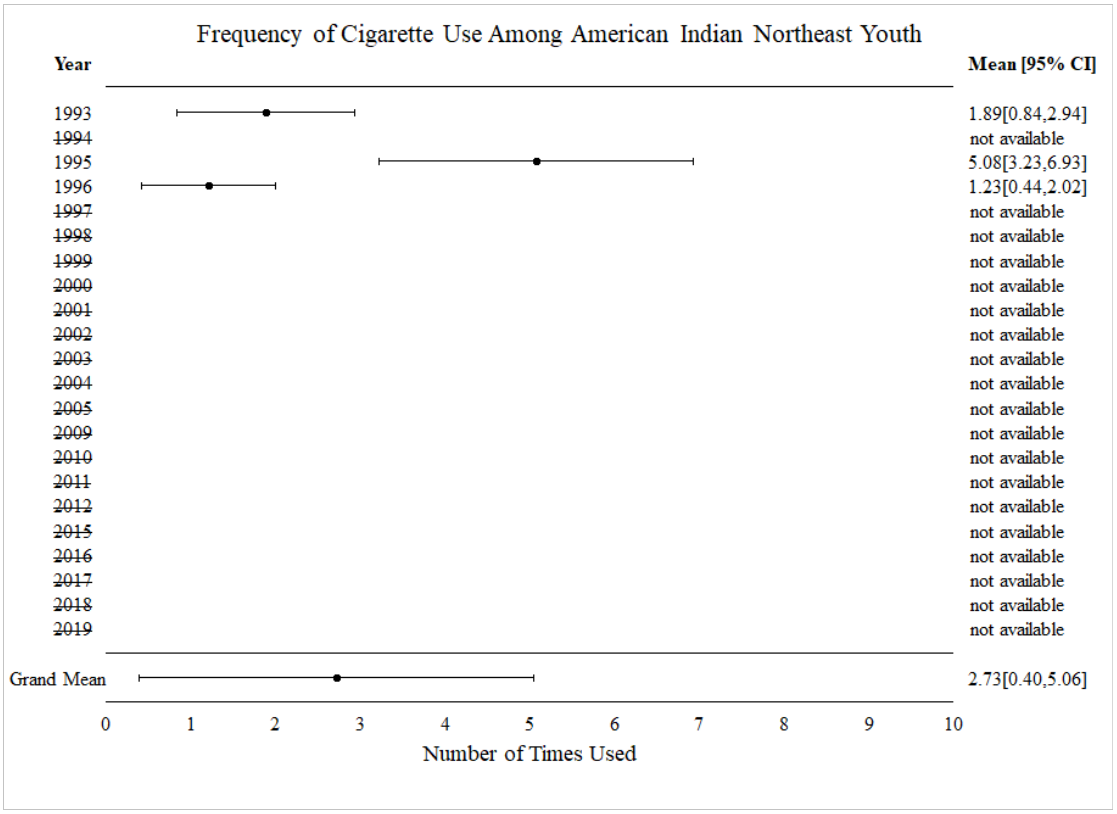
Note: Sample sizes for each year: 1996, n = 88; 2005, n = 93; 2009, n = 62; 2010, n = 11; 2017, n = 71; 2018, n = 15



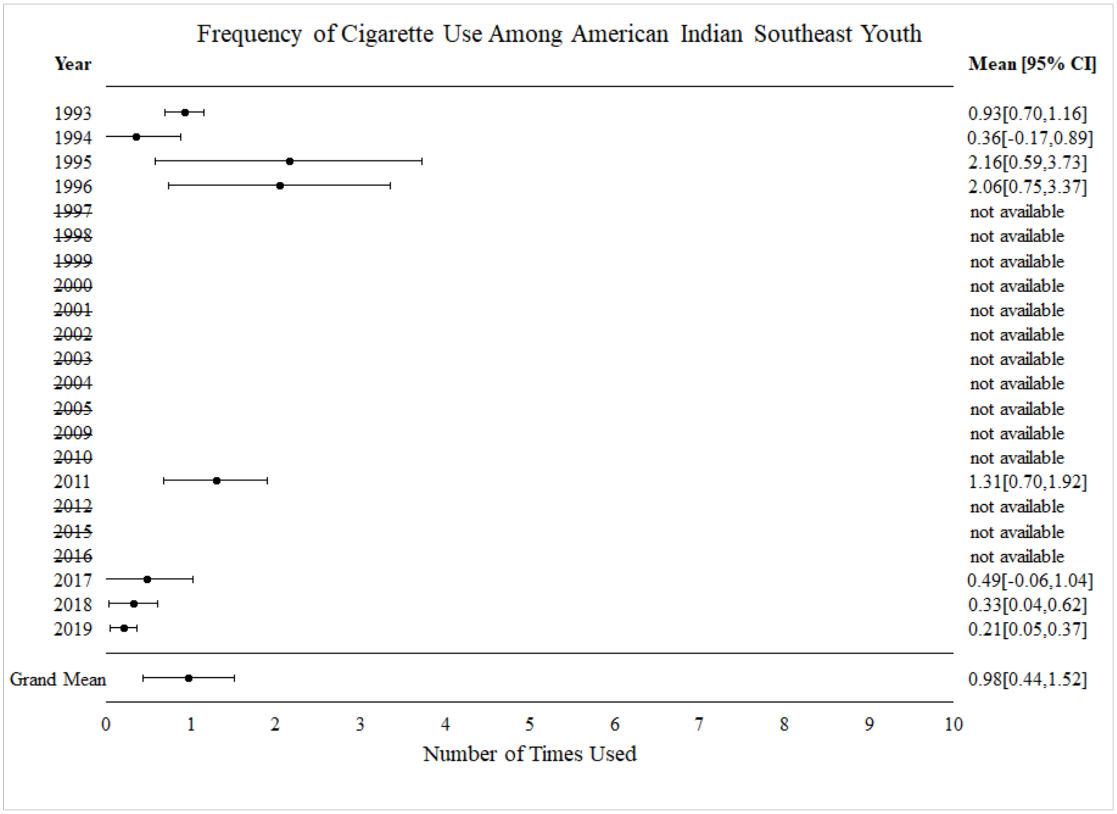
Note: Sample sizes for each year: 1993, n = 368; 1995, n = 193; 1996, n = 162; 1997, n = 94; 1998, n = 131; 1999, n = 248; 2000, n = 604; 2001, n = 49; 2002, n = 250; 2003, n = 63; 2005, n = 440; 2009, n = 496; 2010, n = 685; 2011, n = 324; 2012, n = 140; 2017, n = 220; 2018, n = 120



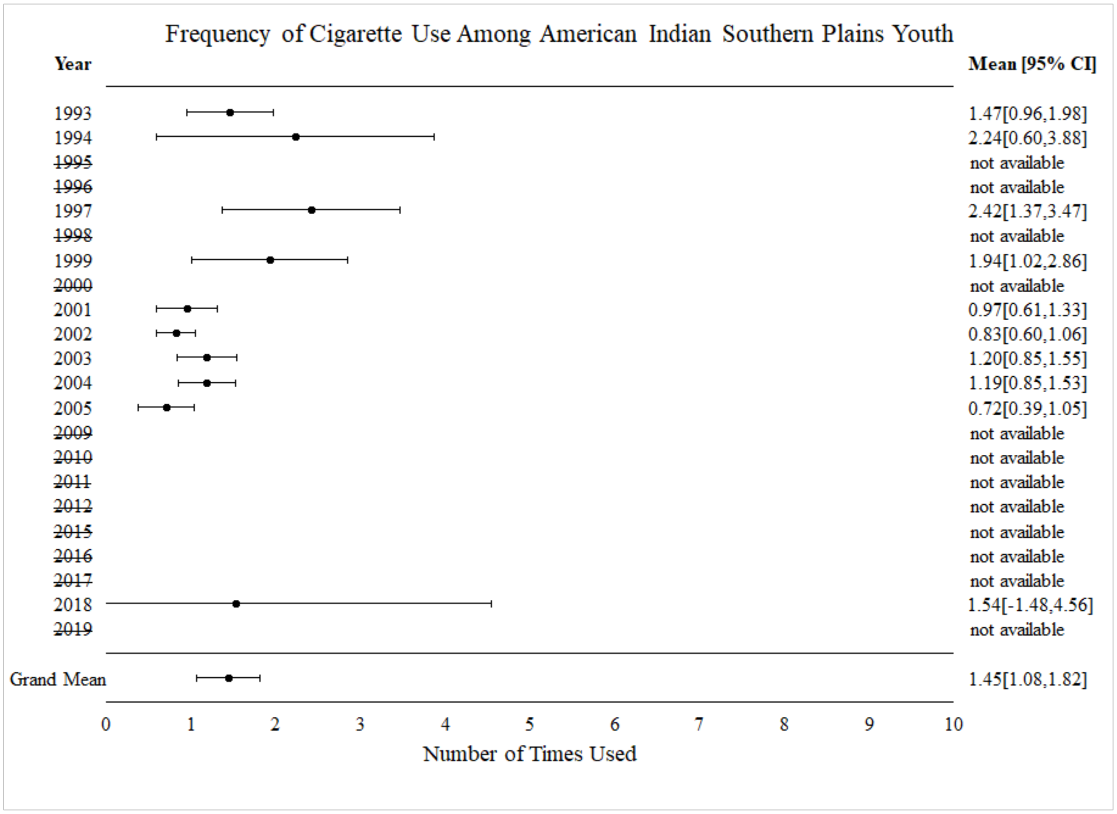
Note: Sample sizes for each year: 1995, n = 16; 1997, n = 126; 1998, n = 202; 2002, n = 63; 2004, n = 77; 2005, n = 121; 2009, n = 217; 2012, n = 131; 2017, n = 119; 2018, n = 68



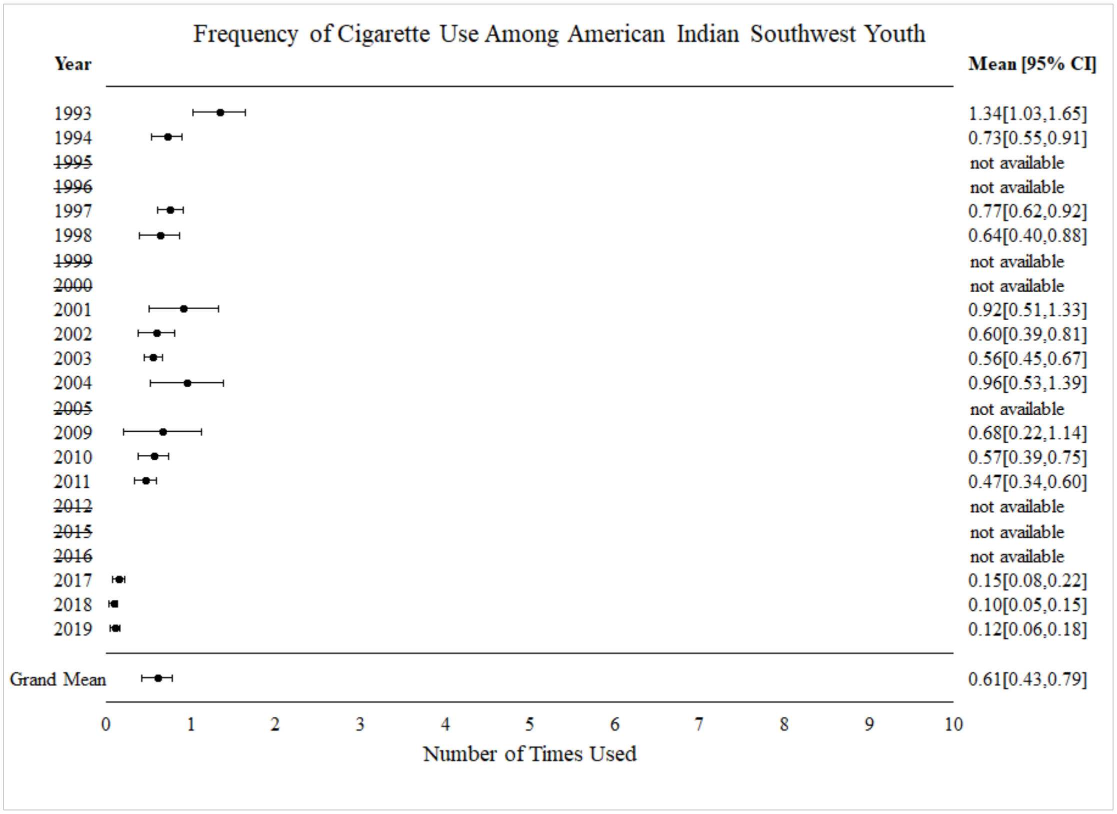
Note: Sample sizes for each year: 1993, n = 42; 1995, n = 48; 1996, n = 42



Note: Sample sizes for each year: 1993, n = 376; 1994, n = 11; 1995, n = 31; 1996, n = 55; 2011, n = 110; 2017, n = 101; 2018, n = 177; 2019, n = 453



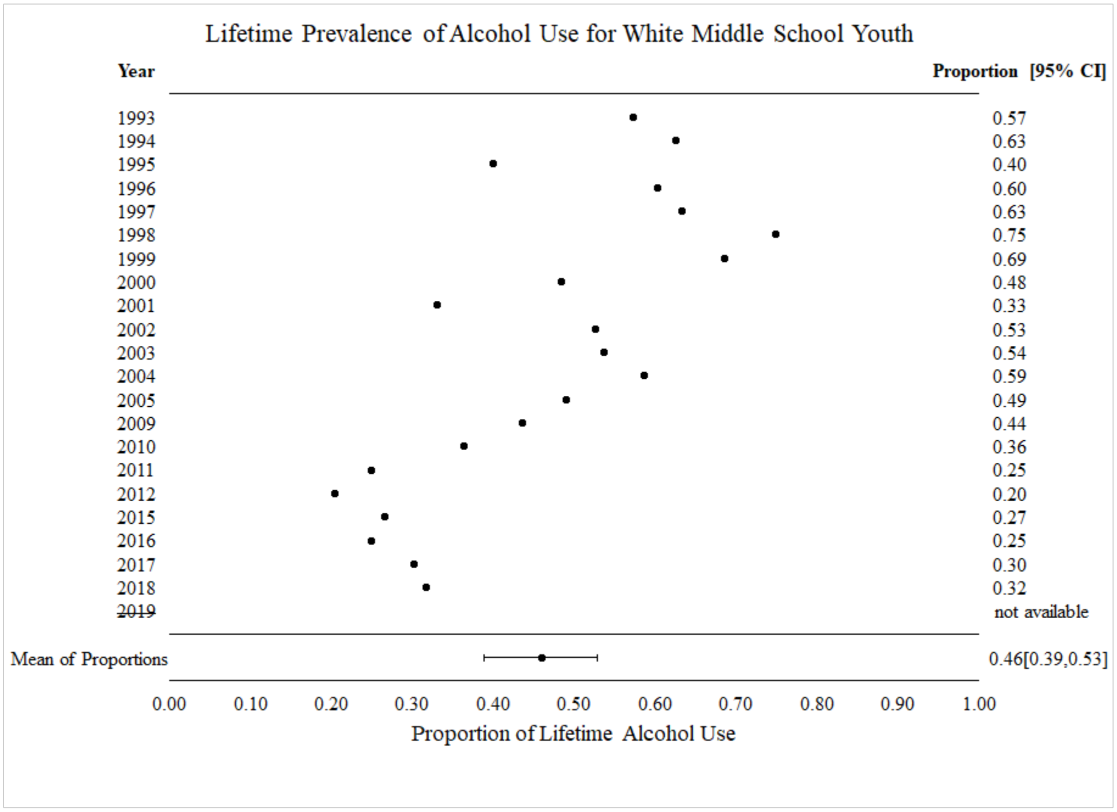
Note: Sample sizes for each year: 1993, n = 208; 1994, n = 41; 1997, n = 95; 1999, n = 94; 2001, n = 215; 2002, n = 528; 2003, n = 408; 2004, n = 394; 2005, n = 181; 2018, n = 13



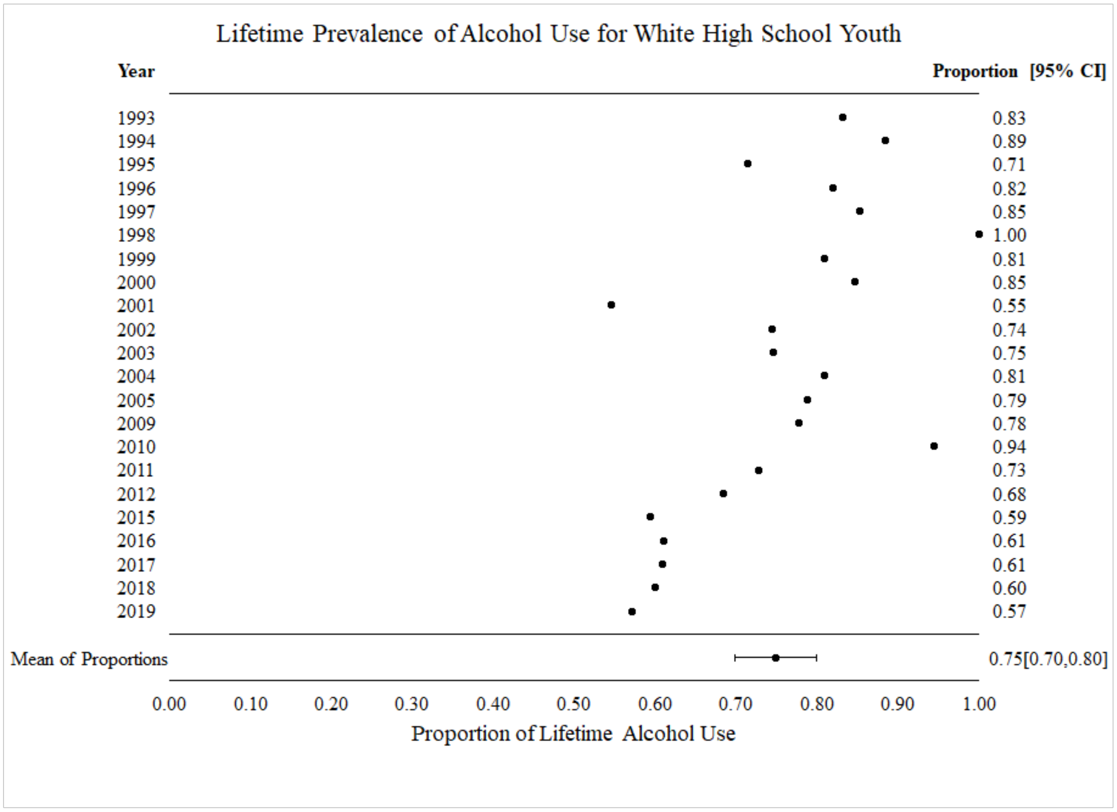
Note: Sample sizes for each year: 1993, n = 481; 1994, n = 371; 1997, n = 814; 1998, n = 316; 2001, n = 124; 2002, n = 296; 2003, n = 971; 2004, n = 163; 2009, n = 146; 2010, n = 161; 2011, n = 694; 2017, n = 524; 2018, n = 683; 2019, n = 455

APPENDIX G

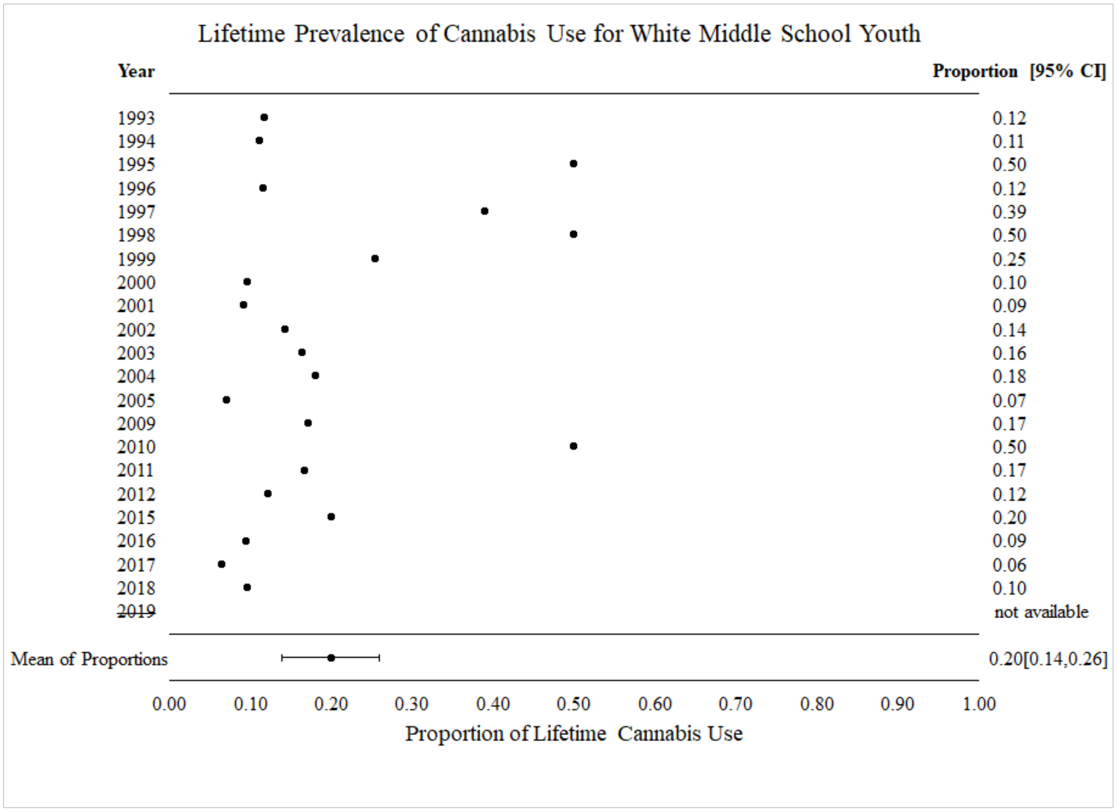
Aim 2: Substance Use for White Youth by Year and Grade Group



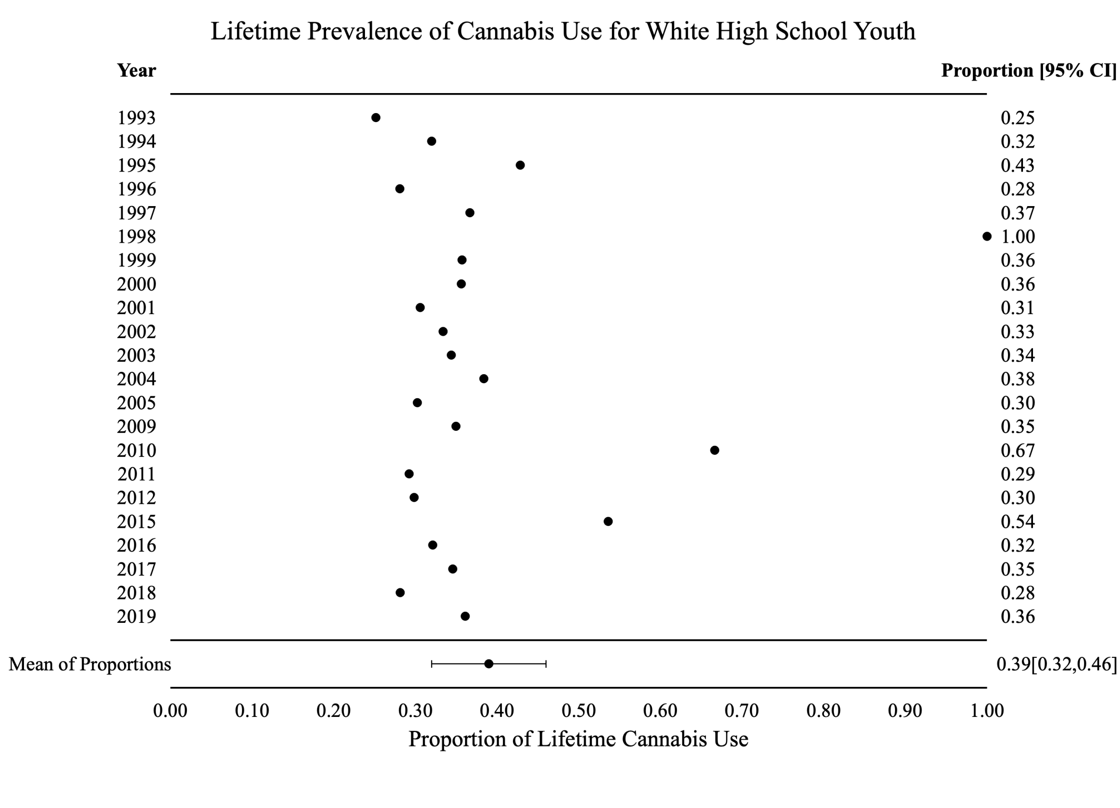
Note: Sample sizes for each year: 1993, n = 478; 1994, n = 198; 1995, n = 10; 1996, n = 53; 1997, n = 41; 1998, n = 4; 1999, n = 67; 2000, n = 31; 2001, n = 109; 2002, n = 535; 2003, n = 205; 2004, n = 273; 2005, n = 210; 2009, n = 117; 2010, n = 11; 2011, n = 12; 2012, n = 49; 2015, n = 45; 2016, n = 309; 2017, n = 344; 2018, n = 312



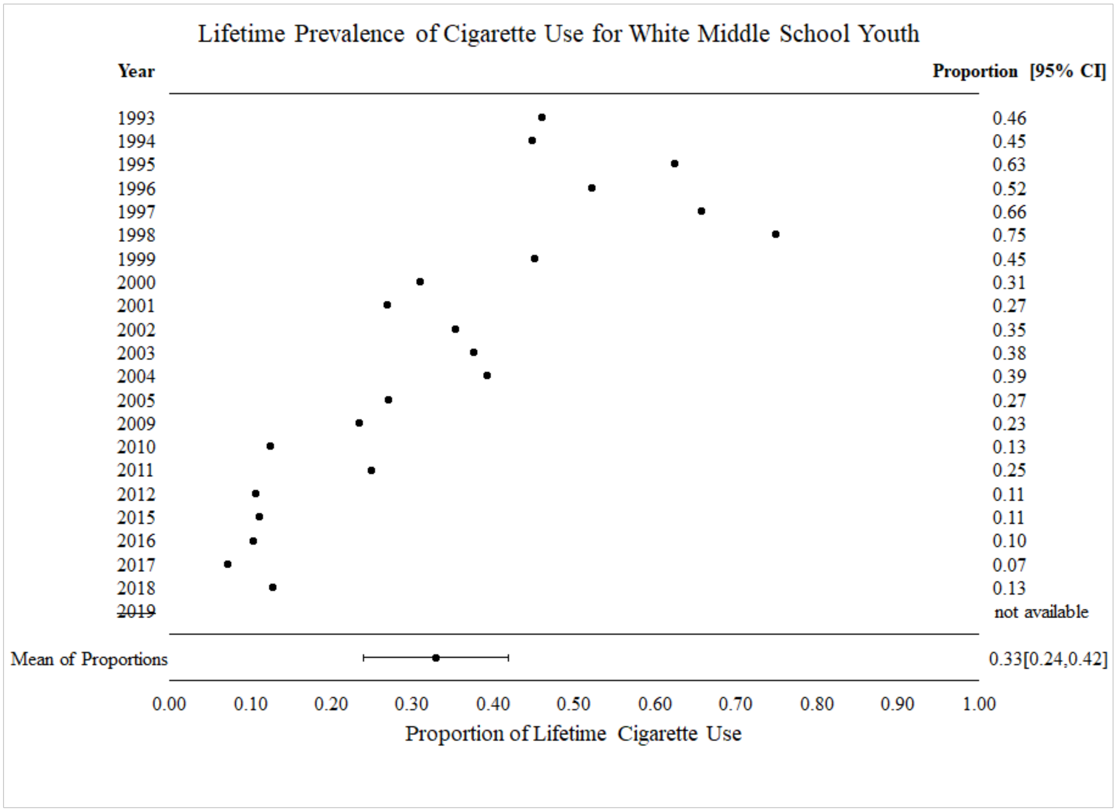
Note: Sample sizes for each year: 1993, n = 669; 1994, n = 296; 1995, n = 7; 1996, n = 89; 1997, n = 683; 1998, n = 1; 1999, n = 84; 2000, n = 59; 2001, n = 506; 2002, n = 739; 2003, n = 406; 2004, n = 395; 2005, n = 897; 2009, n = 643; 2010, n = 18; 2011, n = 346; 2012, n = 402; 2015, n = 69; 2016, n = 686; 2017, n = 110; 2018, n = 265; 2019, n = 238



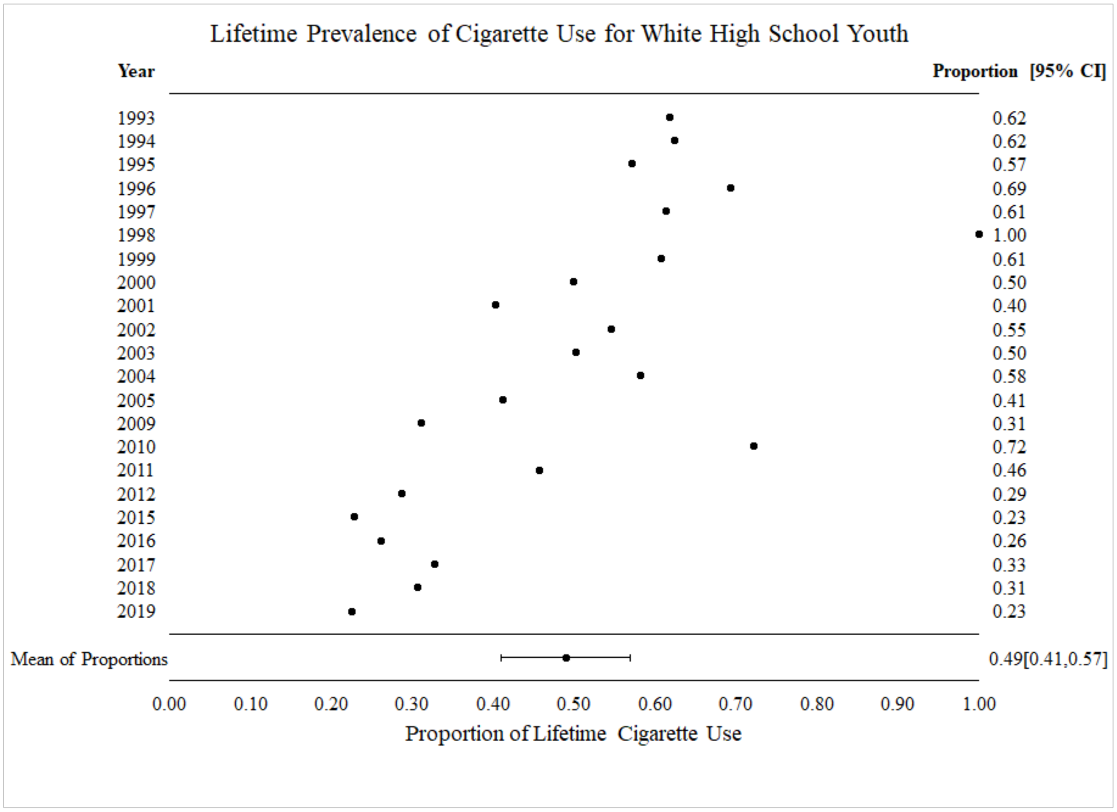
Note: Sample sizes for each year: 1993, n = 477; 1994, n = 198; 1995, n = 10; 1996, n = 52; 1997, n = 41; 1998, n = 4; 1999, n = 67; 2000, n = 31; 2001, n = 109; 2002, n = 536; 2003, n = 207; 2004, n = 272; 2005, n = 210; 2009, n = 117; 2010, n = 10; 2011, n = 12; 2012, n = 49; 2015, n = 45; 2016, n = 308; 2017, n = 340; 2018, n = 310



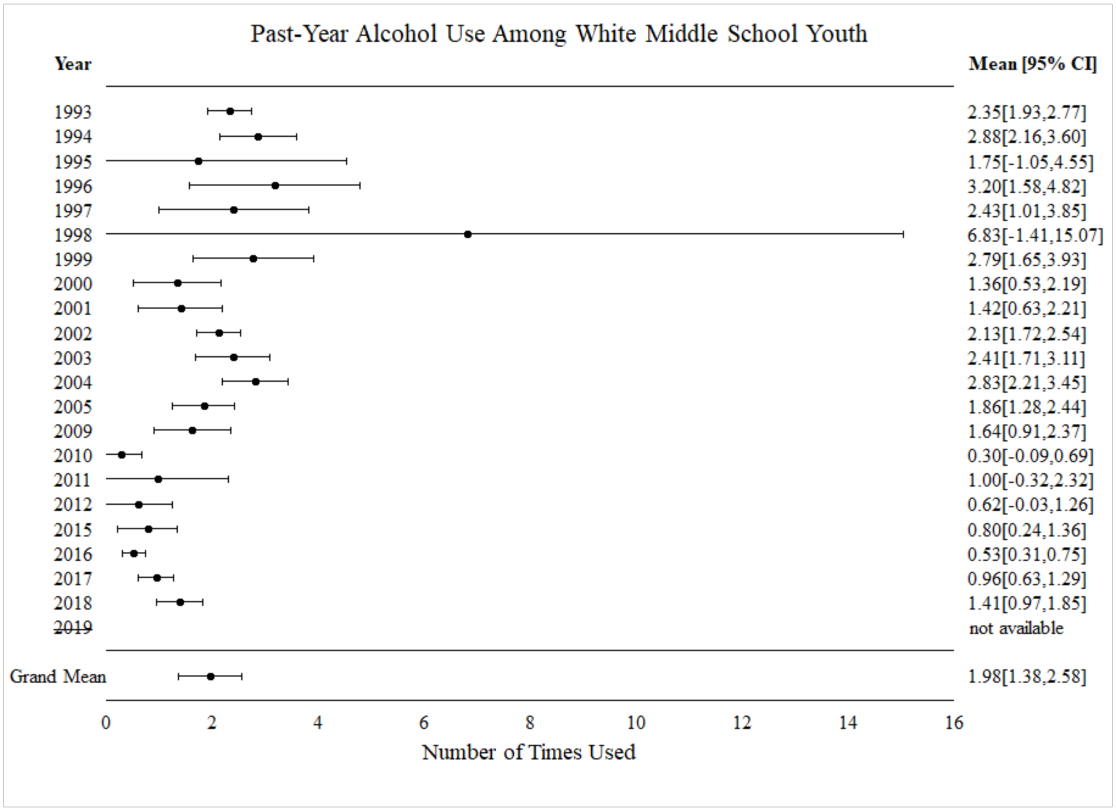
Note: Sample sizes for each year: 1993, n = 668; 1994, n = 297; 1995, n = 7; 1996, n = 89; 1997, n = 682; 1998, n = 1; 1999, n = 84; 2000, n = 59; 2001, n = 507; 2002, n = 740; 2003, n = 407; 2004, n = 396; 2005, n = 896; 2009, n = 638; 2010, n = 18; 2011, n = 342; 2012, n = 392; 2015, n = 69; 2016, n = 682; 2017, n = 110; 2018, n = 263; 2019, n = 230



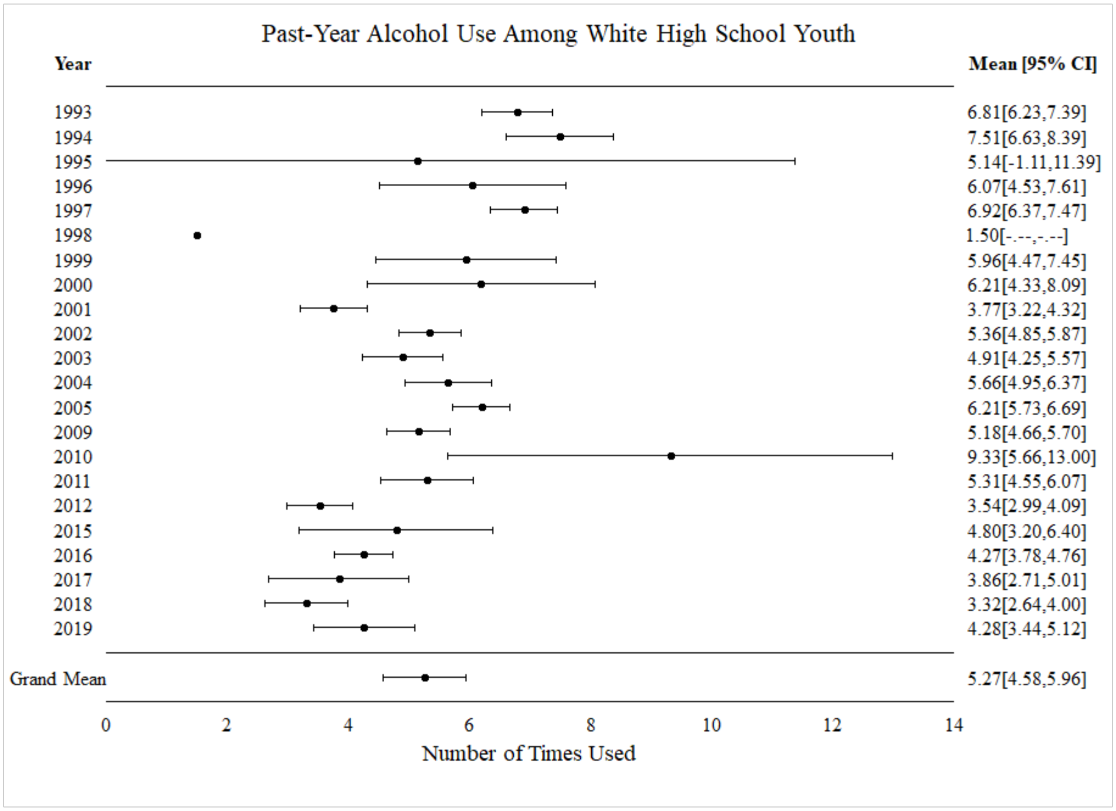
Note: Sample sizes for each year: 1993, n = 415; 1994, n = 163; 1995, n = 8; 1996, n = 44; 1997, n = 35; 1998, n = 4; 1999, n = 62; 2000, n = 29; 2001, n = 89; 2002, n = 446; 2003, n = 170; 2004, n = 224; 2005, n = 174; 2009, n = 111; 2010, n = 8; 2011, n = 12; 2012, n = 47; 2015, n = 45; 2016, n = 310; 2017, n = 345; 2018, n = 312



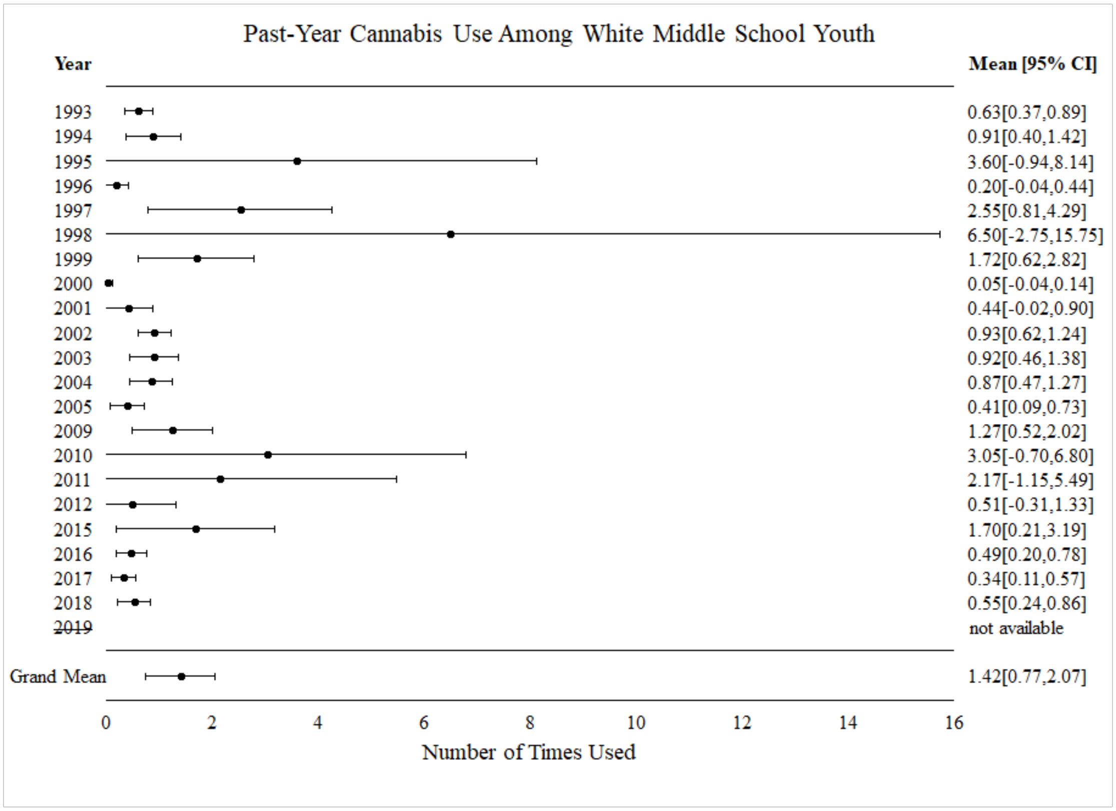
Note: Sample sizes for each year: 1993, n = 609; 1994, n = 266; 1995, n = 7; 1996, n = 85; 1997, n = 629; 1998, n = 1; 1999, n = 79; 2000, n = 52; 2001, n = 456; 2002, n = 676; 2003, n = 370; 2004, n = 352; 2005, n = 797; 2009, n = 636; 2010, n = 18; 2011, n = 328; 2012, n = 386; 2015, n = 70; 2016, n = 687; 2017, n = 110; 2018, n = 267; 2019, n = 239



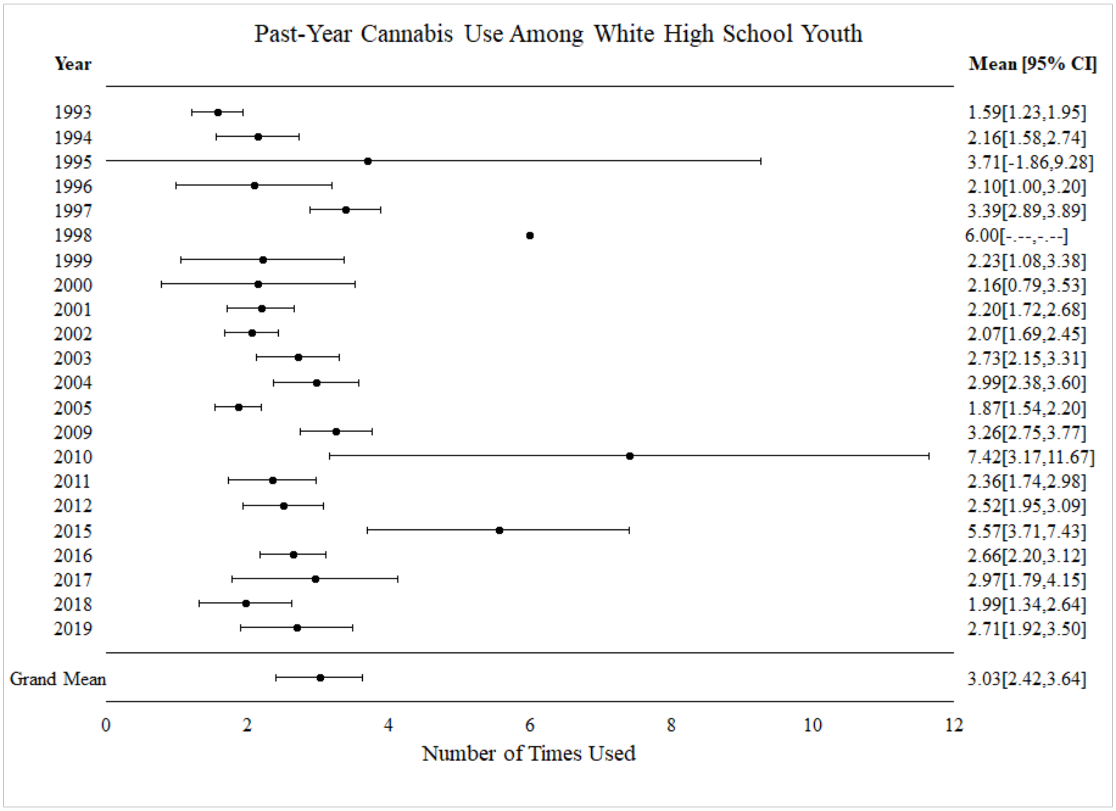
Note: Sample sizes for each year: 1993, n = 471; 1994, n = 195; 1995, n = 10; 1996, n = 51; 1997, n = 40; 1998, n = 3; 1999, n = 65; 2000, n = 31; 2001, n = 106; 2002, n = 527; 2003, n = 204; 2004, n = 269; 2005, n = 207; 2009, n = 116; 2010, n = 10; 2011, n = 12; 2012, n = 48; 2015, n = 45; 2016, n = 308; 2017, n = 344; 2018, n = 312



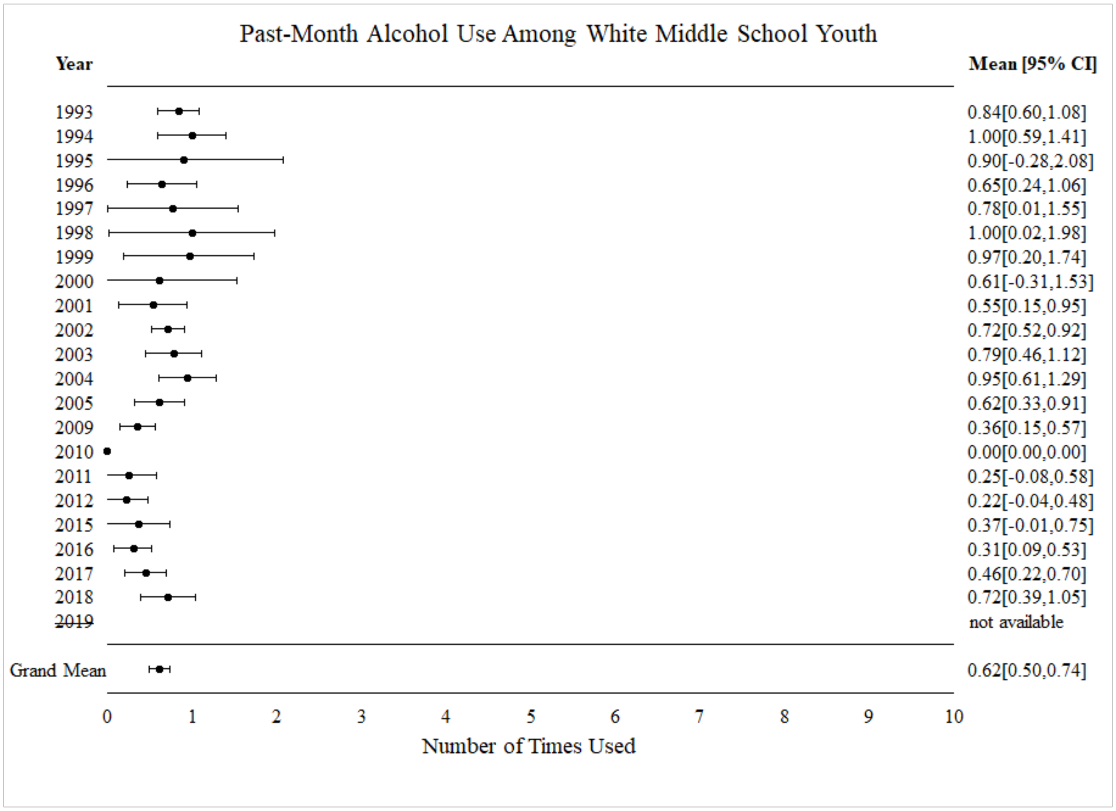
Note: Sample sizes for each year: 1993, n = 655; 1994, n = 290; 1995, n = 7; 1996, n = 88; 1997, n = 675; 1998, n = 1; 1999, n = 84; 2000, n = 58; 2001, n = 503; 2002, n = 732; 2003, n = 396; 2004, n = 389; 2005, n = 885; 2009, n = 632; 2010, n = 18; 2011, n = 343; 2012, n = 394; 2015, n = 69; 2016, n = 685; 2017, n = 110; 2018, n = 264; 2019, n = 238



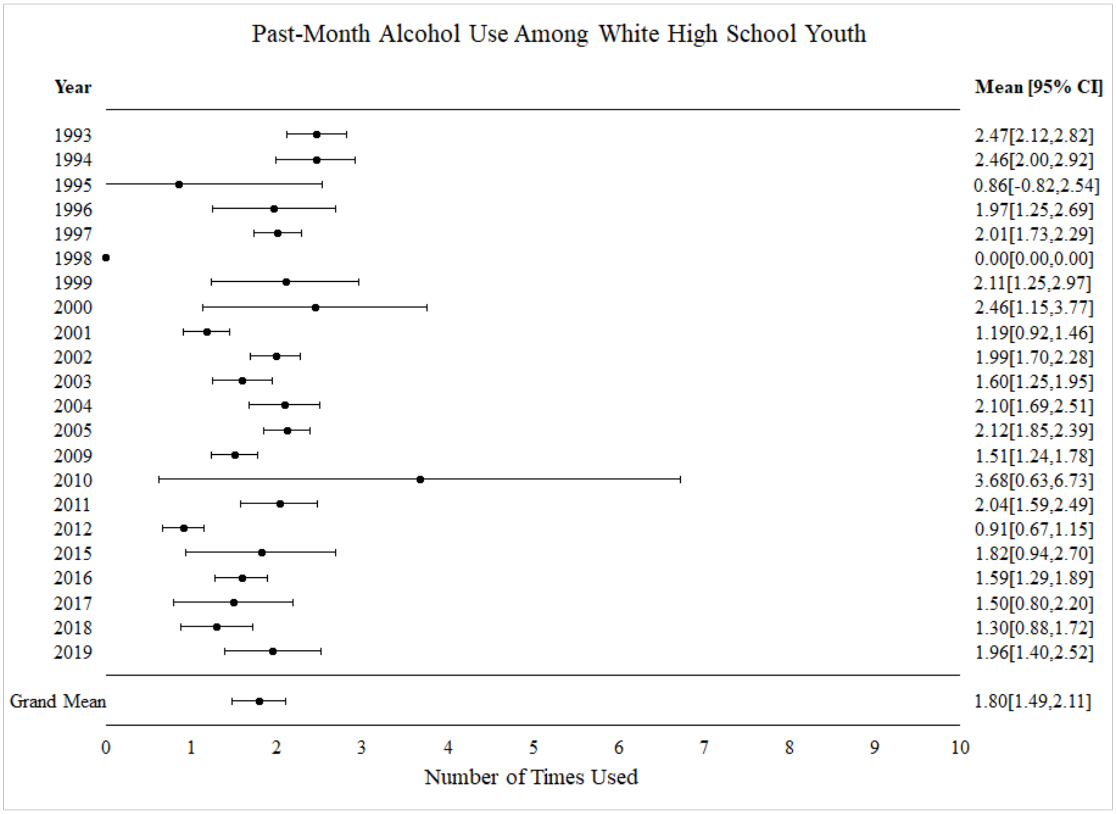
Note: Sample sizes for each year: 1993, n = 477; 1994, n = 198; 1995, n = 10; 1996, n = 52; 1997, n = 41; 1998, n = 4; 1999, n = 67; 2000, n = 31; 2001, n = 109; 2002, n = 537; 2003, n = 207; 2004, n = 273; 2005, n = 209; 2009, n = 117; 2010, n = 10; 2011, n = 12; 2012, n = 48; 2015, n = 45; 2016, n = 308; 2017, n = 340; 2018, n = 311



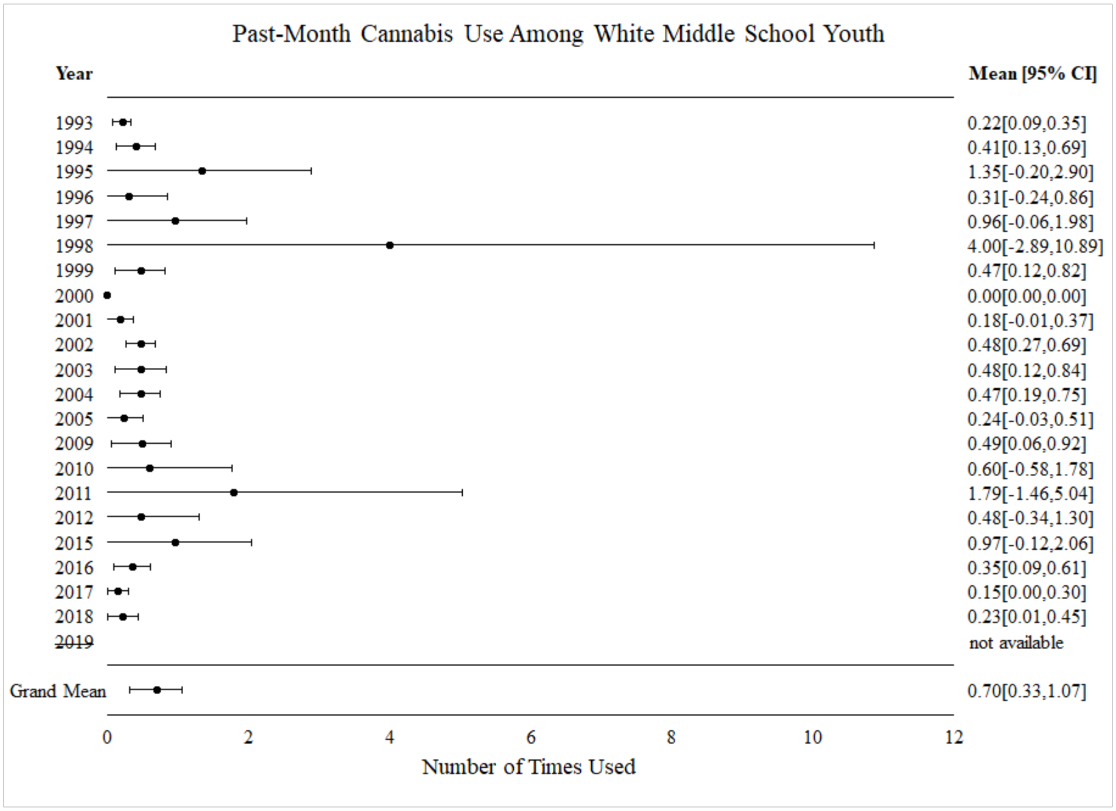
Note: Sample sizes for each year: 1993, n = 667; 1994, n = 294; 1995, n = 7; 1996, n = 89; 1997, n = 684; 1998, n = 1; 1999, n = 84; 2000, n = 59; 2001, n = 507; 2002, n = 740; 2003, n = 407; 2004, n = 395; 2005, n = 893; 2009, n = 638; 2010, n = 18; 2011, n = 341; 2012, n = 392; 2015, n = 69; 2016, n = 681; 2017, n = 110; 2018, n = 262; 2019, n = 230



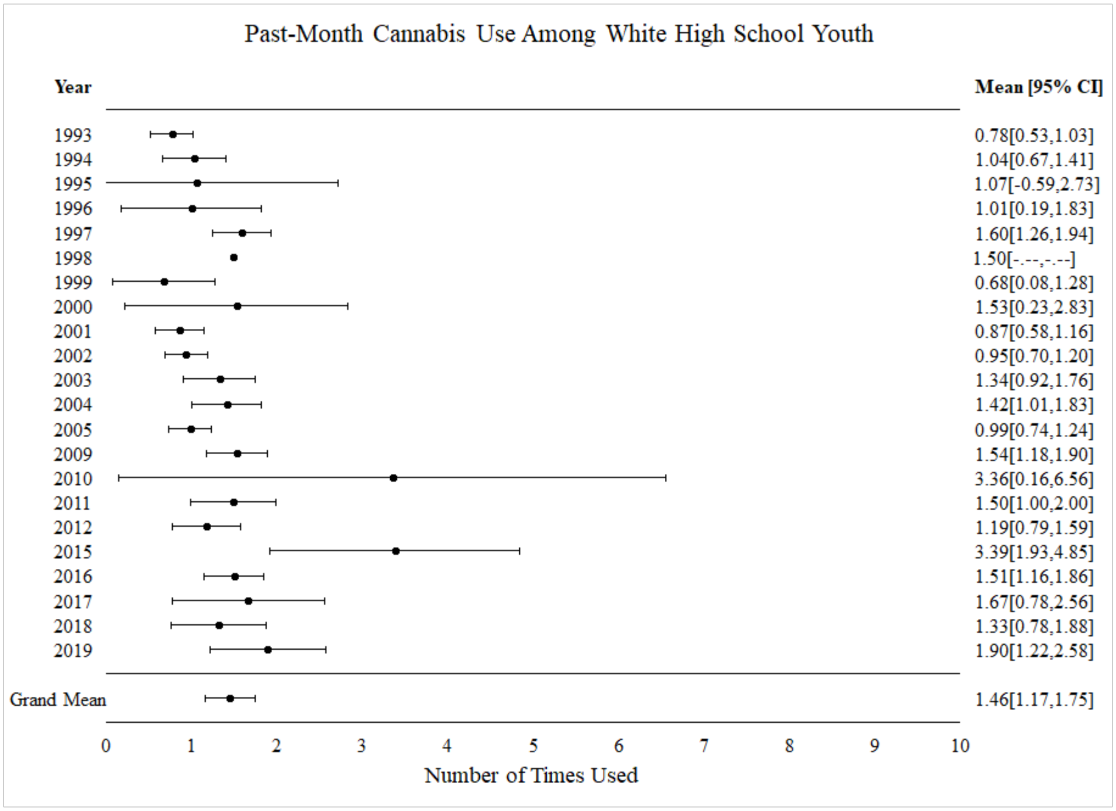
Note: Sample sizes for each year: 1993, n = 472; 1994, n = 197; 1995, n = 10; 1996, n = 51; 1997, n = 40; 1998, n = 3; 1999, n = 65; 2000, n = 31; 2001, n = 108; 2002, n = 527; 2003, n = 203; 2004, n = 267; 2005, n = 208; 2009, n = 117; 2010, n = 10; 2011, n = 12; 2012, n = 48; 2015, n = 45; 2016, n = 308; 2017, n = 344; 2018, n = 312



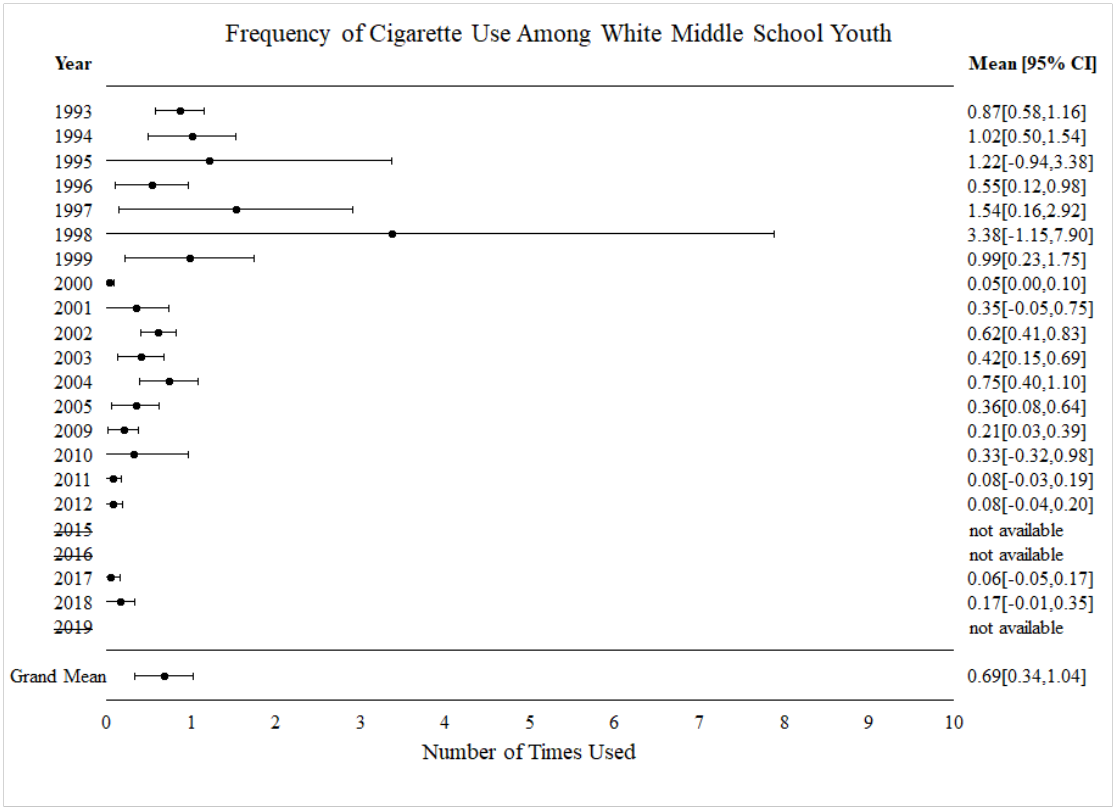
Note: Sample sizes for each year: 1993, n = 657; 1994, n = 292; 1995, n = 7; 1996, n = 88; 1997, n = 673; 1998, n = 1; 1999, n = 84; 2000, n = 56; 2001, n = 502; 2002, n = 731; 2003, n = 403; 2004, n = 388; 2005, n = 883; 2009, n = 636; 2010, n = 17; 2011, n = 344; 2012, n = 393; 2015, n = 69; 2016, n = 684; 2017, n = 110; 2018, n = 264; 2019, n = 238



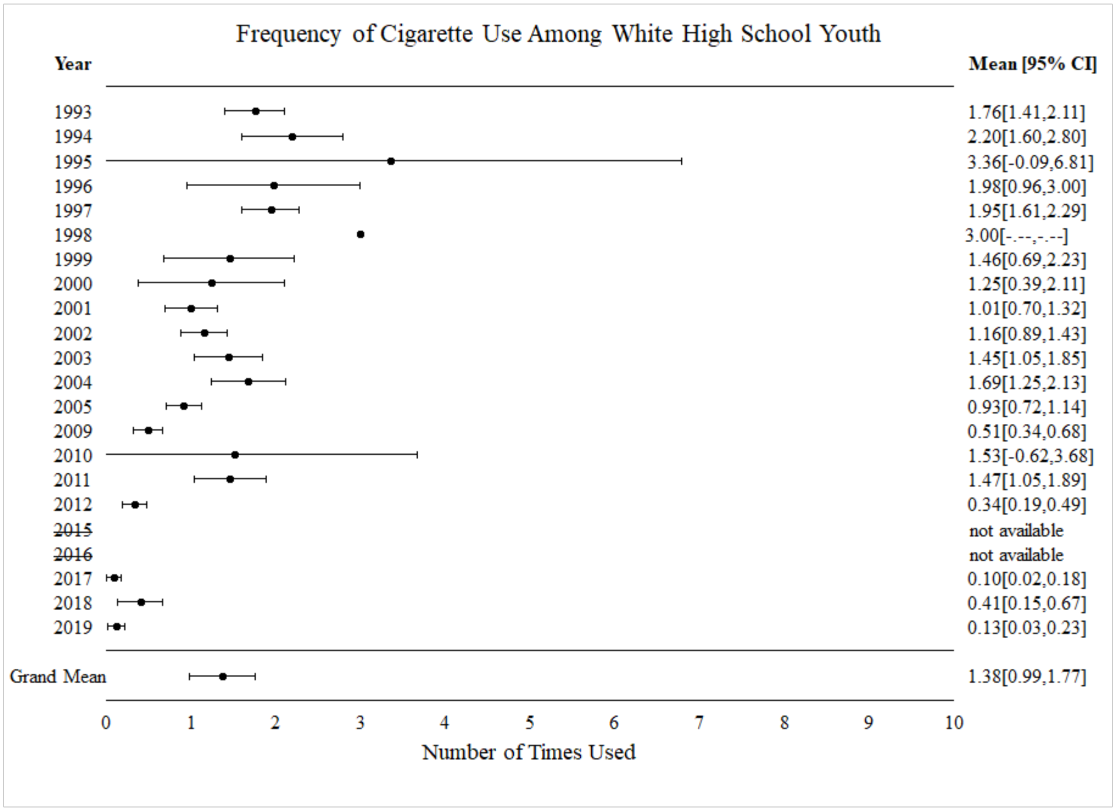
Note: Sample sizes for each year: 1993, n = 477; 1994, n = 198; 1995, n = 10; 1996, n = 52; 1997, n = 41; 1998, n = 4; 1999, n = 67; 2000, n = 31; 2001, n = 108; 2002, n = 535; 2003, n = 207; 2004, n = 273; 2005, n = 210; 2009, n = 117; 2010, n = 10; 2011, n = 12; 2012, n = 48; 2015, n = 45; 2016, n = 308; 2017, n = 340; 2018, n = 311



Note: Sample sizes for each year: 1993, n = 668; 1994, n = 297; 1995, n = 7; 1996, n = 89; 1997, n = 682; 1998, n = 1; 1999, n = 84; 2000, n = 59; 2001, n = 506; 2002, n = 741; 2003, n = 406; 2004, n = 394; 2005, n = 896; 2009, n = 637; 2010, n = 18; 2011, n = 342; 2012, n = 392; 2015, n = 69; 2016, n = 682; 2017, n = 110; 2018, n = 263; 2019, n = 230



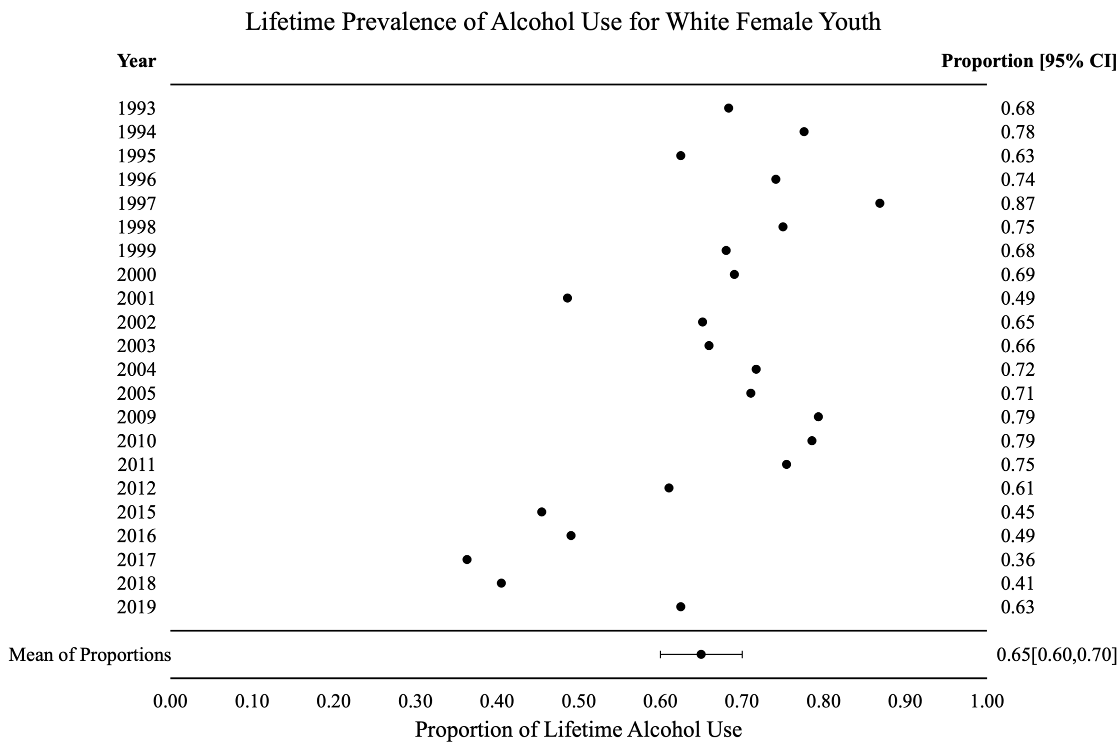
Note: Sample sizes for each year: 1993, n = 474; 1994, n = 195; 1995, n = 9; 1996, n = 51; 1997, n = 41; 1998, n = 4; 1999, n = 67; 2000, n = 31; 2001, n = 108; 2002, n = 536; 2003, n = 206; 2004, n = 270; 2005, n = 211; 2009, n = 117; 2010, n = 9; 2011, n = 12; 2012, n = 49; 2017, n = 345; 2018, n = 312



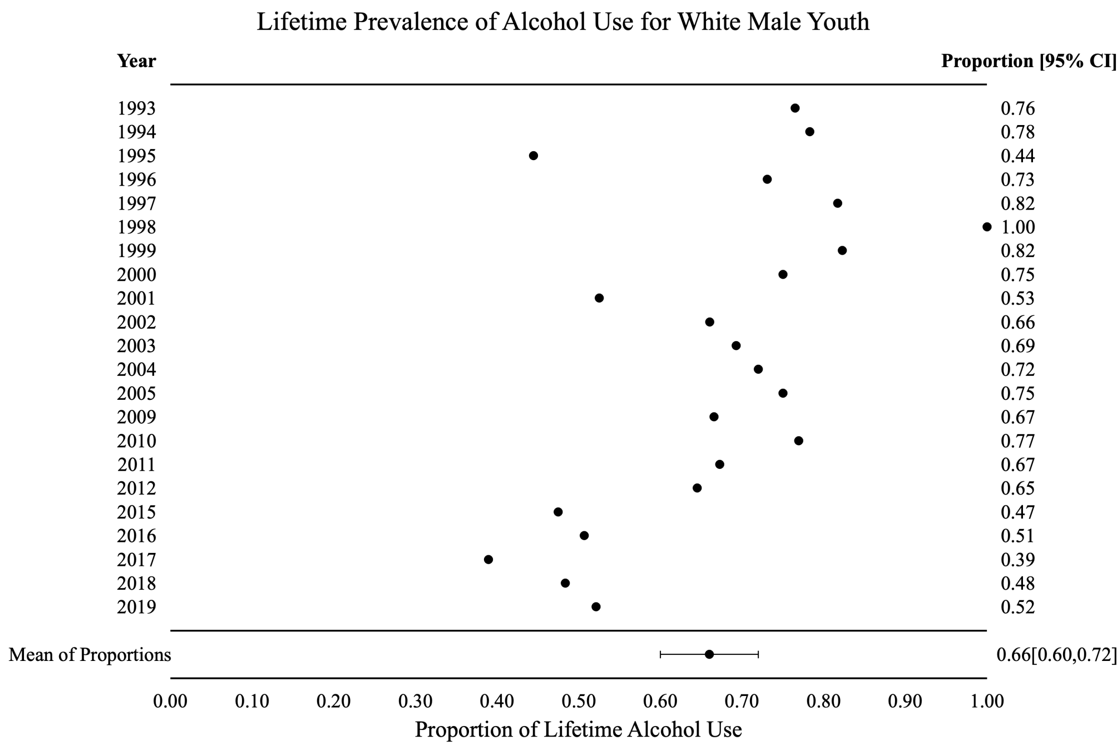
Note: Sample sizes for each year: 1993, n = 667; 1994, n = 296; 1995, n = 7; 1996, n = 89; 1997, n = 681; 1998, n = 1; 1999, n = 83; 2000, n = 59; 2001, n = 503; 2002, n = 738; 2003, n = 407; 2004, n = 392; 2005, n = 894; 2009, n = 633; 2010, n = 18; 2011, n = 337; 2012, n = 390; 2017, n = 110; 2018, n = 267; 2019, n = 239

APPENDIX H

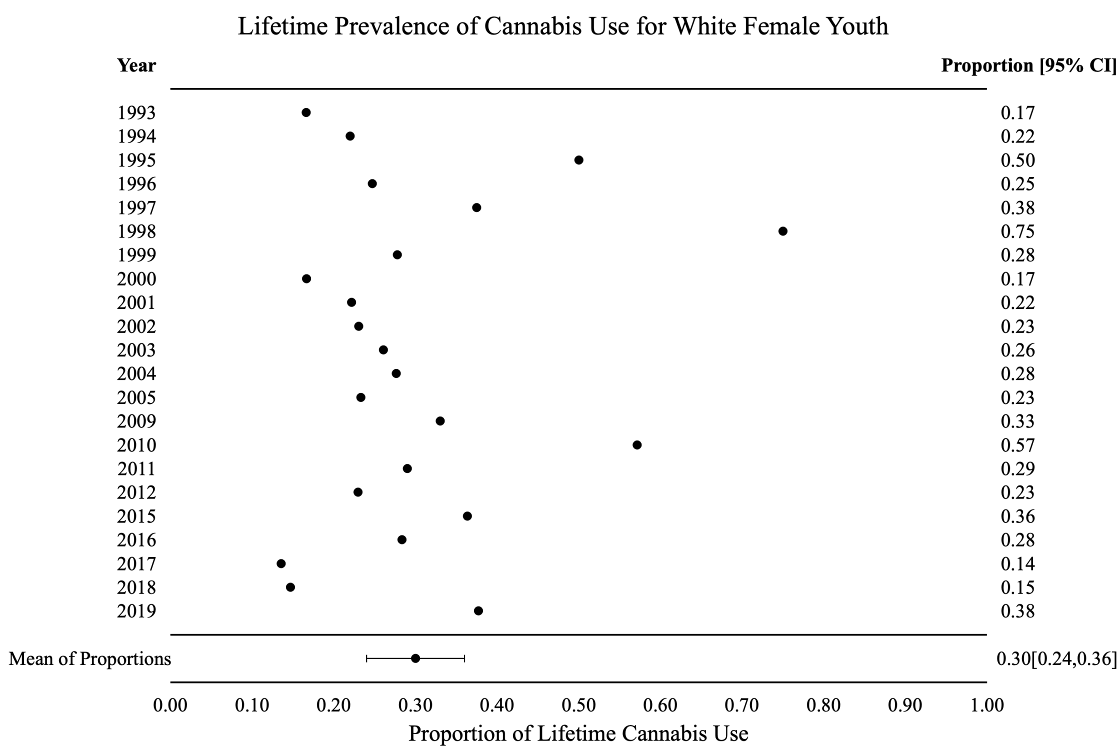
Aim 2: Substance Use for White Youth by Year and Sex



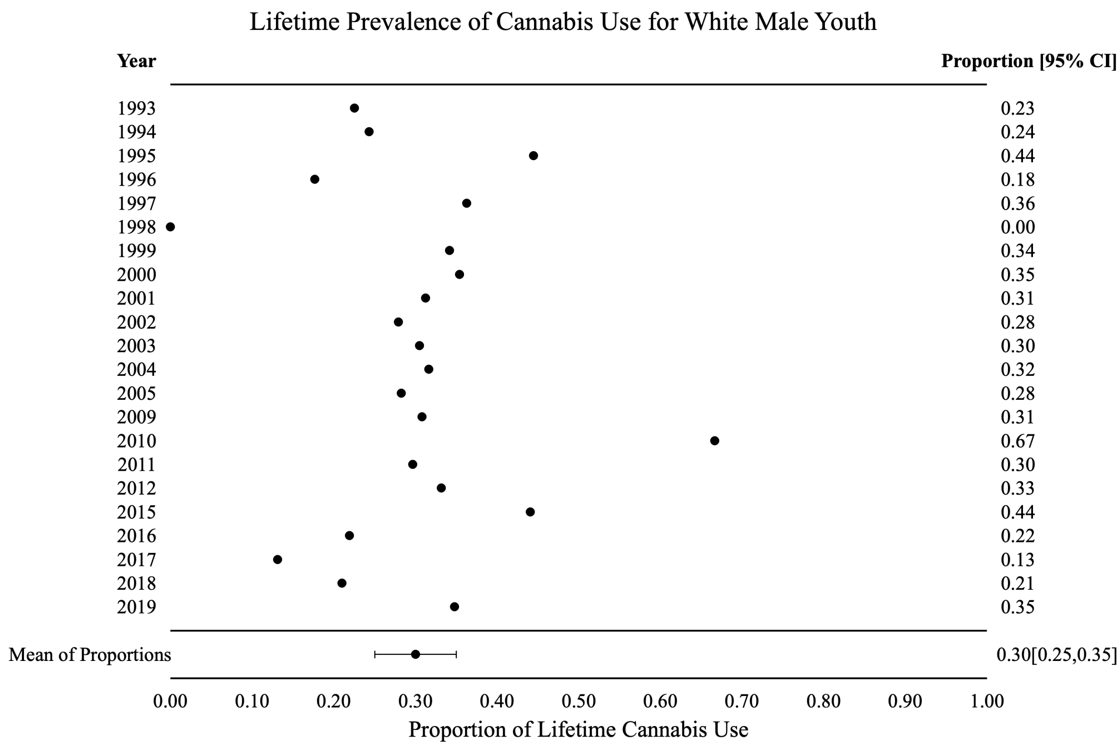
Note: Sample sizes for each year: 1993, n = 566; 1994, n = 232; 1995, n = 8; 1996, n = 89; 1997, n = 335; 1998, n = 4; 1999, n = 72; 2000, n = 42; 2001, n = 292; 2002, n = 643; 2003, n = 329; 2004, n = 304; 2005, n = 536; 2009, n = 344; 2010, n = 14; 2011, n = 171; 2012, n = 213; 2015, n = 55; 2016, n = 473; 2017, n = 223; 2018, n = 274; 2019, n = 120



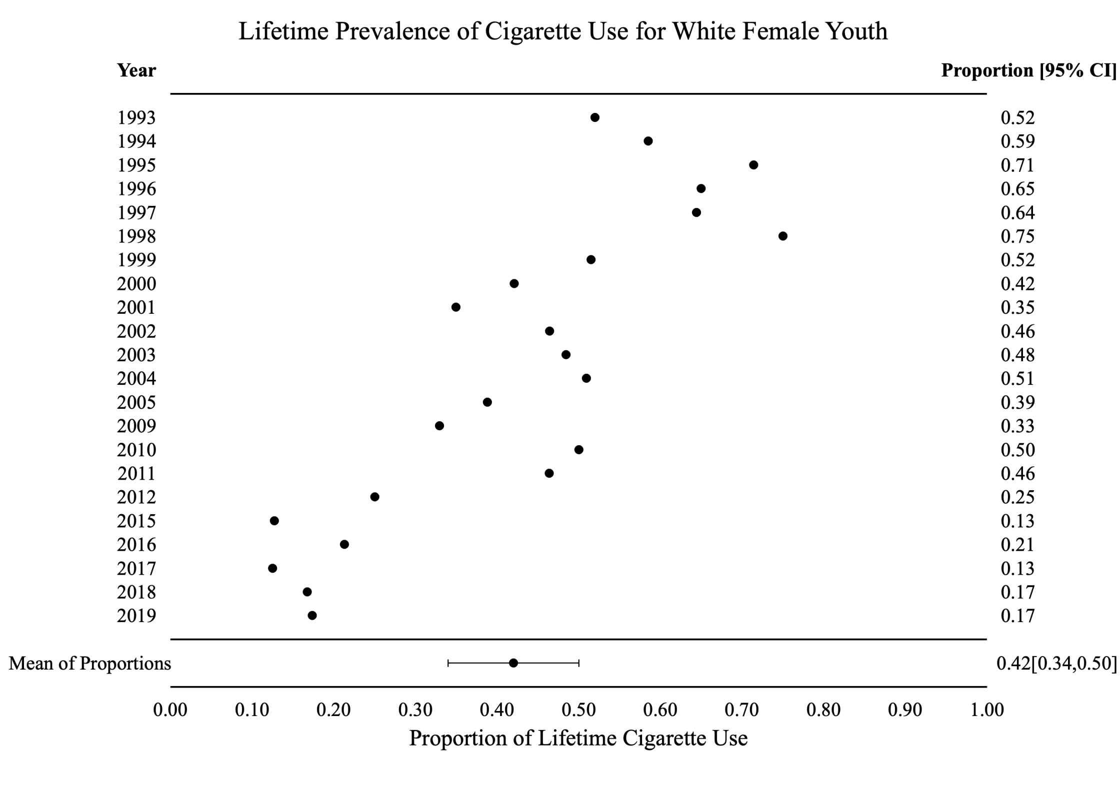
Note: Sample sizes for each year: 1993, n = 574; 1994, n = 258; 1995, n = 9; 1996, n = 52; 1997, n = 388; 1998, n = 1; 1999, n = 79; 2000, n = 48; 2001, n = 320; 2002, n = 624; 2003, n = 280; 2004, n = 357; 2005, n = 564; 2009, n = 383; 2010, n = 13; 2011, n = 174; 2012, n = 217; 2015, n = 59; 2016, n = 521; 2017, n = 231; 2018, n = 302; 2019, n = 117



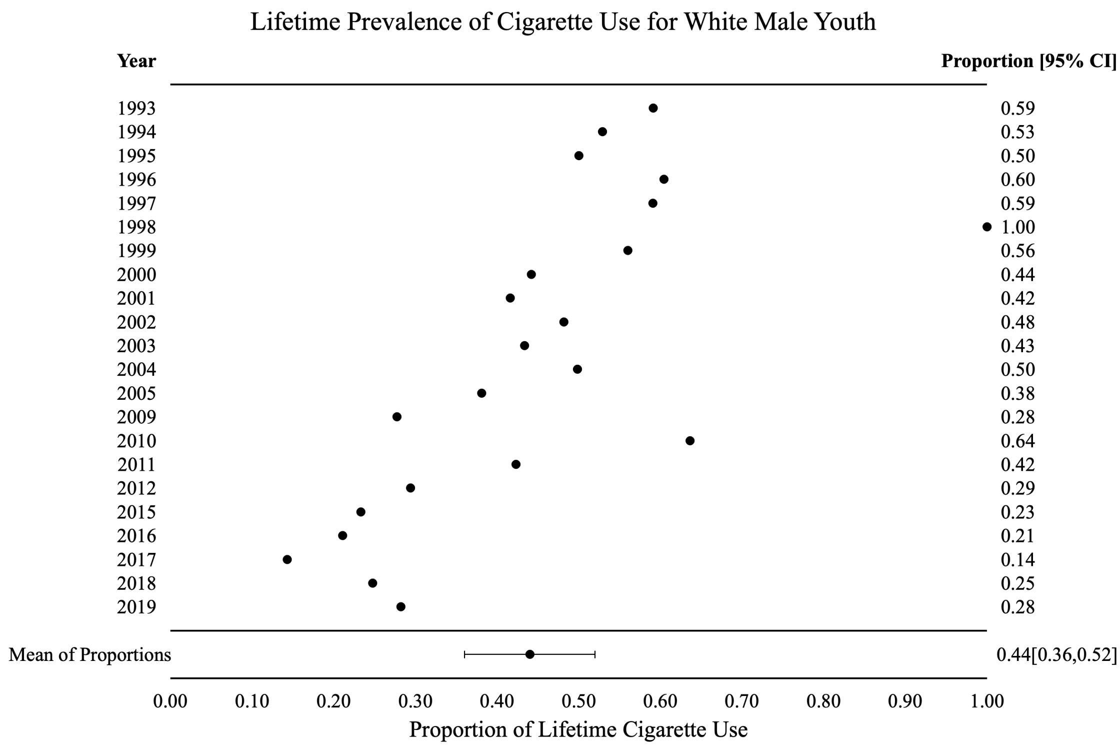
Note: Sample sizes for each year: 1993, n = 565; 1994, n = 232; 1995, n = 8; 1996, n = 89; 1997, n = 336; 1998, n = 4; 1999, n = 72; 2000, n = 42; 2001, n = 293; 2002, n = 642; 2003, n = 330; 2004, n = 304; 2005, n = 536; 2009, n = 342; 2010, n = 14; 2011, n = 169; 2012, n = 209; 2015, n = 55; 2016, n = 473; 2017, n = 221; 2018, n = 272; 2019, n = 114



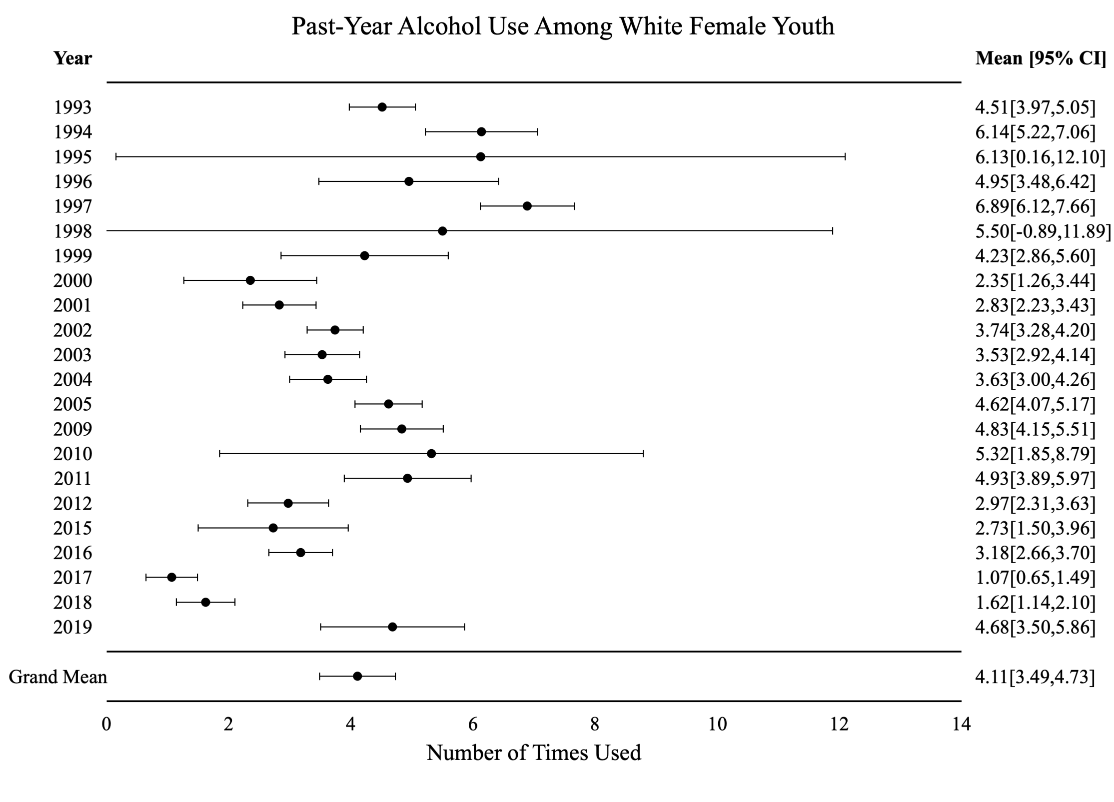
Note: Sample sizes for each year: 1993, n = 573; 1994, n = 259; 1995, n = 9; 1996, n = 51; 1997, n = 386; 1998, n = 1; 1999, n = 79; 2000, n = 48; 2001, n = 320; 2002, n = 627; 2003, n = 282; 2004, n = 357; 2005, n = 563; 2009, n = 380; 2010, n = 12; 2011, n = 172; 2012, n = 211; 2015, n = 59; 2016, n = 516; 2017, n = 229; 2018, n = 300; 2019, n = 115



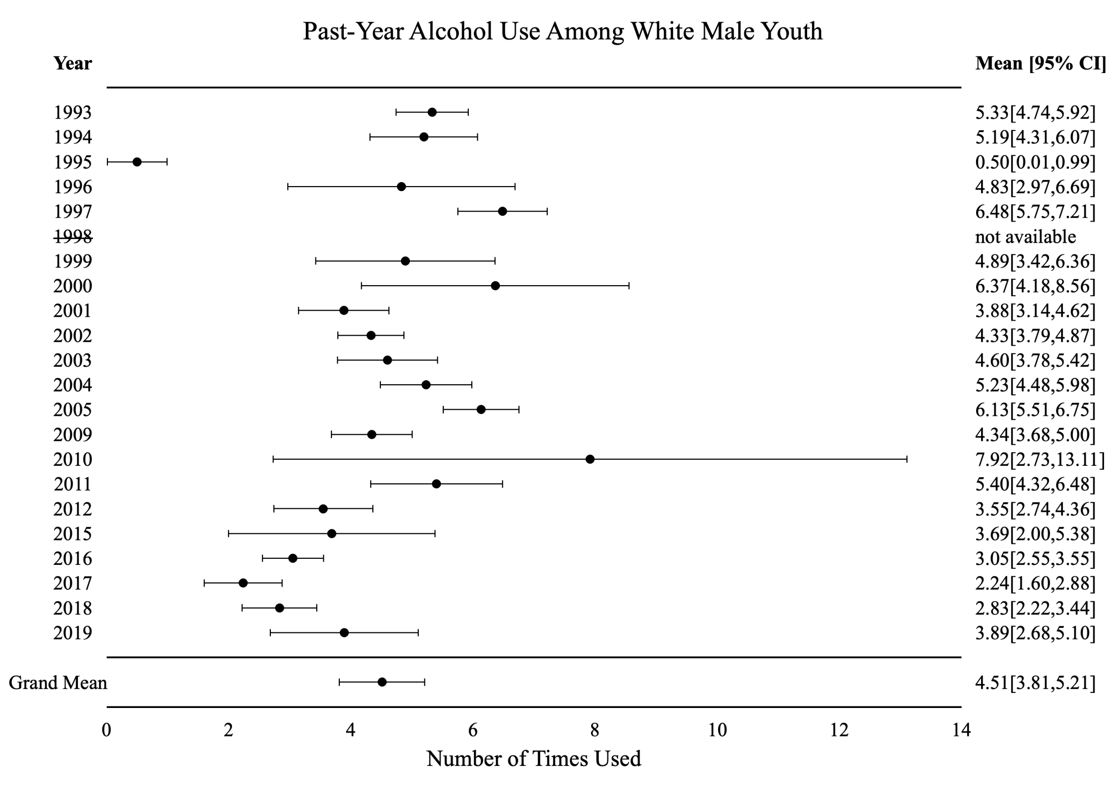
Note: Sample sizes for each year: 1993, n = 523; 1994, n = 200; 1995, n = 7; 1996, n = 80; 1997, n = 312; 1998, n = 4; 1999, n = 66; 2000, n = 38; 2001, n = 269; 2002, n = 571; 2003, n = 289; 2004, n = 265; 2005, n = 487; 2009, n = 340; 2010, n = 14; 2011, n = 166; 2012, n = 208; 2015, n = 55; 2016, n = 474; 2017, n = 224; 2018, n = 275; 2019, n = 121



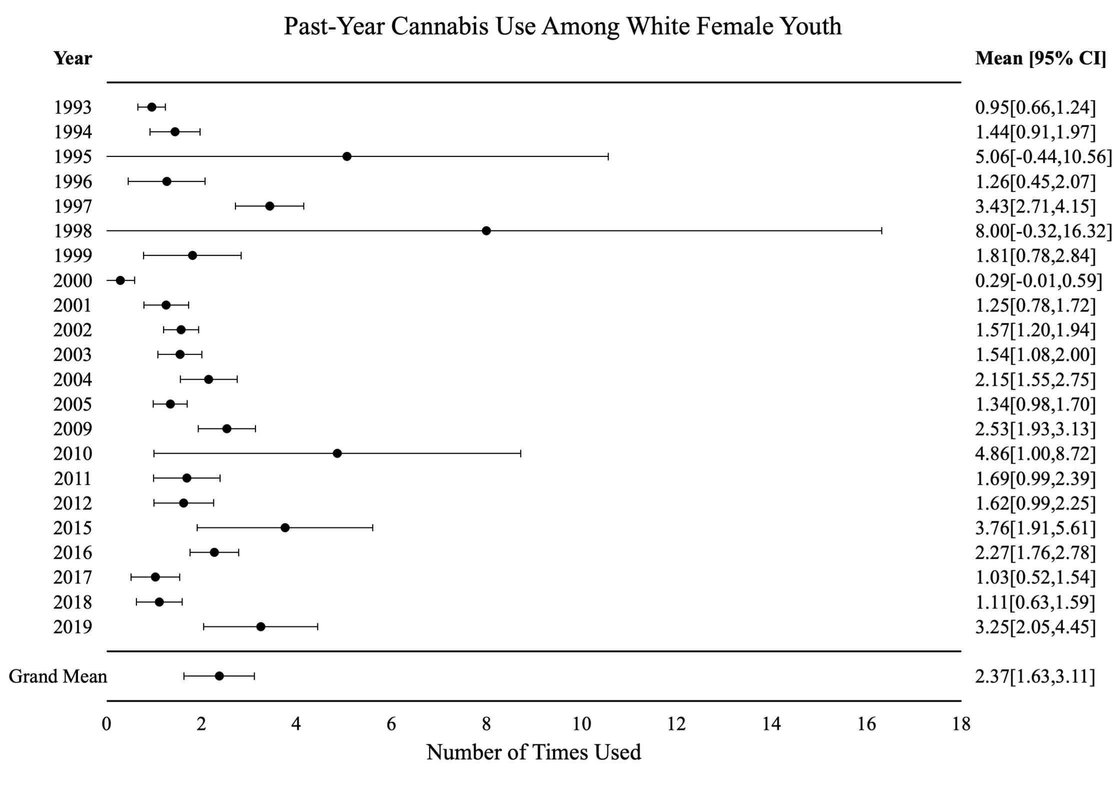
Note: Sample sizes for each year: 1993, n = 494; 1994, n = 225; 1995, n = 8; 1996, n = 48; 1997, n = 352; 1998, n = 1; 1999, n = 75; 2000, n = 43; 2001, n = 274; 2002, n = 544; 2003, n = 249; 2004, n = 305; 2005, n = 480; 2009, n = 375; 2010, n = 11; 2011, n = 163; 2012, n = 204; 2015, n = 60; 2016, n = 522; 2017, n = 231; 2018, n = 303; 2019, n = 117



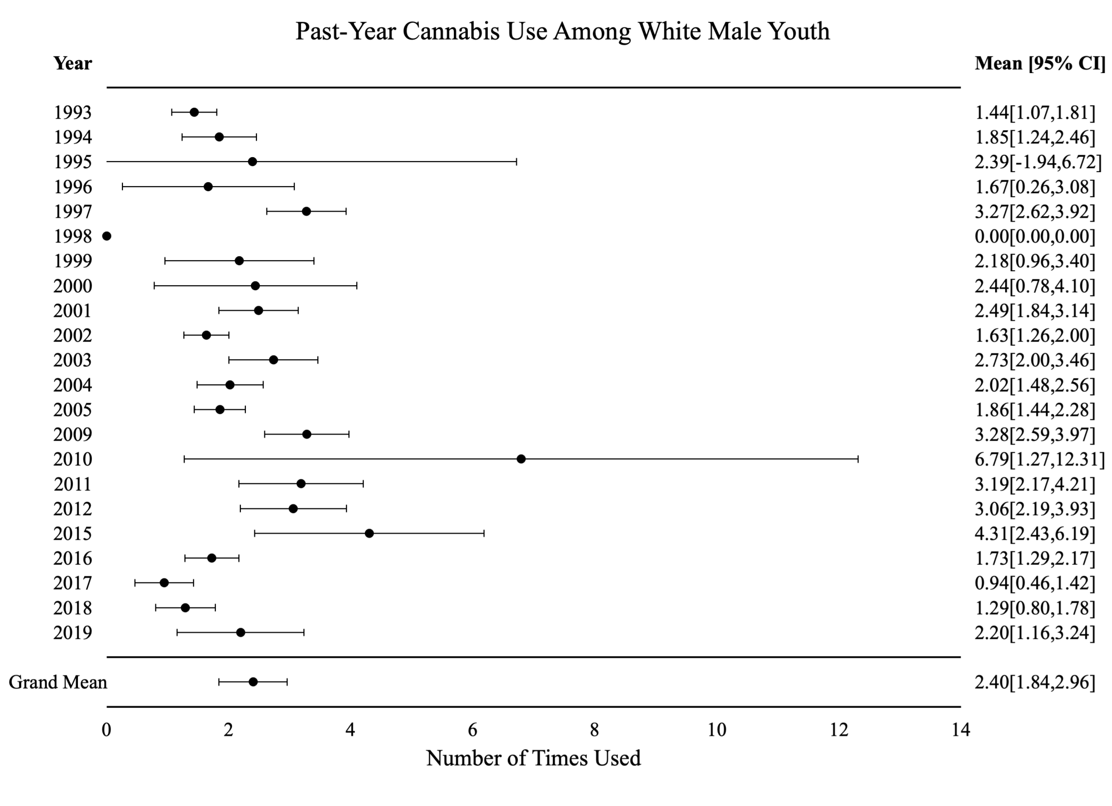
Note: Sample sizes for each year: 1993, n = 557; 1994, n = 229; 1995, n = 8; 1996, n = 88; 1997, n = 333; 1998, n = 4; 1999, n = 71; 2000, n = 41; 2001, n = 292; 2002, n = 633; 2003, n = 326; 2004, n = 300; 2005, n = 531; 2009, n = 341; 2010, n = 14; 2011, n = 170; 2012, n = 213; 2015, n = 55; 2016, n = 473; 2017, n = 223; 2018, n = 274; 2019, n = 120



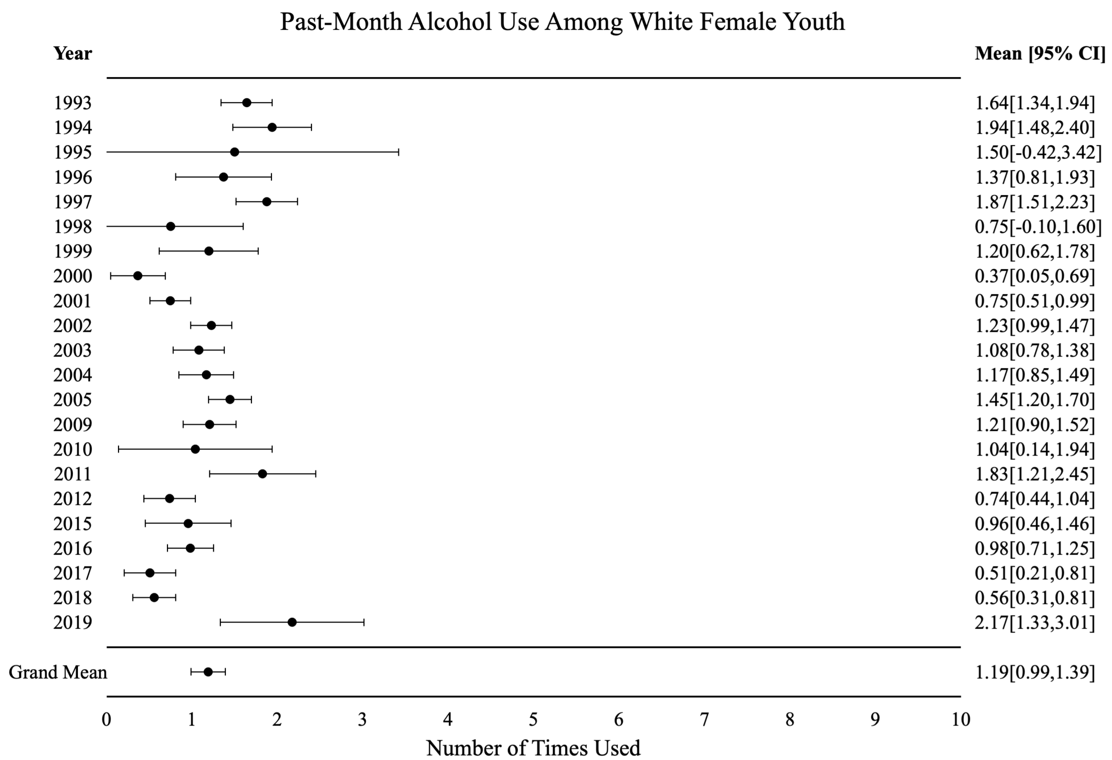
Note: Sample sizes for each year: 1993, n = 562; 1994, n = 253; 1995, n = 9; 1996, n = 50; 1997, n = 381; 1999, n = 78; 2000, n = 48; 2001, n = 314; 2002, n = 619; 2003, n = 272; 2004, n = 352; 2005, n = 554; 2009, n = 375; 2010, n = 12; 2011, n = 172; 2012, n = 209; 2015, n = 59; 2016, n = 519; 2017, n = 231; 2018, n = 301; 2019, n = 117



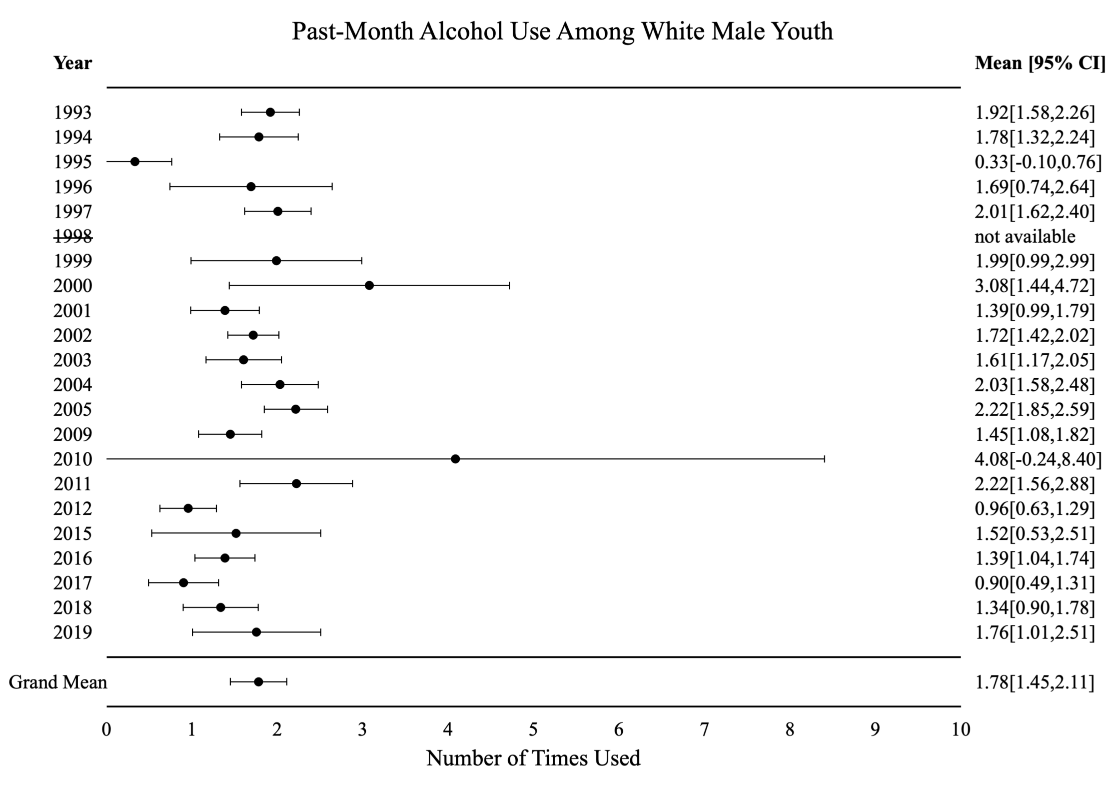
Note: Sample sizes for each year: 1993, n = 564; 1994, n = 232; 1995, n = 8; 1996, n = 89; 1997, n = 336; 1998, n = 4; 1999, n = 72; 2000, n = 42; 2001, n = 293; 2002, n = 643; 2003, n = 330; 2004, n = 303; 2005, n = 534; 2009, n = 342; 2010, n = 14; 2011, n = 168; 2012, n = 209; 2015, n = 55; 2016, n = 472; 2017, n = 221; 2018, n = 273; 2019, n = 114



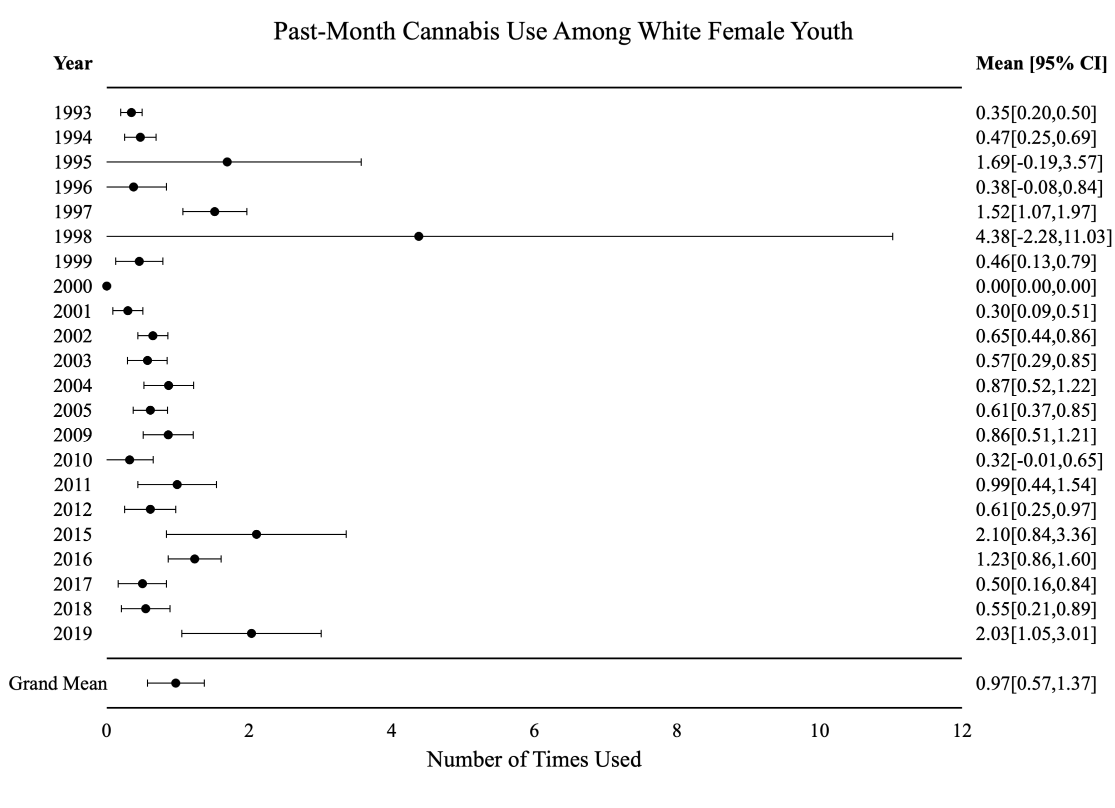
Note: Sample sizes for each year: 1993, n = 573; 1994, n = 256; 1995, n = 9; 1996, n = 51; 1997, n = 388; 1998, n = 1; 1999, n = 79; 2000, n = 48; 2001, n = 320; 2002, n = 627; 2003, n = 282; 2004, n = 358; 2005, n = 561; 2009, n = 380; 2010, n = 12; 2011, n = 172; 2012, n = 210; 2015, n = 59; 2016, n = 516; 2017, n = 229; 2018, n = 300; 2019, n = 115



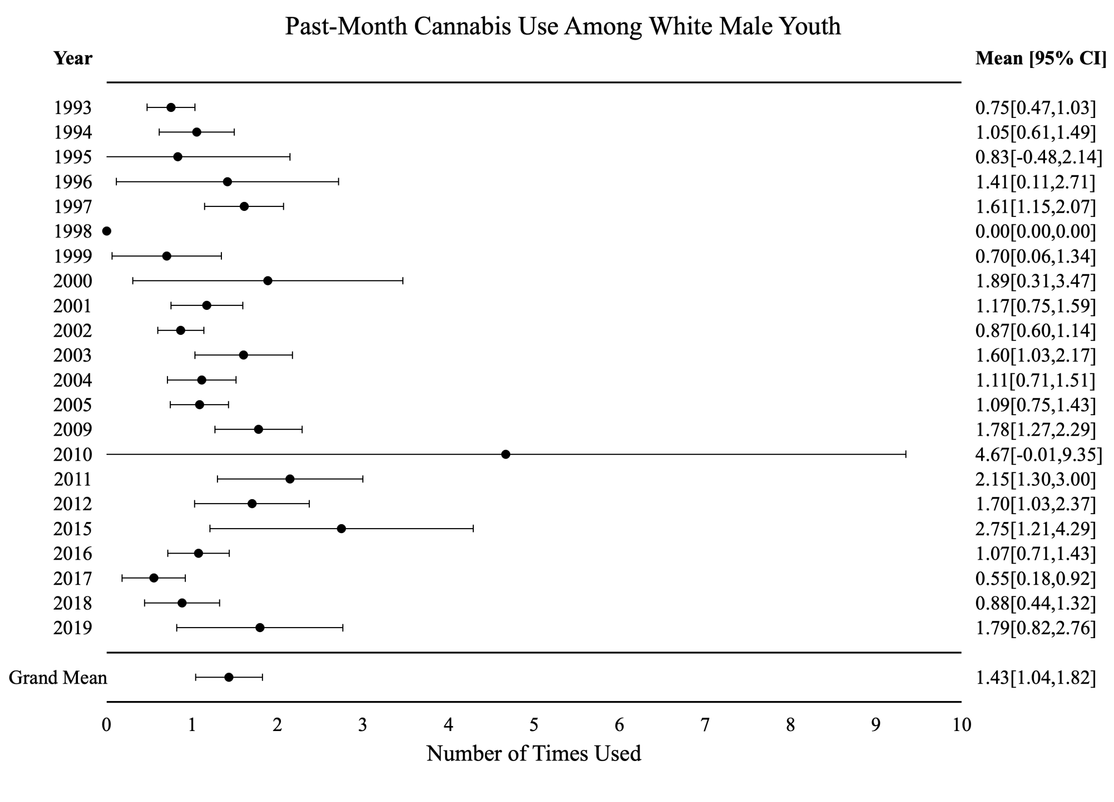
Note: Sample sizes for each year: 1993, n = 559; 1994, n = 231; 1995, n = 8; 1996, n = 88; 1997, n = 333; 1998, n = 4; 1999, n = 71; 2000, n = 41; 2001, n = 291; 2002, n = 637; 2003, n = 328; 2004, n = 297; 2005, n = 532; 2009, n = 342; 2010, n = 13; 2011, n = 171; 2012, n = 211; 2015, n = 55; 2016, n = 473; 2017, n = 223; 2018, n = 274; 2019, n = 120



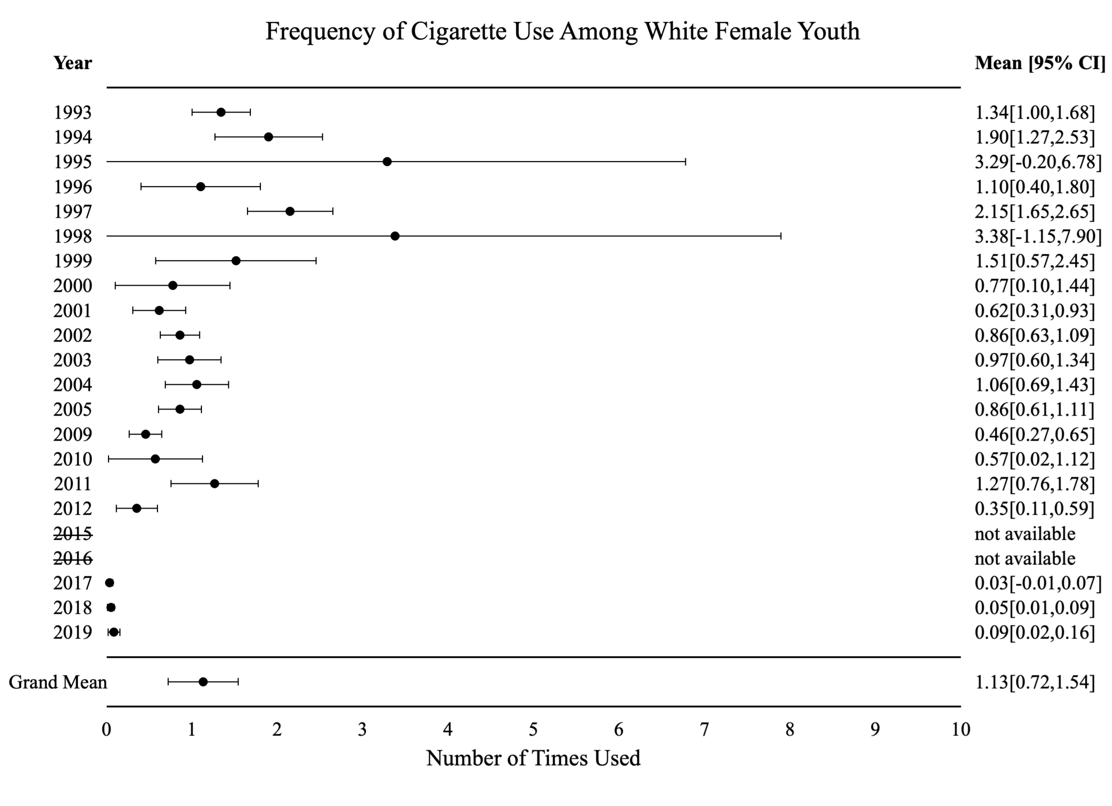
Note: Sample sizes for each year: 1993, n = 563; 1994, n = 254; 1995, n = 9; 1996, n = 50; 1997, n = 379; 1999, n = 78; 2000, n = 46; 2001, n = 316; 2002, n = 615; 2003, n = 276; 2004, n = 351; 2005, n = 552; 2009, n = 378; 2010, n = 12; 2011, n = 172; 2012, n = 210; 2015, n = 59; 2016, n = 518; 2017, n = 231; 2018, n = 301; 2019, n = 117



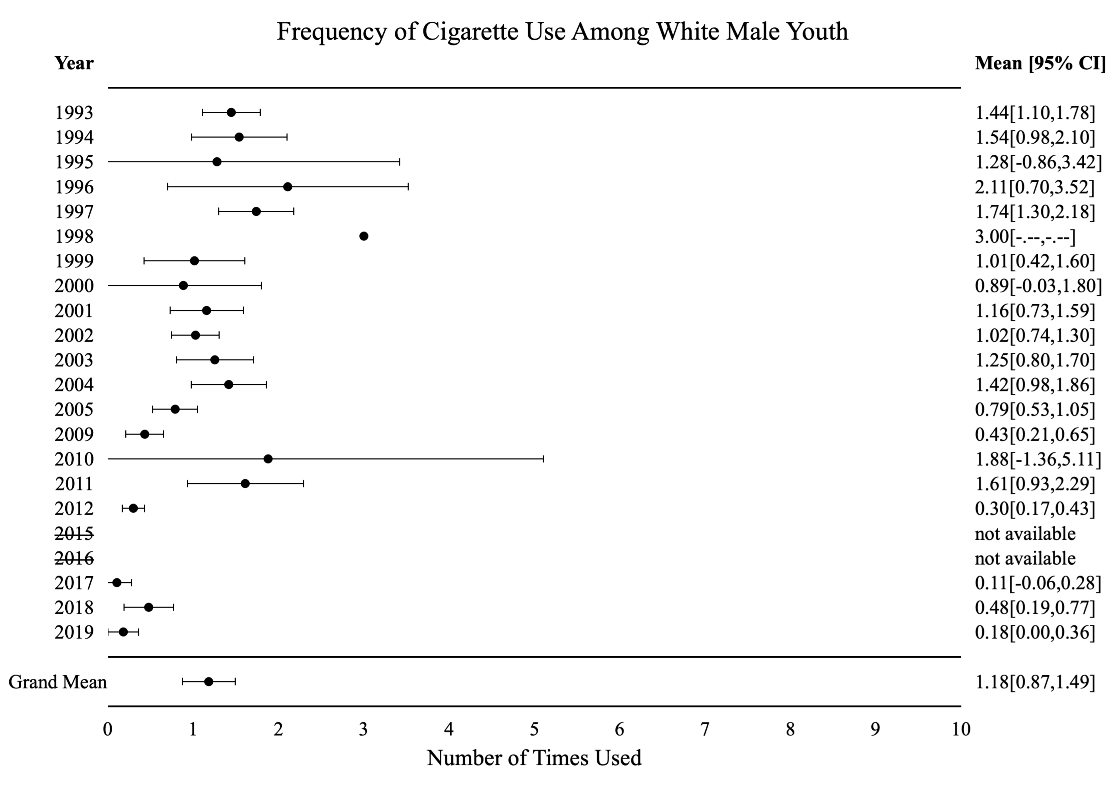
Note: Sample sizes for each year: 1993, n = 565; 1994, n = 232; 1995, n = 8; 1996, n = 89; 1997, n = 335; 1998, n = 4; 1999, n = 72; 2000, n = 42; 2001, n = 292; 2002, n = 642; 2003, n = 329; 2004, n = 303; 2005, n = 536; 2009, n = 341; 2010, n = 14; 2011, n = 169; 2012, n = 209; 2015, n = 55; 2016, n = 473; 2017, n = 221; 2018, n = 273; 2019, n = 114



Note: Sample sizes for each year: 1993, n = 573; 1994, n = 259; 1995, n = 9; 1996, n = 51; 1997, n = 387; 1998, n = 1; 1999, n = 79; 2000, n = 48; 2001, n = 319; 2002, n = 627; 2003, n = 282; 2004, n = 357; 2005, n = 563; 2009, n = 380; 2010, n = 12; 2011, n = 172; 2012, n = 210; 2015, n = 59; 2016, n = 516; 2017, n = 229; 2018, n = 300; 2019, n = 115



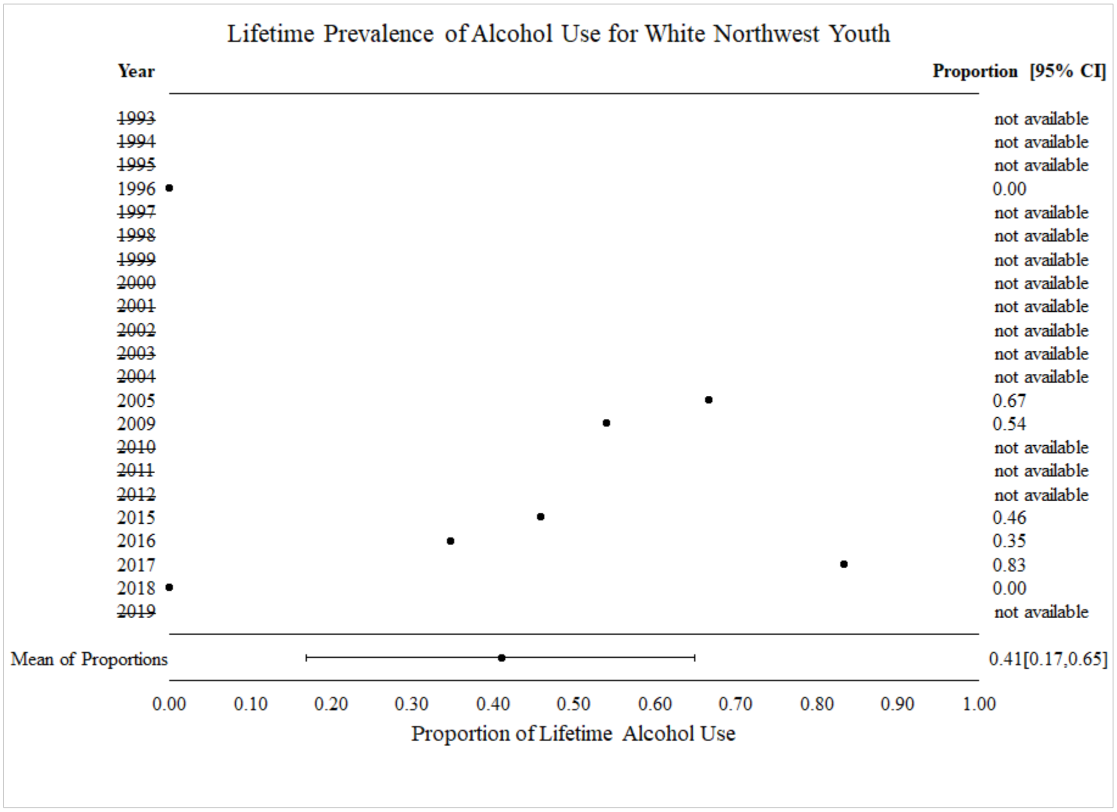
Note: Sample sizes for each year: 1993, n = 563; 1994, n = 229; 1995, n = 7; 1996, n = 88; 1997, n = 336; 1998, n = 4; 1999, n = 72; 2000, n = 42; 2001, n = 292; 2002, n = 641; 2003, n = 330; 2004, n = 302; 2005, n = 536; 2009, n = 339; 2010, n = 14; 2011, n = 169; 2012, n = 209; 2017, n = 224; 2018, n = 275; 2019, n = 121



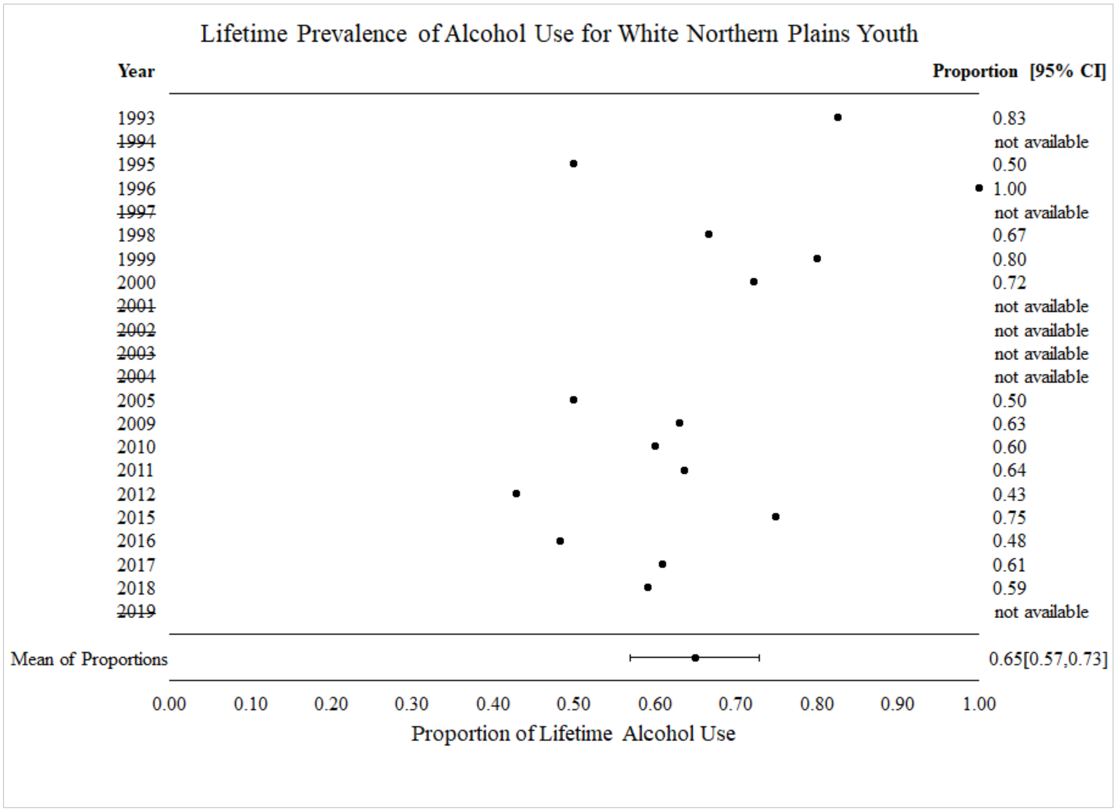
Note: Sample sizes for each year: 1993, n = 571; 1994, n = 258; 1995, n = 9; 1996, n = 51; 1997, n = 385; 1998, n = 1; 1999, n = 78; 2000, n = 48; 2001, n = 316; 2002, n = 626; 2003, n = 281; 2004, n = 353; 2005, n = 562; 2009, n = 379; 2010, n = 12; 2011, n = 168; 2012, n = 210; 2017, n = 231; 2018, n = 303; 2019, n = 117

APPENDIX I

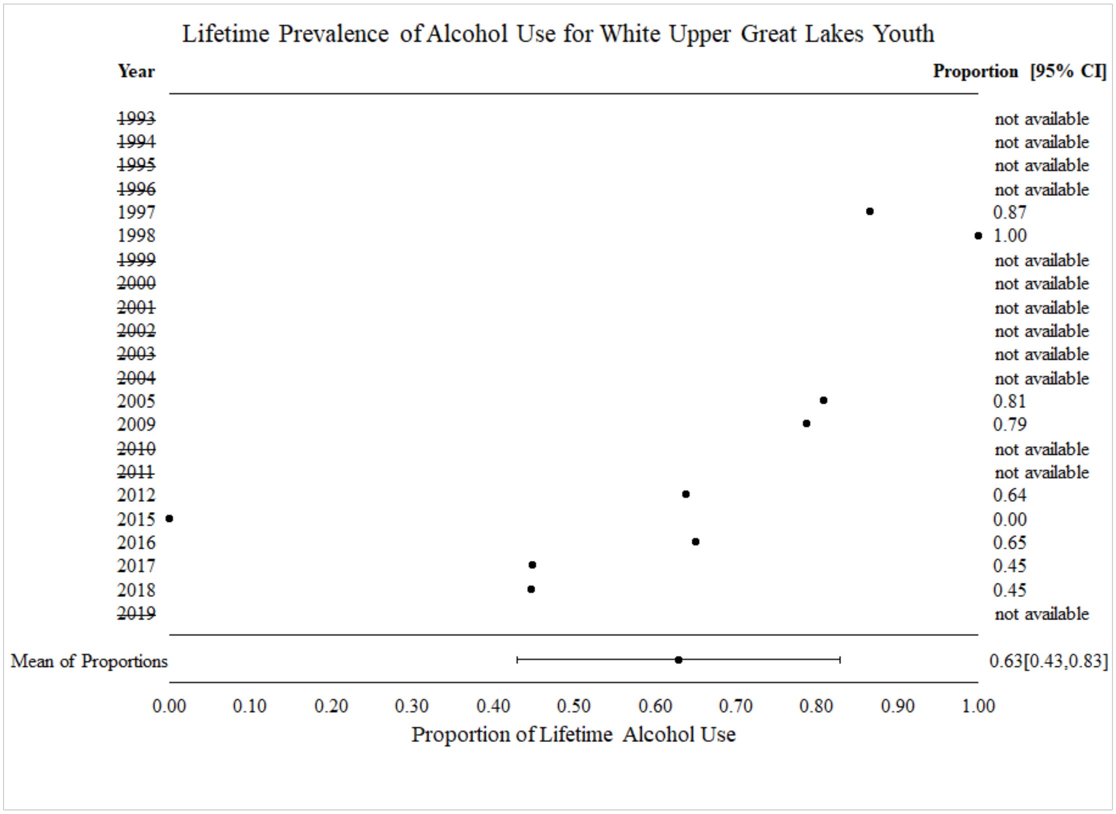
Aim 2: Substance Use for White Youth by Year and Region



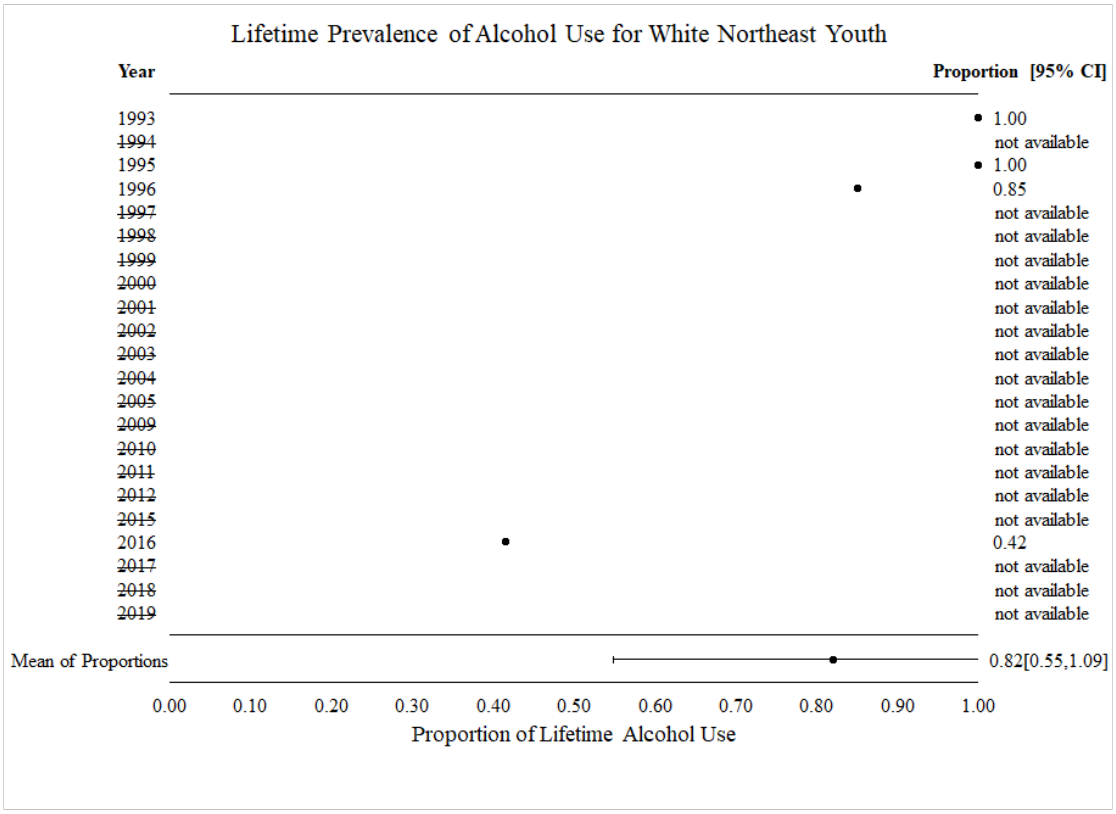
Note: Sample sizes for each year: 1996, n = 2; 2005, n = 6; 2009, n = 137; 2015, n = 109; 2016, n = 49; 2017, n = 6; 2018, n = 1



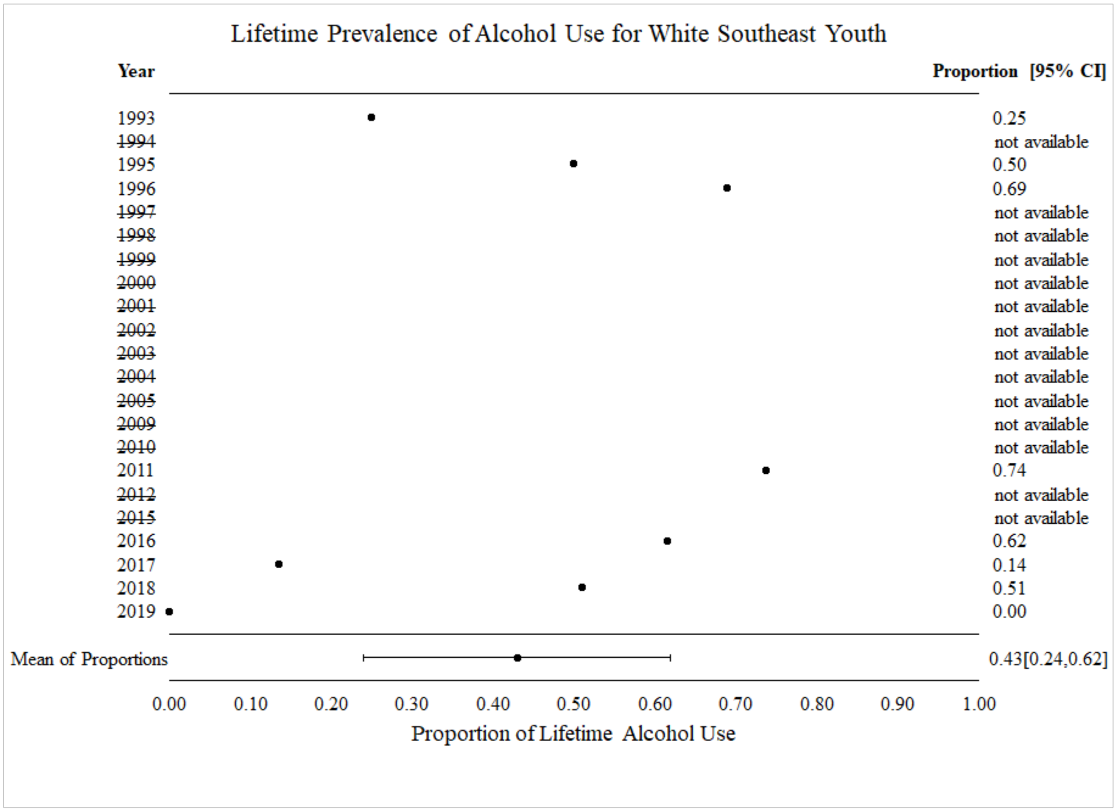
Note: Sample sizes for each year: 1993, n = 86; 1995, n = 14; 1996, n = 3; 1998, n = 3; 1999, n = 35; 2000, n = 90; 2005, n = 24; 2009, n = 84; 2010, n = 15; 2011, n = 22; 2012, n = 14; 2015, n = 4; 2016, n = 178; 2017, n = 69; 2018, n = 93



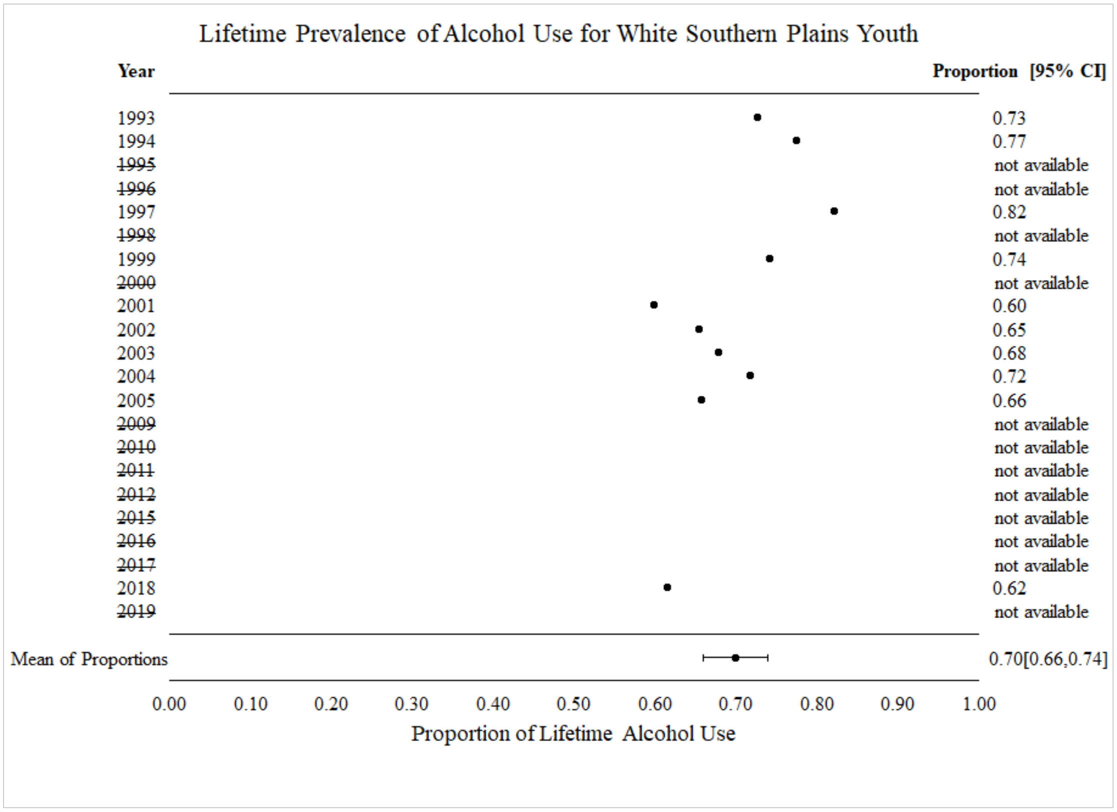
Note: Sample sizes for each year: 1997, n = 564; 1998, n = 2; 2005, n = 572; 2009, n = 539; 2012, n = 437; 2015, n = 1; 2016, n = 298; 2017, n = 69; 2018, n = 163



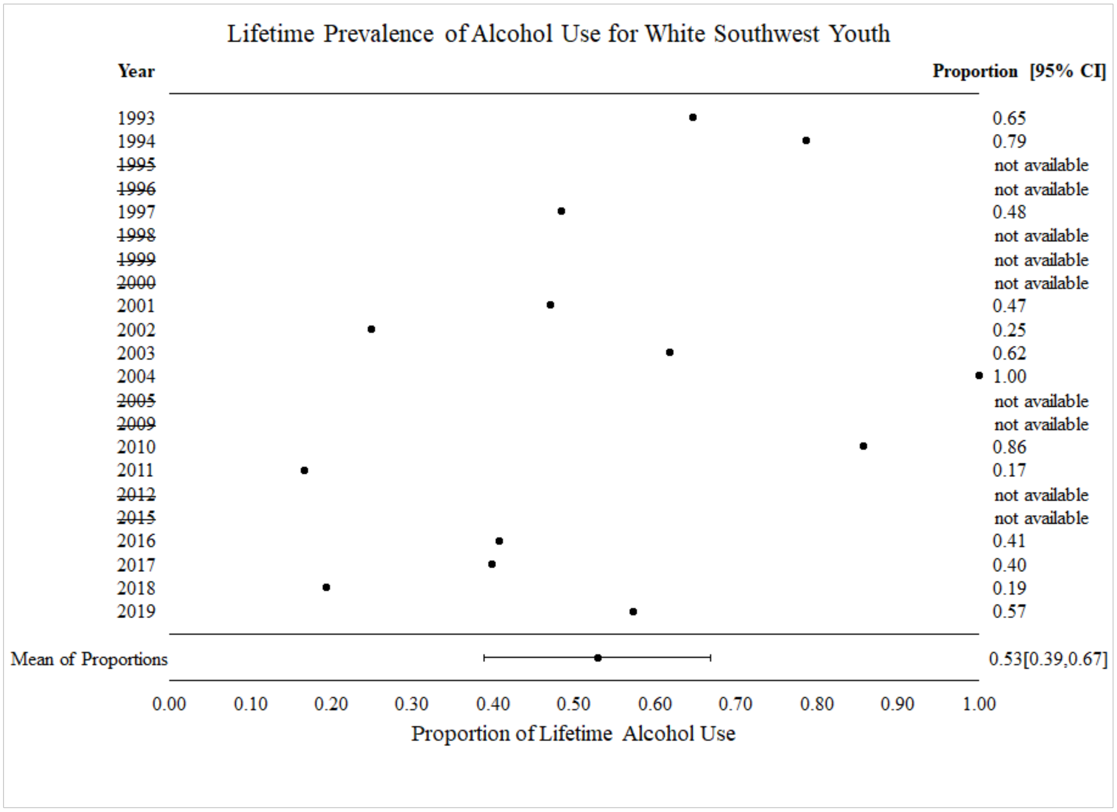
Note: Sample sizes for each year: 1993, n = 1; 1995, n = 1; 1996, n = 47; 2016, n = 178



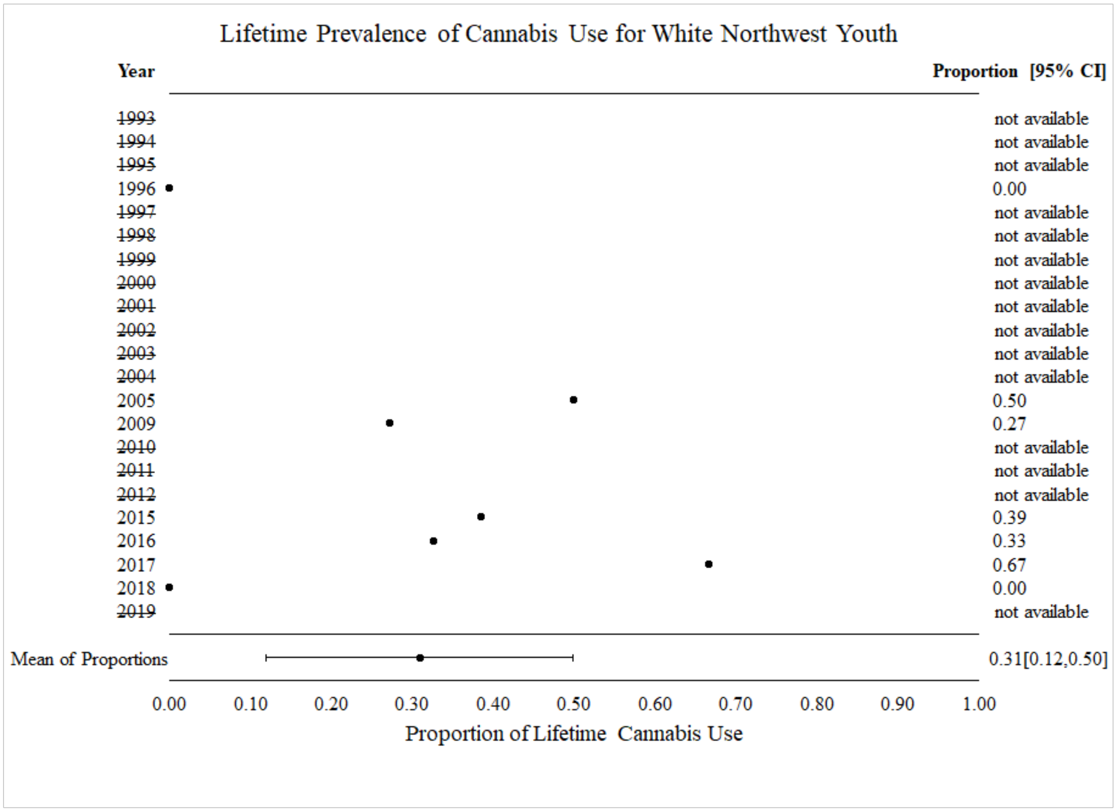
Note: Sample sizes for each year: 1993, n = 4; 1995, n = 2; 1996, n = 90; 2011, n = 324; 2016, n = 26; 2017, n = 118; 2018, n = 145; 2019, n = 1



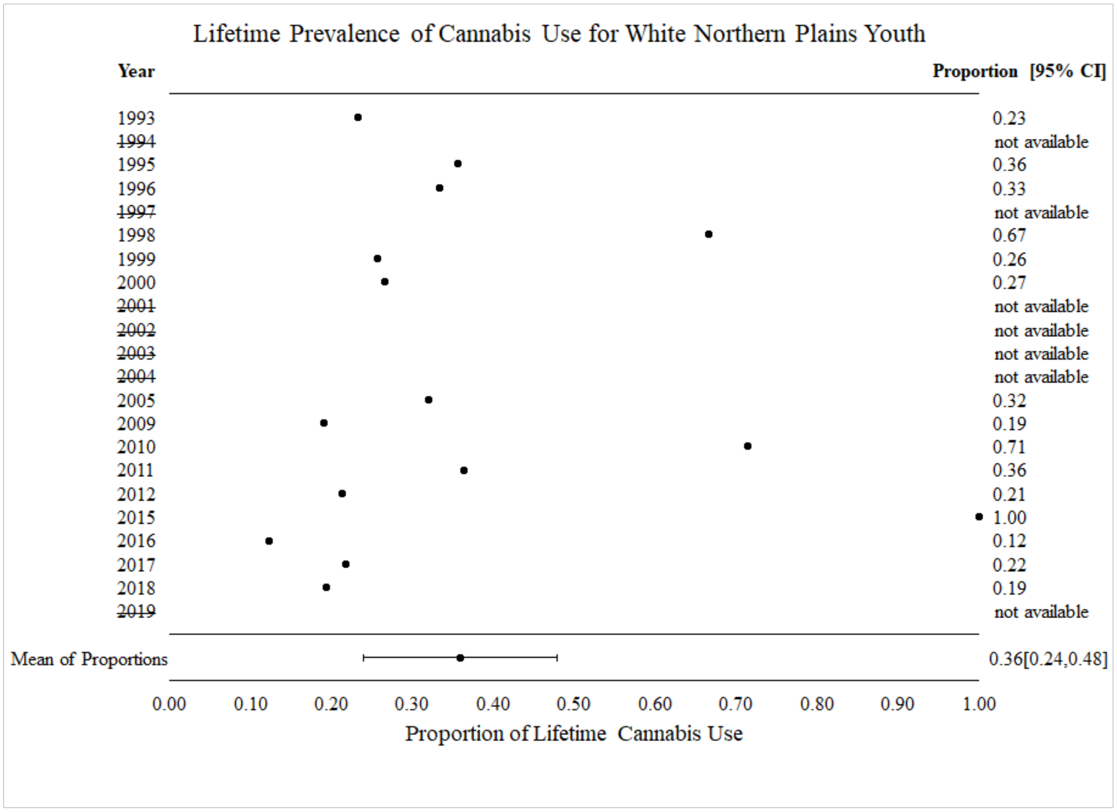
Note: Sample sizes for each year: 1993, n = 940; 1994, n = 231; 1997, n = 129; 1999, n = 116; 2001, n = 177; 2002, n = 1270; 2003, n = 590; 2004, n = 665; 2005, n = 505; 2018, n = 52



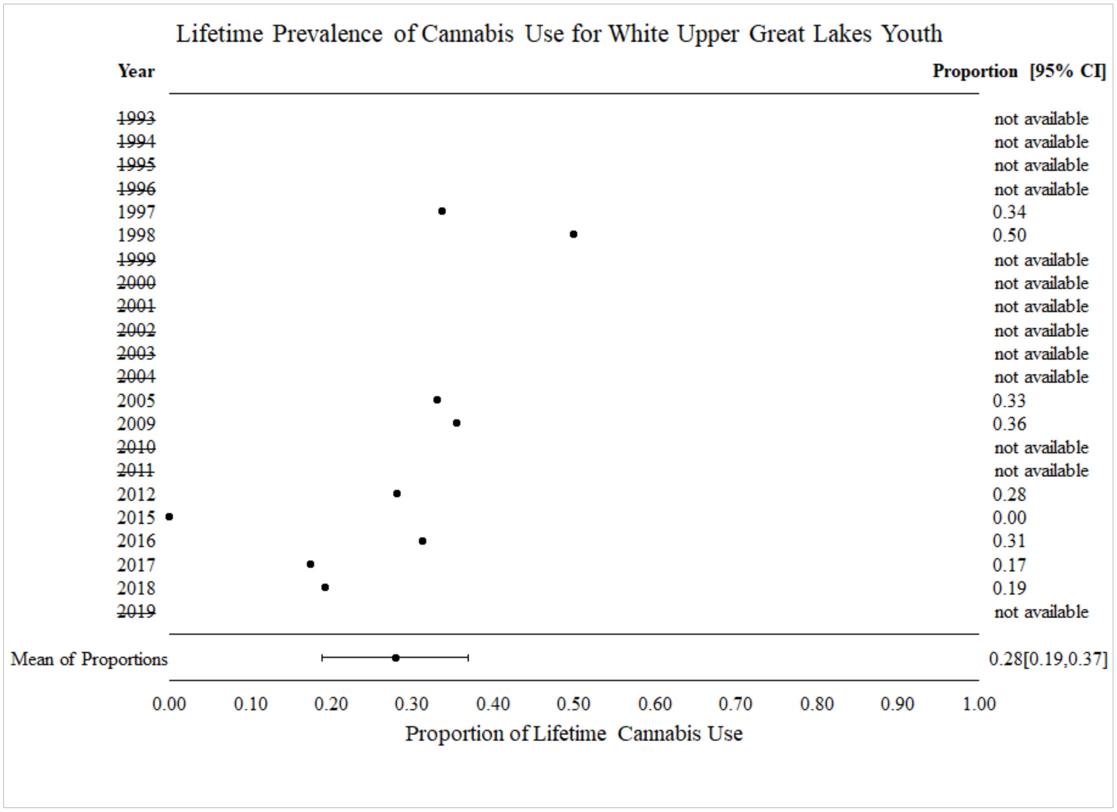
Note: Sample sizes for each year: 1993, n = 116; 1994, n = 263; 1997, n = 31; 2001, n = 438; 2002, n = 4; 2003, n = 21; 2004, n = 3; 2010, n = 14; 2011, n = 12; 2016, n = 267; 2017, n = 193; 2018, n = 124; 2019, n = 237



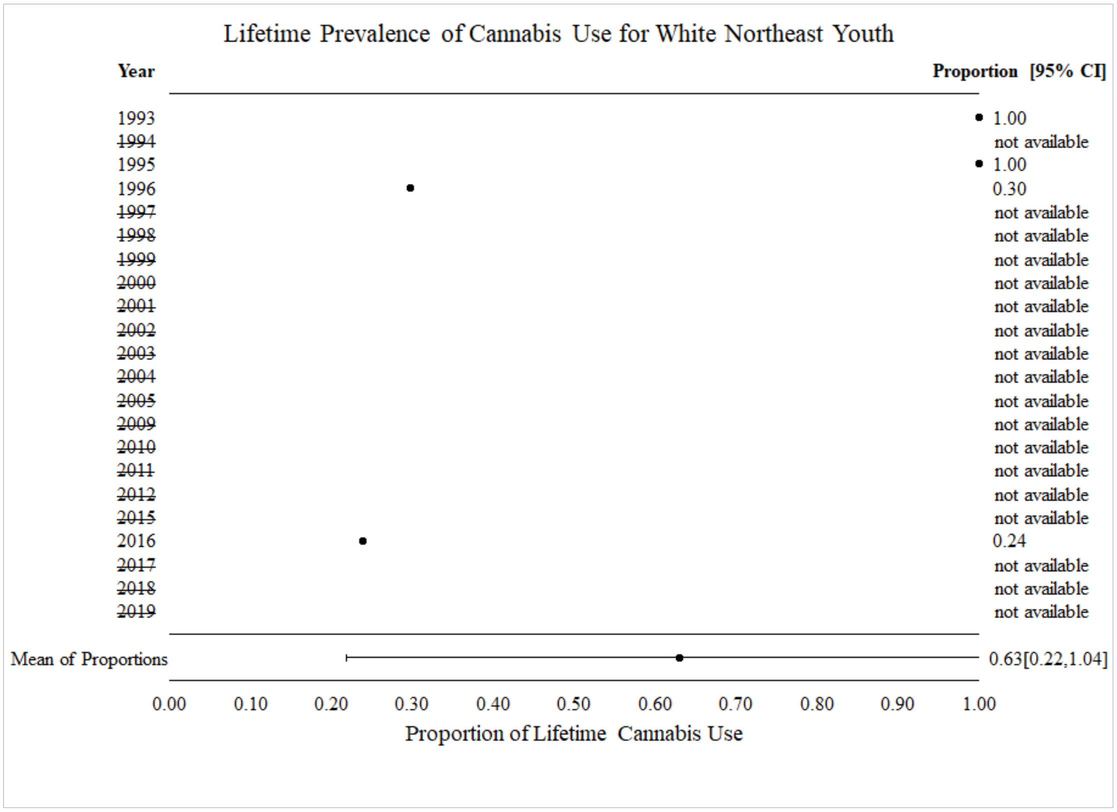
Note: Sample sizes for each year: 1996, n = 2; 2005, n = 6; 2009, n = 136; 2015, n = 109; 2016, n = 49; 2017, n = 6; 2018, n = 1



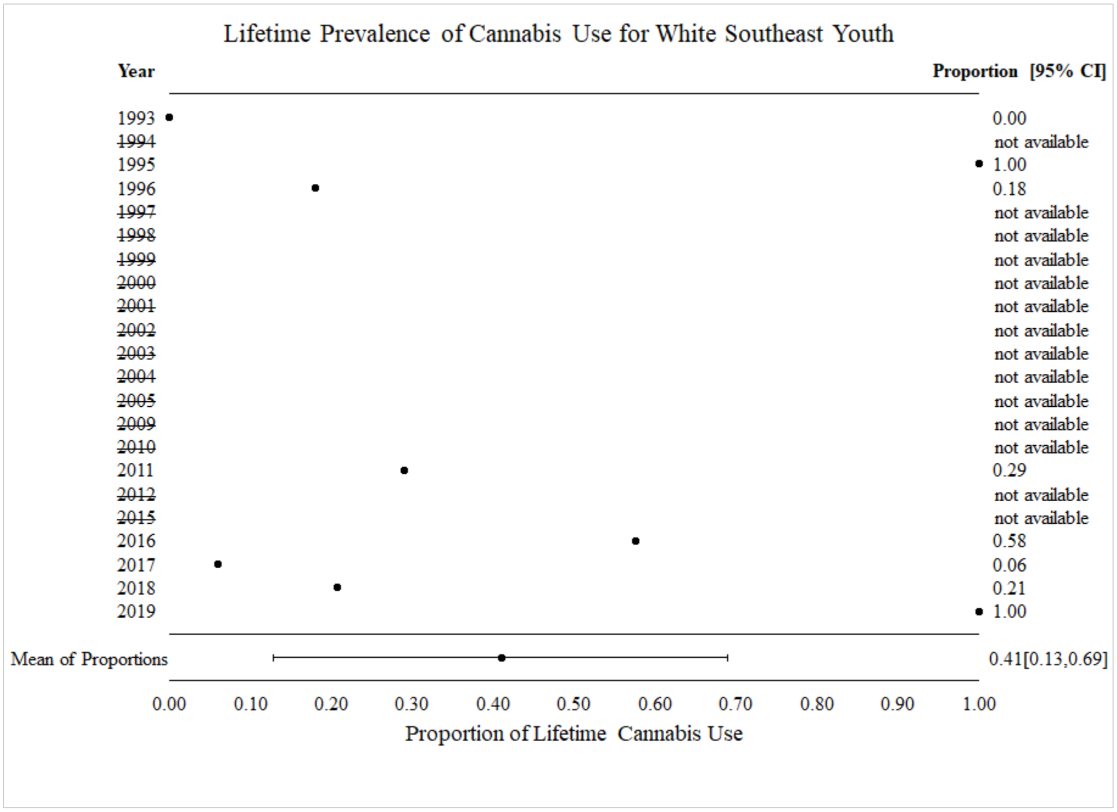
Note: Sample sizes for each year: 1993, n = 86; 1995, n = 14; 1996, n = 3; 1998, n = 3; 1999, n = 35; 2000, n = 90; 2005, n = 25; 2009, n = 84; 2010, n = 14; 2011, n = 22; 2012, n = 14; 2015, n = 4; 2016, n = 178; 2017, n = 69; 2018, n = 93



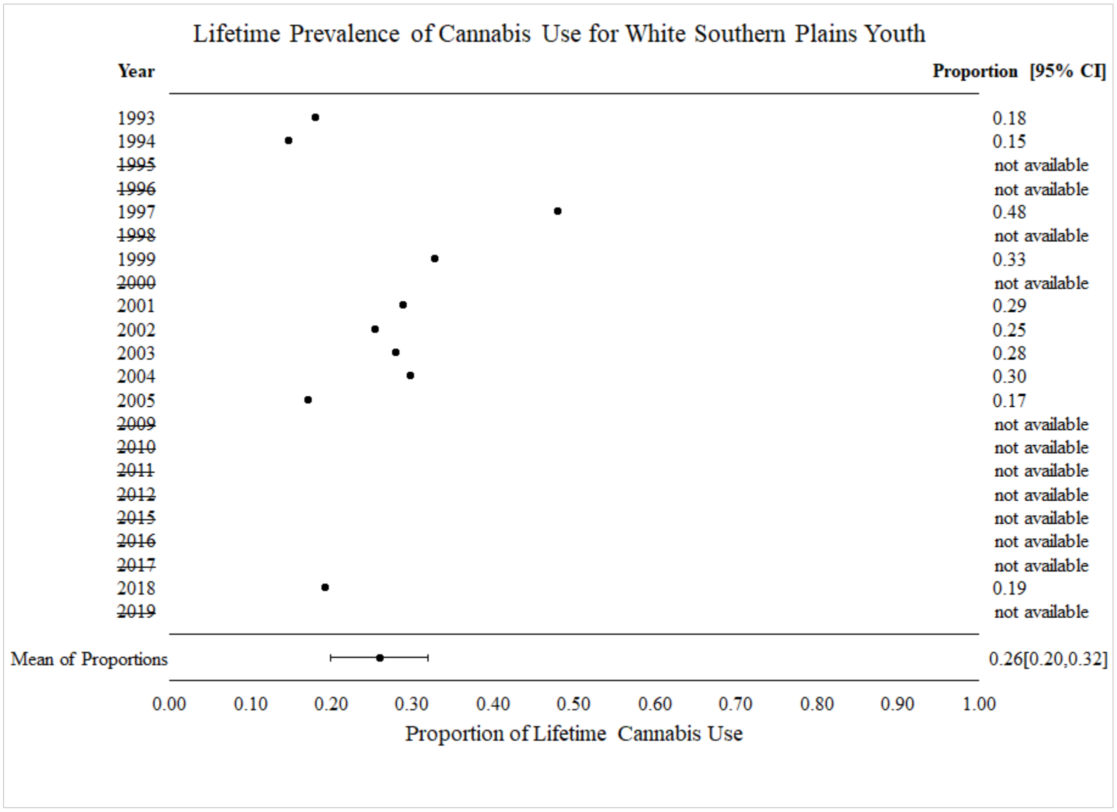
Note: Sample sizes for each year: 1997, n = 563; 1998, n = 2; 2005, n = 572; 2009, n = 535; 2012, n = 427; 2015, n = 1; 2016, n = 297; 2017, n = 69; 2018, n = 161



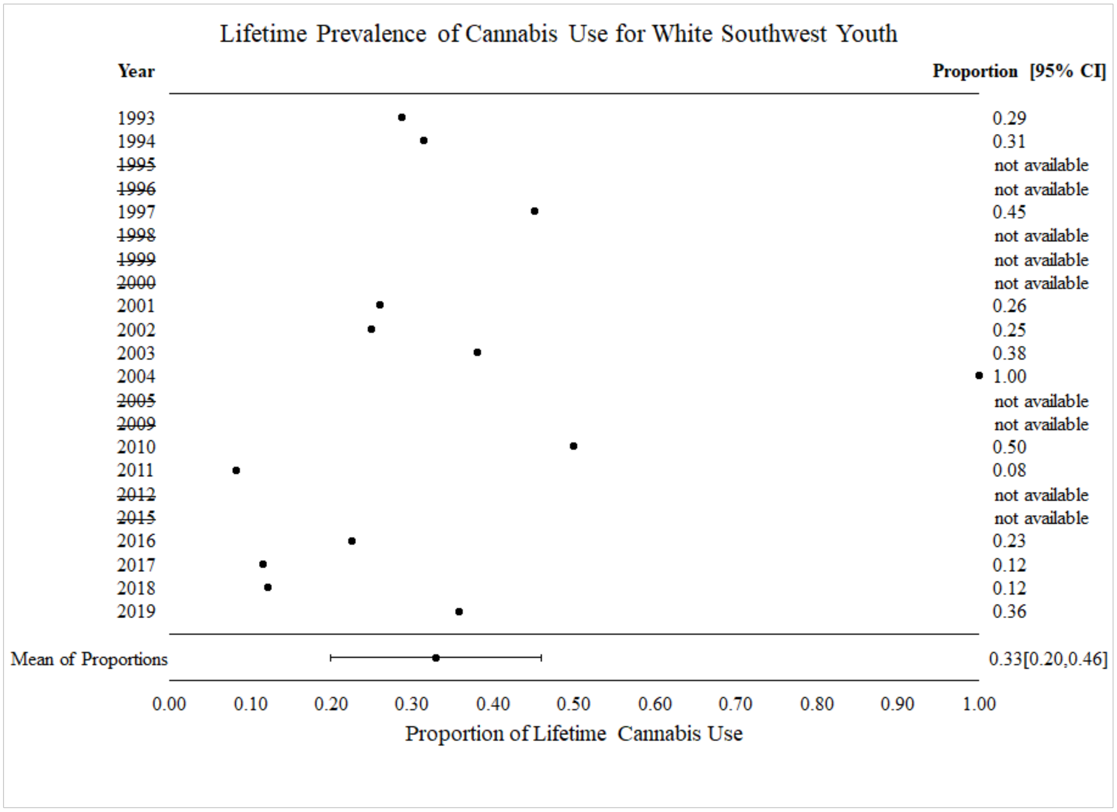
Note: Sample sizes for each year: 1993, n = 1; 1995, n = 1; 1996, n = 47; 2016, n = 176



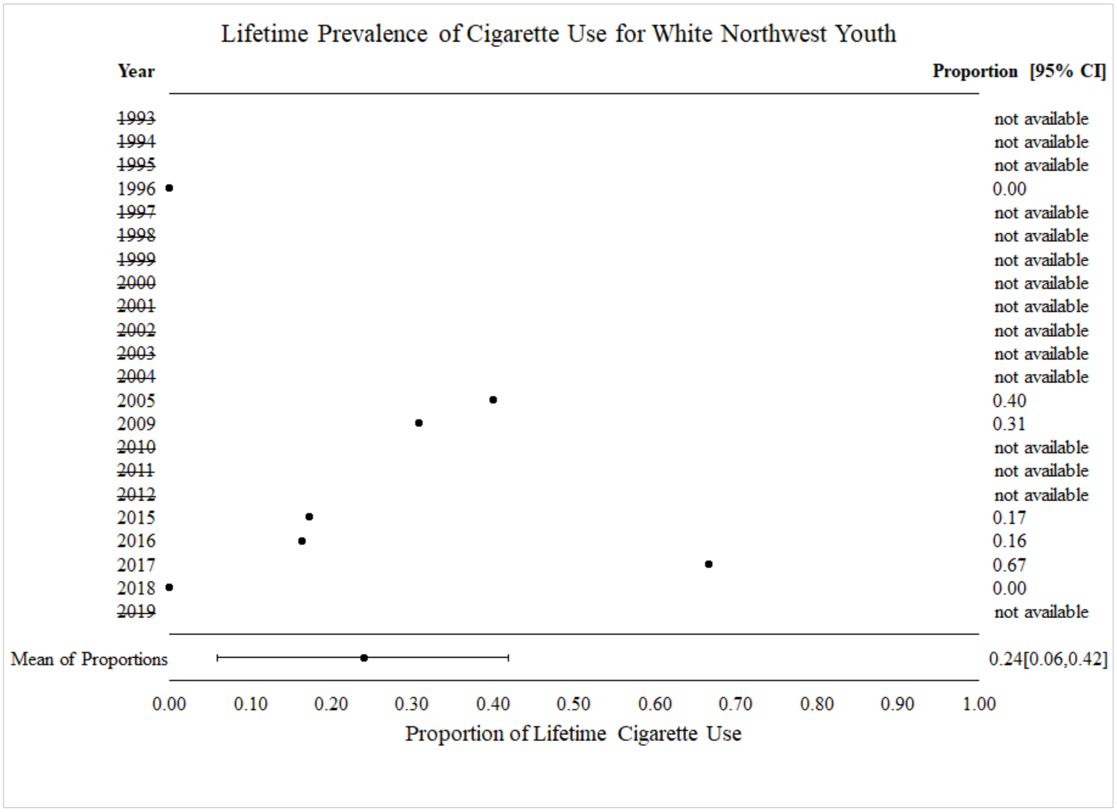
Note: Sample sizes for each year: 1993, n = 4; 1995, n = 2; 1996, n = 89; 2011, n = 320; 2016, n = 26; 2017, n = 117; 2018, n = 144; 2019, n = 1



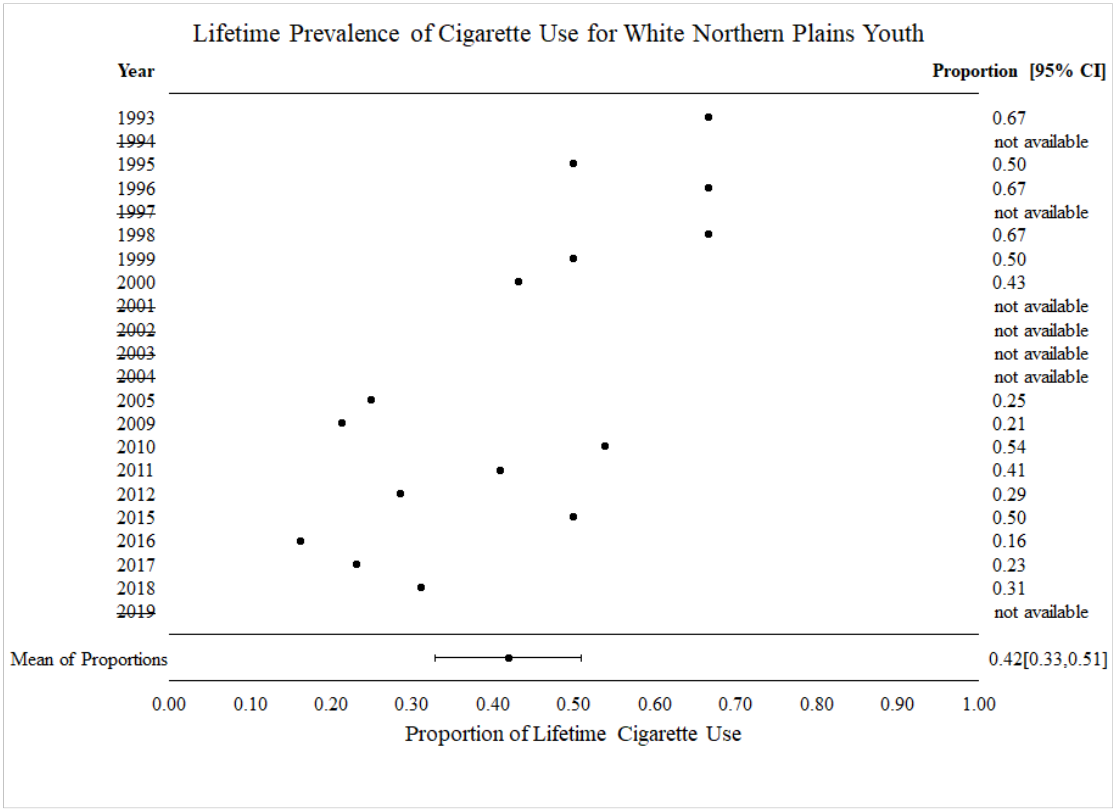
Note: Sample sizes for each year: 1993, n = 939; 1994, n = 231; 1997, n = 129; 1999, n = 116; 2001, n = 177; 2002, n = 1272; 2003, n = 593; 2004, n = 665; 2005, n = 503; 2018, n = 52



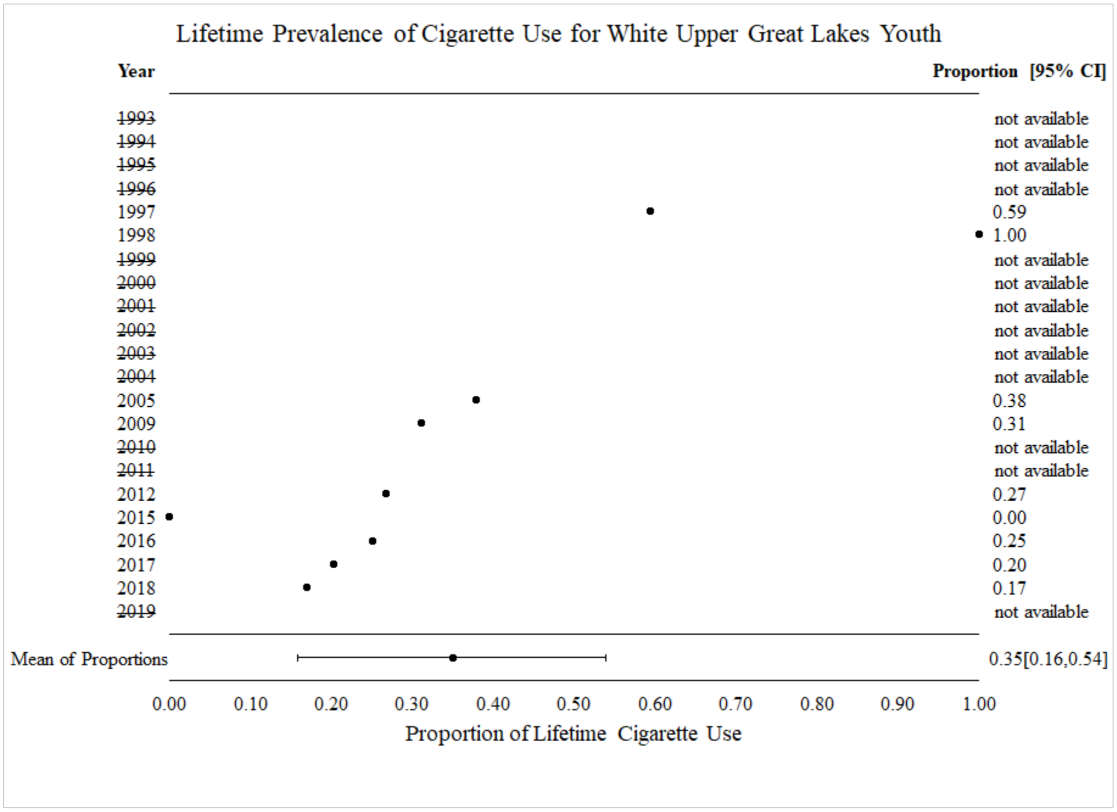
Note: Sample sizes for each year: 1993, n = 115; 1994, n = 264; 1997, n = 31; 2001, n = 439; 2002, n = 4; 2003, n = 21; 2004, n = 3; 2010, n = 14; 2011, n = 12; 2016, n = 265; 2017, n = 190; 2018, n = 123; 2019, n = 229



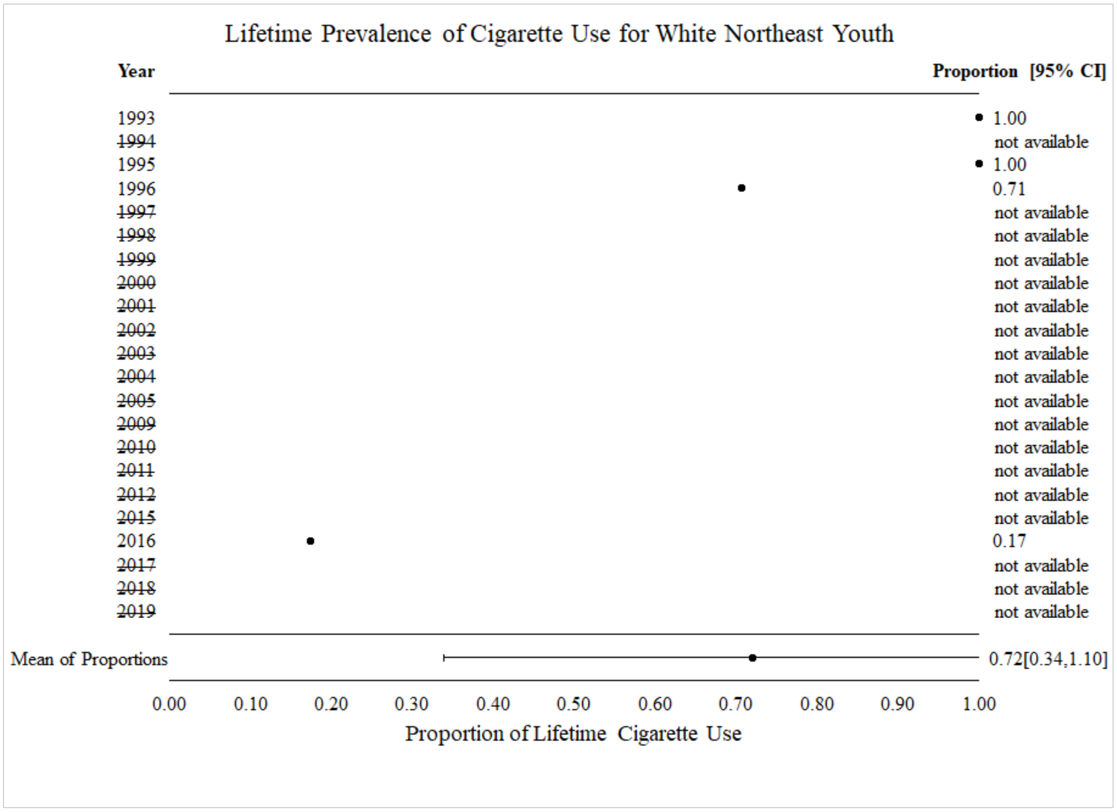
Note: Sample sizes for each year: 1996, n = 1; 2005, n = 5; 2009, n = 130; 2015, n = 110; 2016, n = 49; 2017, n = 6; 2018, n = 1



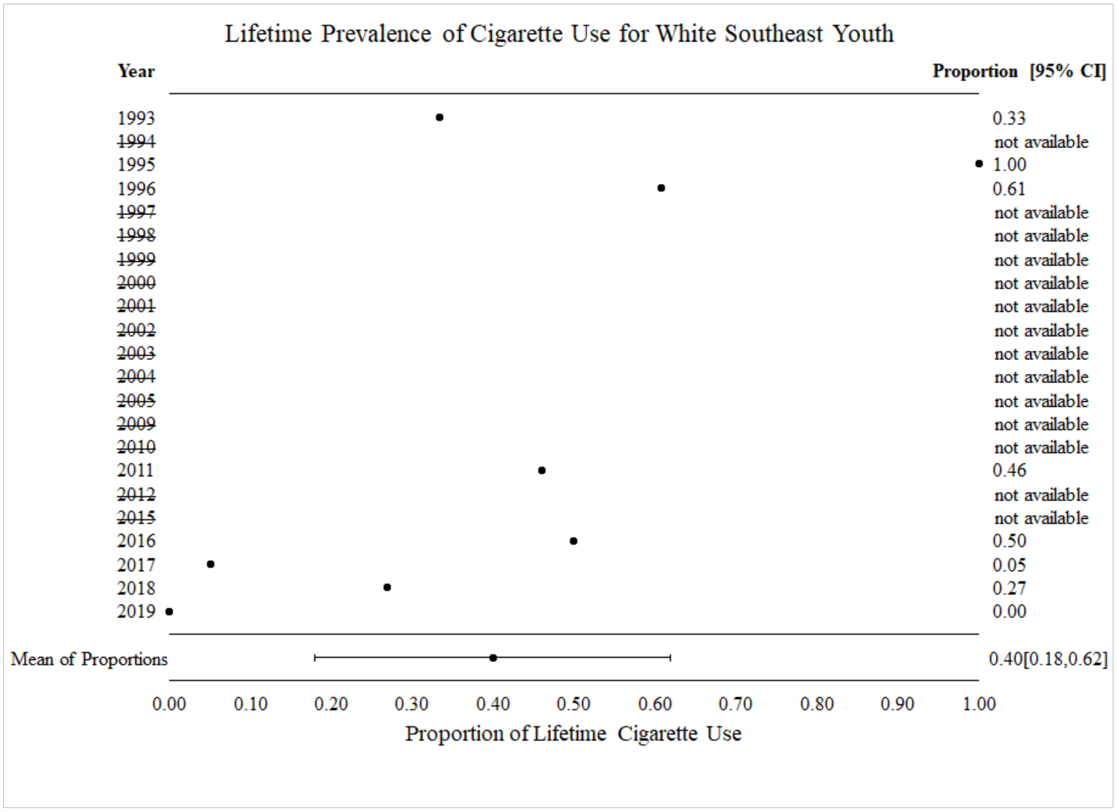
Note: Sample sizes for each year: 1993, n = 78; 1995, n = 12; 1996, n = 3; 1998, n = 3; 1999, n = 30; 2000, n = 81; 2005, n = 24; 2009, n = 84; 2010, n = 13; 2011, n = 22; 2012, n = 14; 2015, n = 4; 2016, n = 178; 2017, n = 69; 2018, n = 93



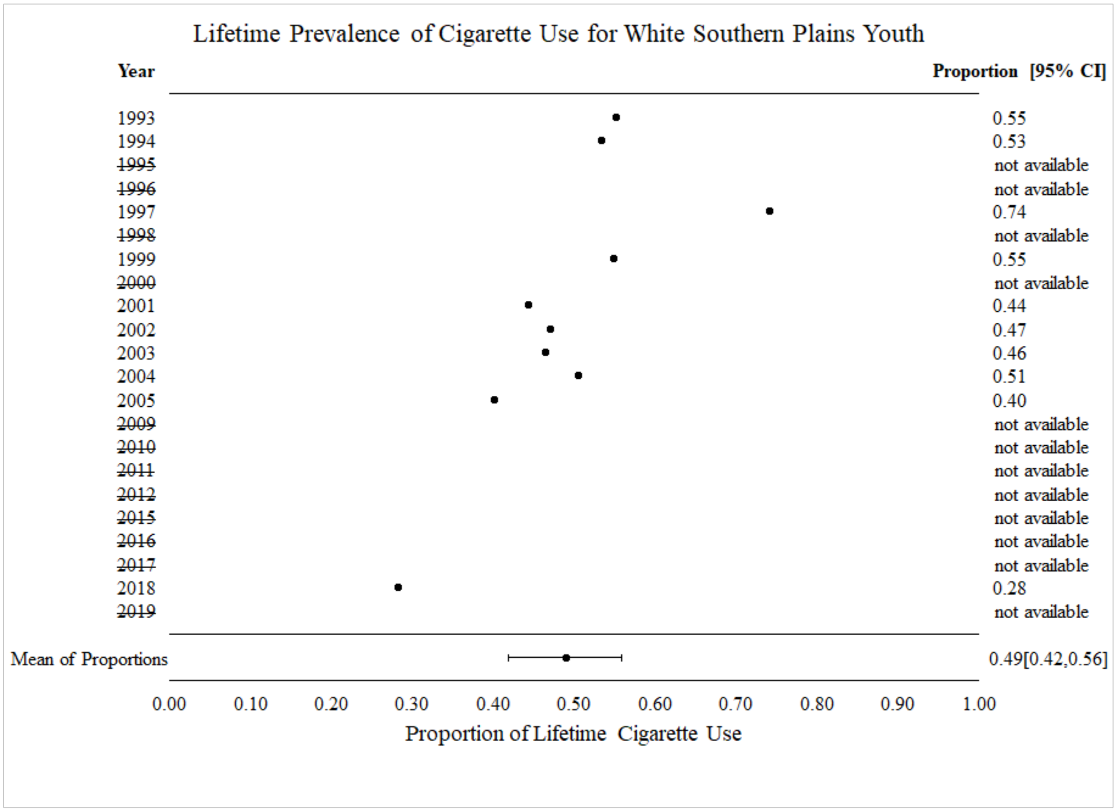
Note: Sample sizes for each year: 1997, n = 520; 1998, n = 2; 2005, n = 507; 2009, n = 533; 2012, n = 419; 2015, n = 1; 2016, n = 299; 2017, n = 69; 2018, n = 164



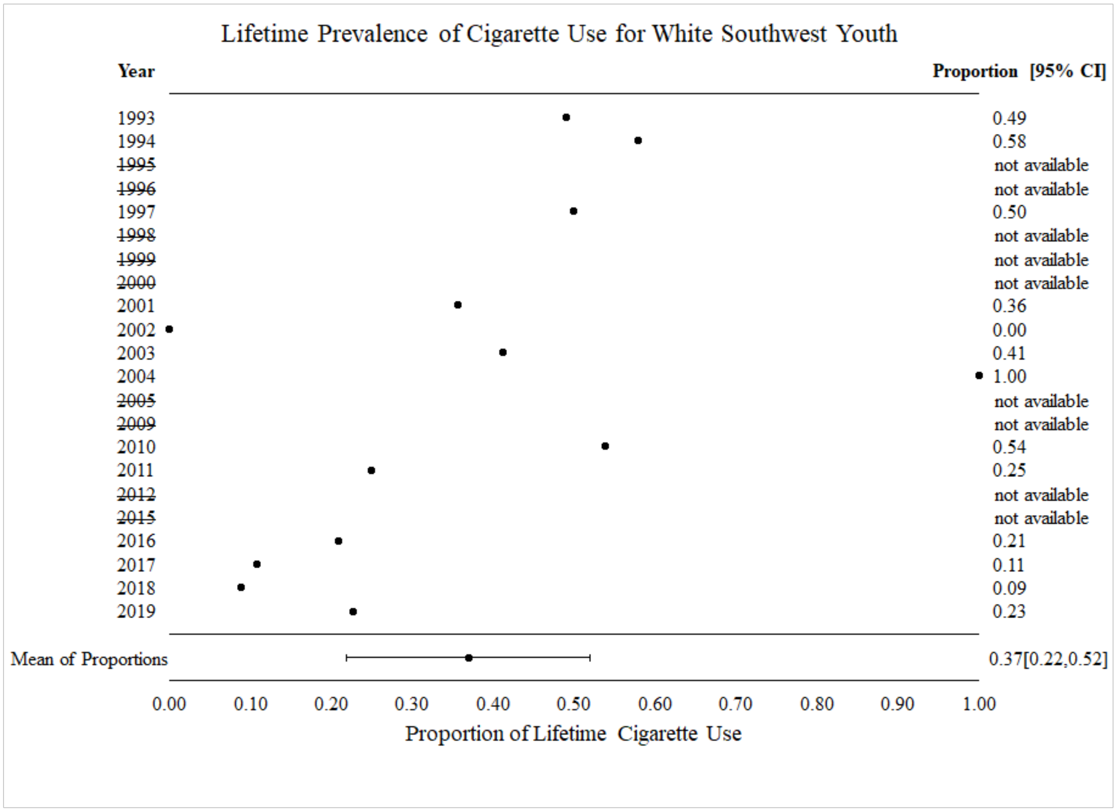
Note: Sample sizes for each year: 1993, n = 1; 1995, n = 1; 1996, n = 41; 2016, n = 178



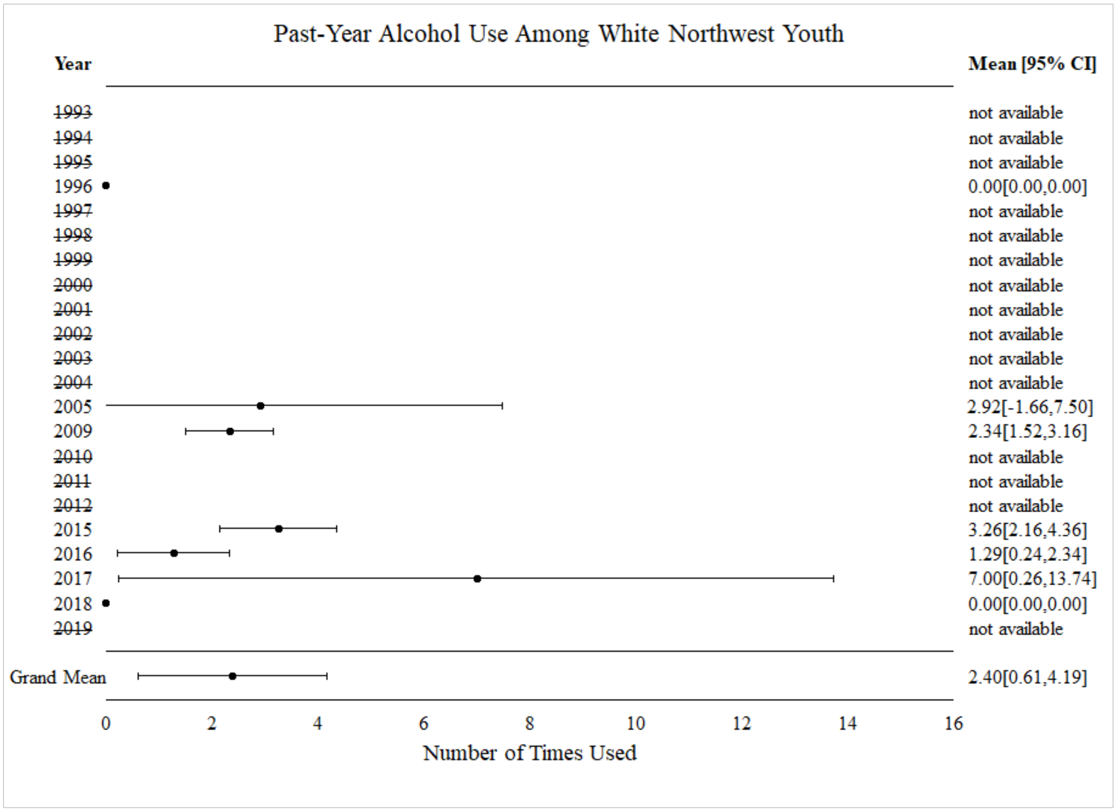
Note: Sample sizes for each year: 1993, n = 3; 1995, n = 2; 1996, n = 84; 2011, n = 306; 2016, n = 26; 2017, n = 119; 2018, n = 145; 2019, n = 1



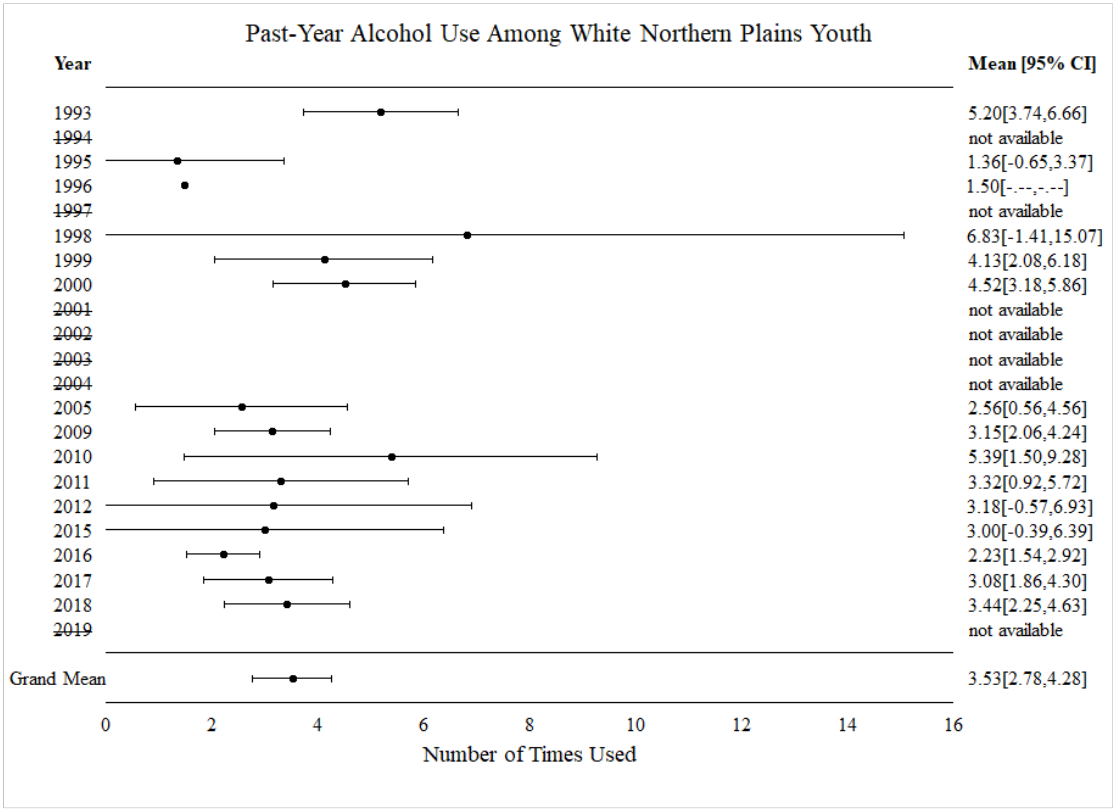
Note: Sample sizes for each year: 1993, n = 836; 1994, n = 208; 1997, n = 116; 1999, n = 111; 2001, n = 153; 2002, n = 1119; 2003, n = 523; 2004, n = 573; 2005, n = 435; 2018, n = 53



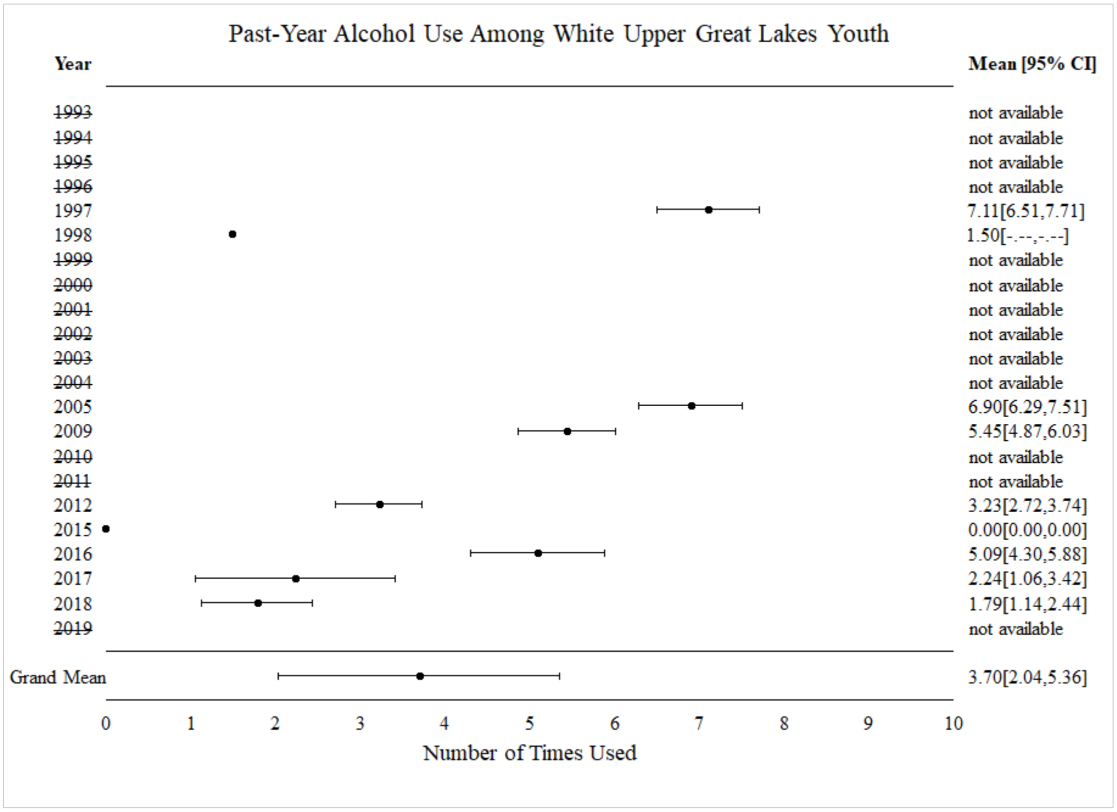
Note: Sample sizes for each year: 1993, n = 106; 1994, n = 221; 1997, n = 28; 2001, n = 392; 2002, n = 3; 2003, n = 17; 2004, n = 3; 2010, n = 13; 2011, n = 12; 2016, n = 268; 2017, n = 193; 2018, n = 124; 2019, n = 238



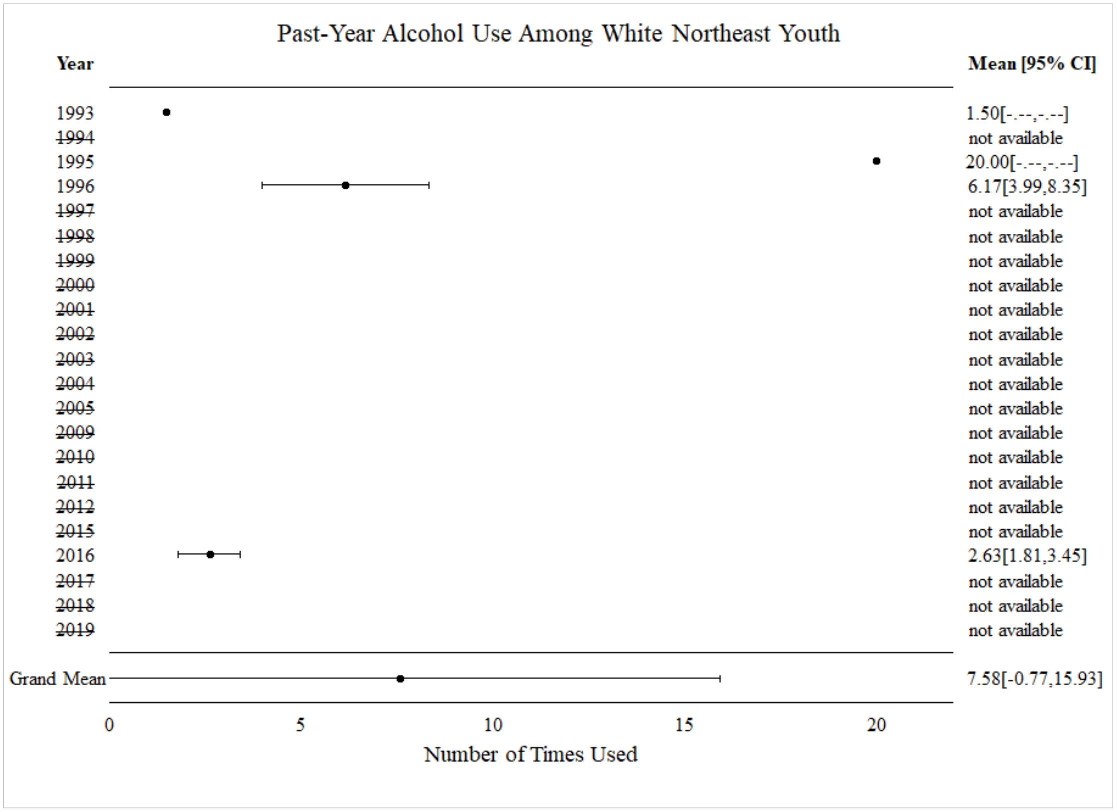
Note: Sample sizes for each year: 1996, n = 2; 2005, n = 6; 2009, n = 136; 2015, n = 109; 2016, n = 49; 2017, n = 6; 2018, n = 1



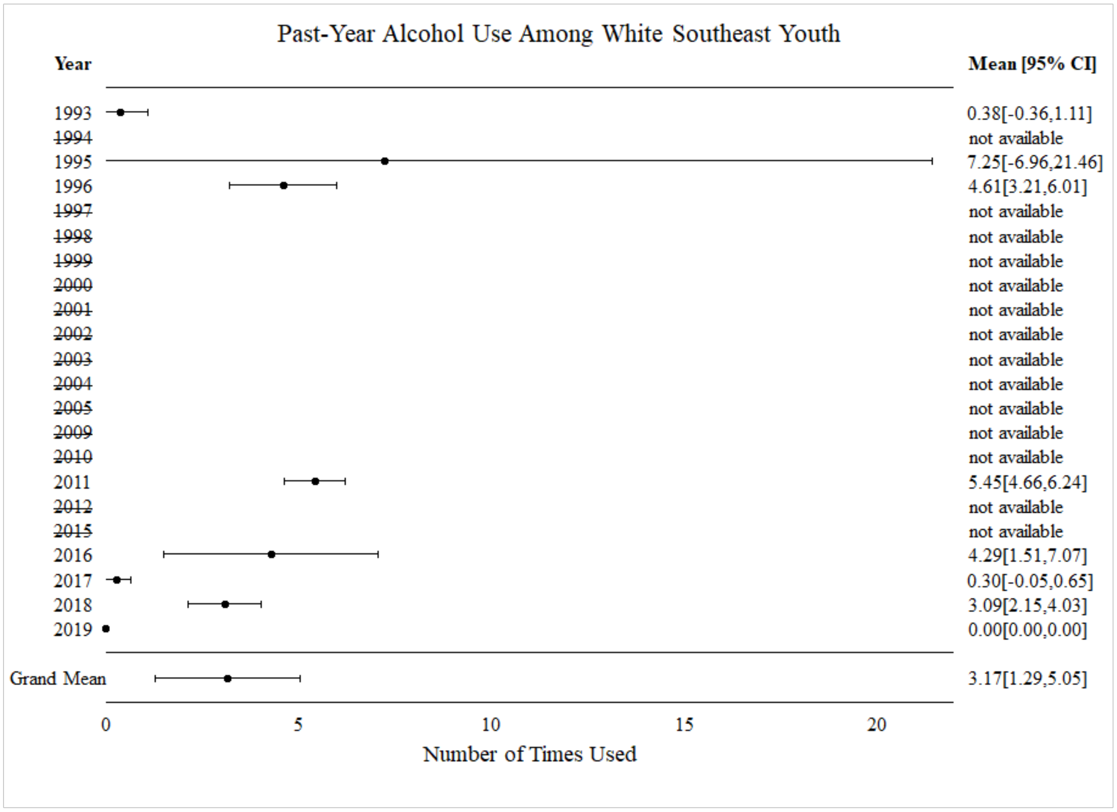
Note: Sample sizes for each year: 1993, n = 85; 1995, n = 14; 1996, n = 2; 1998, n = 3; 1999, n = 35; 2000, n = 89; 2005, n = 24; 2009, n = 83; 2010, n = 14; 2011, n = 22; 2012, n = 14; 2015, n = 4; 2016, n = 178; 2017, n = 69; 2018, n = 93



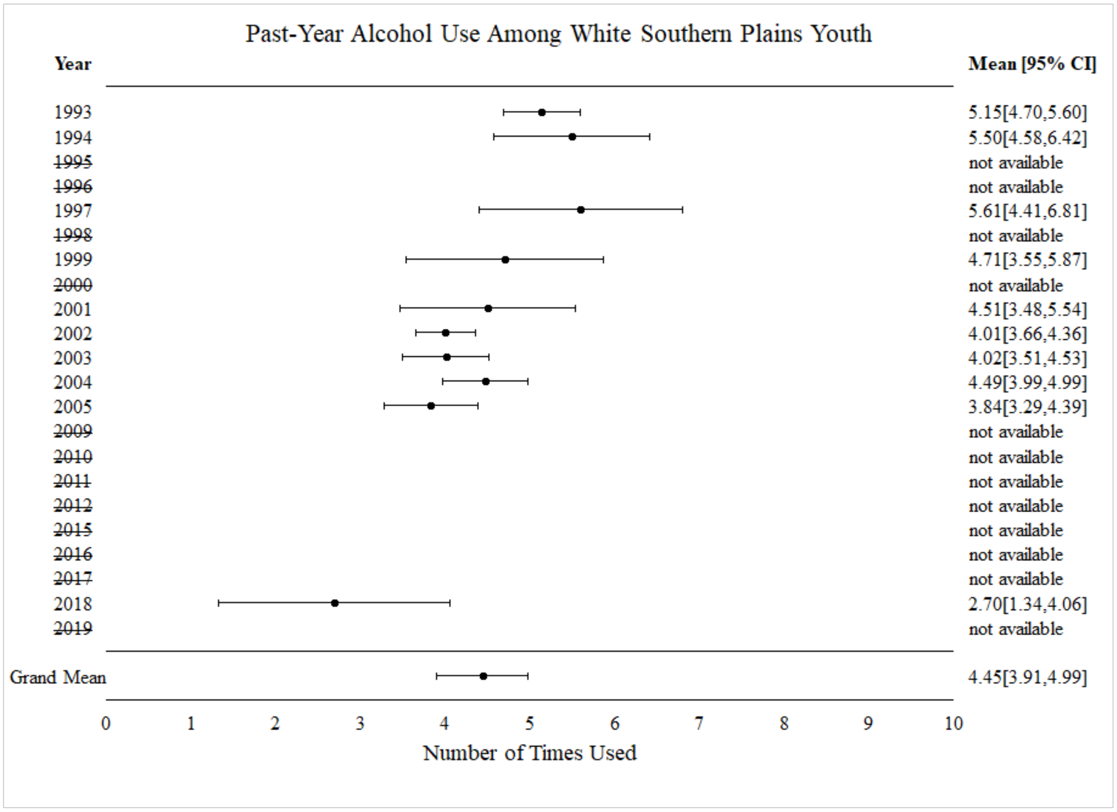
Note: Sample sizes for each year: 1997, n = 557; 1998, n = 1; 2005, n = 562; 2009, n = 529; 2012, n = 428; 2015, n = 1; 2016, n = 298; 2017, n = 69; 2018, n = 162



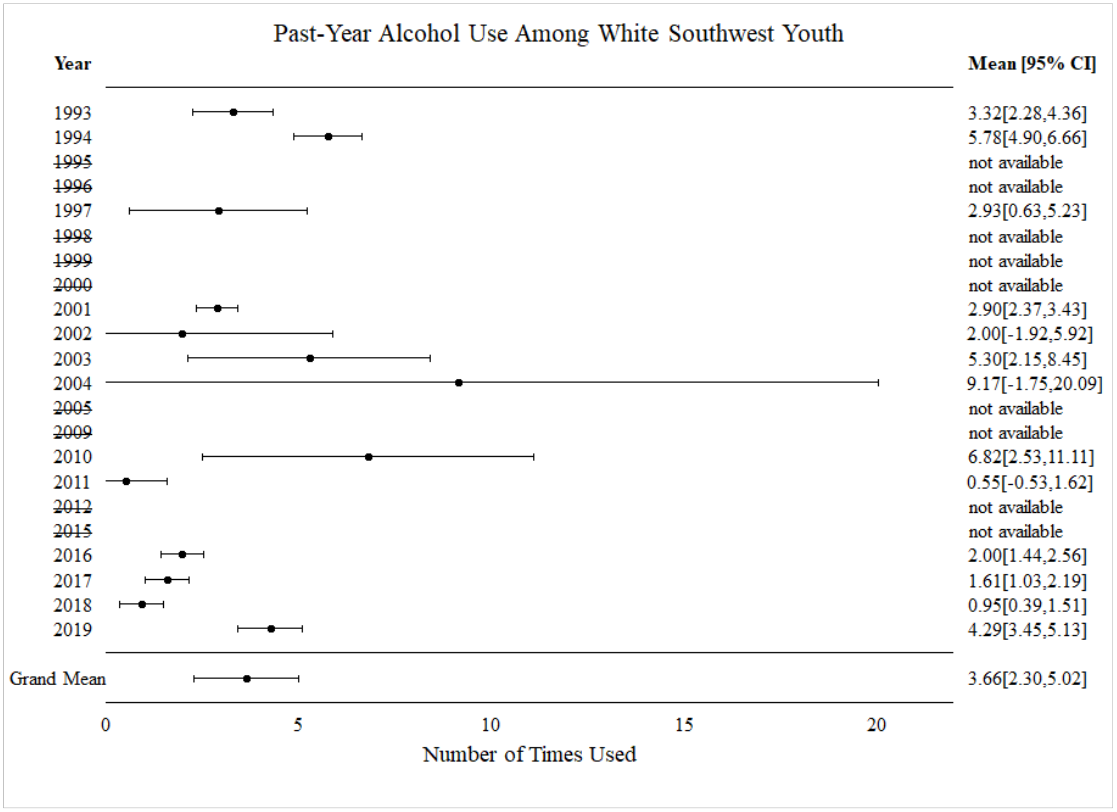
Note: Sample sizes for each year: 1993, n = 1; 1995, n = 1; 1996, n = 46; 2016, n = 177



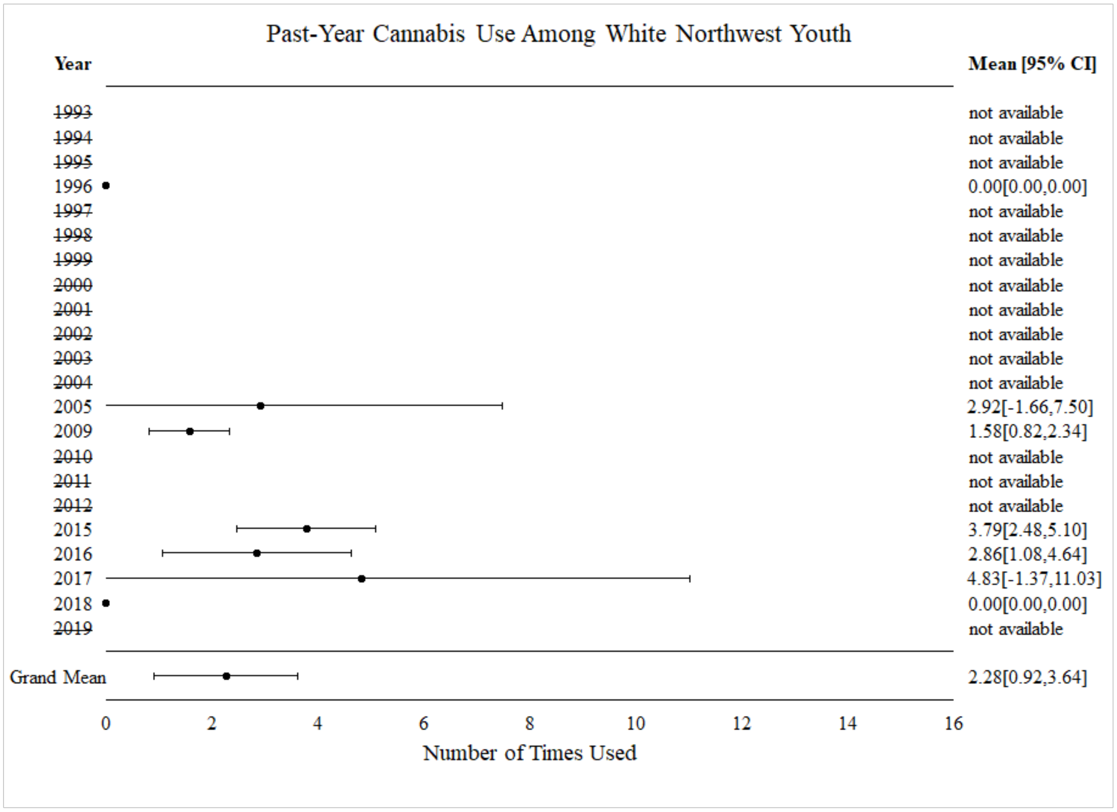
Note: Sample sizes for each year: 1993, n = 4; 1995, n = 2; 1996, n = 89; 2011, n = 322; 2016, n = 26; 2017, n = 118; 2018, n = 145; 2019, n = 1



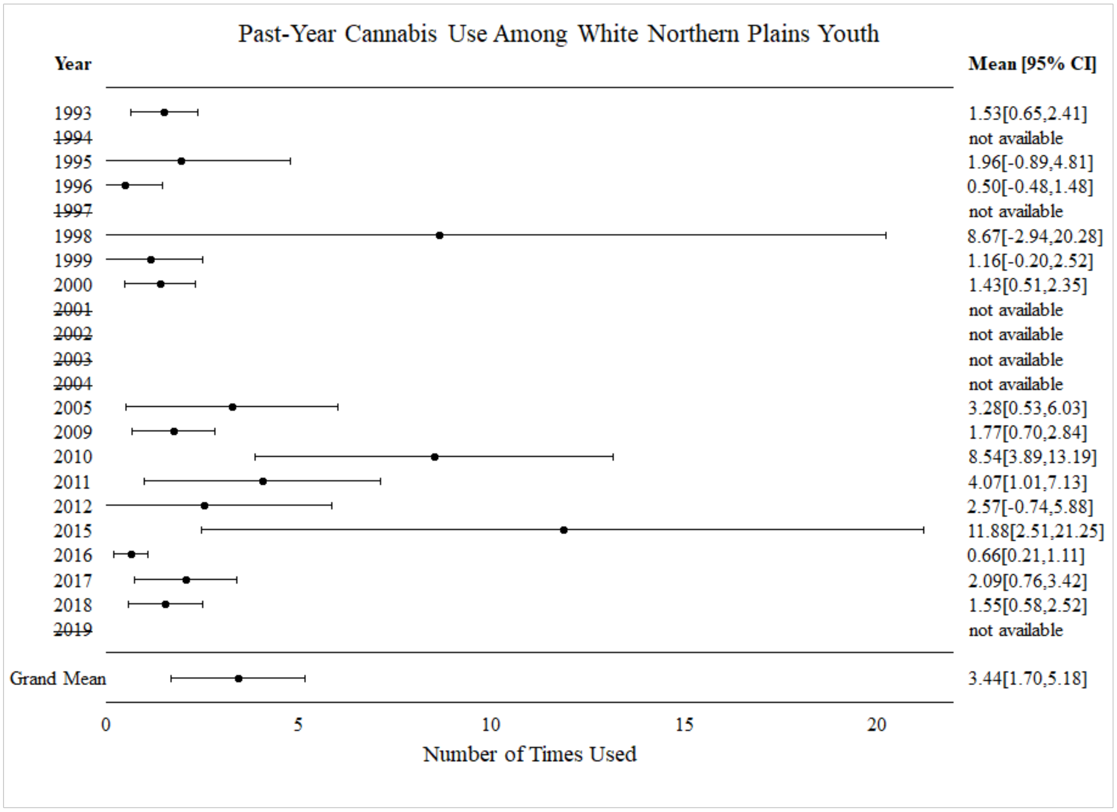
Note: Sample sizes for each year: 1993, n = 920; 1994, n = 227; 1997, n = 128; 1999, n = 114; 2001, n = 173; 2002, n = 1256; 2003, n = 580; 2004, n = 655; 2005, n = 500; 2018, n = 52



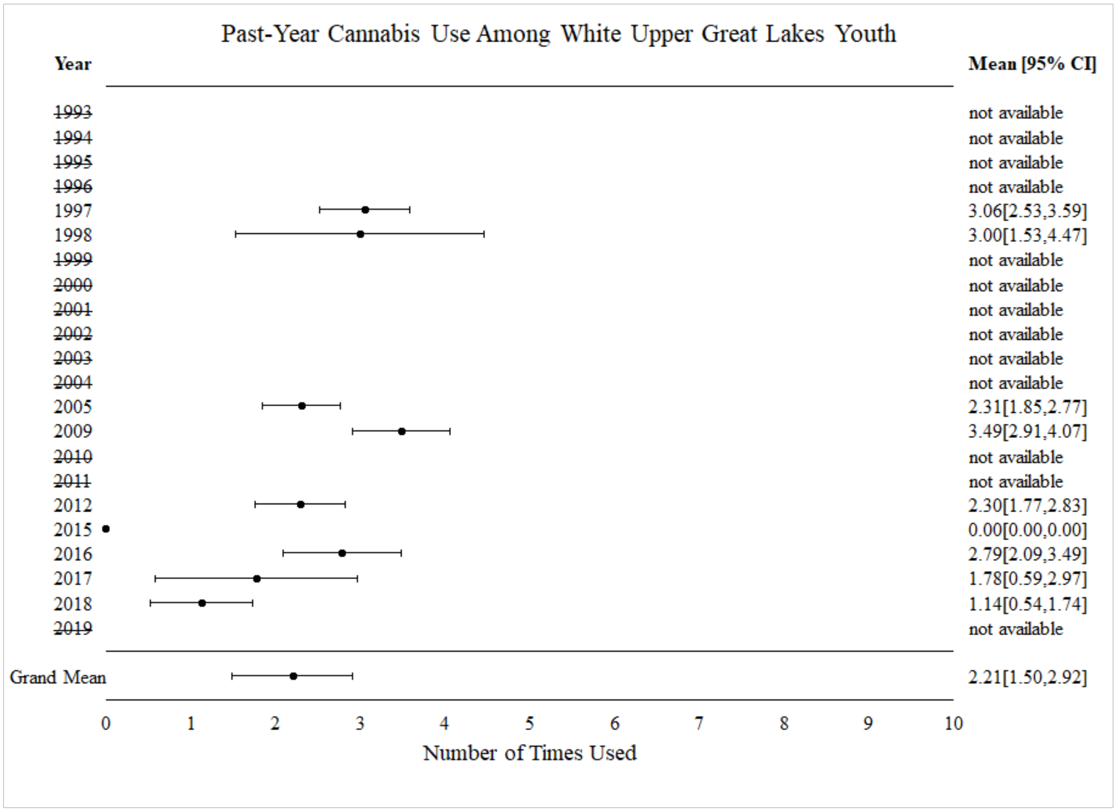
Note: Sample sizes for each year: 1993, n = 116; 1994, n = 258; 1997, n = 30; 2001, n = 436; 2002, n = 3; 2003, n = 20; 2004, n = 3; 2010, n = 14; 2011, n = 11; 2016, n = 266; 2017, n = 193; 2018, n = 124; 2019, n = 237



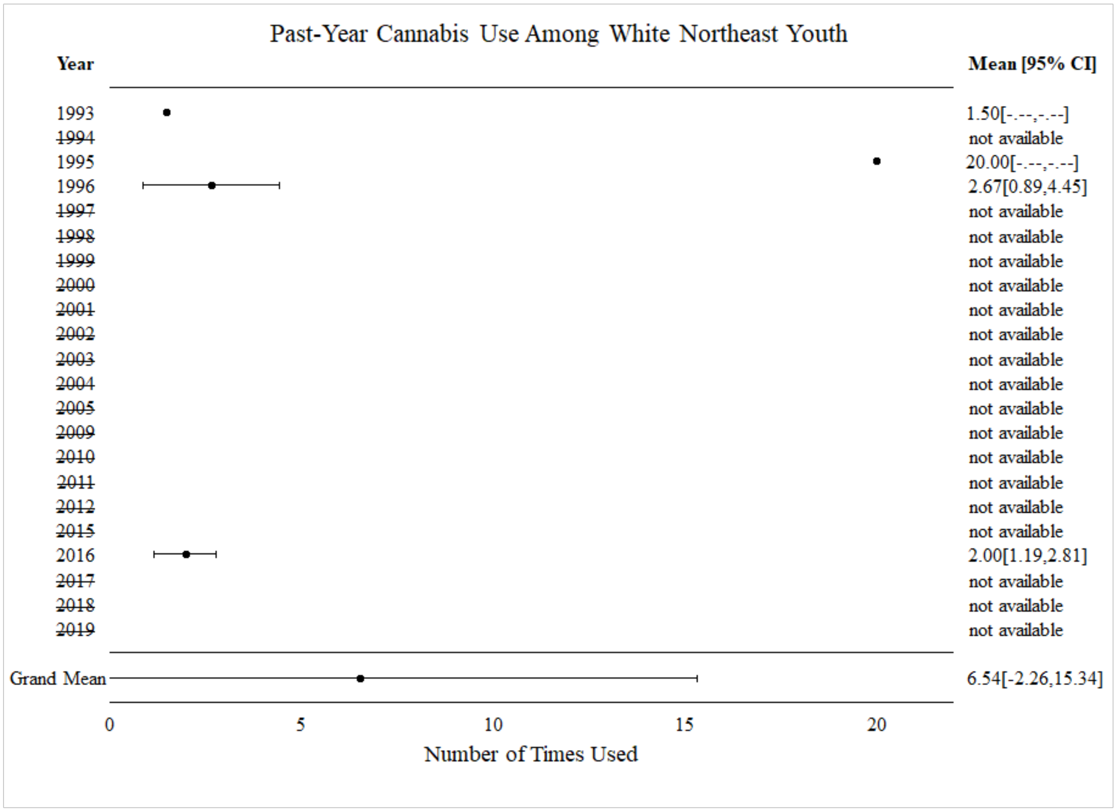
Note: Sample sizes for each year: 1996, n = 2; 2005, n = 6; 2009, n = 136; 2015, n = 109; 2016, n = 49; 2017, n = 6; 2018, n = 1



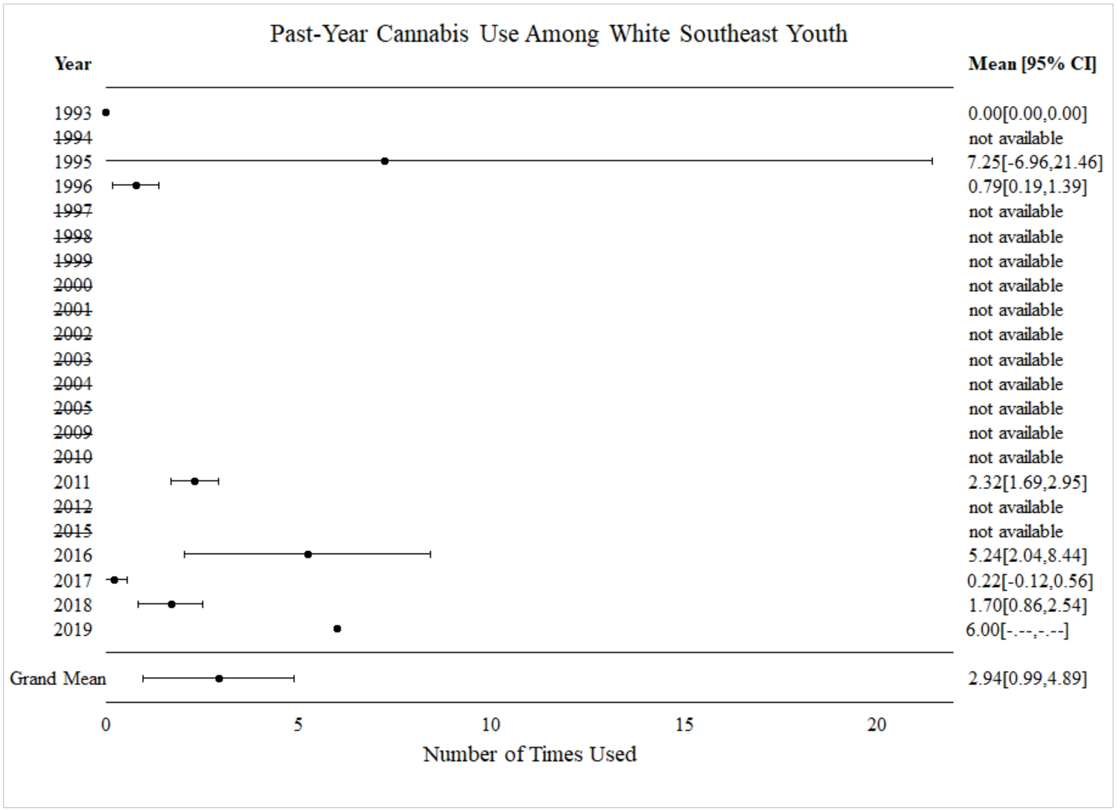
Note: Sample sizes for each year: 1993, n = 86; 1995, n = 14; 1996, n = 3; 1998, n = 3; 1999, n = 35; 2000, n = 90; 2005, n = 25; 2009, n = 84; 2010, n = 14; 2011, n = 22; 2012, n = 14; 2015, n = 4; 2016, n = 178; 2017, n = 69; 2018, n = 93



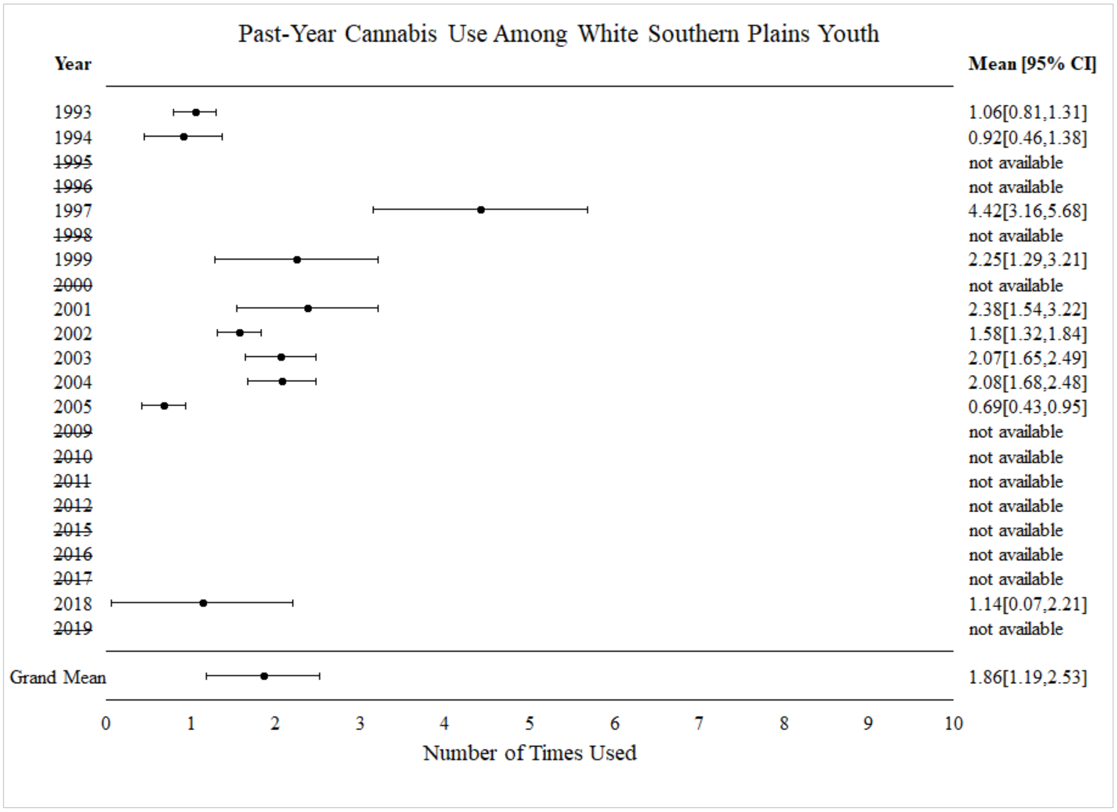
Note: Sample sizes for each year: 1997, n = 564; 1998, n = 2; 2005, n = 570; 2009, n = 535; 2012, n = 426; 2015, n = 1; 2016, n = 297; 2017, n = 69; 2018, n = 161



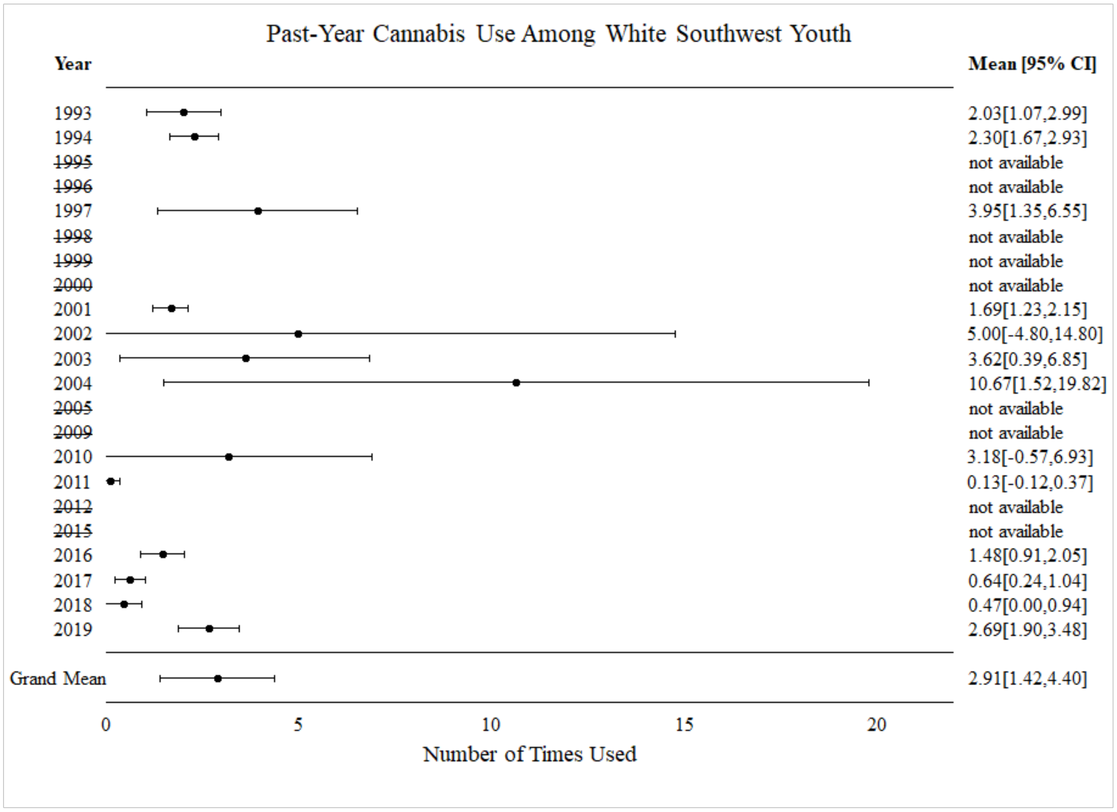
Note: Sample sizes for each year: 1993, n = 1; 1995, n = 1; 1996, n = 47; 2016, n = 176



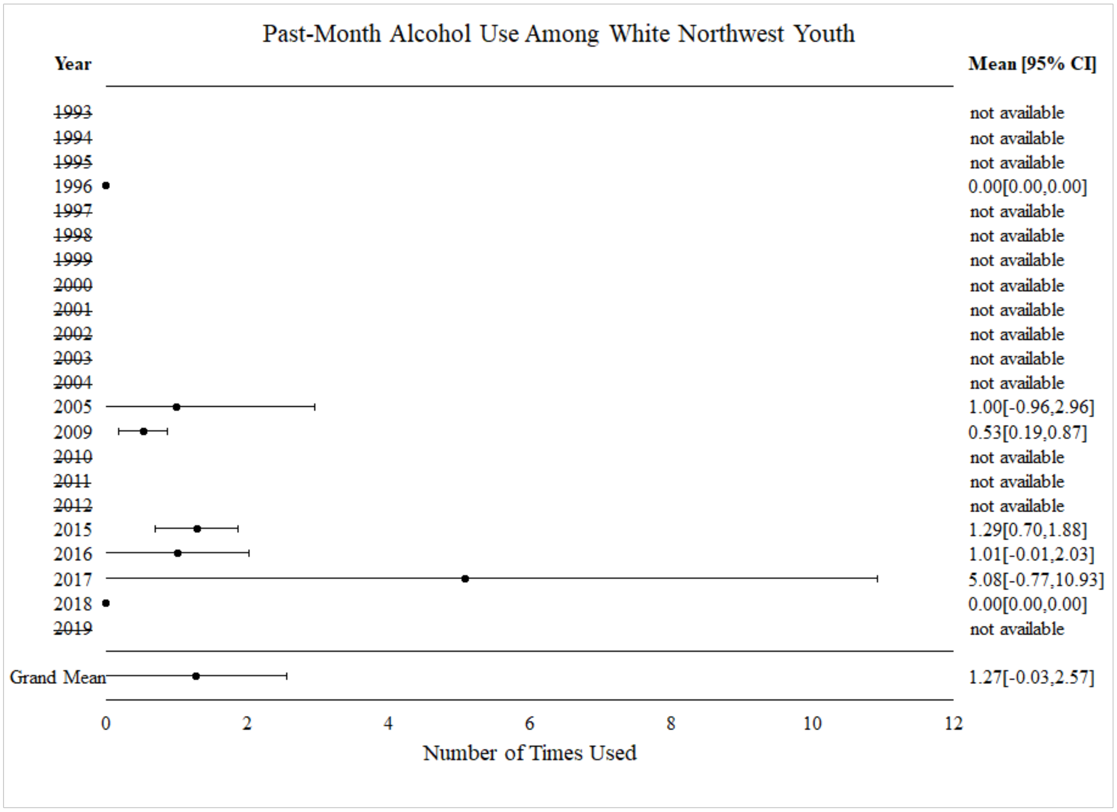
Note: Sample sizes for each year: 1993, n = 4; 1995, n = 2; 1996, n = 89; 2011, n = 319; 2016, n = 25; 2017, n = 117; 2018, n = 144; 2019, n = 1



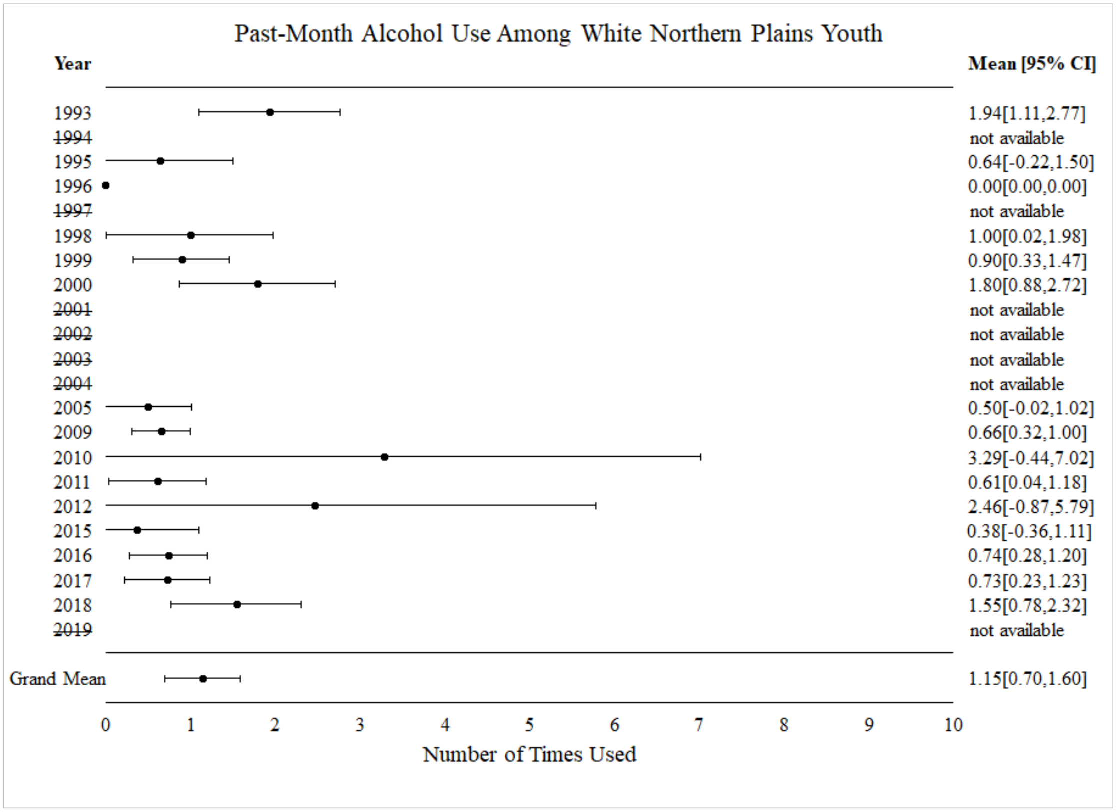
Note: Sample sizes for each year: 1993, n = 937; 1994, n = 230; 1997, n = 130; 1999, n = 116; 2001, n = 177; 2002, n = 1273; 2003, n = 593; 2004, n = 665; 2005, n = 501; 2018, n = 52



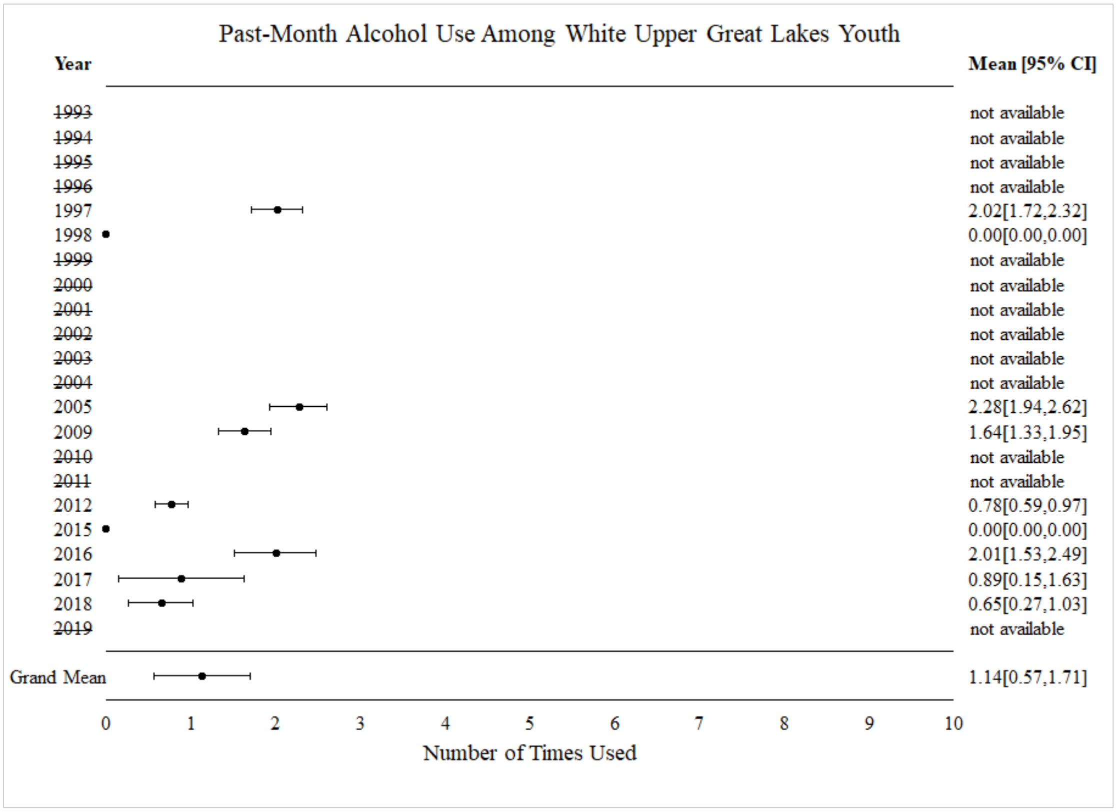
Note: Sample sizes for each year: 1993, n = 116; 1994, n = 262; 1997, n = 31; 2001, n = 439; 2002, n = 4; 2003, n = 21; 2004, n = 3; 2010, n = 14; 2011, n = 12; 2016, n = 265; 2017, n = 190; 2018, n = 123; 2019, n = 229



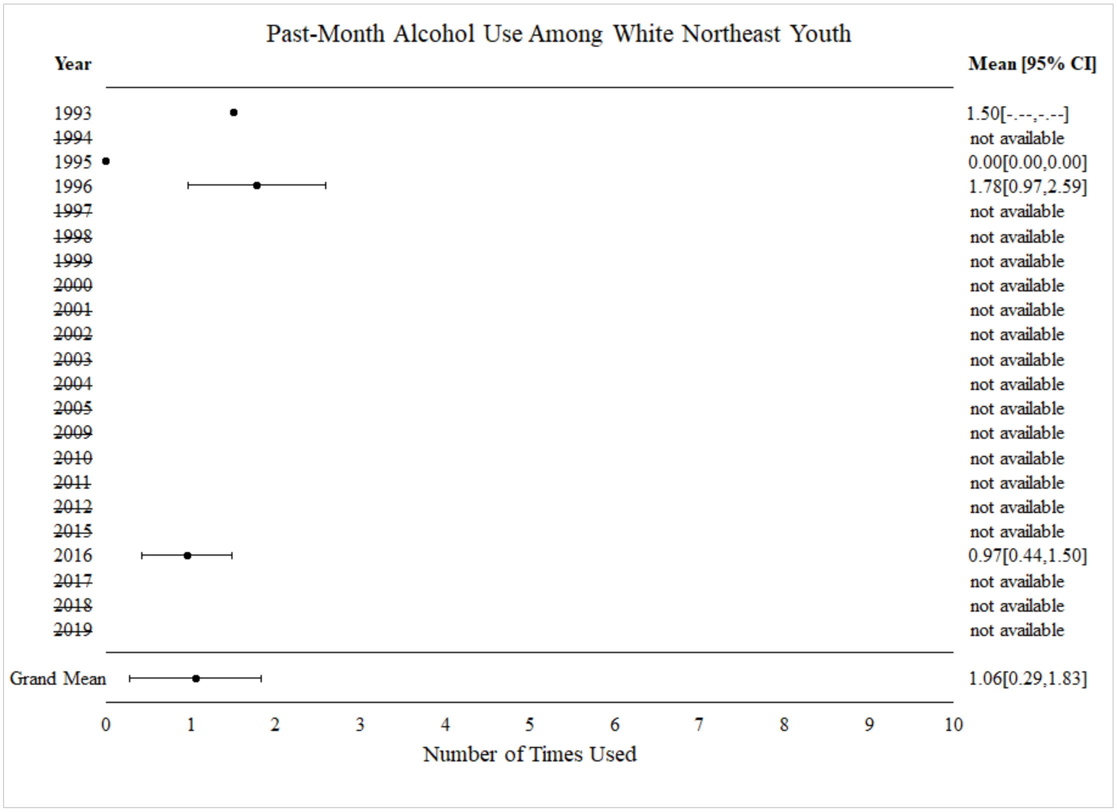
Note: Sample sizes for each year: 1996, n = 2; 2005, n = 6; 2009, n = 137; 2015, n = 109; 2016, n = 49; 2017, n = 6; 2018, n = 1



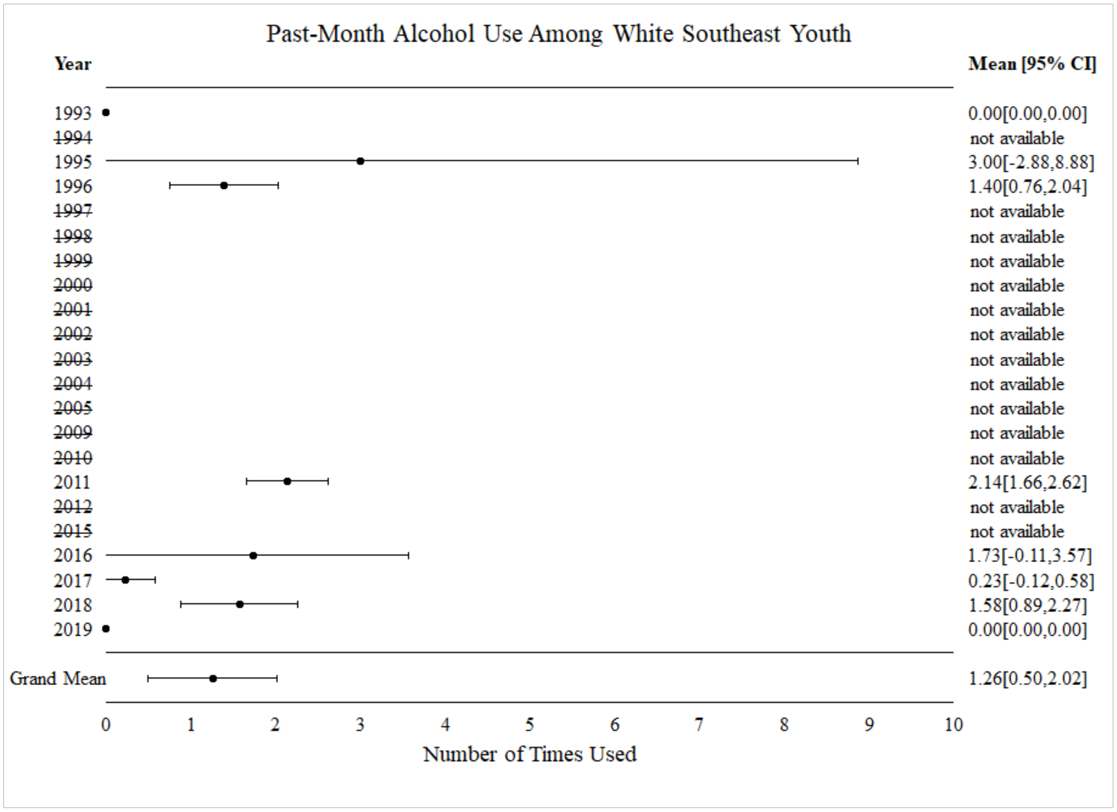
Note: Sample sizes for each year: 1993, n = 86; 1995, n = 14; 1996, n = 2; 1998, n = 3; 1999, n = 35; 2000, n = 87; 2005, n = 24; 2009, n = 84; 2010, n = 14; 2011, n = 22; 2012, n = 14; 2015, n = 4; 2016, n = 178; 2017, n = 69; 2018, n = 93



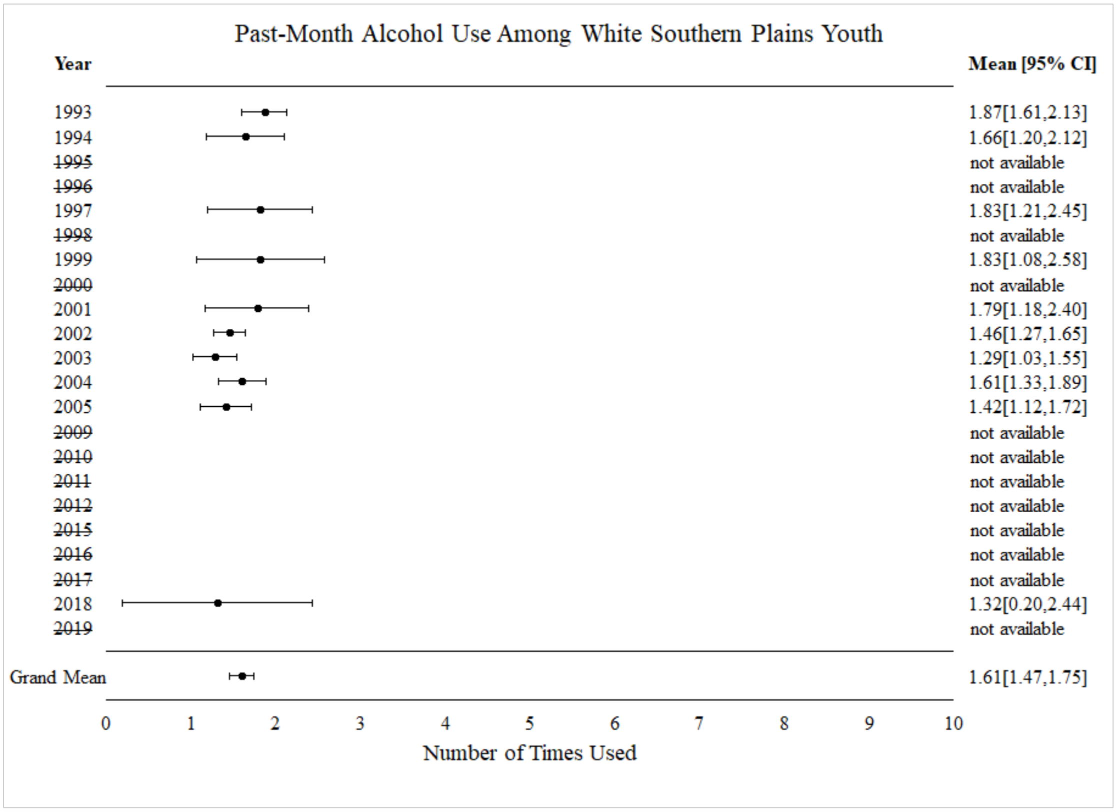
Note: Sample sizes for each year: 1997, n = 558; 1998, n = 1; 2005, n = 560; 2009, n = 532; 2012, n = 427; 2015, n = 1; 2016, n = 298; 2017, n = 69; 2018, n = 162



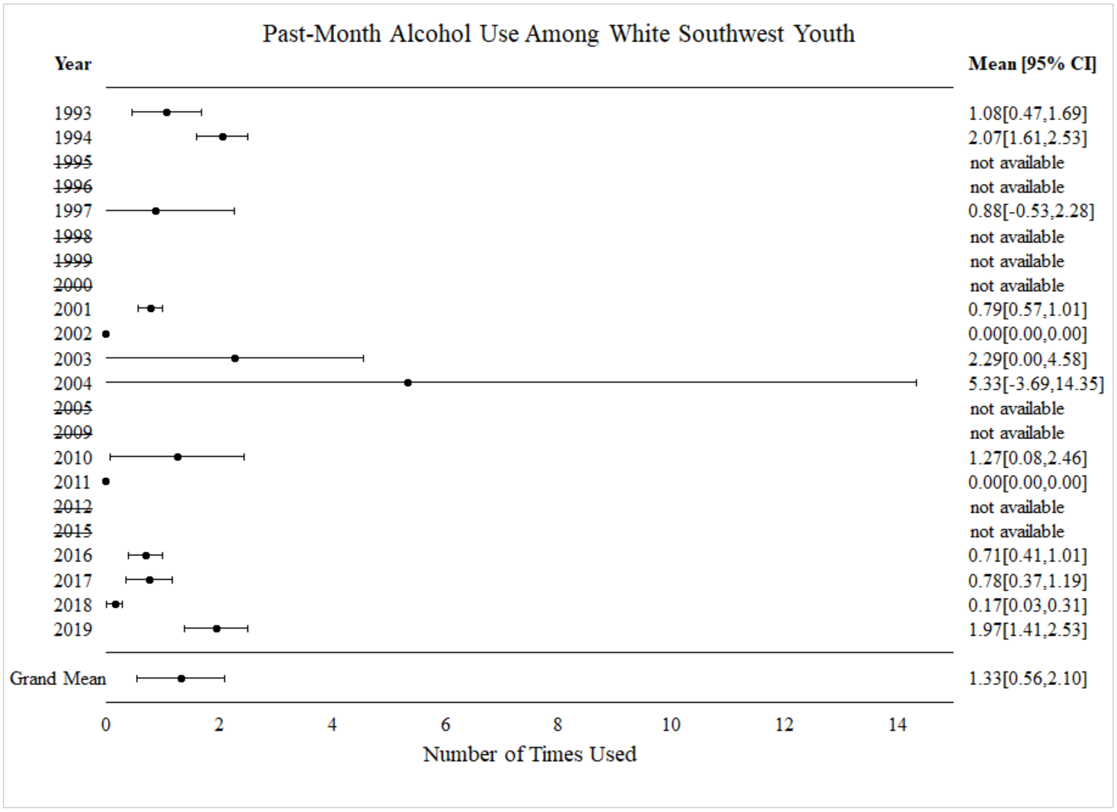
Note: Sample sizes for each year: 1993, n = 1; 1995, n = 1; 1996, n = 46; 2016, n = 176



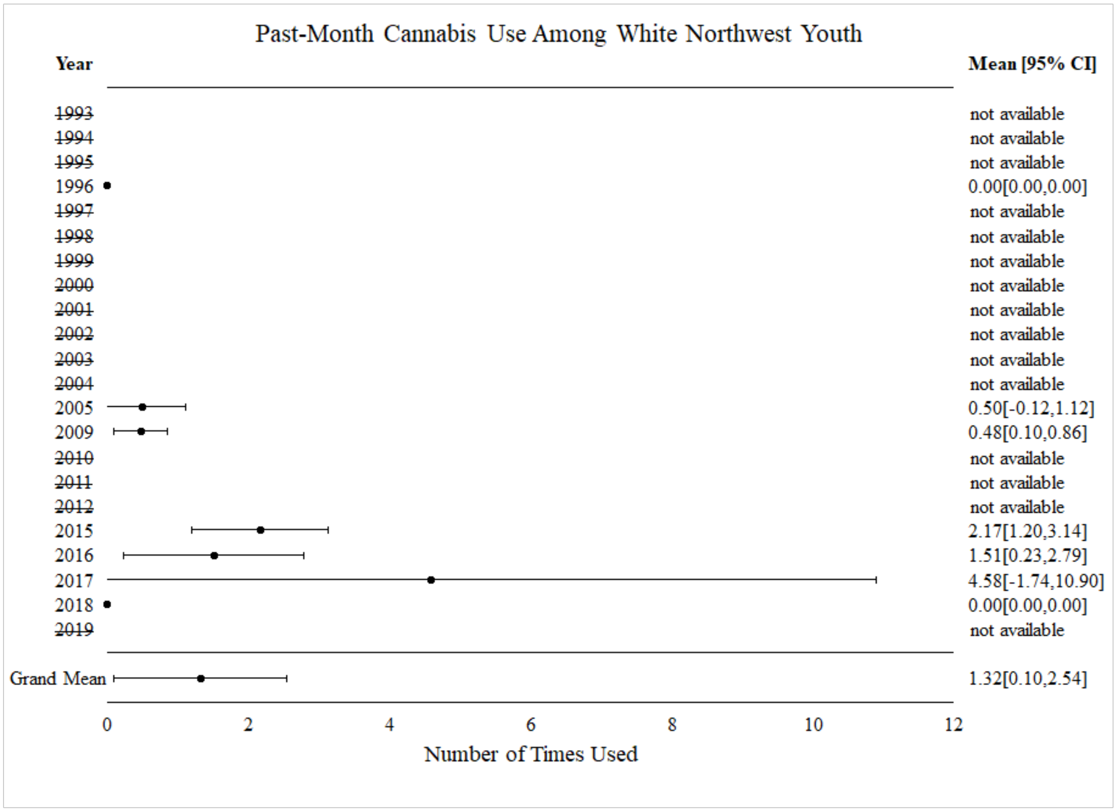
Note: Sample sizes for each year: 1993, n = 4; 1995, n = 2; 1996, n = 89; 2011, n = 322; 2016, n = 26; 2017, n = 118; 2018, n = 145; 2019, n = 1



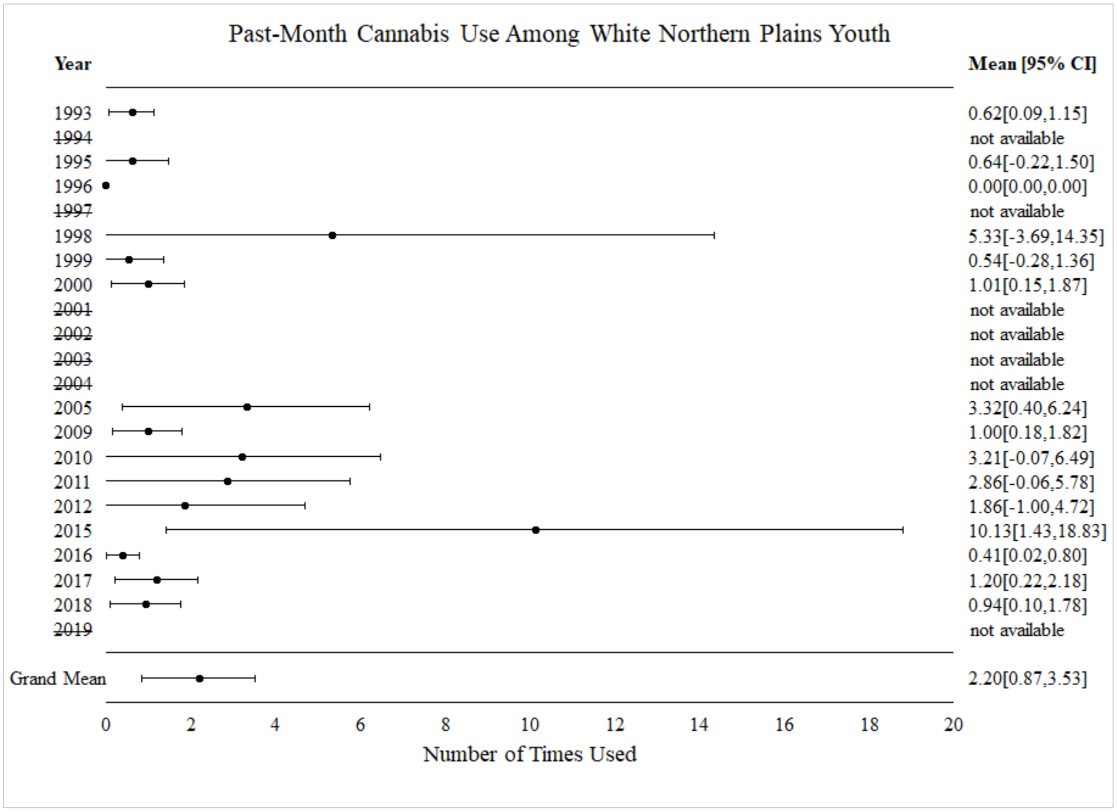
Note: Sample sizes for each year: 1993, n = 923; 1994, n = 230; 1997, n = 127; 1999, n = 114; 2001, n = 174; 2002, n = 1255; 2003, n = 585; 2004, n = 652; 2005, n = 501; 2018, n = 52



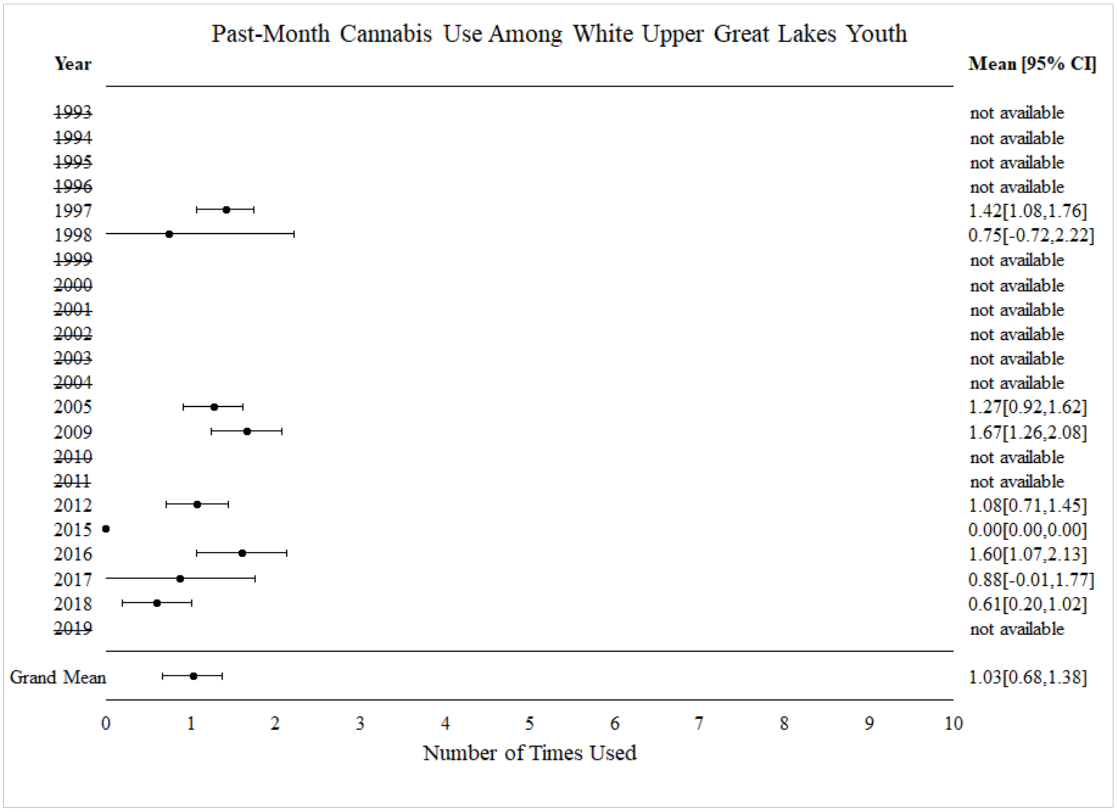
Note: Sample sizes for each year: 1993, n = 115; 1994, n = 259; 1997, n = 28; 2001, n = 436; 2002, n = 3; 2003, n = 21; 2004, n = 3; 2010, n = 13; 2011, n = 12; 2016, n = 266; 2017, n = 193; 2018, n = 124; 2019, n = 237



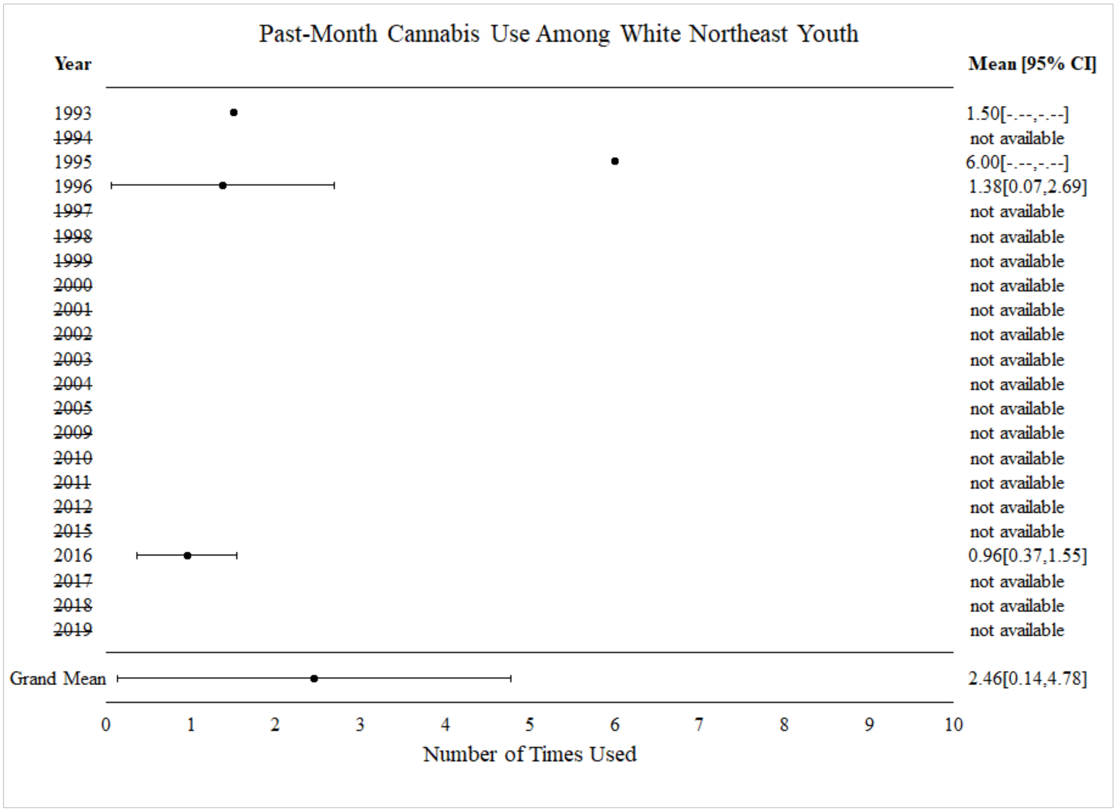
Note: Sample sizes for each year: 1996, n = 2; 2005, n = 6; 2009, n = 135; 2015, n = 109; 2016, n = 49; 2017, n = 6; 2018, n = 1



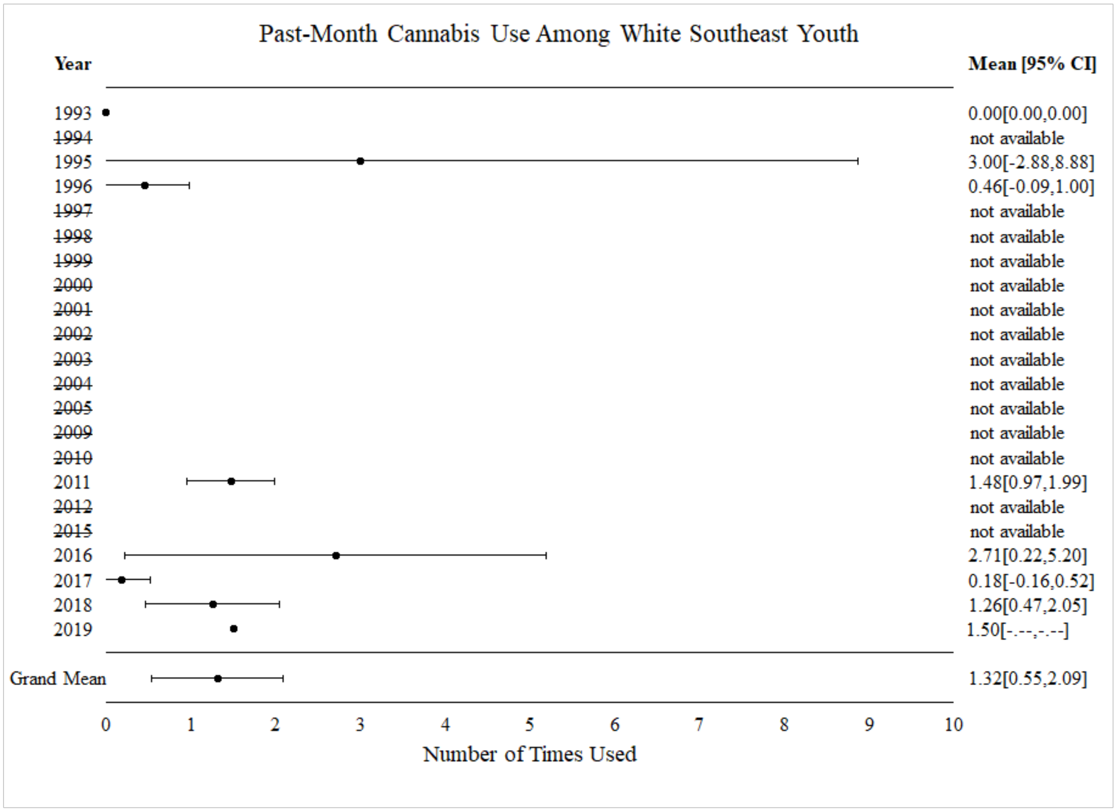
Note: Sample sizes for each year: 1993, n = 86; 1995, n = 14; 1996, n = 3; 1998, n = 3; 1999, n = 35; 2000, n = 90; 2005, n = 25; 2009, n = 84; 2010, n = 14; 2011, n = 22; 2012, n = 14; 2015, n = 4; 2016, n = 178; 2017, n = 69; 2018, n = 93



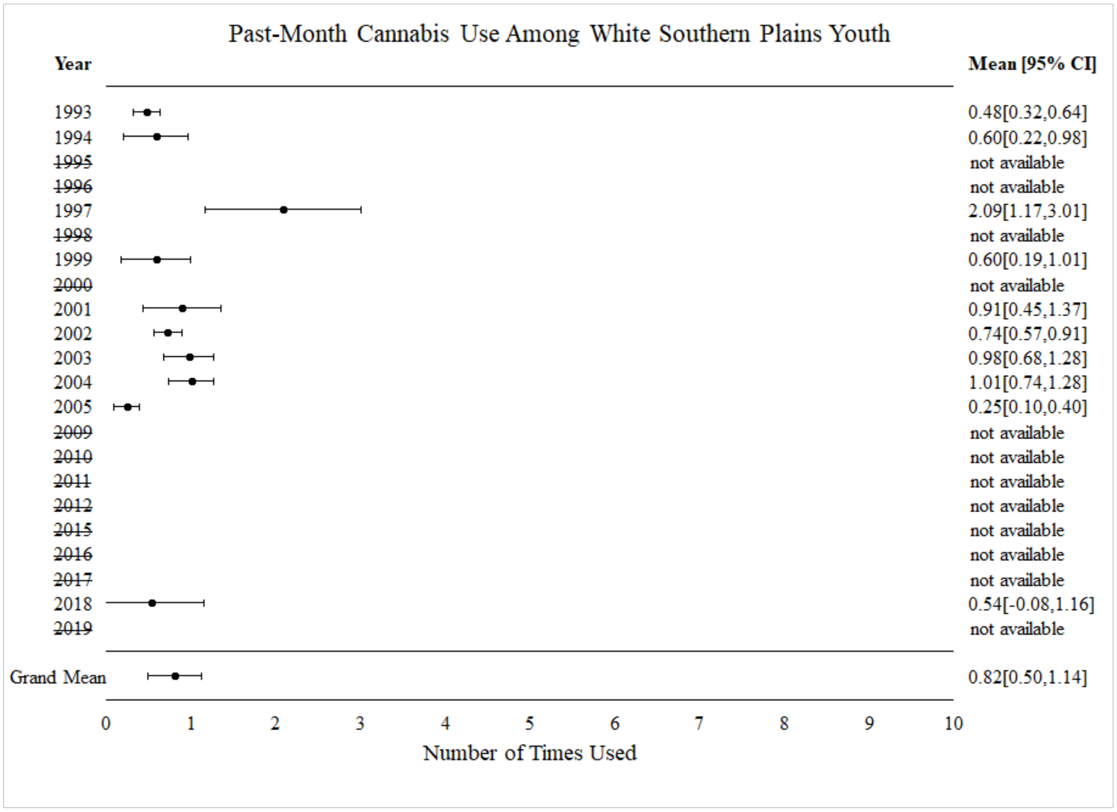
Note: Sample sizes for each year: 1997, n = 562; 1998, n = 2; 2005, n = 572; 2009, n = 535; 2012, n = 426; 2015, n = 1; 2016, n = 297; 2017, n = 69; 2018, n = 162



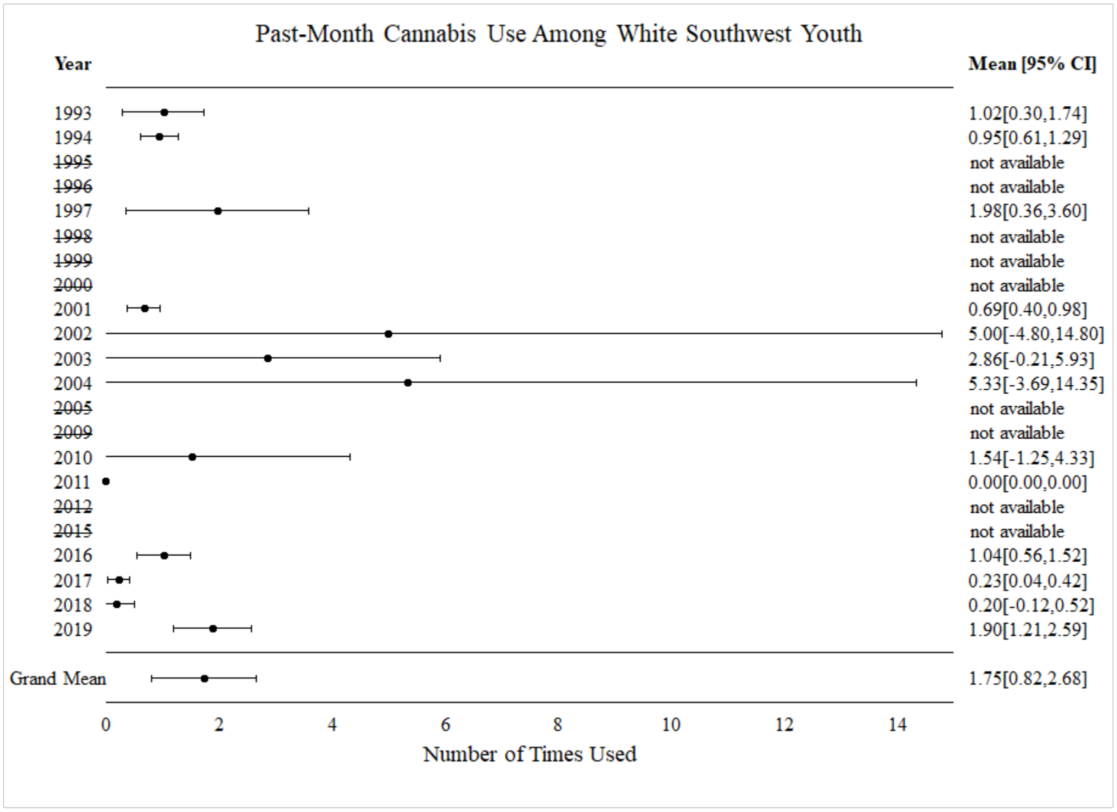
Note: Sample sizes for each year: 1993, n = 1; 1995, n = 1; 1996, n = 47; 2016, n = 176



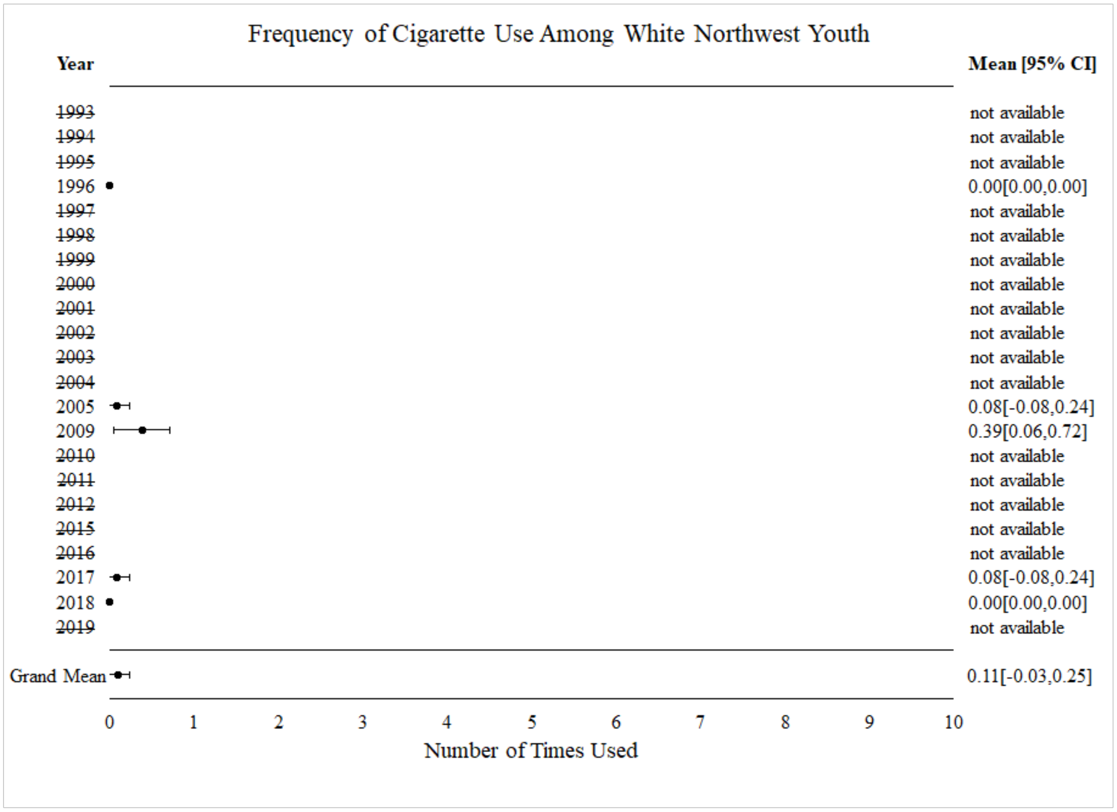
Note: Sample sizes for each year: 1993, n = 4; 1995, n = 2; 1996, n = 89; 2011, n = 320; 2016, n = 26; 2017, n = 117; 2018, n = 144; 2019, n = 1



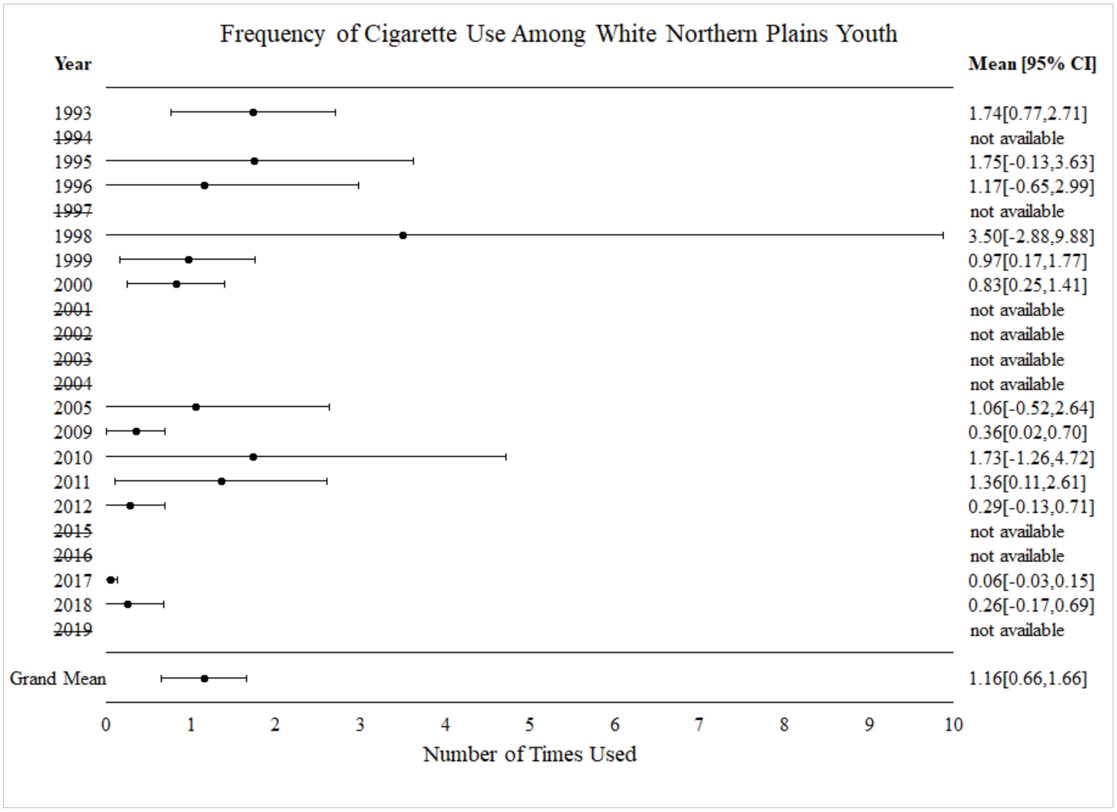
Note: Sample sizes for each year: 1993, n = 938; 1994, n = 231; 1997, n = 130; 1999, n = 116; 2001, n = 176; 2002, n = 1272; 2003, n = 592; 2004, n = 664; 2005, n = 503; 2018, n = 52



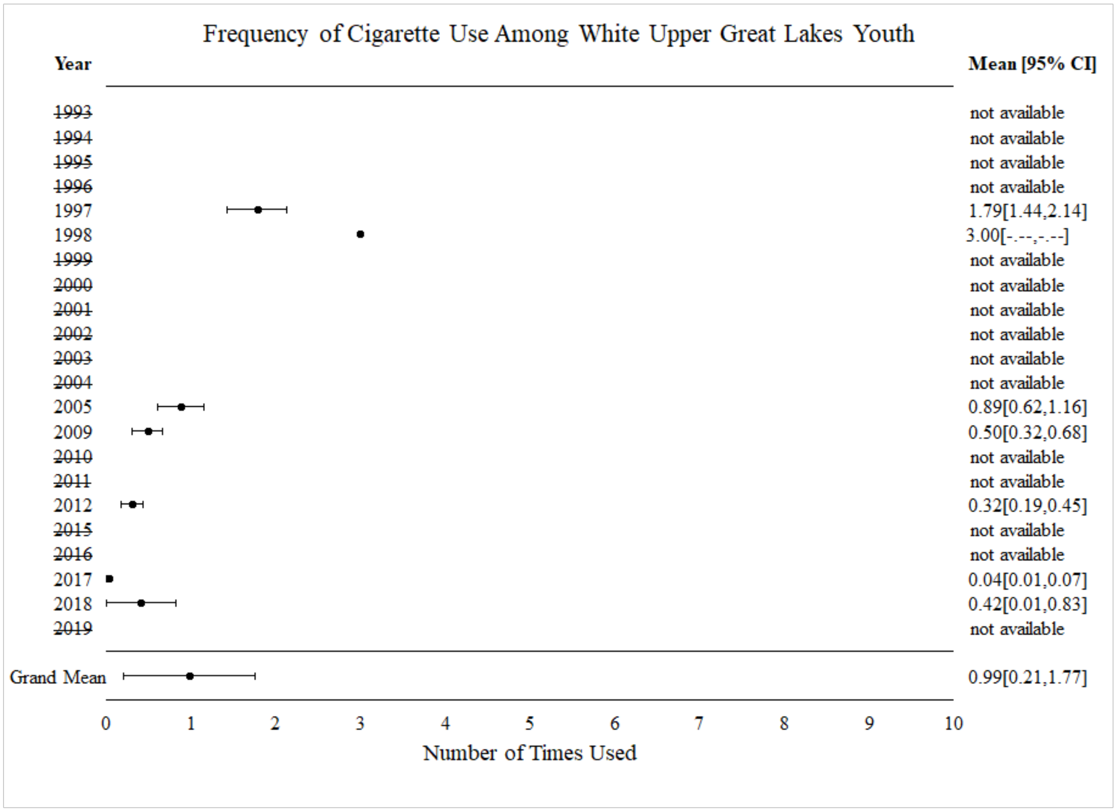
Note: Sample sizes for each year: 1993, n = 116; 1994, n = 264; 1997, n = 31; 2001, n = 438; 2002, n = 4; 2003, n = 21; 2004, n = 3; 2010, n = 14; 2011, n = 12; 2016, n = 265; 2017, n = 190; 2018, n = 123; 2019, n = 229



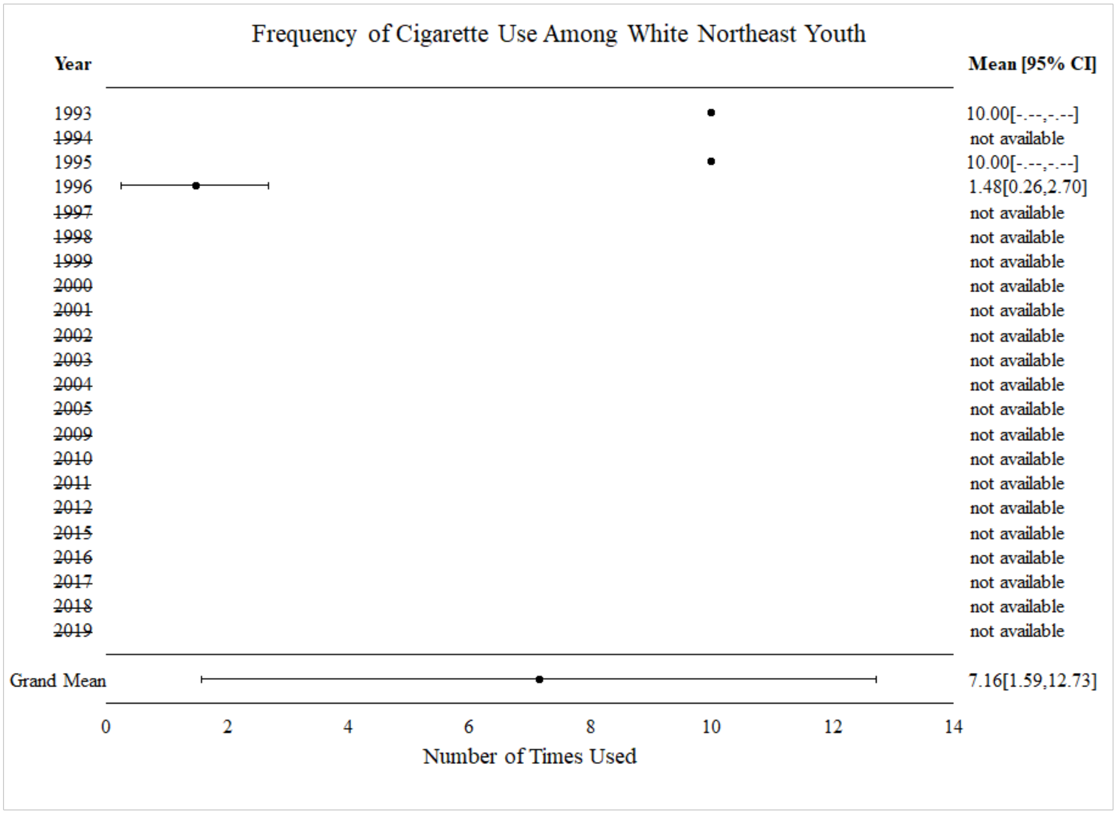
Note: Sample sizes for each year: 1996, n = 2; 2005, n = 6; 2009, n = 135; 2017, n = 6; 2018, n = 1



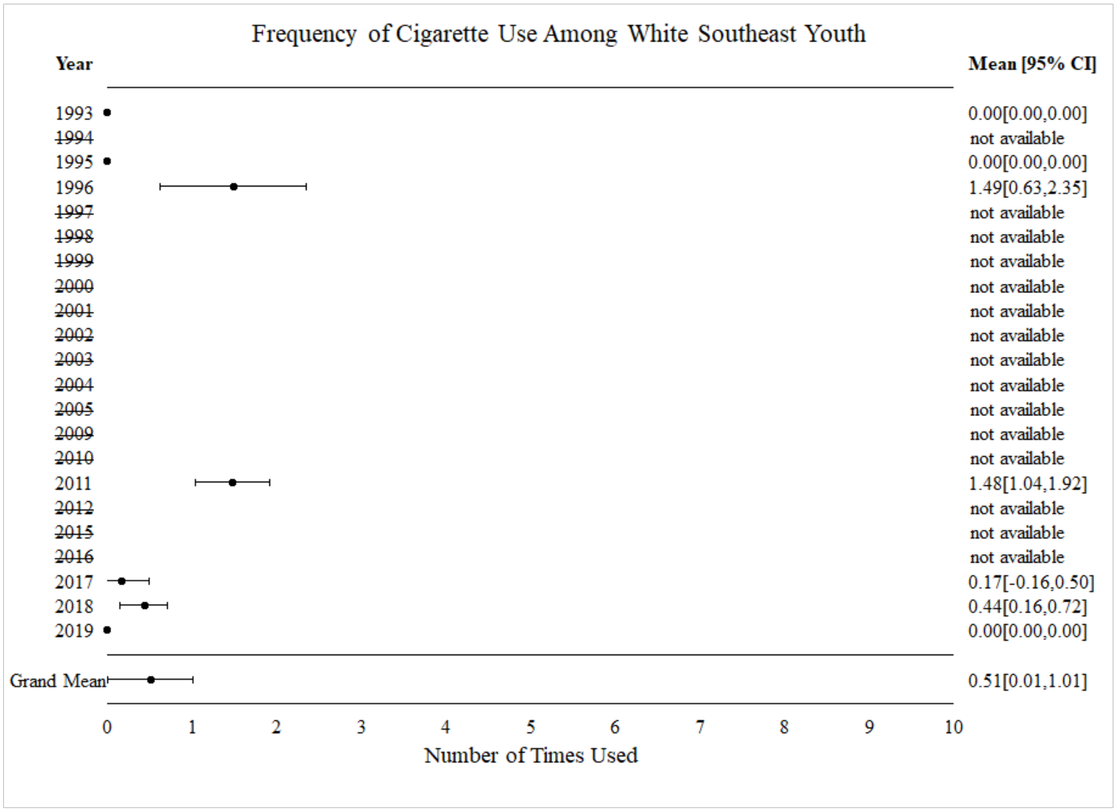
Note: Sample sizes for each year: 1993, n = 86; 1995, n = 14; 1996, n = 3; 1998, n = 3; 1999, n = 35; 2000, n = 90; 2005, n = 25; 2009, n = 84; 2010, n = 13; 2011, n = 22; 2012, n = 14; 2017, n = 69; 2018, n = 93



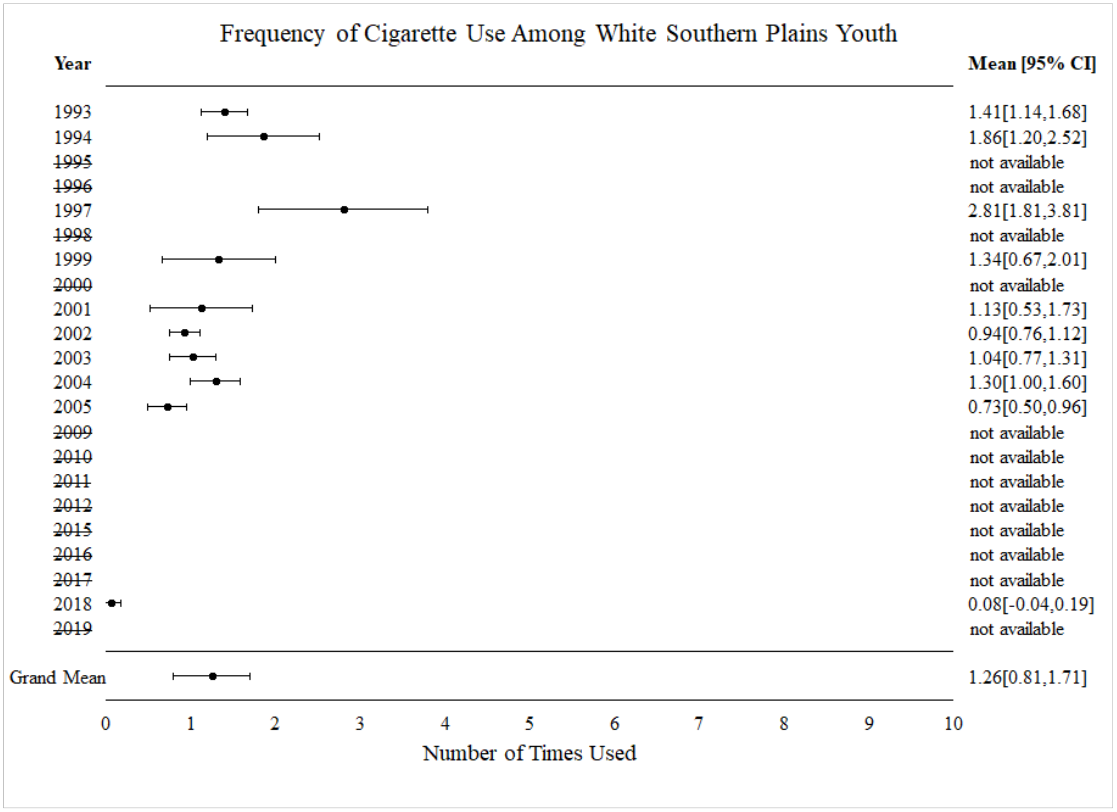
Note: Sample sizes for each year: 1997, n = 561; 1998, n = 2; 2005, n = 571; 2009, n = 531; 2012, n = 425; 2017, n = 69; 2018, n = 164



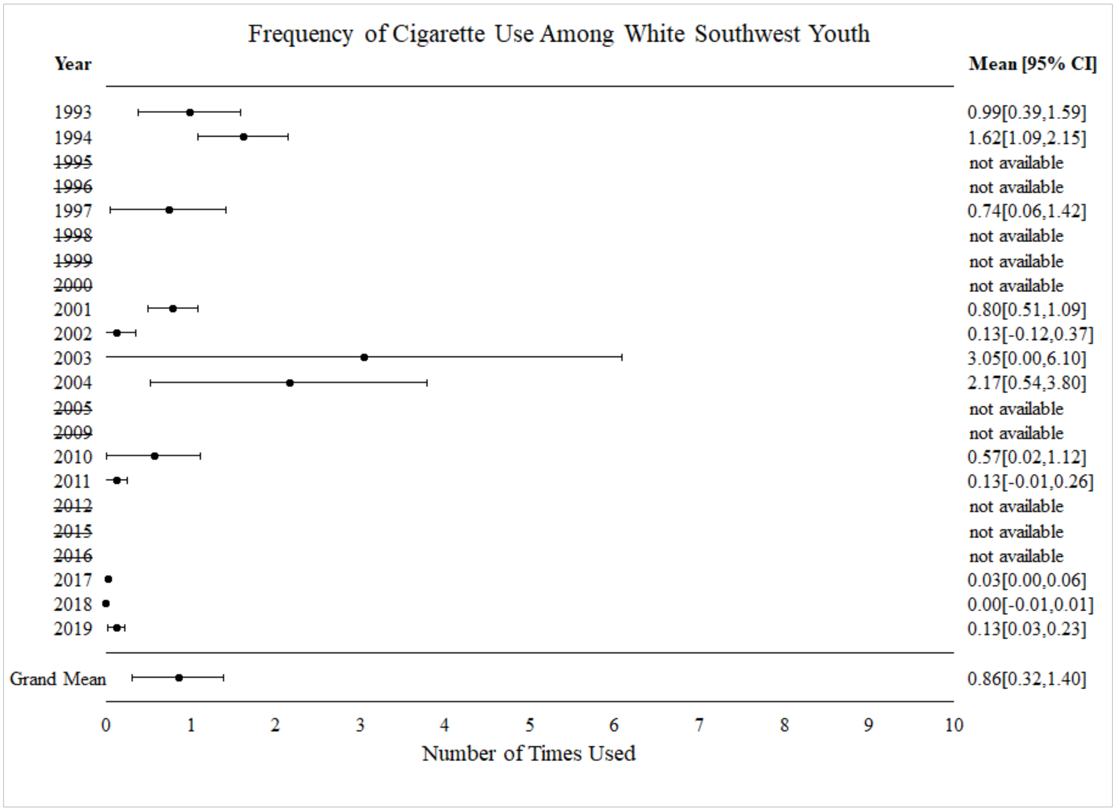
Note: Sample sizes for each year: 1993, n = 1; 1995, n = 1; 1996, n = 47



Note: Sample sizes for each year: 1993, n = 4; 1995, n = 1; 1996, n = 88; 2011, n = 315; 2017, n = 119; 2018, n = 145; 2019, n = 1



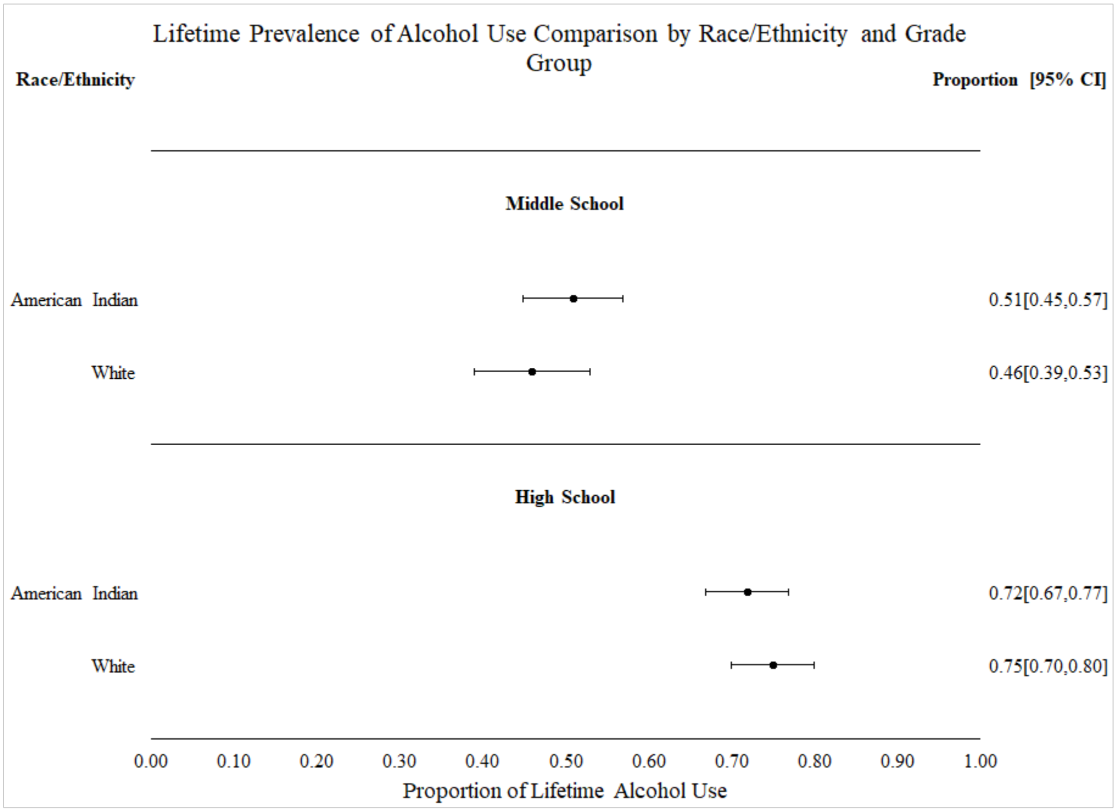
Note: Sample sizes for each year: 1993, n = 934; 1994, n = 229; 1997, n = 130; 1999, n = 115; 2001, n = 175; 2002, n = 1270; 2003, n = 592; 2004, n = 659; 2005, n = 503; 2018, n = 53

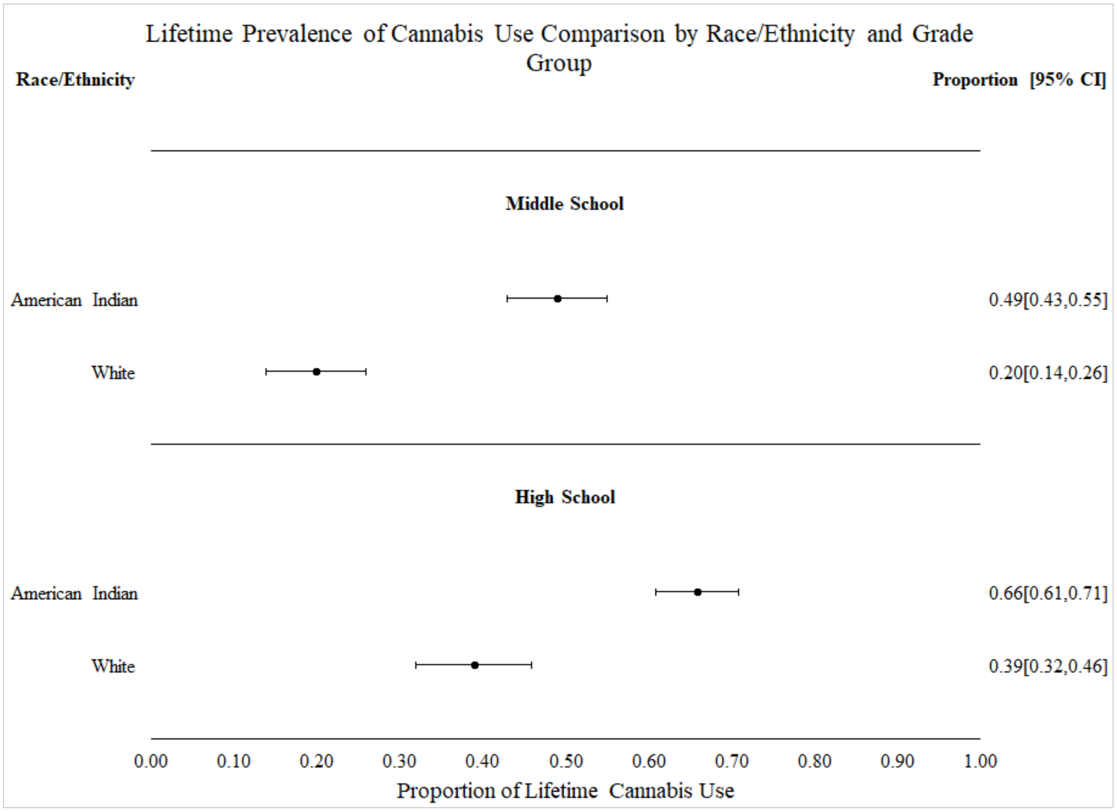


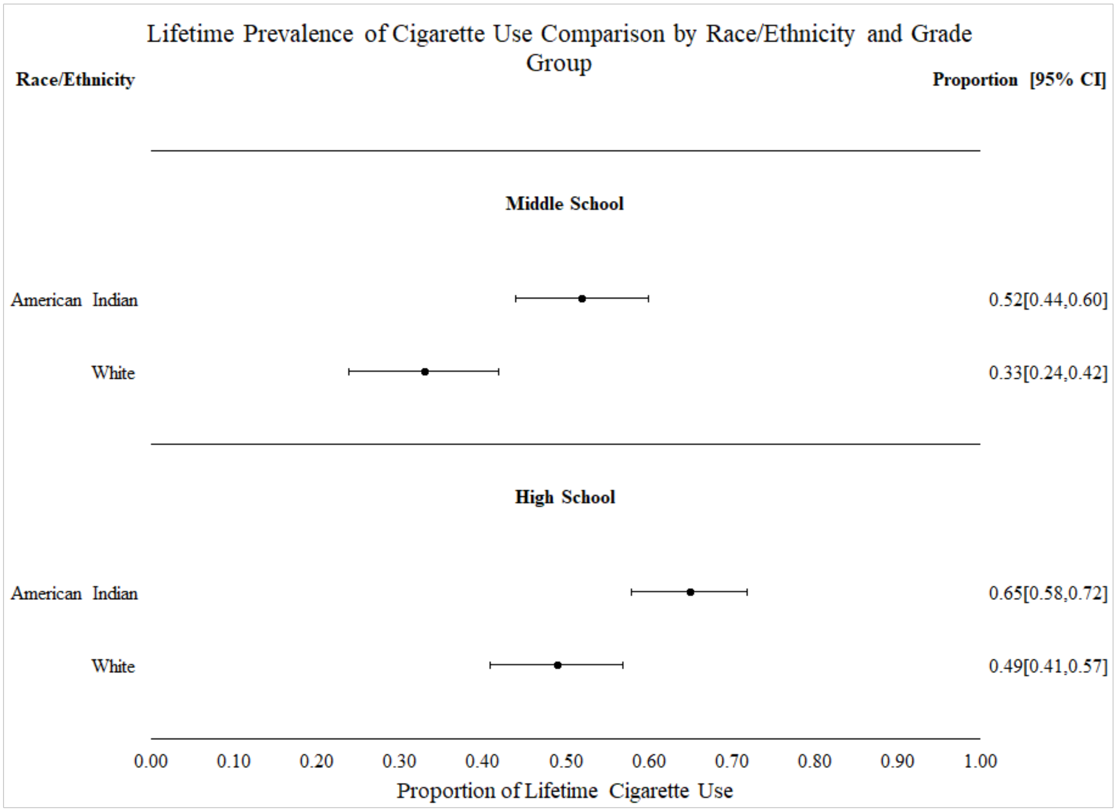
Note: Sample sizes for each year: 1993, n = 116; 1994, n = 262; 1997, n = 31; 2001, n = 436; 2002, n = 4; 2003, n = 21; 2004, n = 3; 2010, n = 14; 2011, n = 12; 2017, n = 193; 2018, n = 124; 2019, n = 238

APPENDIX J

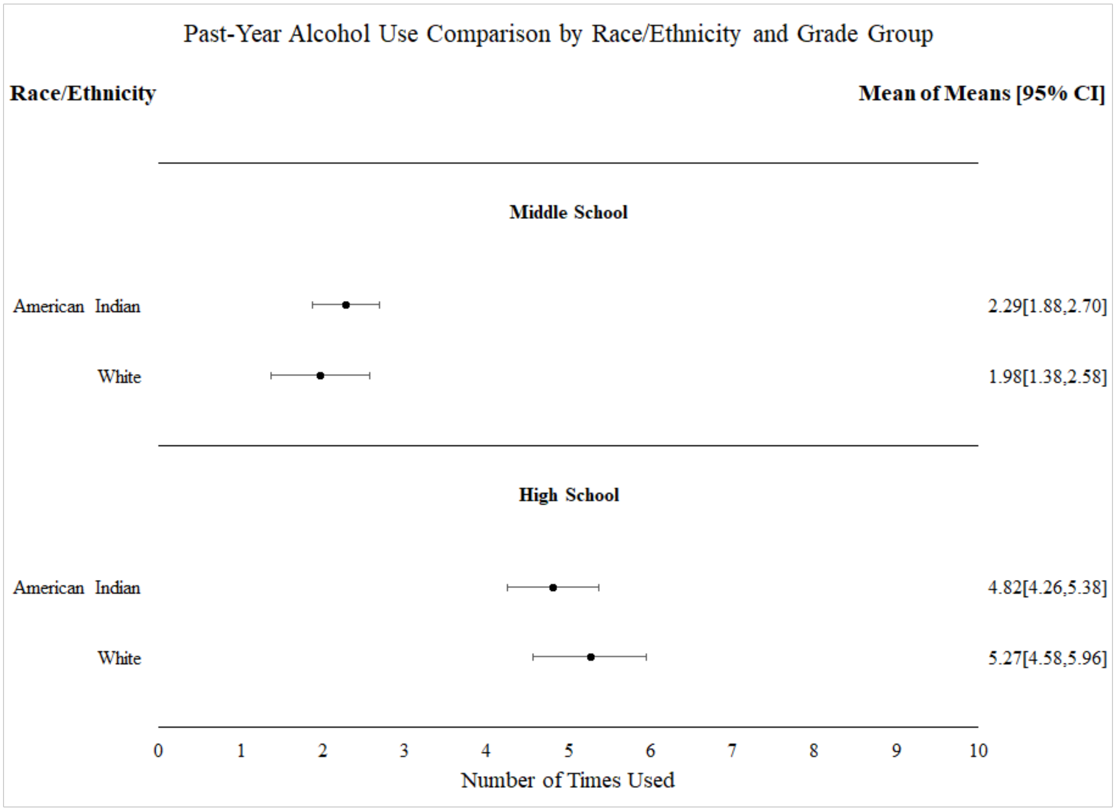
Aim 2: Substance Use Comparisons by Race/Ethnicity and Grade Group


Lifetime Prevalence of Alcohol Use Comparison by Race/Ethnicity and Grade Group
Race/Ethnicity
Proportion [95% CI]
Middle School
American Indian
0.51[0.45,0.57]
White
0.46[0.39,0.53]
High School
American Indian
0.72[0.67,0.77]
White
0.75[0.70,0.80]
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Proportion of Lifetime Alcohol Use

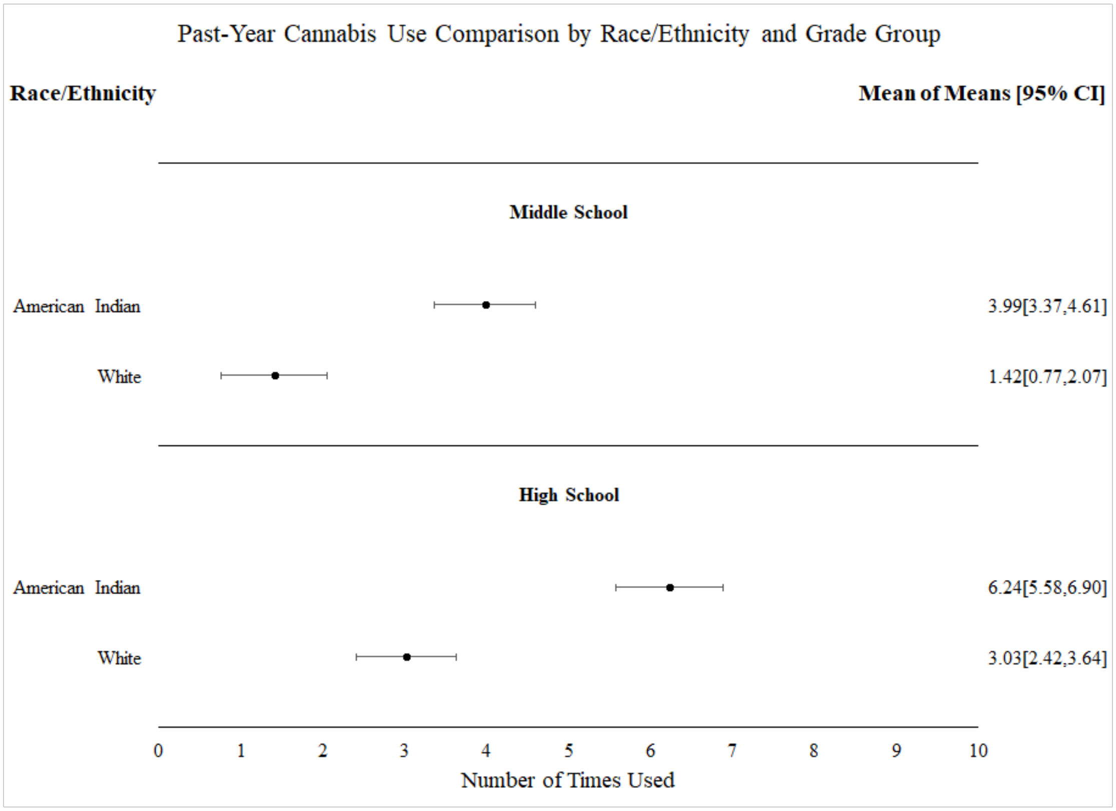

Lifetime Prevalence of Cannabis Use Comparison by Race/Ethnicity and Grade Group
Race/Ethnicity
Proportion [95% CI]
Middle School
American Indian
0.49[0.43,0.55]
White
0.20[0.14,0.26]
High School
American Indian
0.66[0.61,0.71]
White
0.39[0.32,0.46]
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00
Proportion of Lifetime Cannabis Use

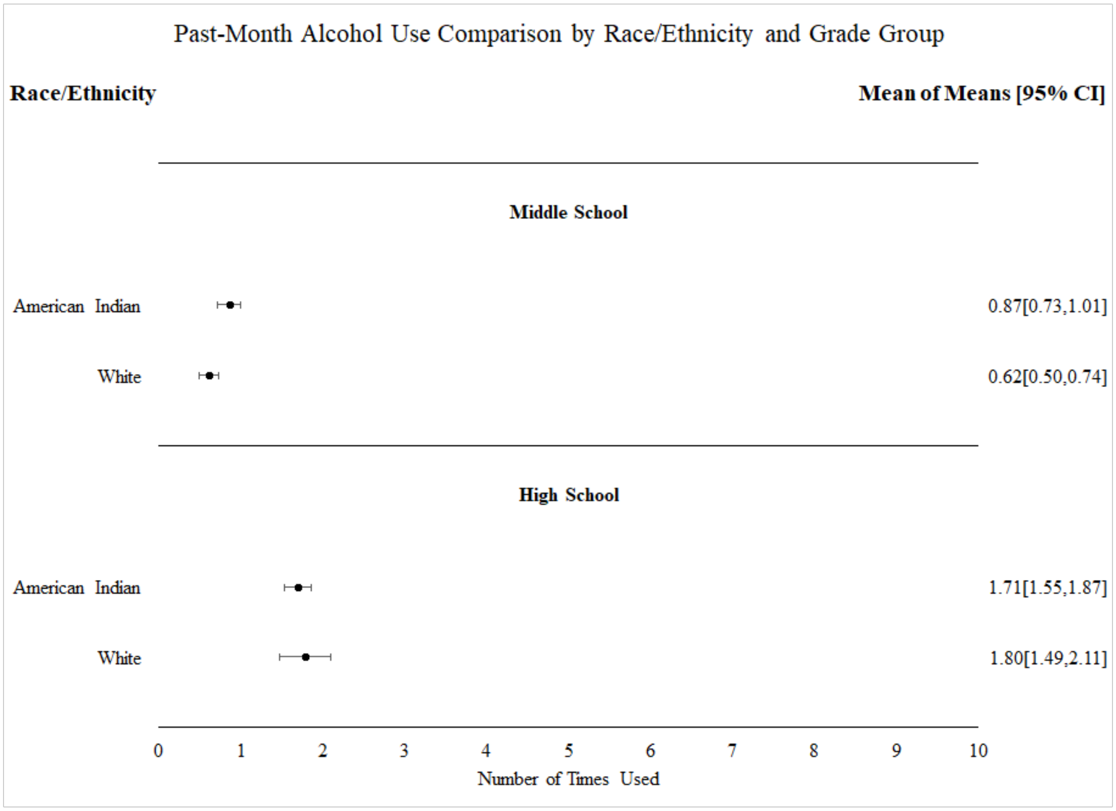


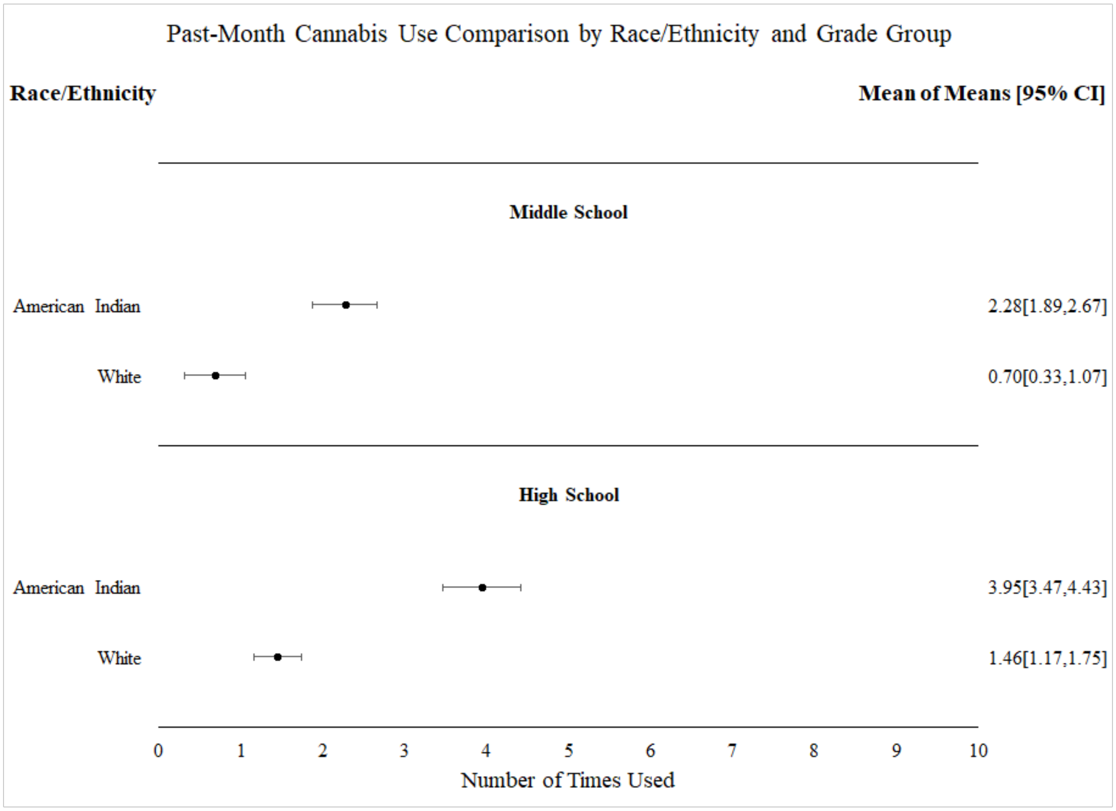
Lifetime Prevalence of Cigarette Use Comparison by Race/Ethnicity and Grade Group
Race/Ethnicity
Proportion [95% CI]
Middle School
American Indian
0.52[0.44,0.60]
White
0.33[0.24,0.42]
High School
American Indian
0.65[0.58,0.72]
White
0.49[0.41,0.57]
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Proportion of Lifetime Cigarette Use

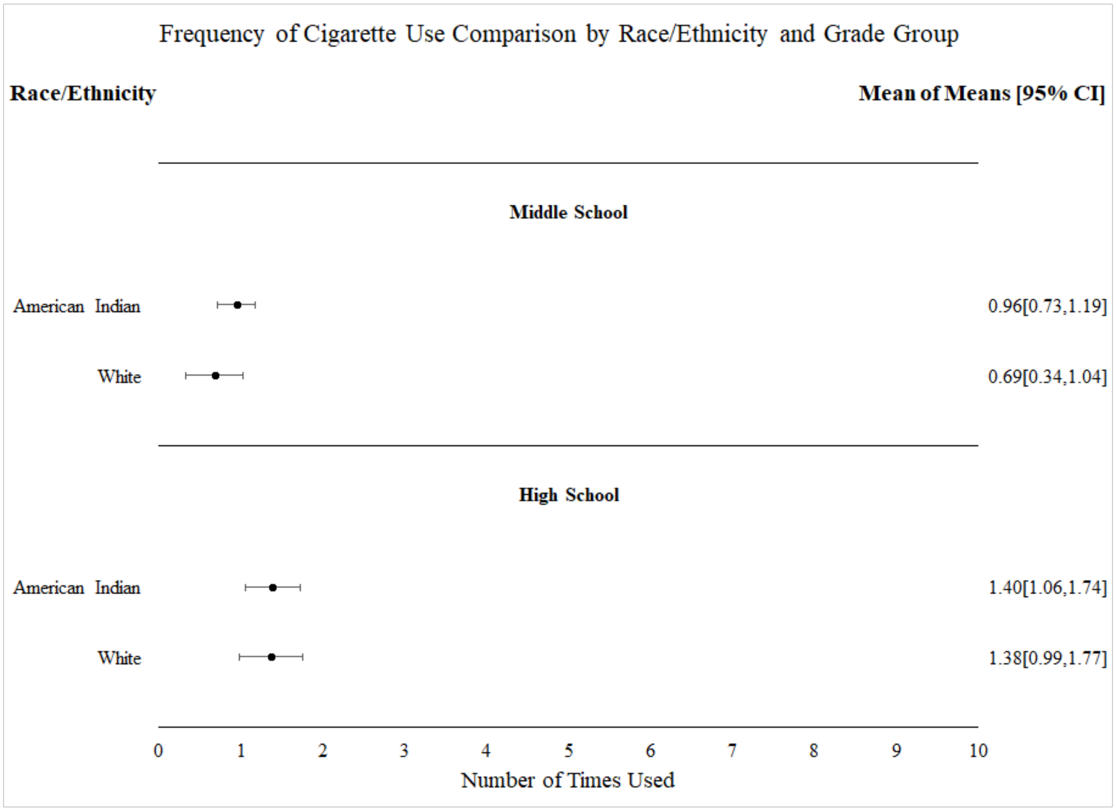


Past-Year Alcohol Use Comparison by Race/Ethnicity and Grade Group
Race/Ethnicity
Mean of Means [95% CI]
Middle School
American Indian
2.29[1.88,2.70]
White
1.98[1.38,2.58]
High School
American Indian
4.82[4.26,5.38]
White
5.27[4.58,5.96]
0
1
2
3
4
5
6
7
8
9
10
Number of Times Used


Past-Year Cannabis Use Comparison by Race/Ethnicity and Grade Group
Race/Ethnicity
Mean of Means [95% CI]
Middle School
American Indian
3.99[3.37,4.61]
White
1.42[0.77,2.07]
High School
American Indian
6.24[5.58,6.90]
White
3.03[2.42,3.64]
0 1 2 3 4 5 6 7 8 9 10
Number of Times Used


Past-Month Alcohol Use Comparison by Race/Ethnicity and Grade Group
Race/Ethnicity
Mean of Means [95% CI]
Middle School
American Indian
0.87[0.73,1.01]
White
0.62[0.50,0.74]
High School
American Indian
1.71[1.55,1.87]
White
1.80[1.49,2.11]
0
1
2
3
4
5
6
7
8
9
10
Number of Times Used

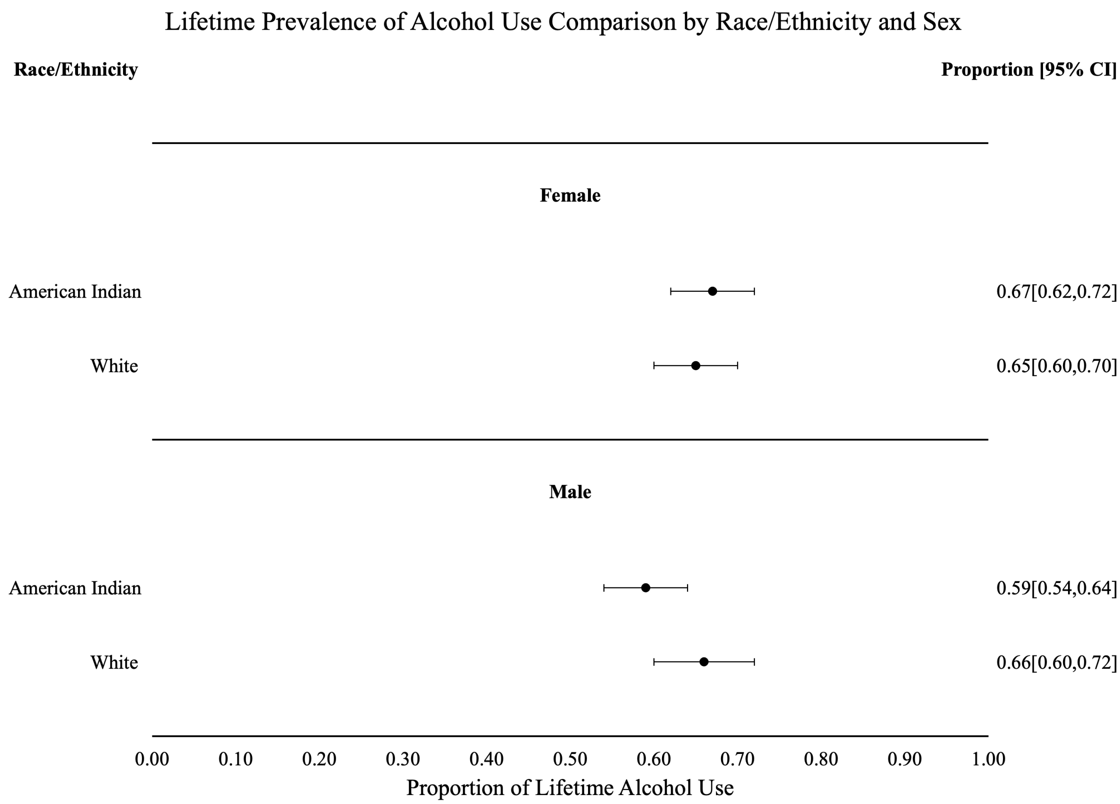

Past-Month Cannabis Use Comparison by Race/Ethnicity and Grade Group
Race/Ethnicity
Mean of Means [95% CI]
Middle School
American Indian
2.28[1.89,2.67]
White
0.70[0.33,1.07]
High School
American Indian
3.95[3.47,4.43]
White
1.46[1.17,1.75]
0
1
2
3
4
5
6
7
8
9
10
Number of Times Used

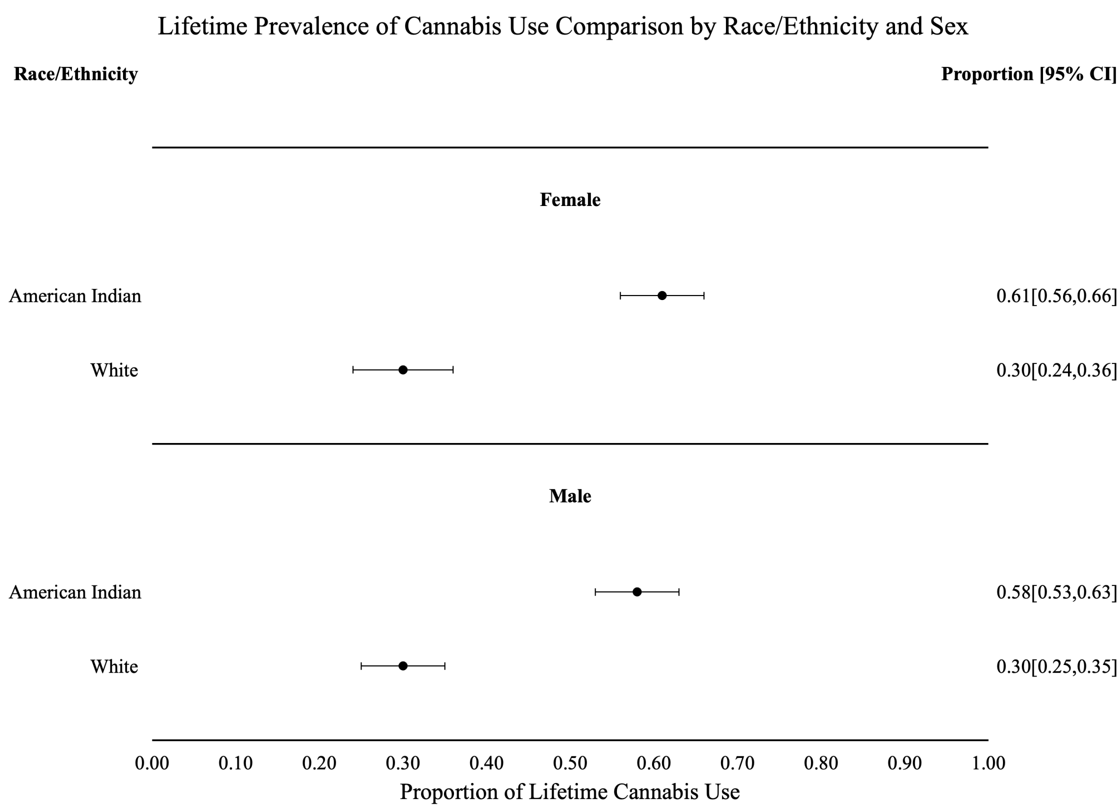


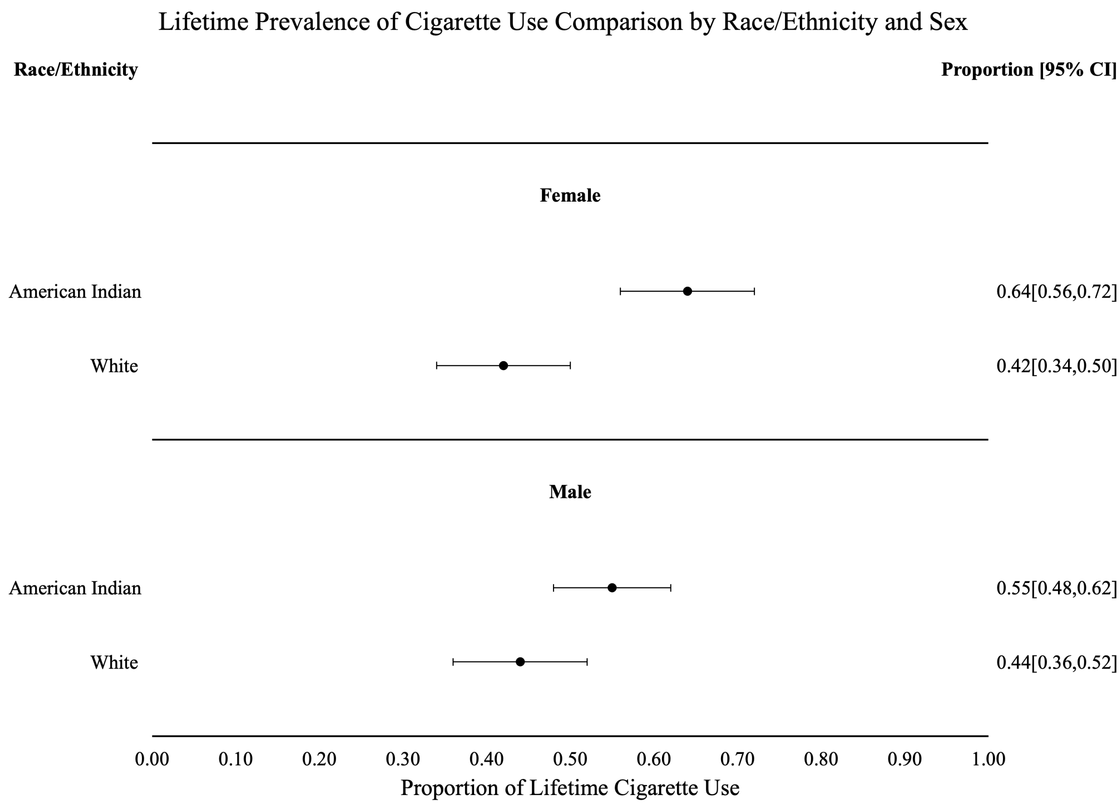
Frequency of Cigarette Use Comparison by Race/Ethnicity and Grade Group
Race/Ethnicity
Mean of Means [95% CI]
Middle School
American Indian
0.96[0.73,1.19]
White
0.69[0.34,1.04]
High School
American Indian
1.40[1.06,1.74]
White
1.38[0.99,1.77]
0 1 2 3 4 5 6 7 8 9 10
Number of Times Used

APPENDIX K

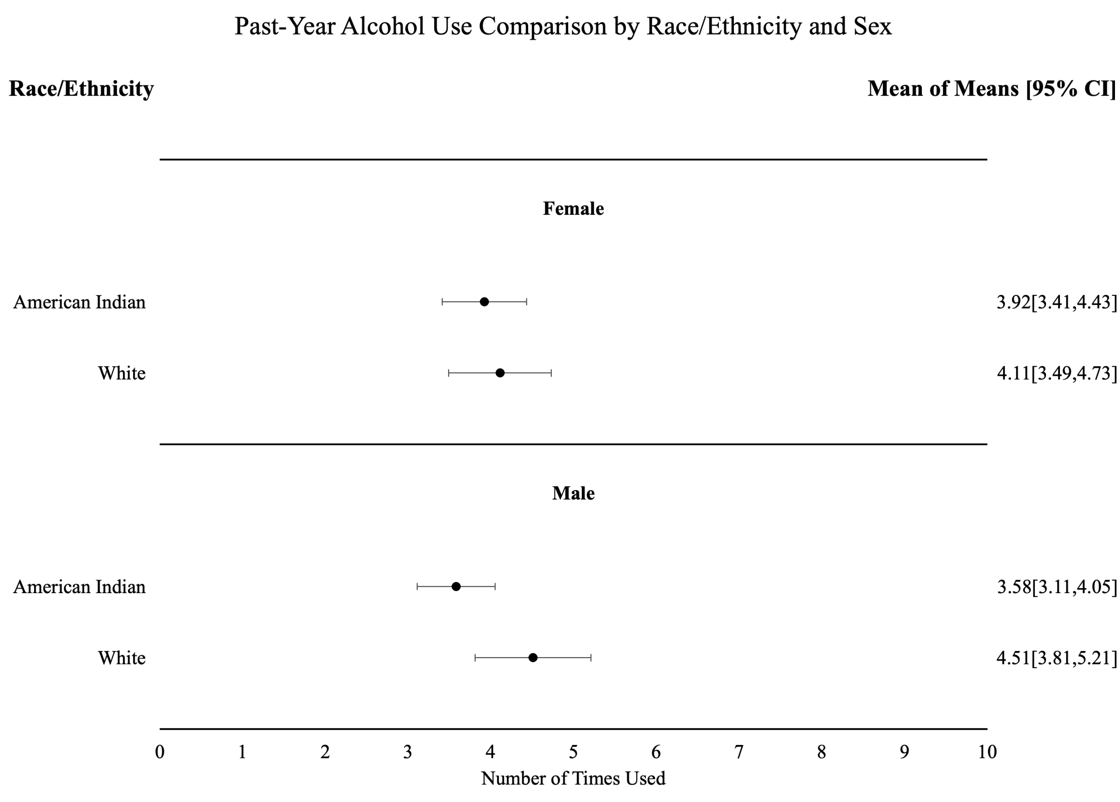
Aim 2: Substance Use Comparisons by Race/Ethnicity and Sex

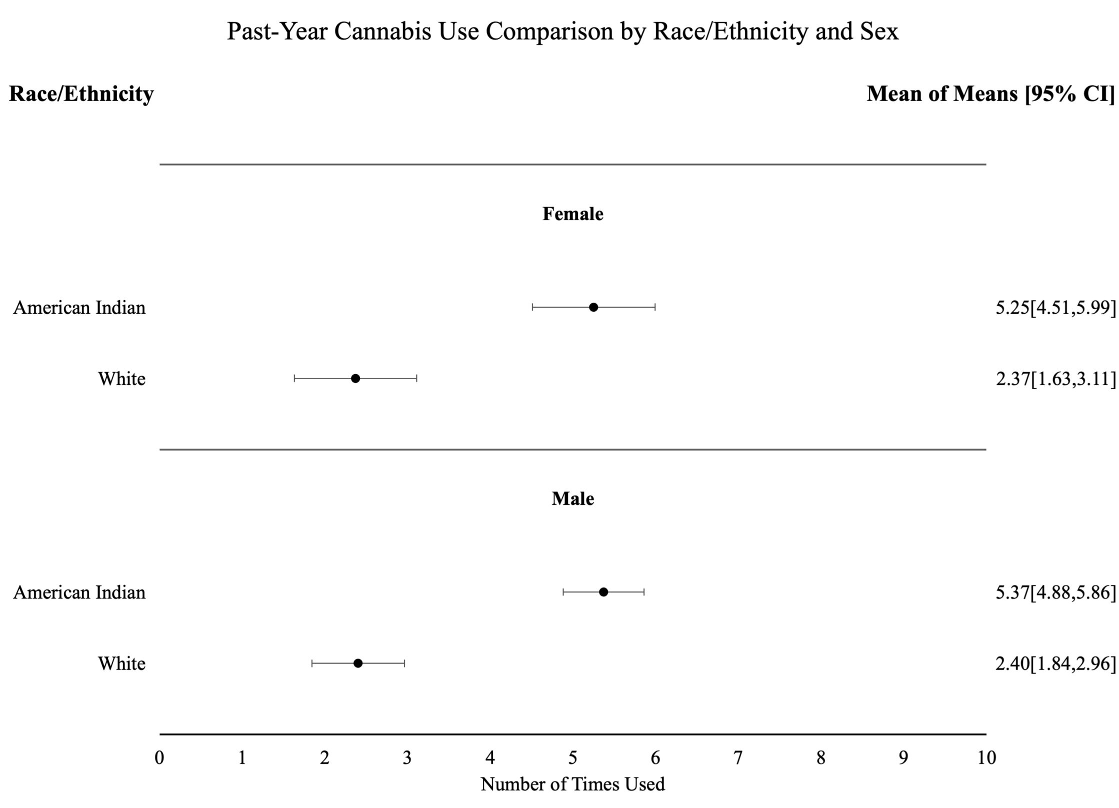

Lifetime Prevalence of Alcohol Use Comparison by Race/Ethnicity and Sex
Race/Ethnicity
Proportion [95% CI]
Female
American Indian
0.67[0.62,0.72]
White
0.65[0.60,0.70]
Male
American Indian
0.59[0.54,0.64]
White
0.66[0.60,0.72]
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Proportion of Lifetime Alcohol Use

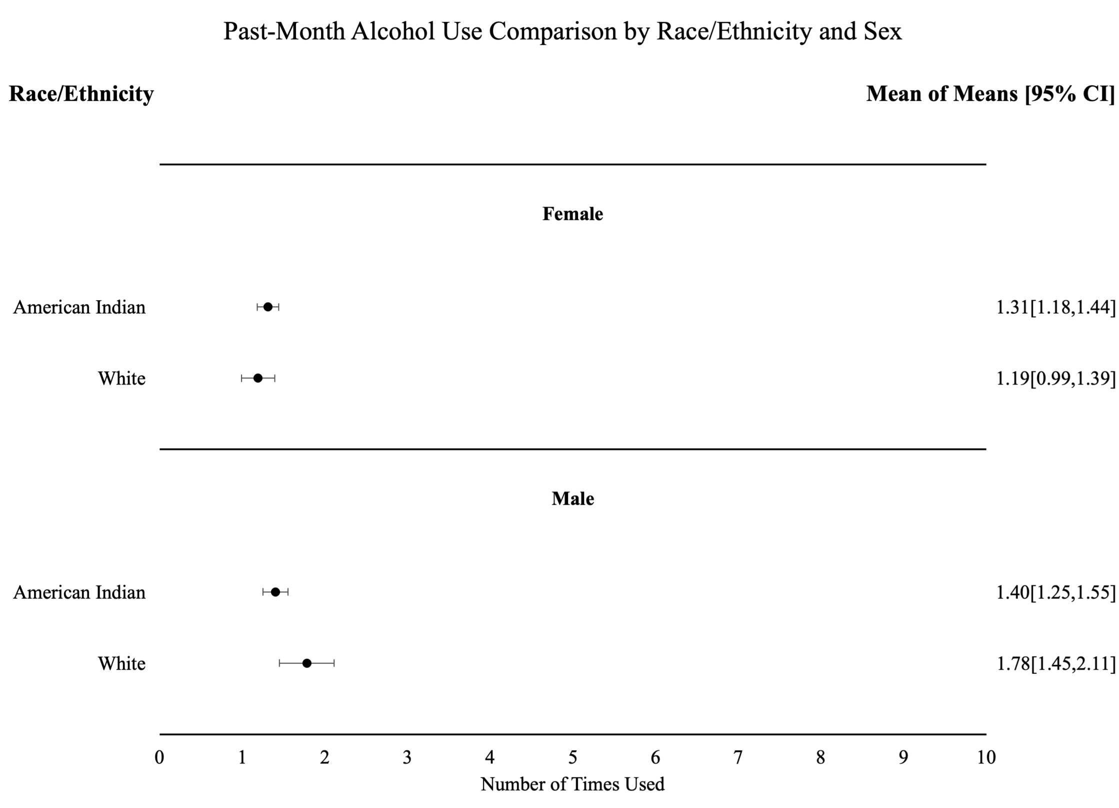

Lifetime Prevalence of Cannabis Use Comparison by Race/Ethnicity and Sex
Race/Ethnicity
Proportion [95% CI]
Female
American Indian
0.61[0.56,0.66]
White
0.30[0.24,0.36]
Male
American Indian
0.58[0.53,0.63]
White
0.30[0.25,0.35]
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Proportion of Lifetime Cannabis Use

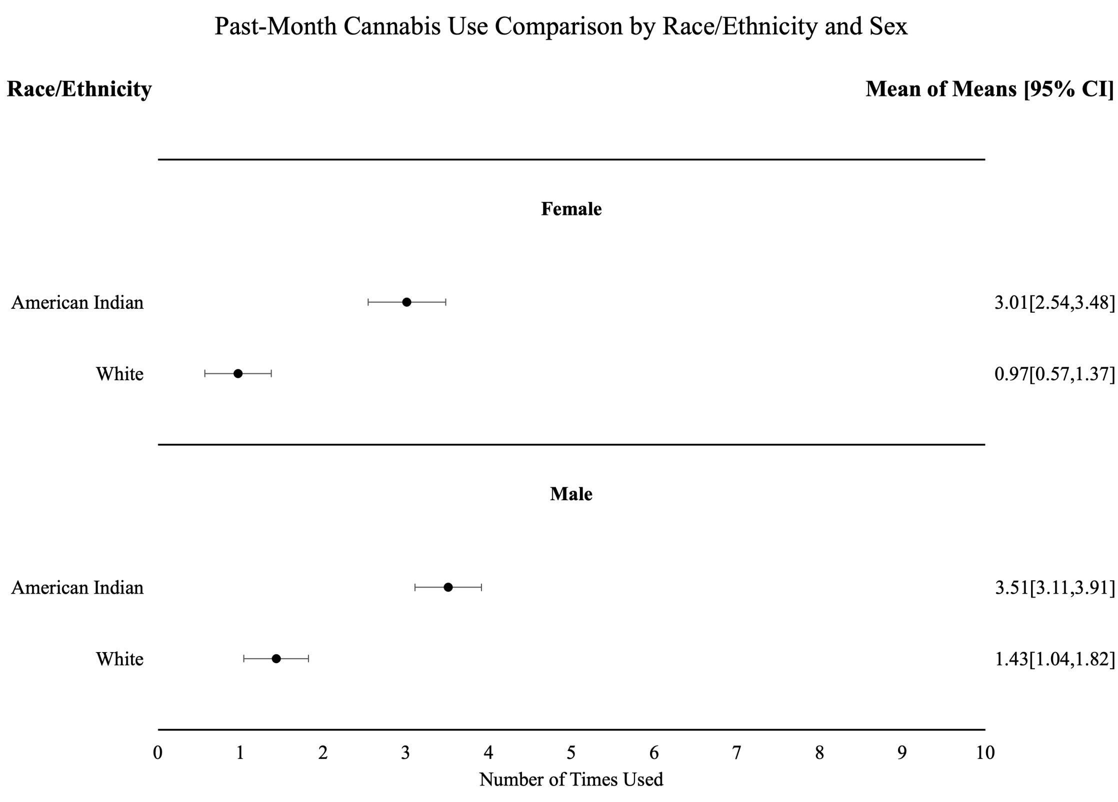


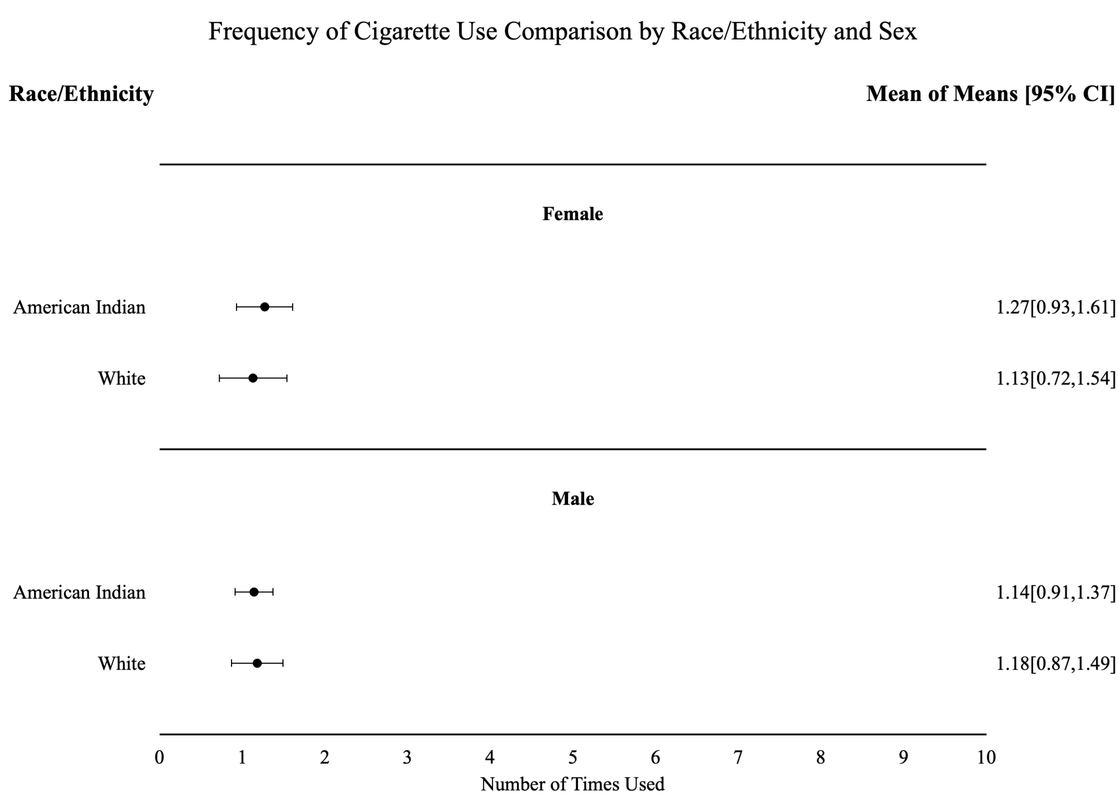
Lifetime Prevalence of Cigarette Use Comparison by Race/Ethnicity and Sex
Race/Ethnicity
Proportion [95% CI]
Female
American Indian
0.64[0.56,0.72]
White
0.42[0.34,0.50]
Male
American Indian
0.55[0.48,0.62]
White
0.44[0.36,0.52]
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00
Proportion of Lifetime Cigarette Use


Past-Year Alcohol Use Comparison by Race/Ethnicity and Sex
Race/Ethnicity
Mean of Means [95% CI]
Female
American Indian
3.92[3.41,4.43]
White
4.11[3.49,4.73]
Male
American Indian
3.58[3.11,4.05]
White
4.51[3.81,5.21]
0
1
2
3
4
5
6
7
8
9
10
Number of Times Used


Past-Year Cannabis Use Comparison by Race/Ethnicity and Sex
Race/Ethnicity
Mean of Means [95% CI]
Female
American Indian
5.25[4.51,5.99]
White
2.37[1.63,3.11]
Male
American Indian
5.37[4.88,5.86]
White
2.40[1.84,2.96]
0
1
2
3
4
5
6
7
8
9
10
Number of Times Used


Past-Month Alcohol Use Comparison by Race/Ethnicity and Sex
Race/Ethnicity
Mean of Means [95% CI]
Female
American Indian
1.31[1.18,1.44]
White
1.19[0.99,1.39]
Male
American Indian
1.40[1.25,1.55]
White
1.78[1.45,2.11]
0
1
2
3
4
5
6
7
8
9
10
Number of Times Used

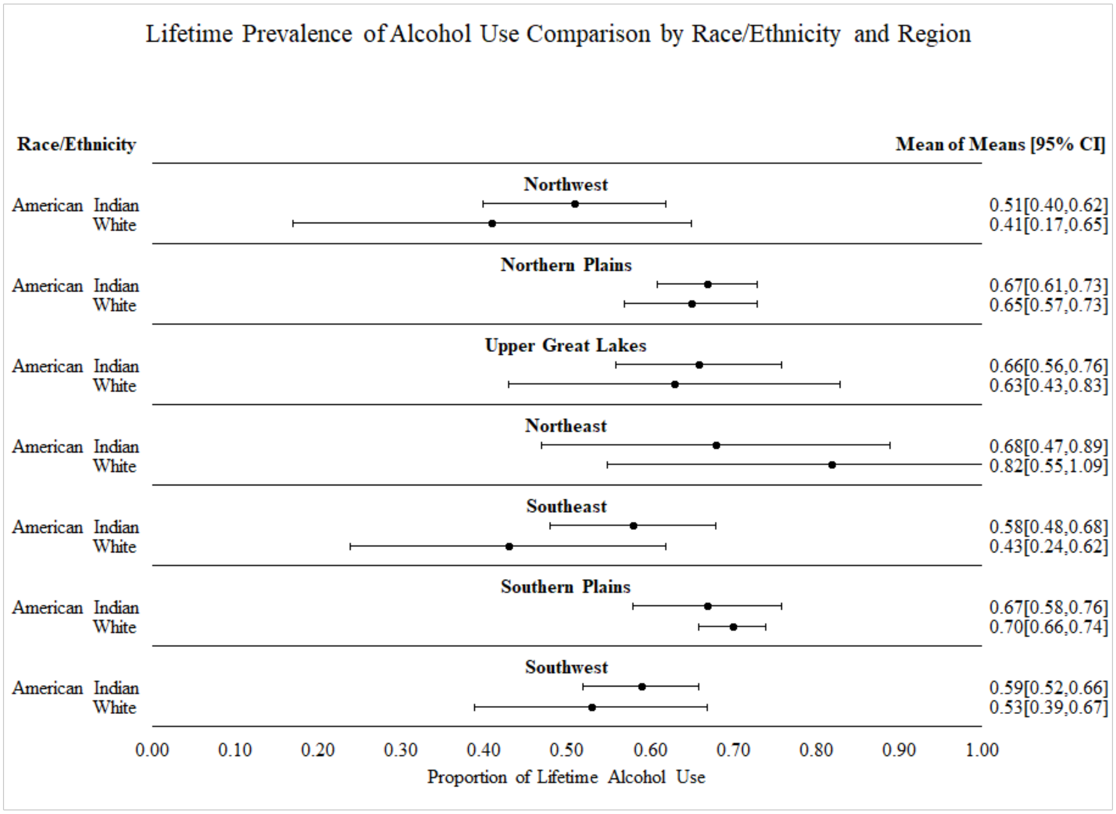

Past-Month Cannabis Use Comparison by Race/Ethnicity and Sex
Race/Ethnicity
Mean of Means [95% CI]
Female
American Indian
3.01[2.54,3.48]
White
0.97[0.57,1.37]
Male
American Indian
3.51[3.11,3.91]
White
1.43[1.04,1.82]
0 1 2 3 4 5 6 7 8 9 10
Number of Times Used

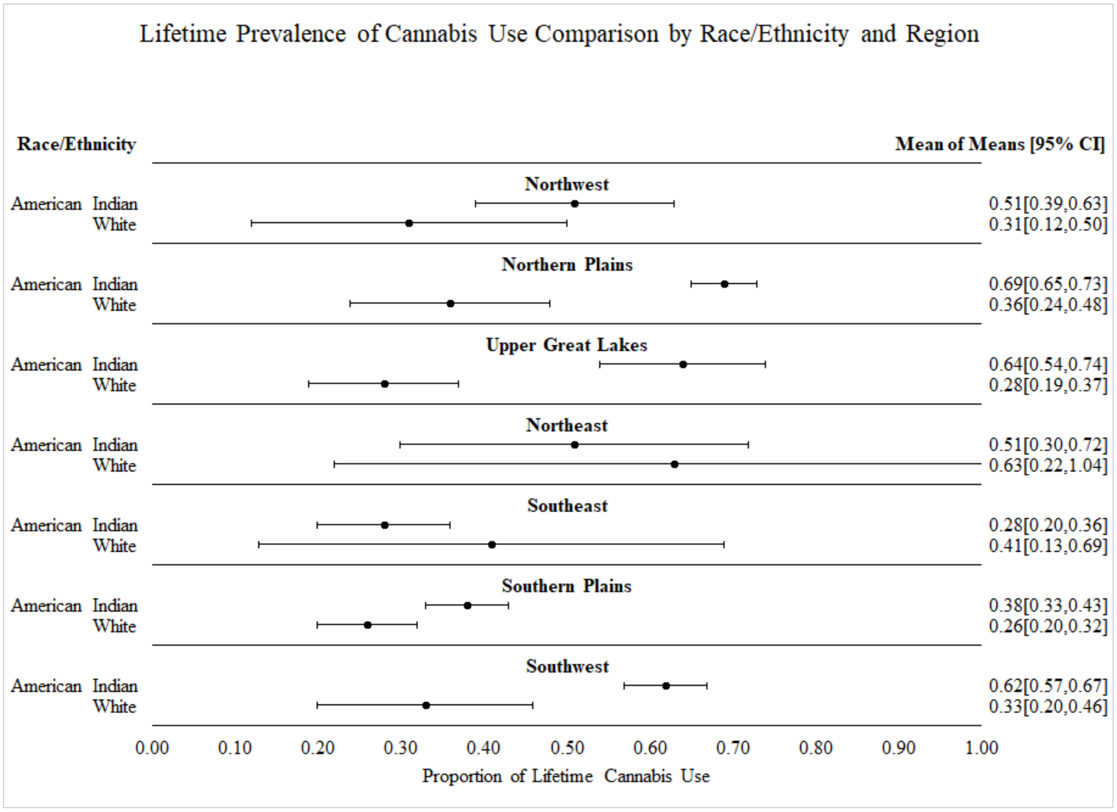


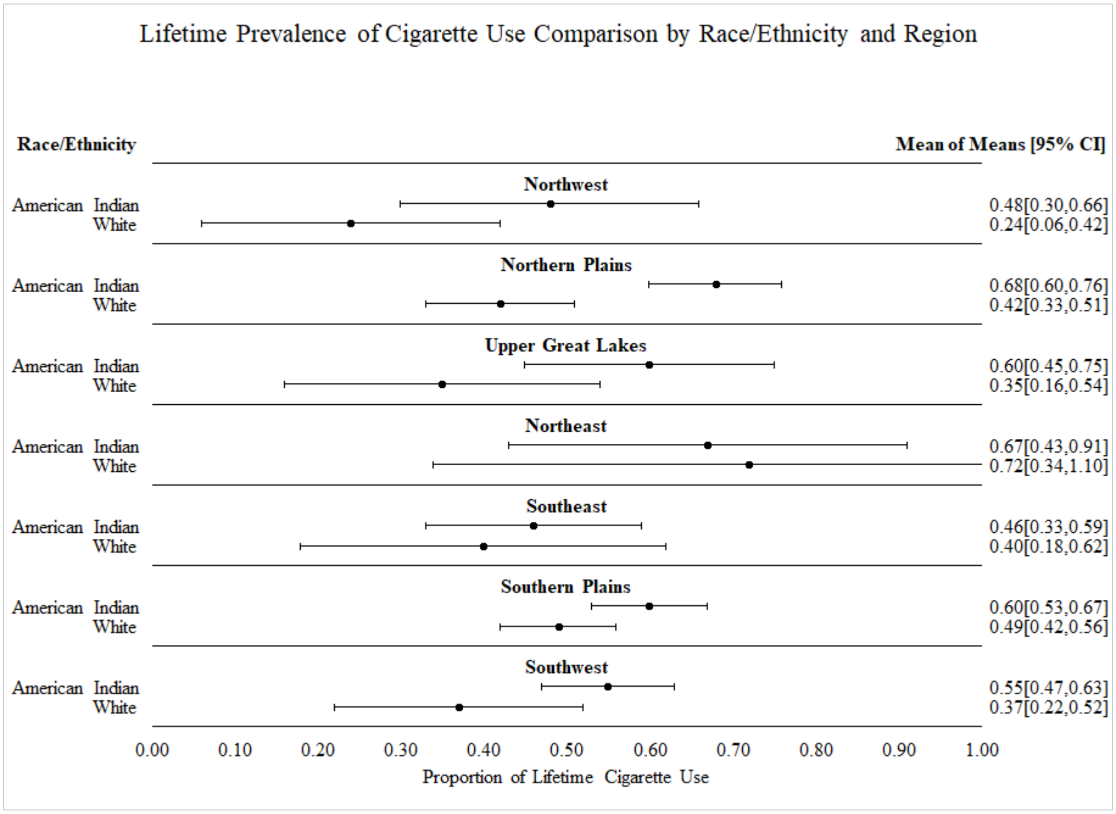
Frequency of Cigarette Use Comparison by Race/Ethnicity and Sex
Race/Ethnicity
Mean of Means [95% CI]
Female
American Indian
1.27[0.93,1.61]
White
1.13[0.72,1.54]
Male
American Indian
1.14[0.91,1.37]
White
1.18[0.87,1.49]
0
1
2
3
4
5
6
7
8
9
10
Number of Times Used

APPENDIX L

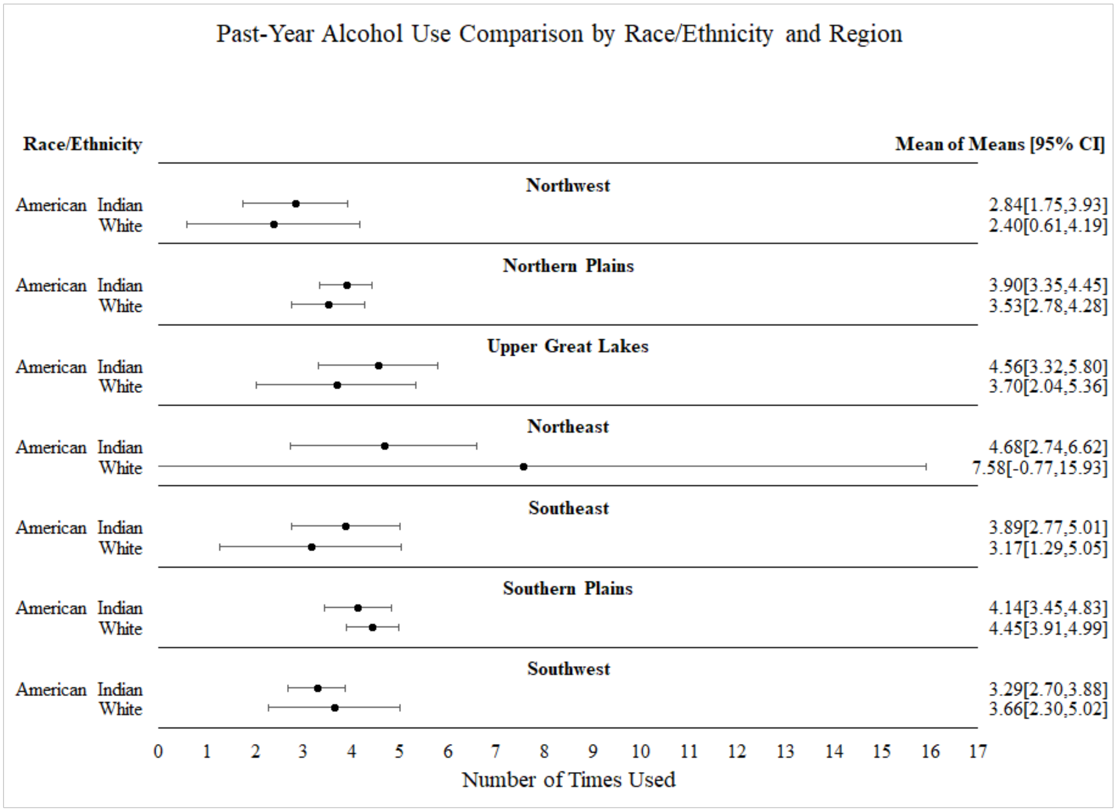
Aim 2: Substance Use Comparisons by Race/Ethnicity and Region

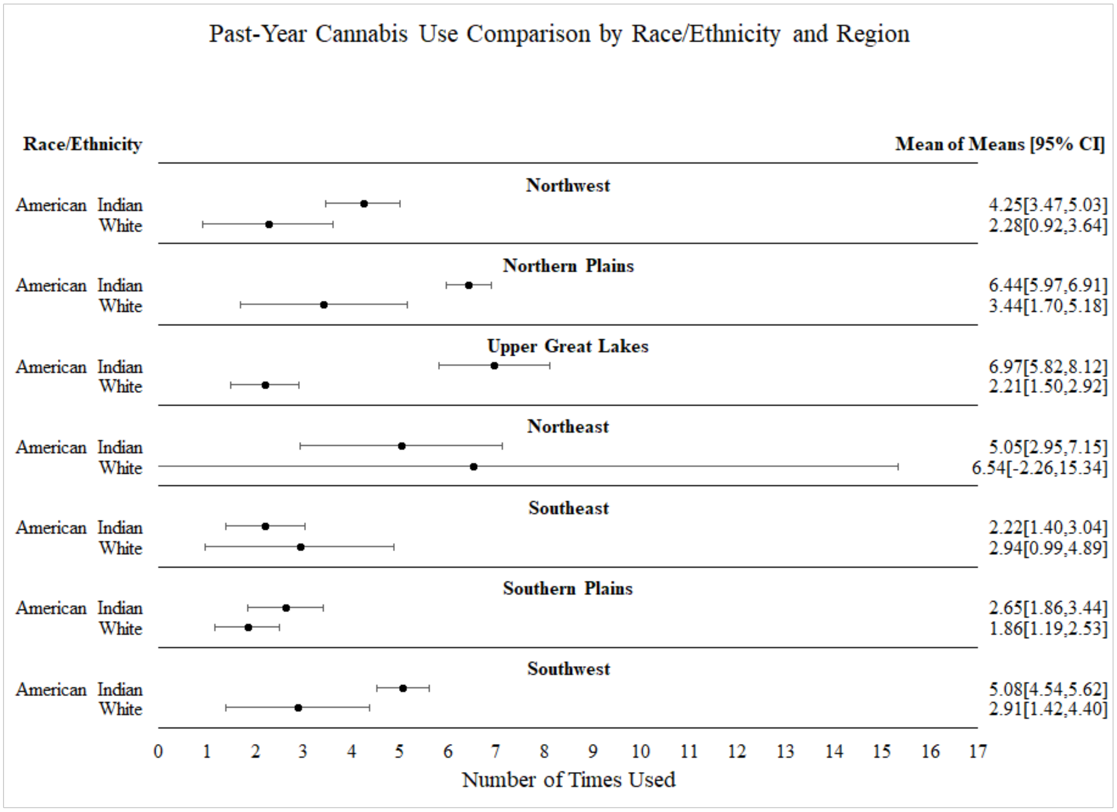

Lifetime Prevalence of Alcohol Use Comparison by Race/Ethnicity and Region
Race/Ethnicity
Mean of Means [95% CI]
Northwest
American Indian
White
0.51[0.40,0.62]
0.41[0.17,0.65]
Northern Plains
American Indian
White
0.67[0.61,0.73]
0.65[0.57,0.73]
Upper Great Lakes
American Indian
White
0.66[0.56,0.76]
0.63[0.43,0.83]
Northeast
American Indian
White
0.68[0.47,0.89]
0.82[0.55,1.09]
Southeast
American Indian
White
0.58[0.48,0.68]
0.43[0.24,0.62]
Southern Plains
American Indian
White
0.67[0.58,0.76]
0.70[0.66,0.74]
Southwest
American Indian
White
0.59[0.52,0.66]
0.53[0.39,0.67]
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00
Proportion of Lifetime Alcohol Use

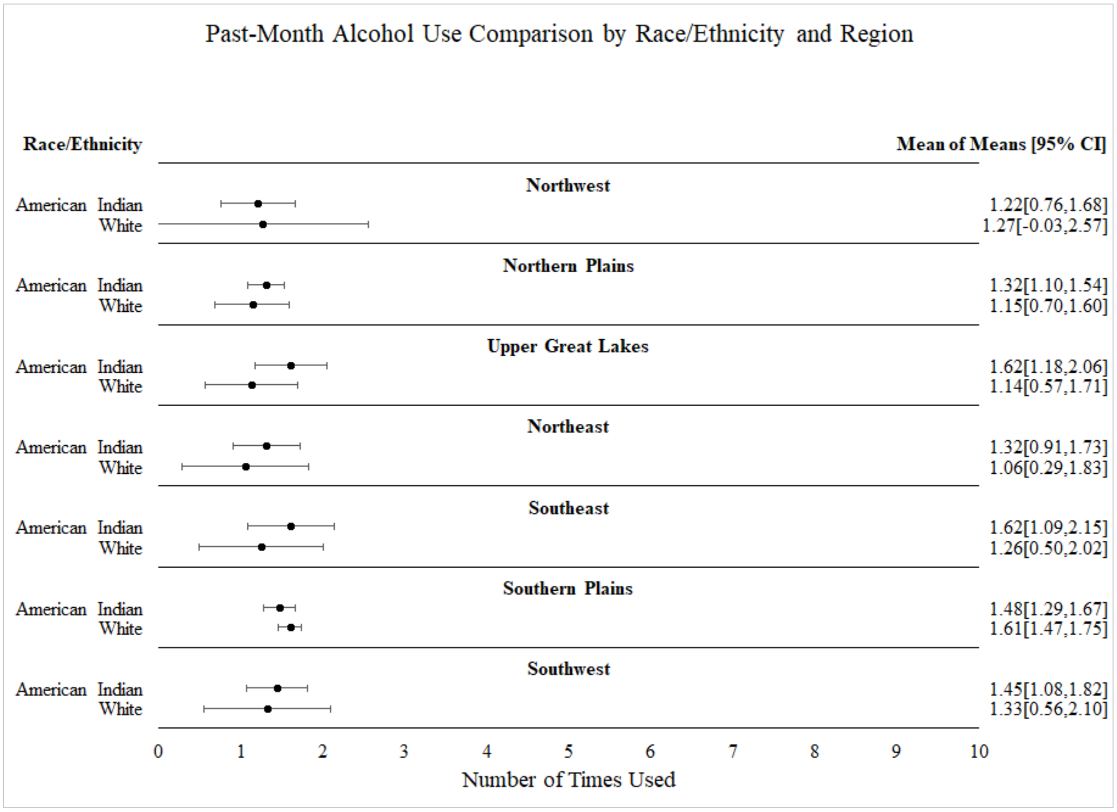

Lifetime Prevalence of Cannabis Use Comparison by Race/Ethnicity and Region
Race/Ethnicity
Mean of Means [95% CI]
Northwest
American Indian 0.51[0.39,0.63]
White 0.31[0.12,0.50]
Northern Plains
American Indian 0.69[0.65,0.73]
White 0.36[0.24,0.48]
Upper Great Lakes
American Indian 0.64[0.54,0.74]
White 0.28[0.19,0.37]
Northeast
American Indian 0.51[0.30,0.72]
White 0.63[0.22,1.04]
Southeast
American Indian 0.28[0.20,0.36]
White 0.41[0.13,0.69]
Southern Plains
American Indian 0.38[0.33,0.43]
White 0.26[0.20,0.32]
Southwest
American Indian 0.62[0.57,0.67]
White 0.33[0.20,0.46]
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00
Proportion of Lifetime Cannabis Use

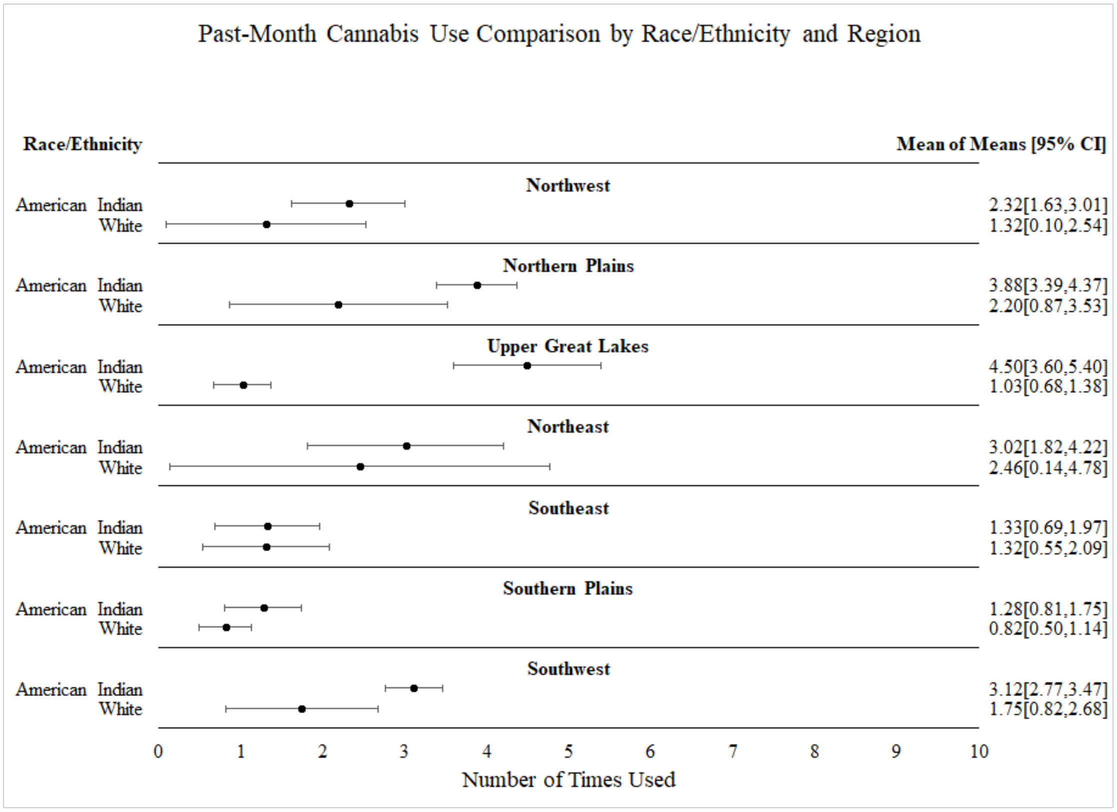


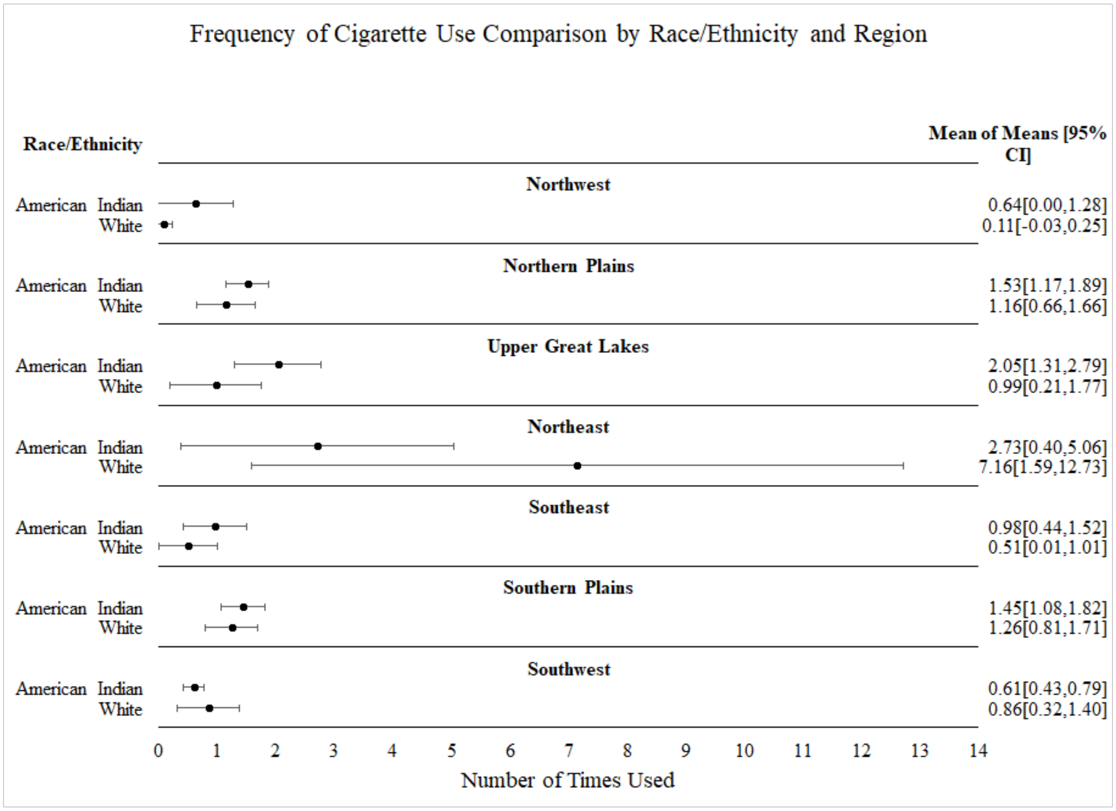
Lifetime Prevalence of Cigarette Use Comparison by Race/Ethnicity and Region
Race/Ethnicity
Mean of Means [95% CI]
Northwest
American Indian
White
0.48[0.30,0.66]
0.24[0.06,0.42]
Northern Plains
American Indian
White
0.68[0.60,0.76]
0.42[0.33,0.51]
Upper Great Lakes
American Indian
White
0.60[0.45,0.75]
0.35[0.16,0.54]
Northeast
American Indian
White
0.67[0.43,0.91]
0.72[0.34,1.10]
Southeast
American Indian
White
0.46[0.33,0.59]
0.40[0.18,0.62]
Southern Plains
American Indian
White
0.60[0.53,0.67]
0.49[0.42,0.56]
Southwest
American Indian
White
0.55[0.47,0.63]
0.37[0.22,0.52]
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00
Proportion of Lifetime Cigarette Use


Past-Year Alcohol Use Comparison by Race/Ethnicity and Region
Race/Ethnicity
Mean of Means [95% CI]
Northwest
American Indian
White
2.84[1.75,3.93]
2.40[0.61,4.19]
Northern Plains
American Indian
White
3.90[3.35,4.45]
3.53[2.78,4.28]
Upper Great Lakes
American Indian
White
4.56[3.32,5.80]
3.70[2.04,5.36]
Northeast
American Indian
White
4.68[2.74,6.62]
7.58[-0.77,15.93]
Southeast
American Indian
White
3.89[2.77,5.01]
3.17[1.29,5.05]
Southern Plains
American Indian
White
4.14[3.45,4.83]
4.45[3.91,4.99]
Southwest
American Indian
White
3.29[2.70,3.88]
3.66[2.30,5.02]
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Number of Times Used


Past-Year Cannabis Use Comparison by Race/Ethnicity and Region
Race/Ethnicity
Mean of Means [95% CI]
Northwest
American Indian
White
4.25[3.47,5.03]
2.28[0.92,3.64]
Northern Plains
American Indian
White
6.44[5.97,6.91]
3.44[1.70,5.18]
Upper Great Lakes
American Indian
White
6.97[5.82,8.12]
2.21[1.50,2.92]
Northeast
American Indian
White
5.05[2.95,7.15]
6.54[-2.26,15.34]
Southeast
American Indian
White
2.22[1.40,3.04]
2.94[0.99,4.89]
Southern Plains
American Indian
White
2.65[1.86,3.44]
1.86[1.19,2.53]
Southwest
American Indian
White
5.08[4.54,5.62]
2.91[1.42,4.40]
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Number of Times Used


Past-Month Alcohol Use Comparison by Race/Ethnicity and Region
Race/Ethnicity
Mean of Means [95% CI]
Northwest
American Indian
White
1.22[0.76,1.68]
1.27[-0.03,2.57]
Northern Plains
American Indian
White
1.32[1.10,1.54]
1.15[0.70,1.60]
Upper Great Lakes
American Indian
White
1.62[1.18,2.06]
1.14[0.57,1.71]
Northeast
American Indian
White
1.32[0.91,1.73]
1.06[0.29,1.83]
Southeast
American Indian
White
1.62[1.09,2.15]
1.26[0.50,2.02]
Southern Plains
American Indian
White
1.48[1.29,1.67]
1.61[1.47,1.75]
Southwest
American Indian
White
1.45[1.08,1.82]
1.33[0.56,2.10]
0 1 2 3 4 5 6 7 8 9 10
Number of Times Used

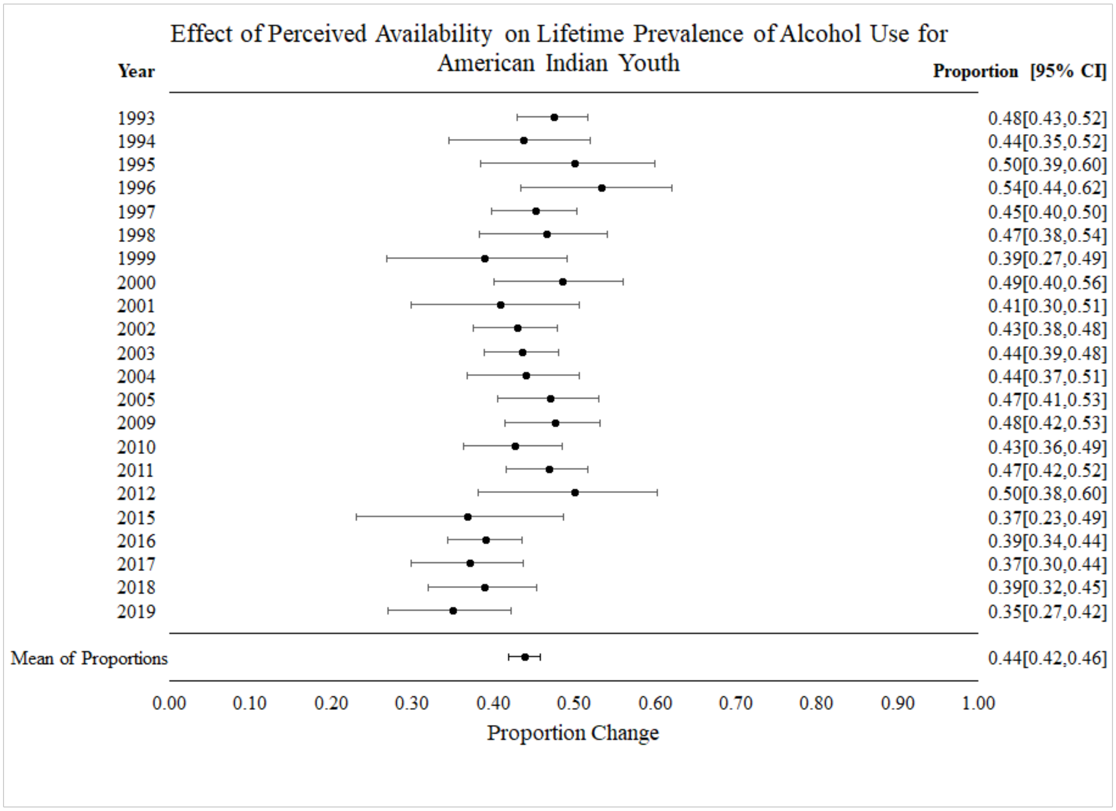

Past-Month Cannabis Use Comparison by Race/Ethnicity and Region
Race/Ethnicity
Mean of Means [95% CI]
Northwest
American Indian
White
2.32[1.63,3.01]
1.32[0.10,2.54]
Northern Plains
American Indian
White
3.88[3.39,4.37]
2.20[0.87,3.53]
Upper Great Lakes
American Indian
White
4.50[3.60,5.40]
1.03[0.68,1.38]
Northeast
American Indian
White
3.02[1.82,4.22]
2.46[0.14,4.78]
Southeast
American Indian
White
1.33[0.69,1.97]
1.32[0.55,2.09]
Southern Plains
American Indian
White
1.28[0.81,1.75]
0.82[0.50,1.14]
Southwest
American Indian
White
3.12[2.77,3.47]
1.75[0.82,2.68]
0 1 2 3 4 5 6 7 8 9 10
Number of Times Used



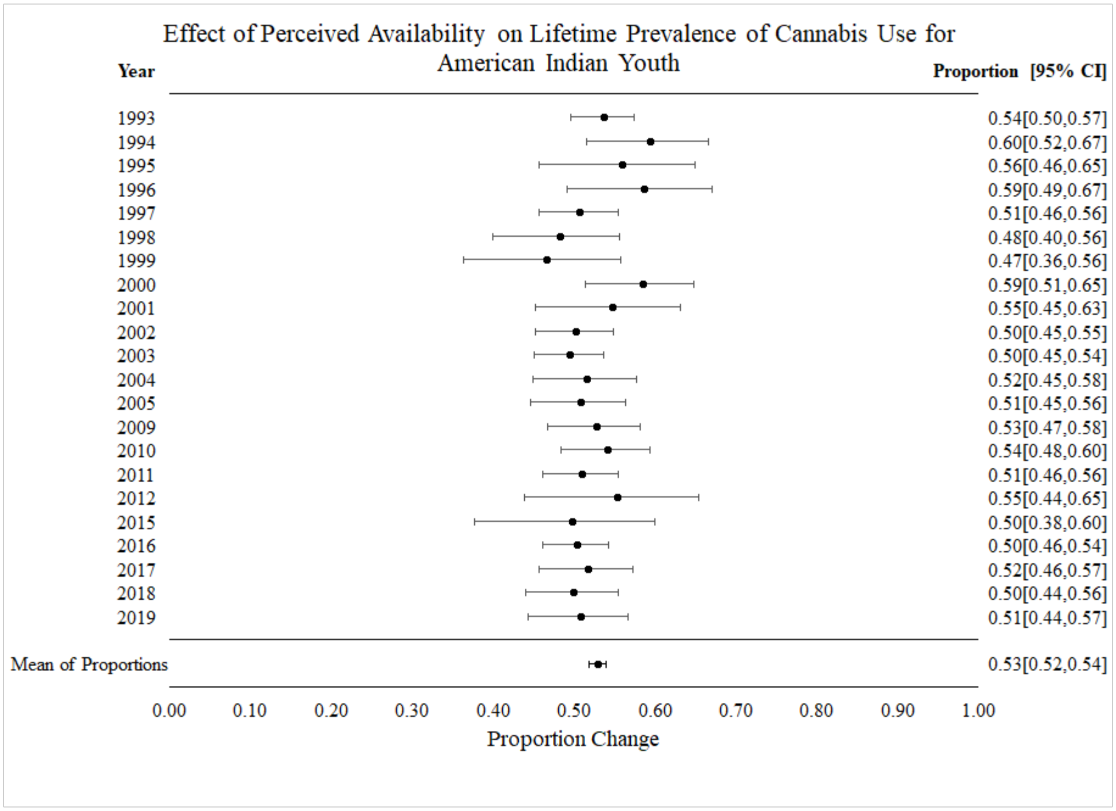
Frequency of Cigarette Use Comparison by Race/Ethnicity and Region
Race/Ethnicity
Mean of Means [95% CI]
Northwest
American Indian 0.64[0.00,1.28]
White 0.11[-0.03,0.25]
Northern Plains
American Indian 1.53[1.17,1.89]
White 1.16[0.66,1.66]
Upper Great Lakes
American Indian 2.05[1.31,2.79]
White 0.99[0.21,1.77]
Northeast
American Indian 2.73[0.40,5.06]
White 7.16[1.59,12.73]
Southeast
American Indian 0.98[0.44,1.52]
White 0.51[0.01,1.01]
Southern Plains
American Indian 1.45[1.08,1.82]
White 1.26[0.81,1.71]
Southwest
American Indian 0.61[0.43,0.79]
White 0.86[0.32,1.40]
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
Number of Times Used

APPENDIX M

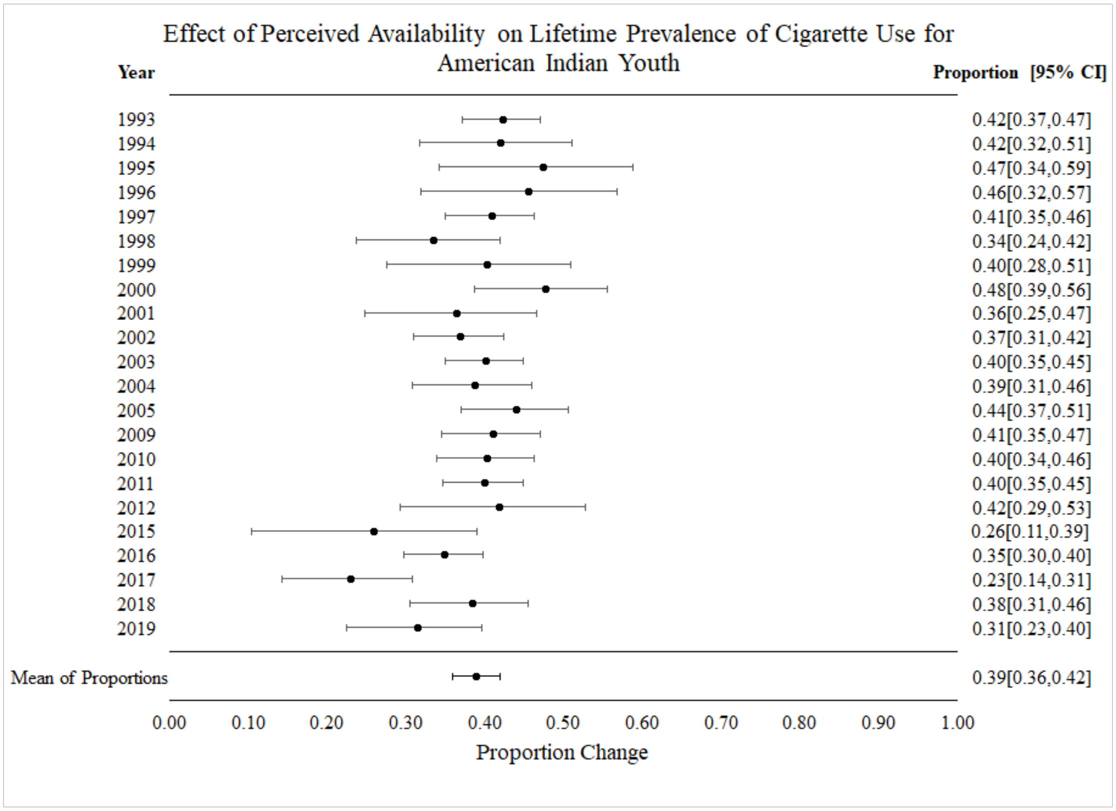
Aim 3: Effects of Perceived Availability for American Indian Youth by Year



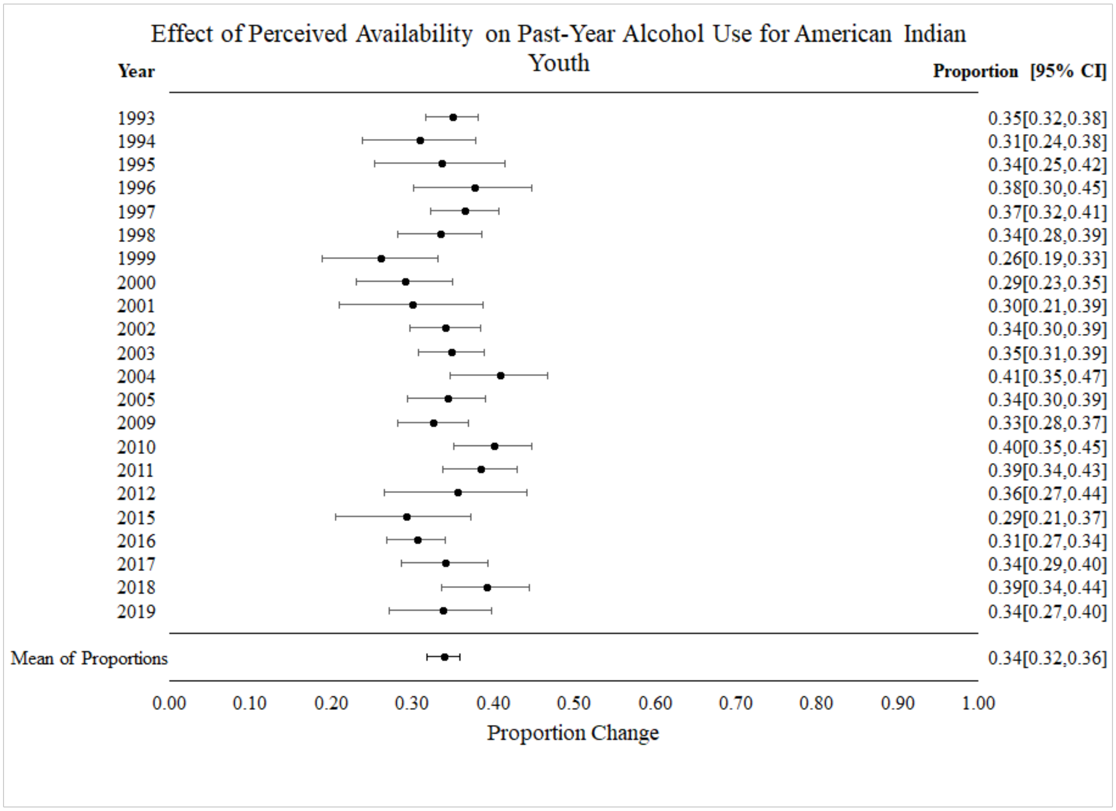
Note: Sample sizes for each year: 1993, n = 1448; 1994, n = 403; 1995, n = 286; 1996, n = 340; 1997, n = 1107; 1998, n = 637; 1999, n = 342; 2000, n = 591; 2001, n = 377; 2002, n = 1120; 2003, n = 1395; 2004, n = 618; 2005, n = 824; 2009, n = 897; 2010, n = 822; 2011, n = 1095; 2012, n = 263; 2015, n = 238; 2016, n = 1453; 2017, n = 710; 2018, n = 642; 2019, n = 556



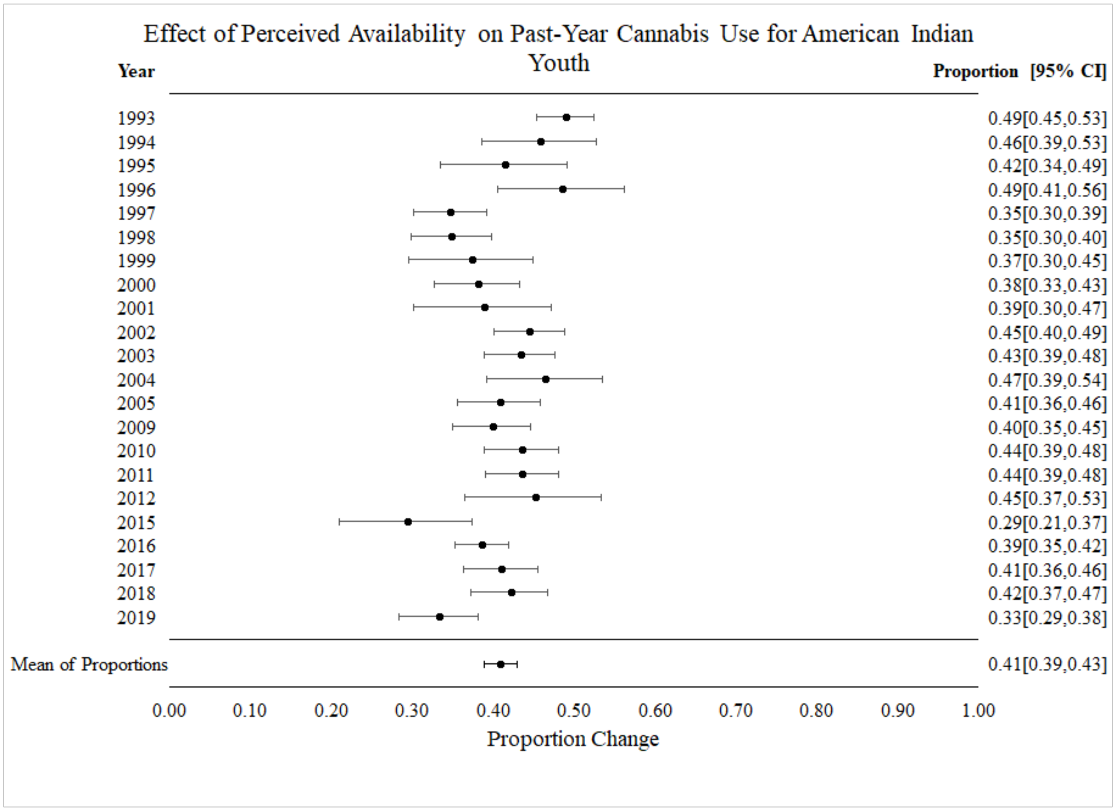
Note: Sample sizes for each year: 1993, n = 1448; 1994, n = 403; 1995, n = 285; 1996, n = 341; 1997, n = 1103; 1998, n = 625; 1999, n = 334; 2000, n = 584; 2001, n = 375; 2002, n = 1114; 2003, n = 1389; 2004, n = 618; 2005, n = 820; 2009, n = 889; 2010, n = 810; 2011, n = 1091; 2012, n = 263; 2015, n = 246; 2016, n = 1511; 2017, n = 758; 2018, n = 678; 2019, n = 608



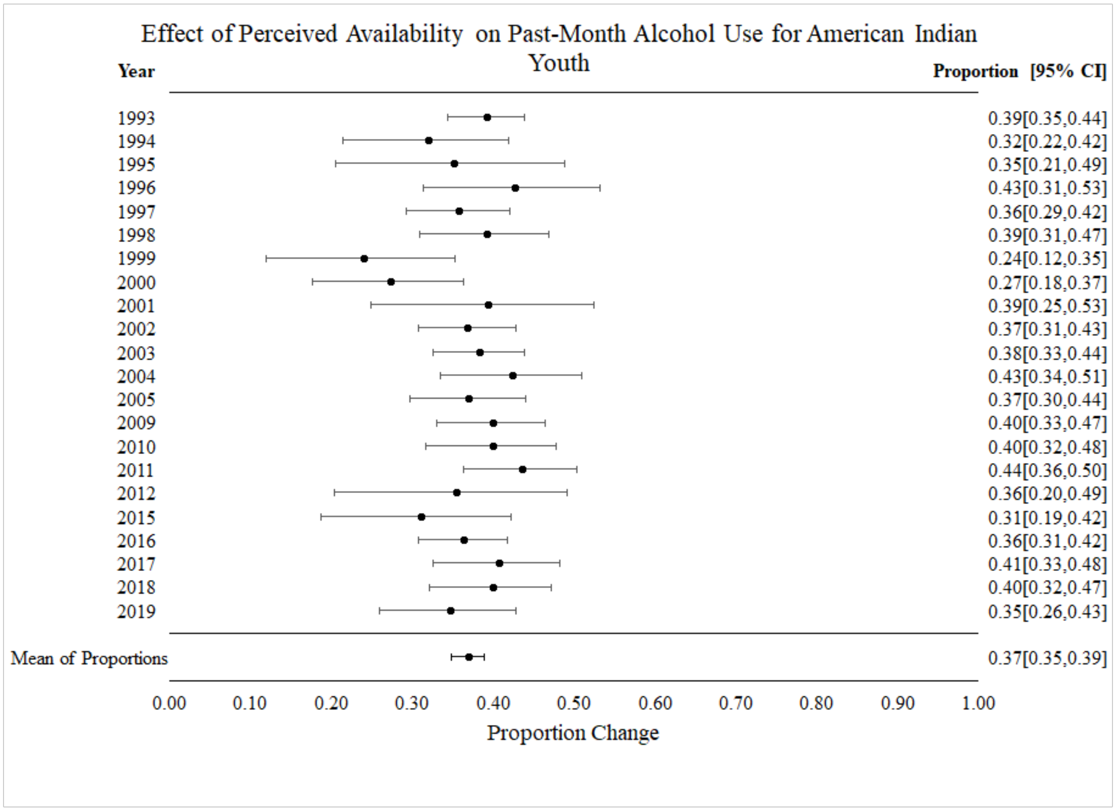
Note: Sample sizes for each year: 1993, n = 1273; 1994, n = 334; 1995, n = 250; 1996, n = 299; 1997, n = 971; 1998, n = 530; 1999, n = 286; 2000, n = 505; 2001, n = 335; 2002, n = 955; 2003, n = 1183; 2004, n = 530; 2005, n = 692; 2009, n = 856; 2010, n = 784; 2011, n = 1065; 2012, n = 258; 2015, n = 223; 2016, n = 1410; 2017, n = 677; 2018, n = 602; 2019, n = 504



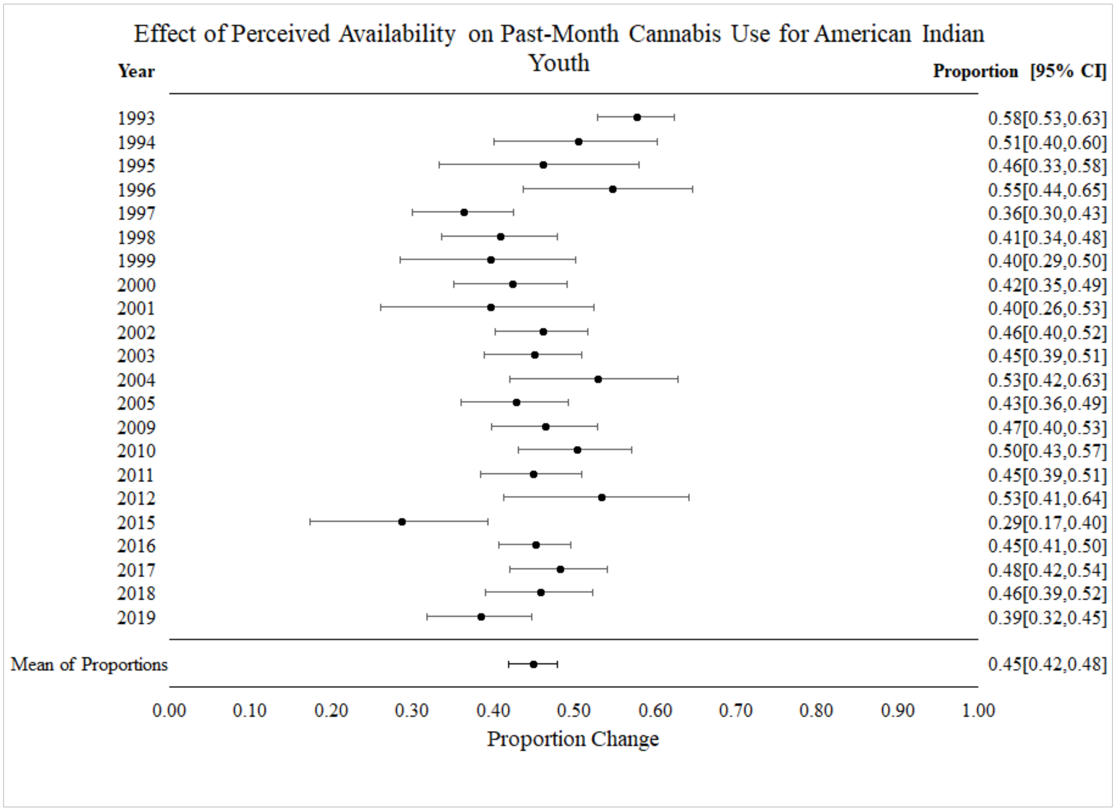
Note: Sample sizes for each year: 1993, n = 1417; 1994, n = 397; 1995, n = 273; 1996, n = 326; 1997, n = 1081; 1998, n = 613; 1999, n = 332; 2000, n = 566; 2001, n = 365; 2002, n = 1097; 2003, n = 1367; 2004, n = 605; 2005, n = 806; 2009, n = 889; 2010, n = 801; 2011, n = 1086; 2012, n = 262; 2015, n = 238; 2016, n = 1453; 2017, n = 710; 2018, n = 641; 2019, n = 556



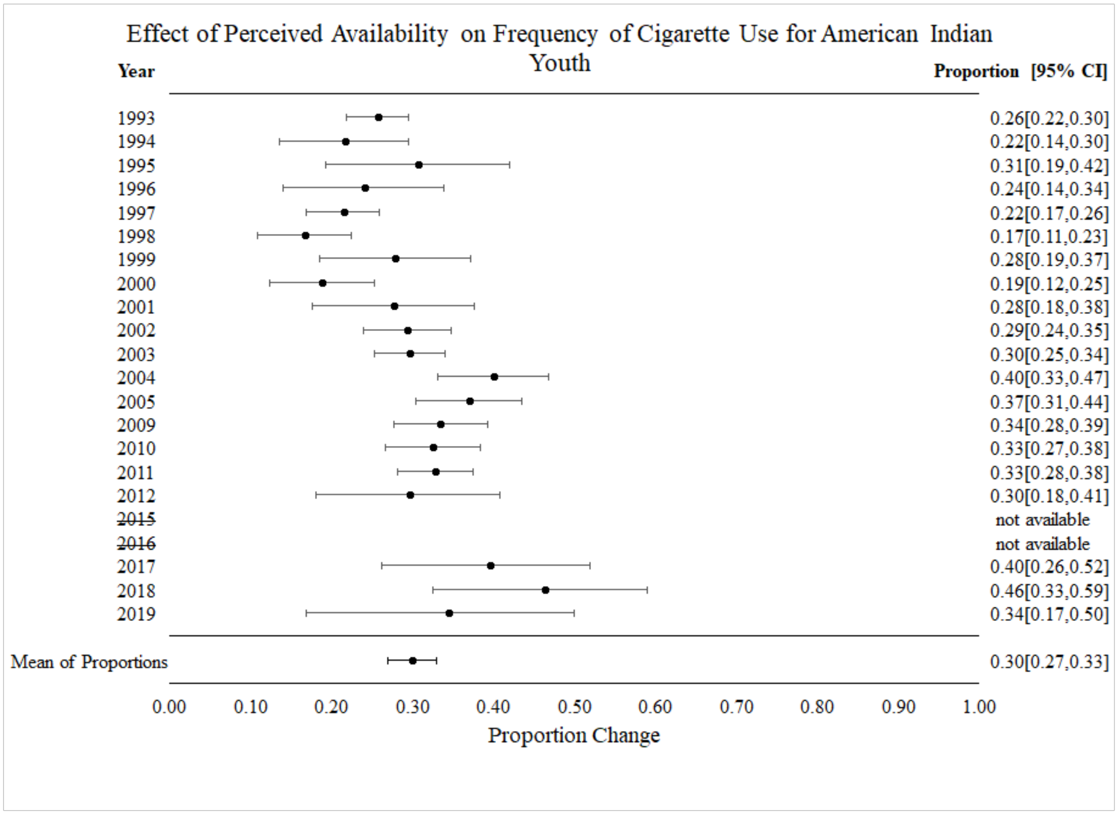
Note: Sample sizes for each year: 1993, n = 1445; 1994, n = 401; 1995, n = 283; 1996, n = 339; 1997, n = 1102; 1998, n = 624; 1999, n = 334; 2000, n = 581; 2001, n = 375; 2002, n = 1114; 2003, n = 1391; 2004, n = 617; 2005, n = 820; 2009, n = 887; 2010, n = 809; 2011, n = 1089; 2012, n = 262; 2015, n = 246; 2016, n = 1511; 2017, n = 759; 2018, n = 678; 2019, n = 608



Note: Sample sizes for each year: 1993, n = 1431; 1994, n = 396; 1995, n = 274; 1996, n = 323; 1997, n = 1082; 1998, n = 609; 1999, n = 334; 2000, n = 572; 2001, n = 364; 2002, n = 1091; 2003, n = 1372; 2004, n = 606; 2005, n = 812; 2009, n = 887; 2010, n = 797; 2011, n = 1083; 2012, n = 262; 2015, n = 238; 2016, n = 1453; 2017, n = 710; 2018, n = 642; 2019, n = 556



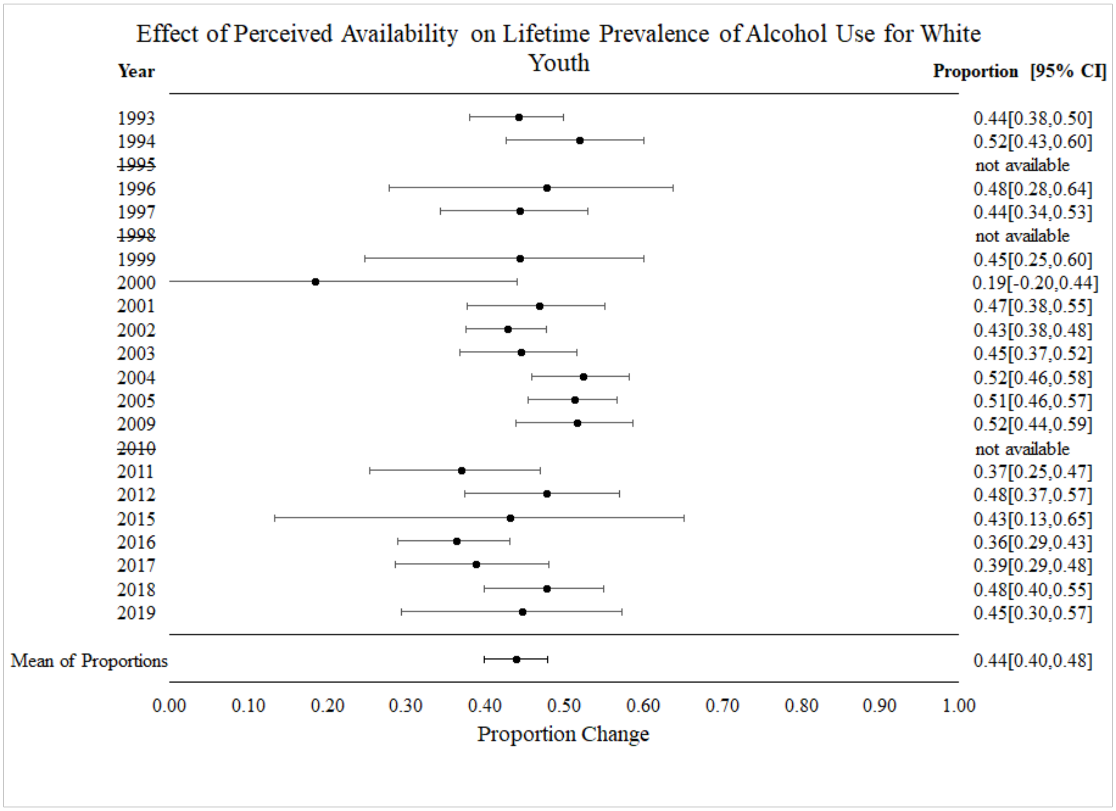
Note: Sample sizes for each year: 1993, n = 1447; 1994, n = 403; 1995, n = 286; 1996, n = 341; 1997, n = 1103; 1998, n = 627; 1999, n = 334; 2000, n = 583; 2001, n = 375; 2002, n = 1115; 2003, n = 1396; 2004, n = 618; 2005, n = 821; 2009, n = 891; 2010, n = 811; 2011, n = 1090; 2012, n = 262; 2015, n = 246; 2016, n = 1511; 2017, n = 759; 2018, n = 678; 2019, n = 608



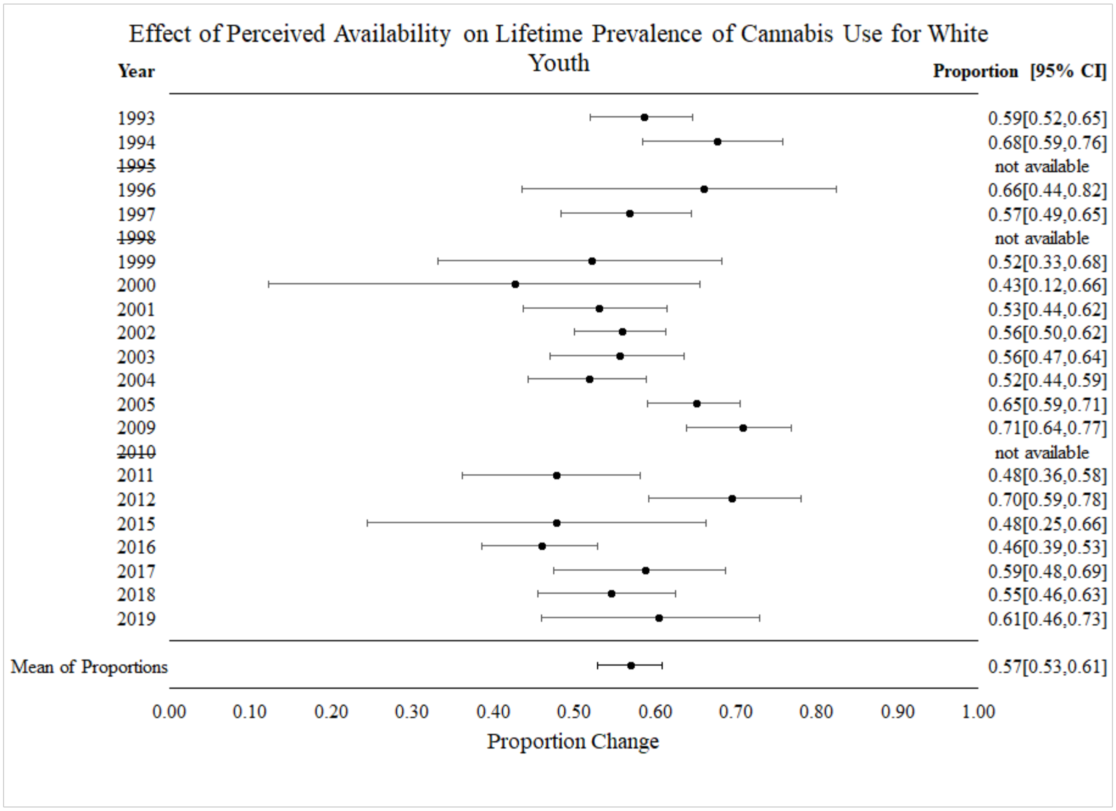
Note: Sample sizes for each year: 1993, n = 1415; 1994, n = 389; 1995, n = 283; 1996, n = 338; 1997, n = 1093; 1998, n = 620; 1999, n = 331; 2000, n = 586; 2001, n = 372; 2002, n = 1100; 2003, n = 1376; 2004, n = 610; 2005, n = 804; 2009, n = 870; 2010, n = 799; 2011, n = 1088; 2012, n = 260; 2017, n = 677; 2018, n = 602; 2019, n = 504

APPENDIX N

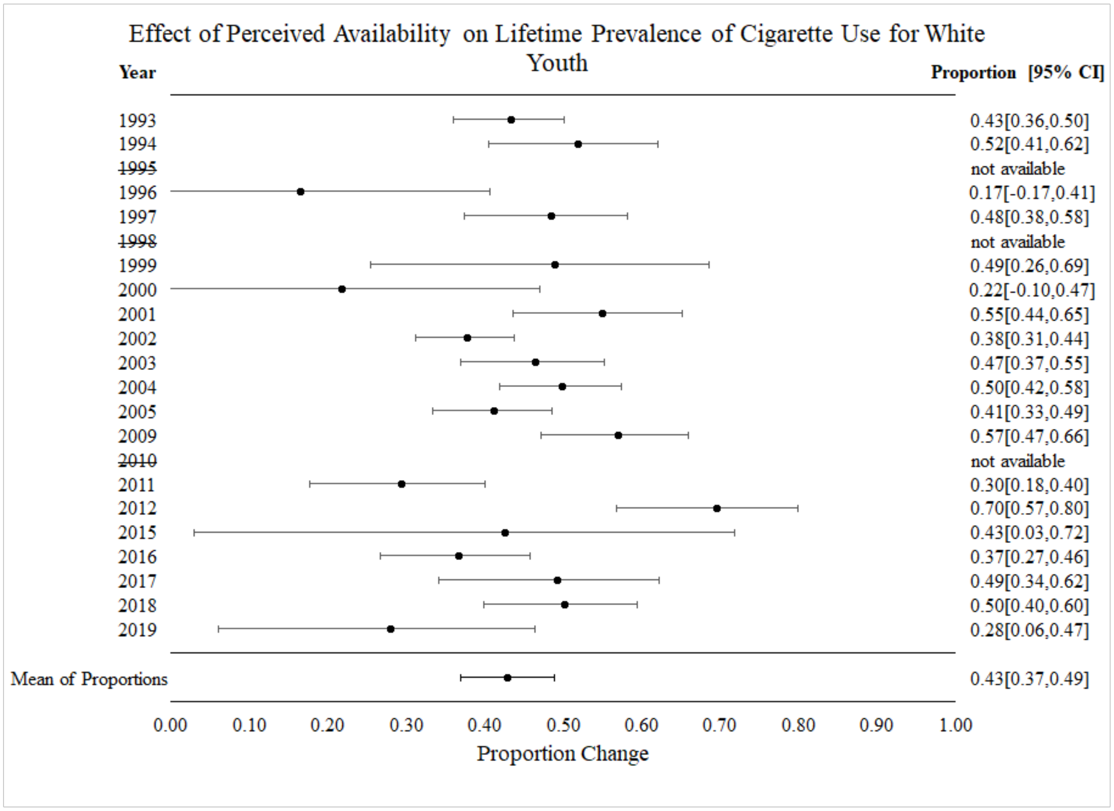
Aim 3: Effects of Perceived Availability for White Youth by Year



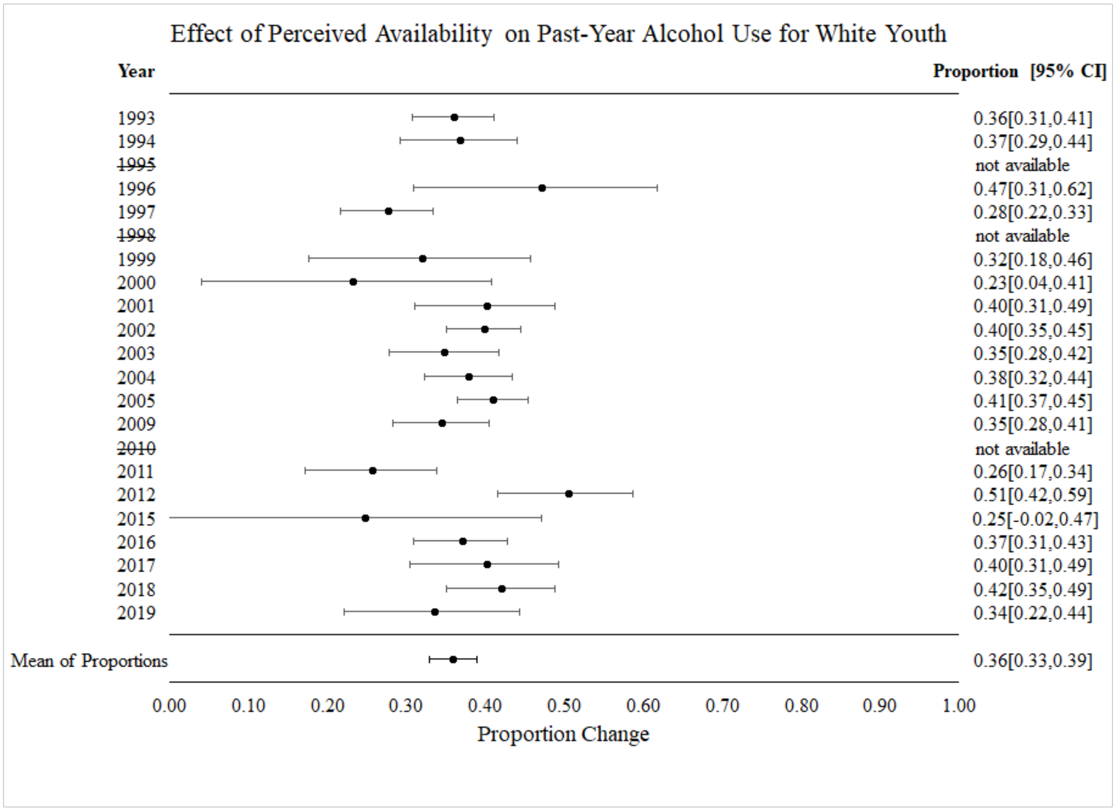
Note: Sample sizes for each year: 1993, n = 1127; 1994, n = 481; 1996, n = 140; 1997, n = 719; 1999, n = 151; 2000, n = 89; 2001, n = 607; 2002, n = 1259; 2003, n = 605; 2004, n = 663; 2005, n = 1093; 2009, n = 745; 2011, n = 336; 2012, n = 437; 2015, n = 106; 2016, n = 839; 2017, n = 370; 2018, n = 453; 2019, n = 178



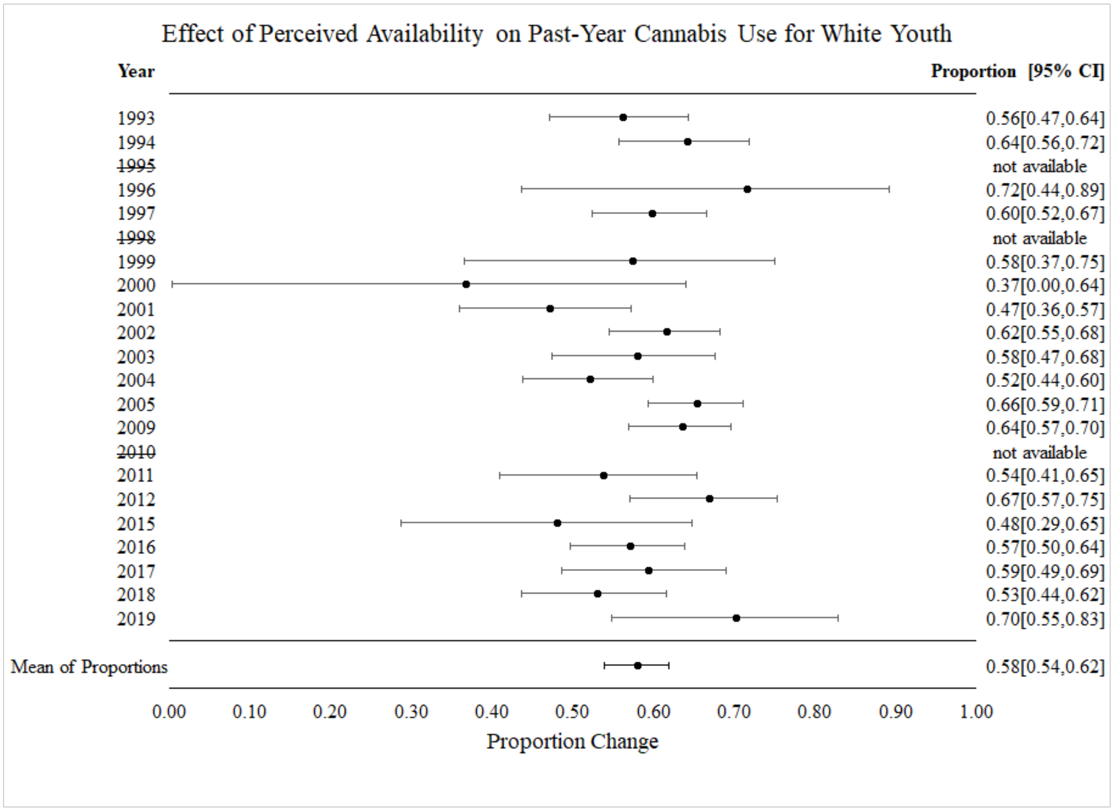
Note: Sample sizes for each year: 1993, n = 1116; 1994, n = 480; 1996, n = 140; 1997, n = 717; 1999, n = 151; 2000, n = 90; 2001, n = 606; 2002, n = 1259; 2003, n = 605; 2004, n = 658; 2005, n = 1088; 2009, n = 739; 2011, n = 337; 2012, n = 429; 2015, n = 99; 2016, n = 775; 2017, n = 330; 2018, n = 402; 2019, n = 168



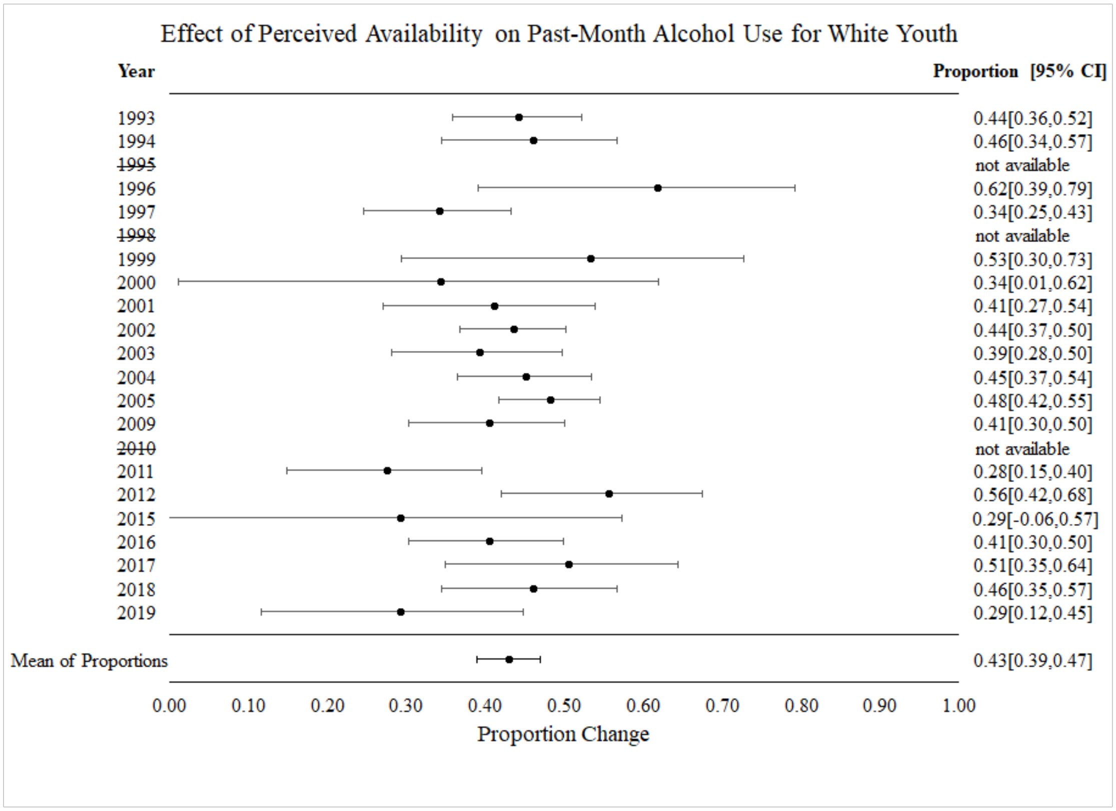
Note: Sample sizes for each year: 1993, n = 1000; 1994, n = 414; 1996, n = 126; 1997, n = 657; 1999, n = 140; 2000, n = 78; 2001, n = 536; 2002, n = 1095; 2003, n = 532; 2004, n = 568; 2005, n = 950; 2009, n = 731; 2011, n = 330; 2012, n = 420; 2015, n = 101; 2016, n = 807; 2017, n = 359; 2018, n = 442; 2019, n = 170



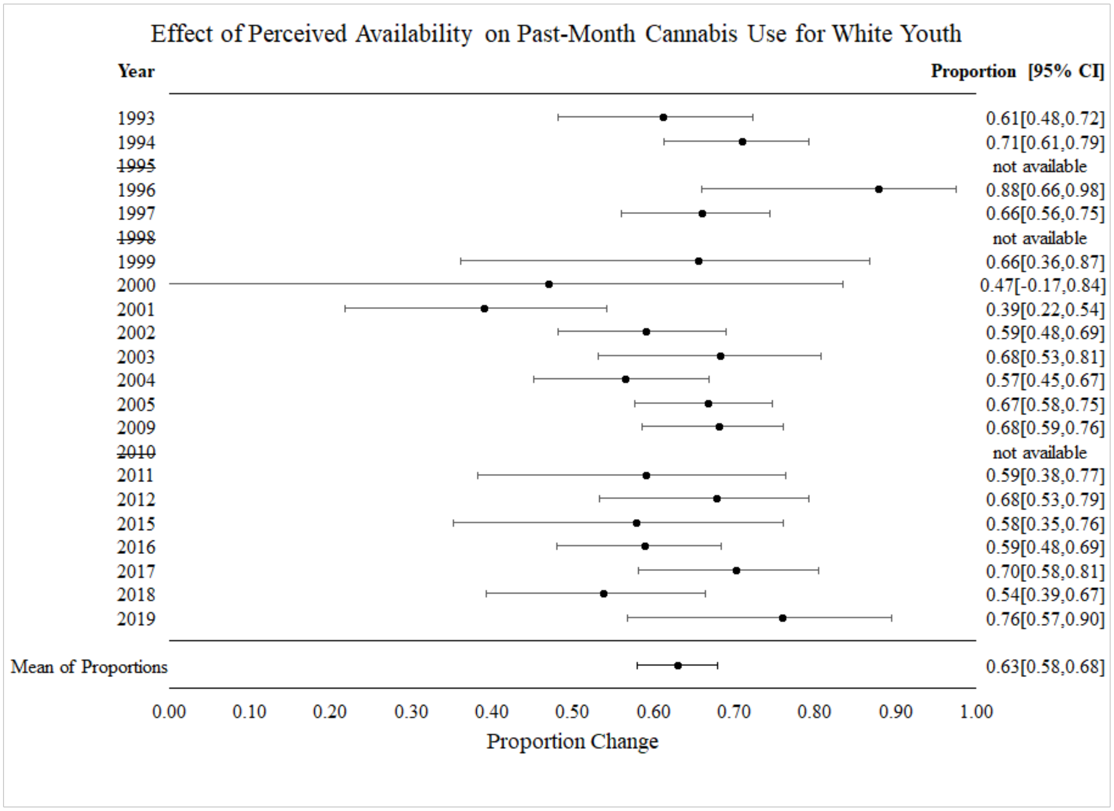
Note: Sample sizes for each year: 1993, n = 1107; 1994, n = 473; 1996, n = 137; 1997, n = 710; 1999, n = 149; 2000, n = 88; 2001, n = 601; 2002, n = 1245; 2003, n = 594; 2004, n = 654; 2005, n = 1079; 2009, n = 733; 2011, n = 332; 2012, n = 429; 2015, n = 106; 2016, n = 839; 2017, n = 370; 2018, n = 453; 2019, n = 178



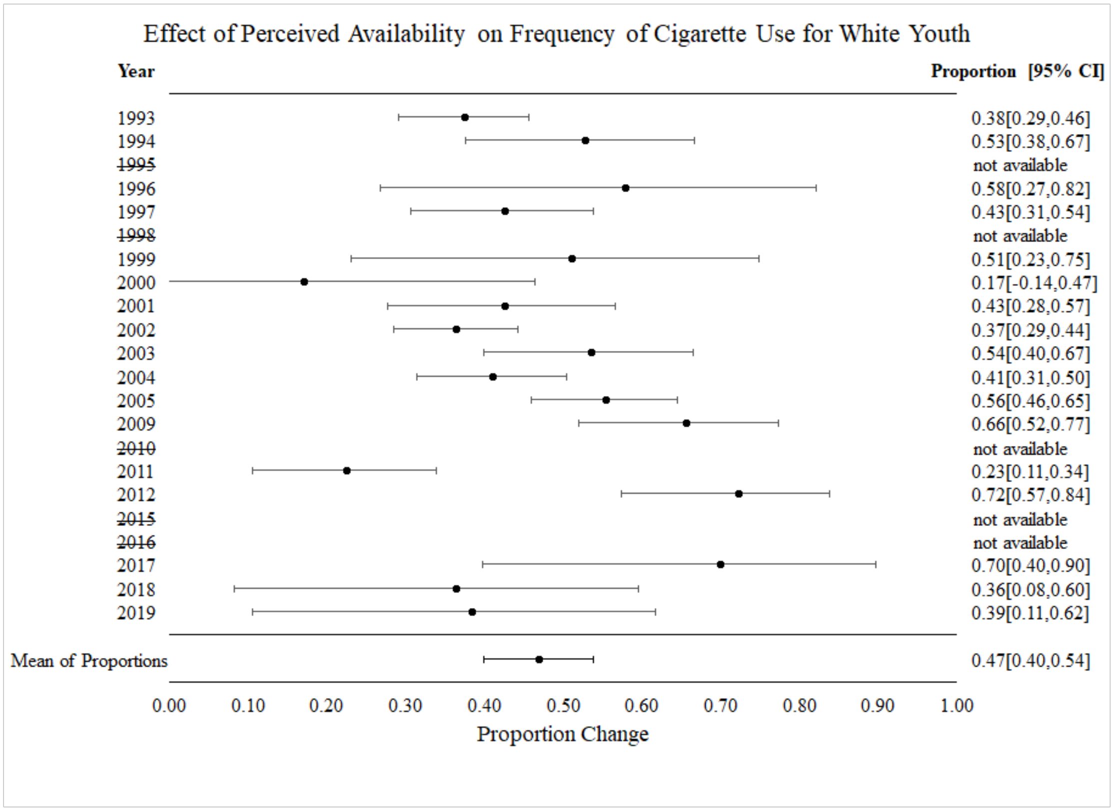
Note: Sample sizes for each year: 1993, n = 1115; 1994, n = 477; 1996, n = 140; 1997, n = 719; 1999, n = 151; 2000, n = 90; 2001, n = 606; 2002, n = 1260; 2003, n = 605; 2004, n = 658; 2005, n = 1084; 2009, n = 739; 2011, n = 336; 2012, n = 429; 2015, n = 99; 2016, n = 775; 2017, n = 330; 2018, n = 403; 2019, n = 168



Note: Sample sizes for each year: 1993, n = 1110; 1994, n = 476; 1996, n = 137; 1997, n = 708; 1999, n = 149; 2000, n = 86; 2001, n = 603; 2002, n = 1244; 2003, n = 600; 2004, n = 651; 2005, n = 1079; 2009, n = 738; 2011, n = 335; 2012, n = 429; 2015, n = 106; 2016, n = 838; 2017, n = 370; 2018, n = 453; 2019, n = 178



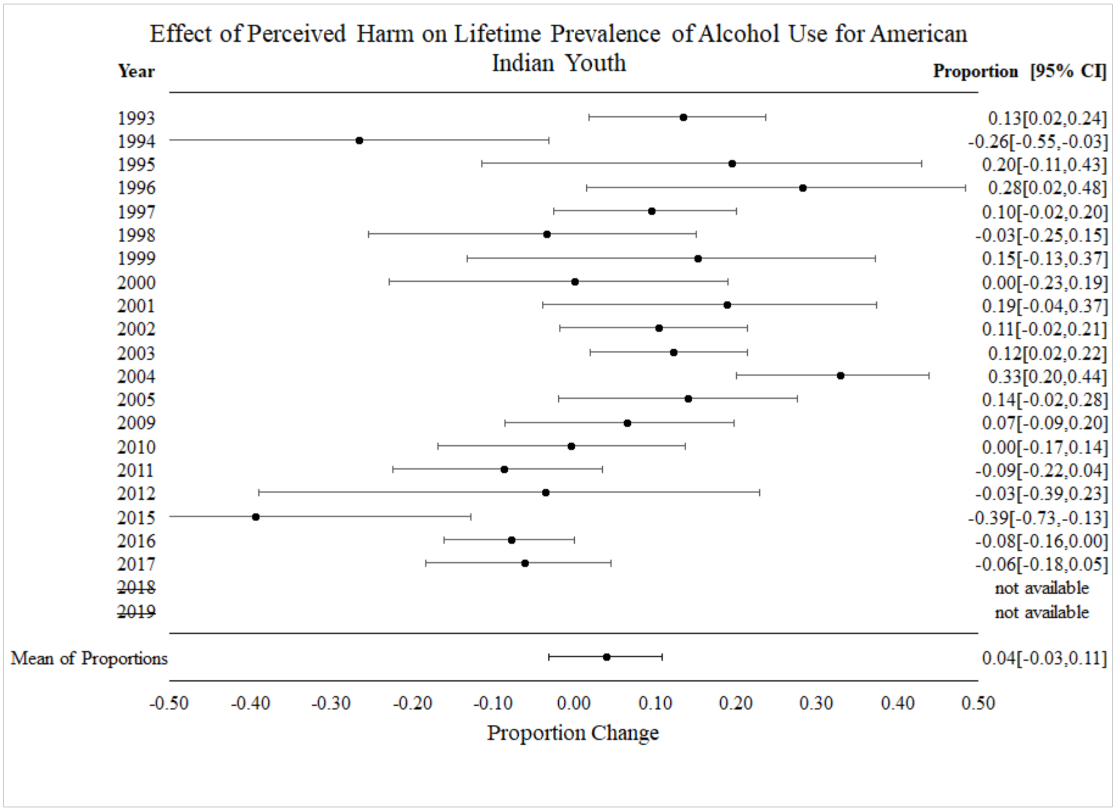
Note: Sample sizes for each year: 1993, n = 1116; 1994, n = 480; 1996, n = 140; 1997, n = 717; 1999, n = 151; 2000, n = 90; 2001, n = 605; 2002, n = 1261; 2003, n = 604; 2004, n = 657; 2005, n = 1088; 2009, n = 739; 2011, n = 337; 2012, n = 429; 2015, n = 99; 2016, n = 775; 2017, n = 330; 2018, n = 403; 2019, n = 168



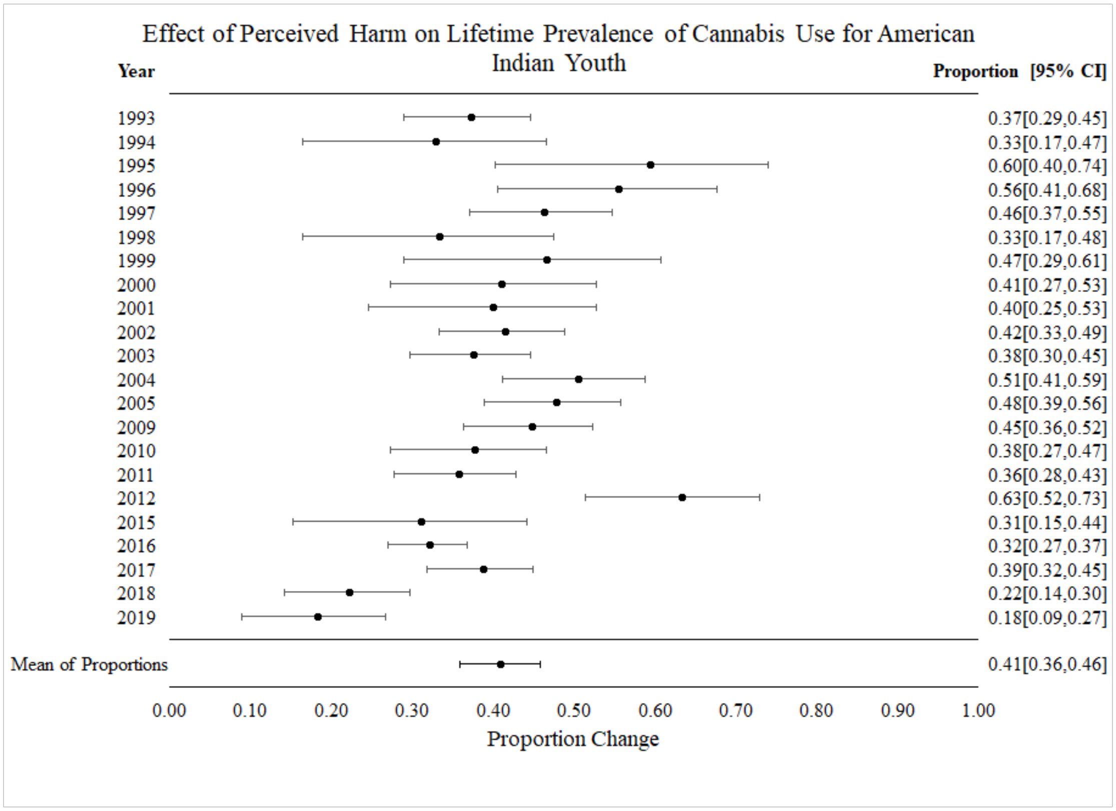
Note: Sample sizes for each year: 1993, n = 1107; 1994, n = 472; 1996, n = 137; 1997, n = 715; 1999, n = 149; 2000, n = 86; 2001, n = 601; 2002, n = 1243; 2003, n = 602; 2004, n = 652; 2005, n = 1080; 2009, n = 736; 2011, n = 337; 2012, n = 425; 2017, n = 359; 2018, n = 442; 2019, n = 170

APPENDIX O

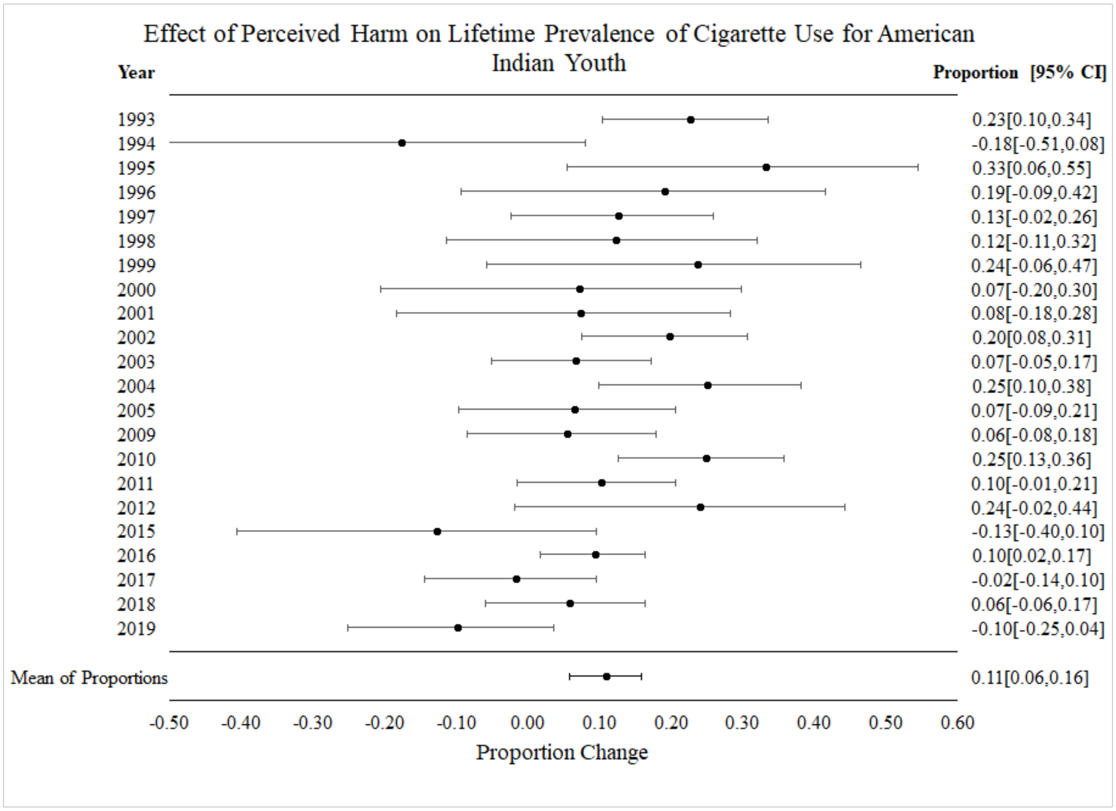
Aim 3: Effects of Perceived Harm for American Indian Youth by Year



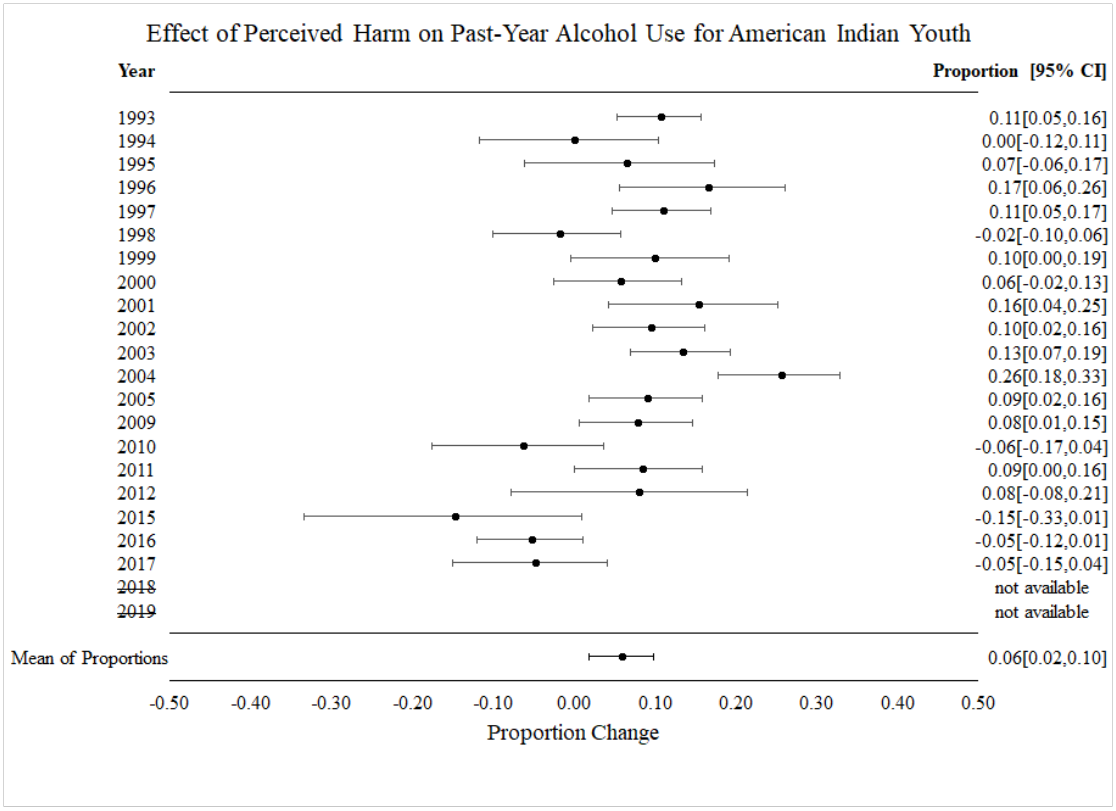
Note: Sample sizes for each year: 1993, n = 1407; 1994, n = 388; 1995, n = 272; 1996, n = 327; 1997, n = 1085; 1998, n = 603; 1999, n = 326; 2000, n = 566; 2001, n = 362; 2002, n = 1073; 2003, n = 1379; 2004, n = 611; 2005, n = 805; 2009, n = 885; 2010, n = 804; 2011, n = 1097; 2012, n = 266; 2015, n = 297; 2016, n = 2040; 2017, n = 1011



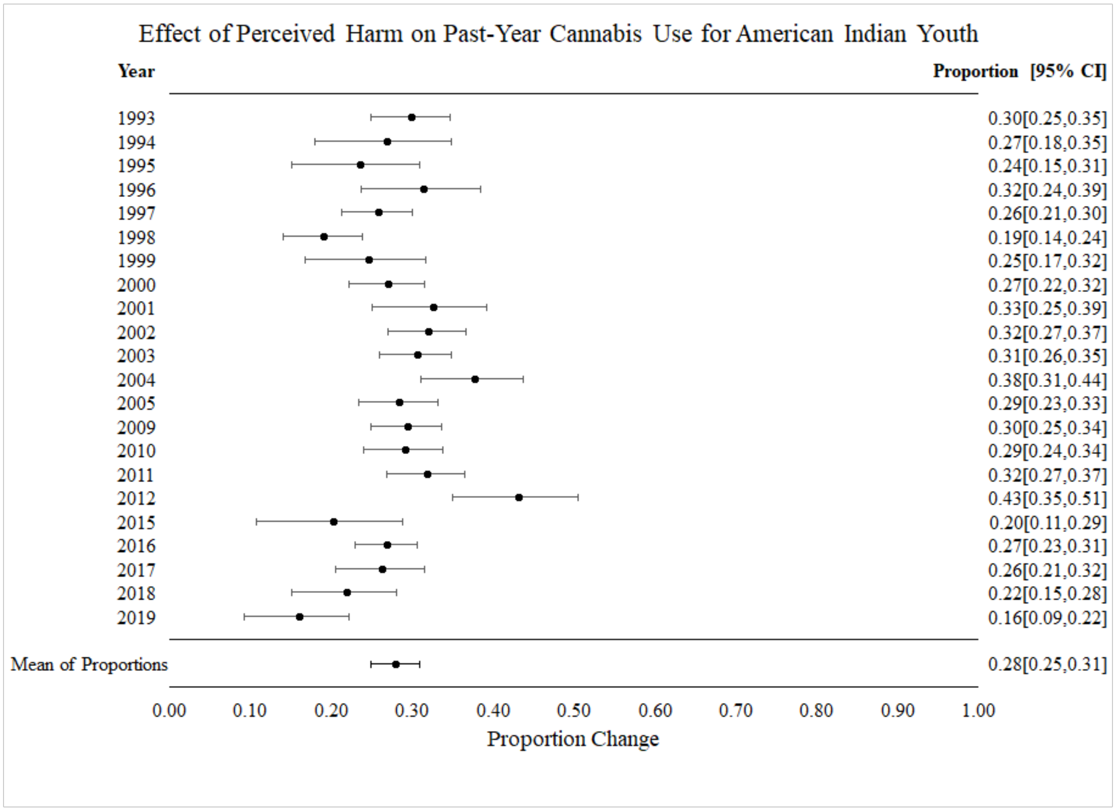
Note: Sample sizes for each year: 1993, n = 1099; 1994, n = 320; 1995, n = 237; 1996, n = 295; 1997, n = 928; 1998, n = 558; 1999, n = 293; 2000, n = 500; 2001, n = 321; 2002, n = 897; 2003, n = 1148; 2004, n = 500; 2005, n = 705; 2009, n = 763; 2010, n = 685; 2011, n = 914; 2012, n = 240; 2015, n = 297; 2016, n = 2038; 2017, n = 1009; 2018, n = 1010; 2019, n = 834



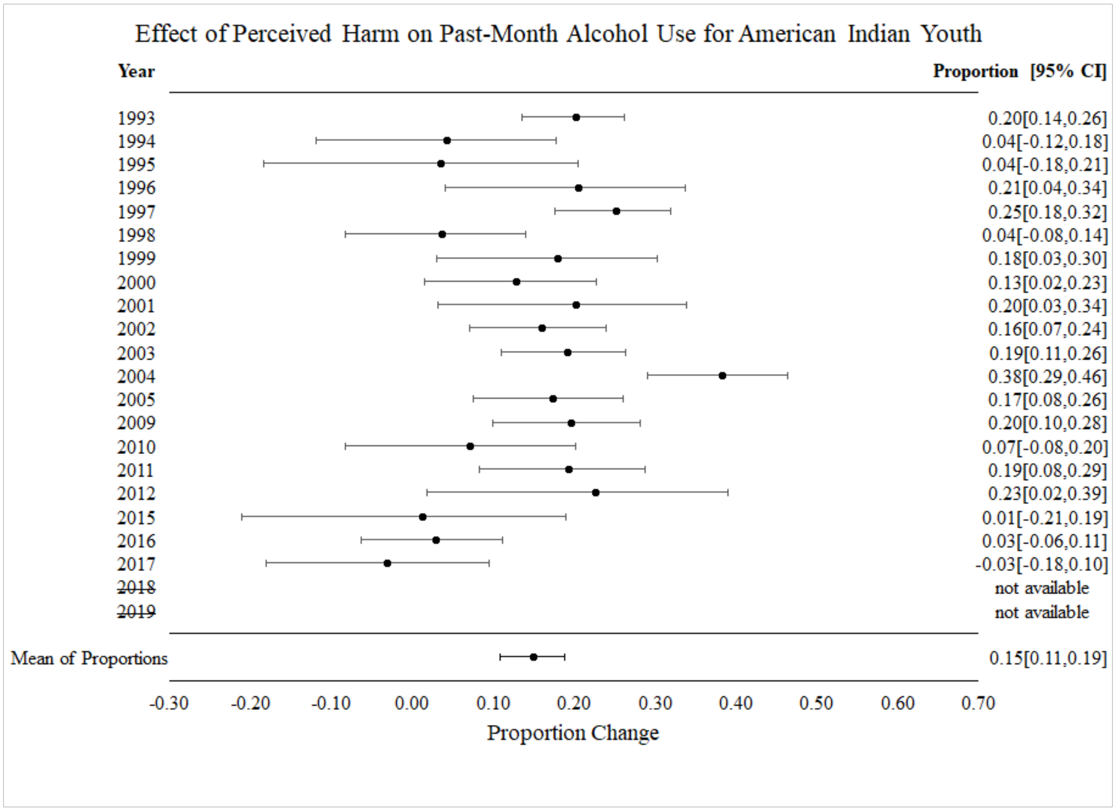
Note: Sample sizes for each year: 1993, n = 1001; 1994, n = 253; 1995, n = 206; 1996, n = 257; 1997, n = 765; 1998, n = 415; 1999, n = 249; 2000, n = 404; 2001, n = 269; 2002, n = 738; 2003, n = 901; 2004, n = 403; 2005, n = 567; 2009, n = 683; 2010, n = 621; 2011, n = 801; 2012, n = 216; 2015, n = 298; 2016, n = 2047; 2017, n = 1012; 2018, n = 1013; 2019, n = 834



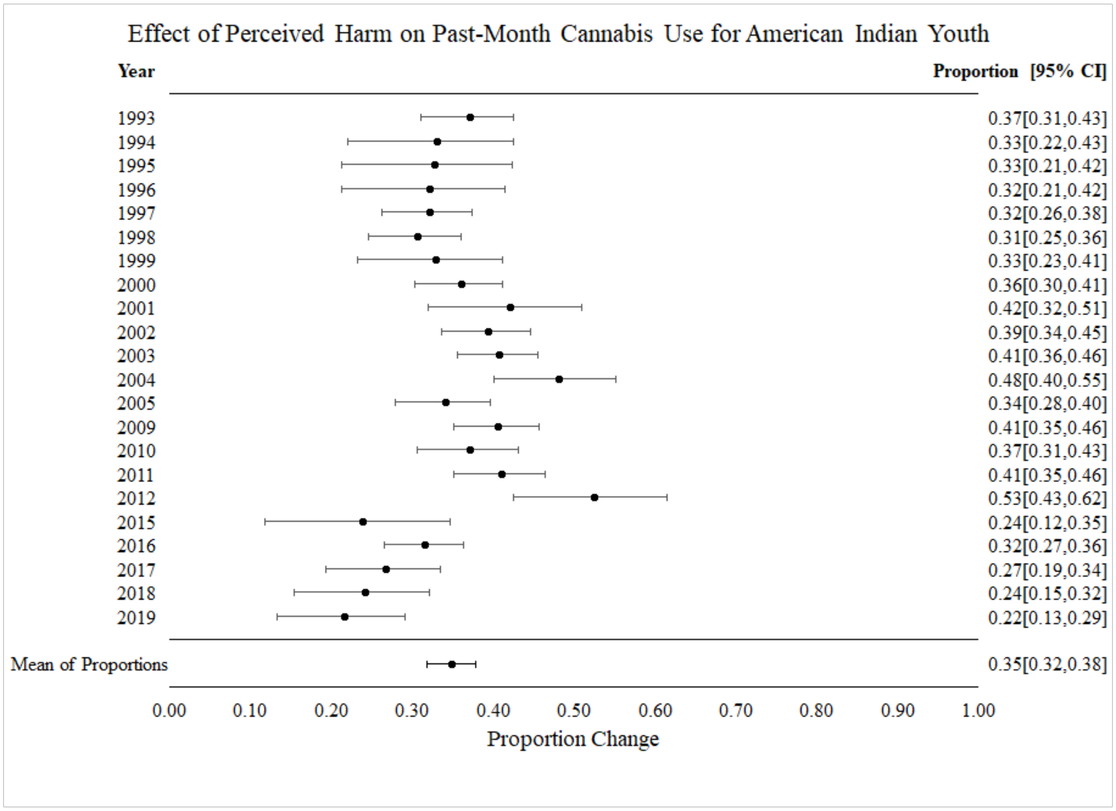
Note: Sample sizes for each year: 1993, n = 1382; 1994, n = 381; 1995, n = 261; 1996, n = 318; 1997, n = 1061; 1998, n = 588; 1999, n = 320; 2000, n = 545; 2001, n = 354; 2002, n = 1055; 2003, n = 1350; 2004, n = 601; 2005, n = 787; 2009, n = 879; 2010, n = 787; 2011, n = 1088; 2012, n = 264; 2015, n = 297; 2016, n = 2040; 2017, n = 1011



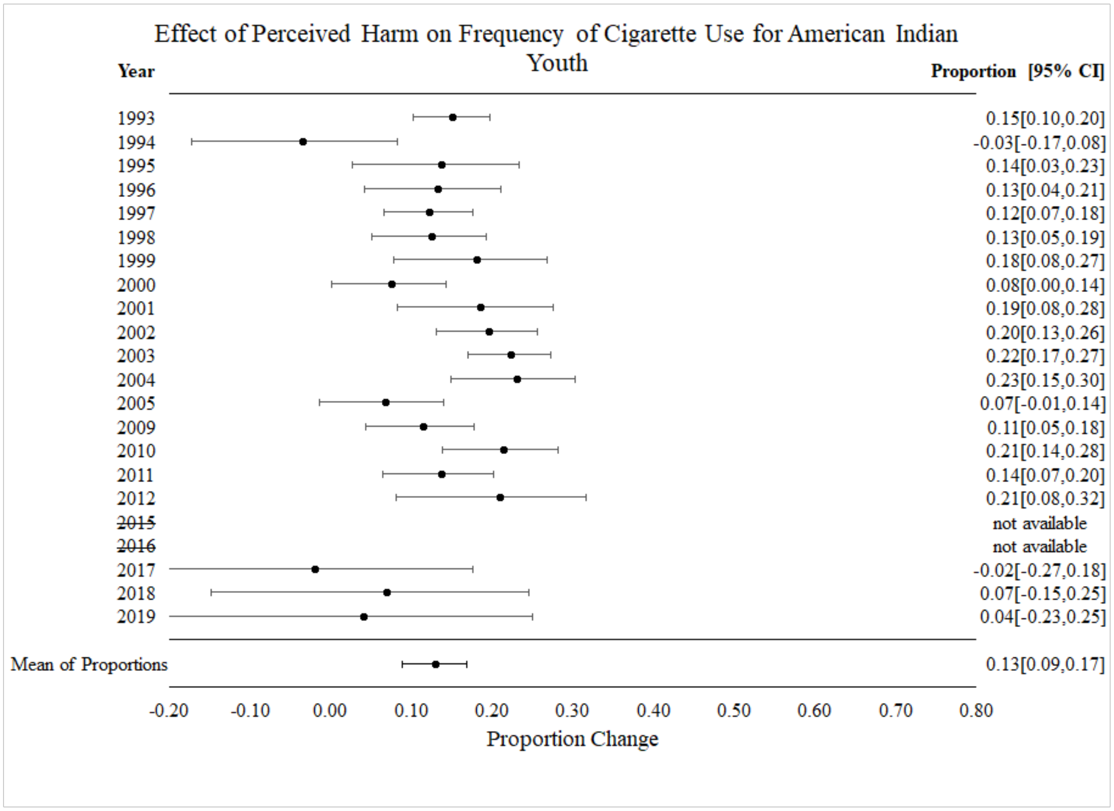
Note: Sample sizes for each year: 1993, n = 1097; 1994, n = 318; 1995, n = 235; 1996, n = 293; 1997, n = 926; 1998, n = 559; 1999, n = 293; 2000, n = 497; 2001, n = 321; 2002, n = 897; 2003, n = 1151; 2004, n = 498; 2005, n = 705; 2009, n = 762; 2010, n = 684; 2011, n = 912; 2012, n = 239; 2015, n = 297; 2016, n = 2038; 2017, n = 1010; 2018, n = 1010; 2019, n = 834



Note: Sample sizes for each year: 1993, n = 1393; 1994, n = 382; 1995, n = 262; 1996, n = 316; 1997, n = 1064; 1998, n = 584; 1999, n = 322; 2000, n = 553; 2001, n = 353; 2002, n = 1052; 2003, n = 1356; 2004, n = 602; 2005, n = 796; 2009, n = 877; 2010, n = 785; 2011, n = 1086; 2012, n = 265; 2015, n = 297; 2016, n = 2039; 2017, n = 1011



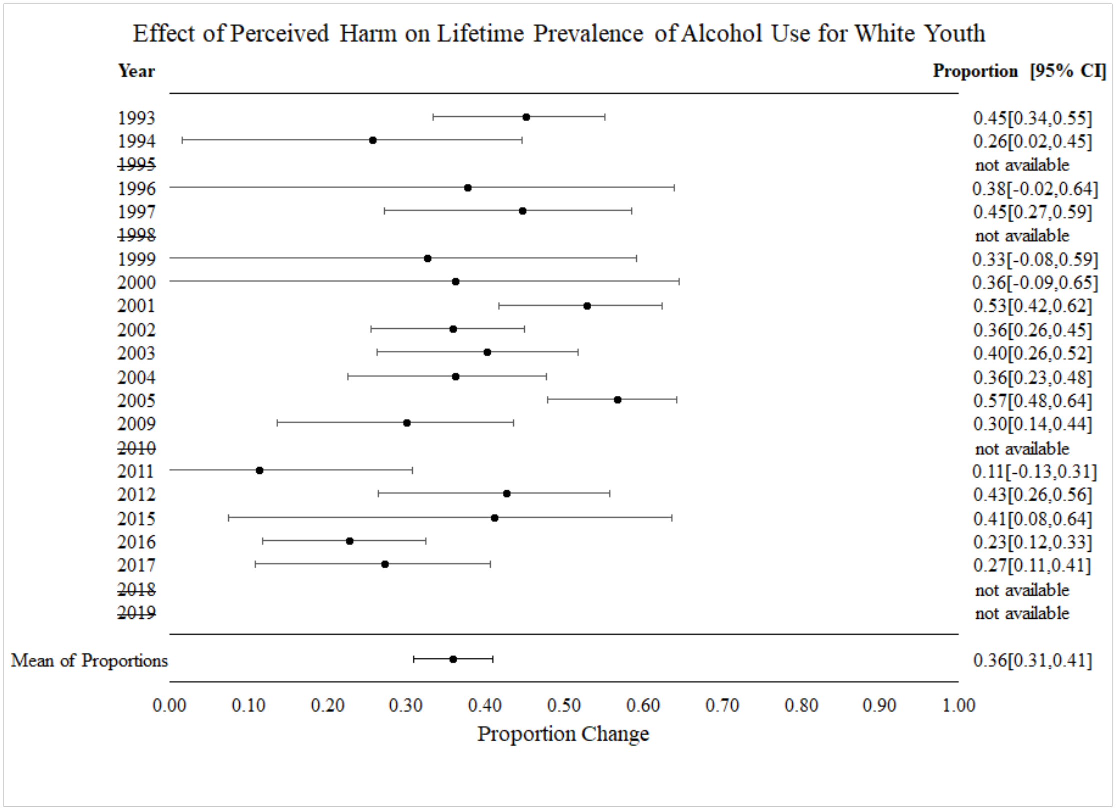
Note: Sample sizes for each year: 1993, n = 1098; 1994, n = 320; 1995, n = 238; 1996, n = 295; 1997, n = 927; 1998, n = 561; 1999, n = 293; 2000, n = 499; 2001, n = 321; 2002, n = 897; 2003, n = 1153; 2004, n = 499; 2005, n = 706; 2009, n = 765; 2010, n = 685; 2011, n = 913; 2012, n = 239; 2015, n = 297; 2016, n = 2038; 2017, n = 1010; 2018, n = 1010; 2019, n = 834



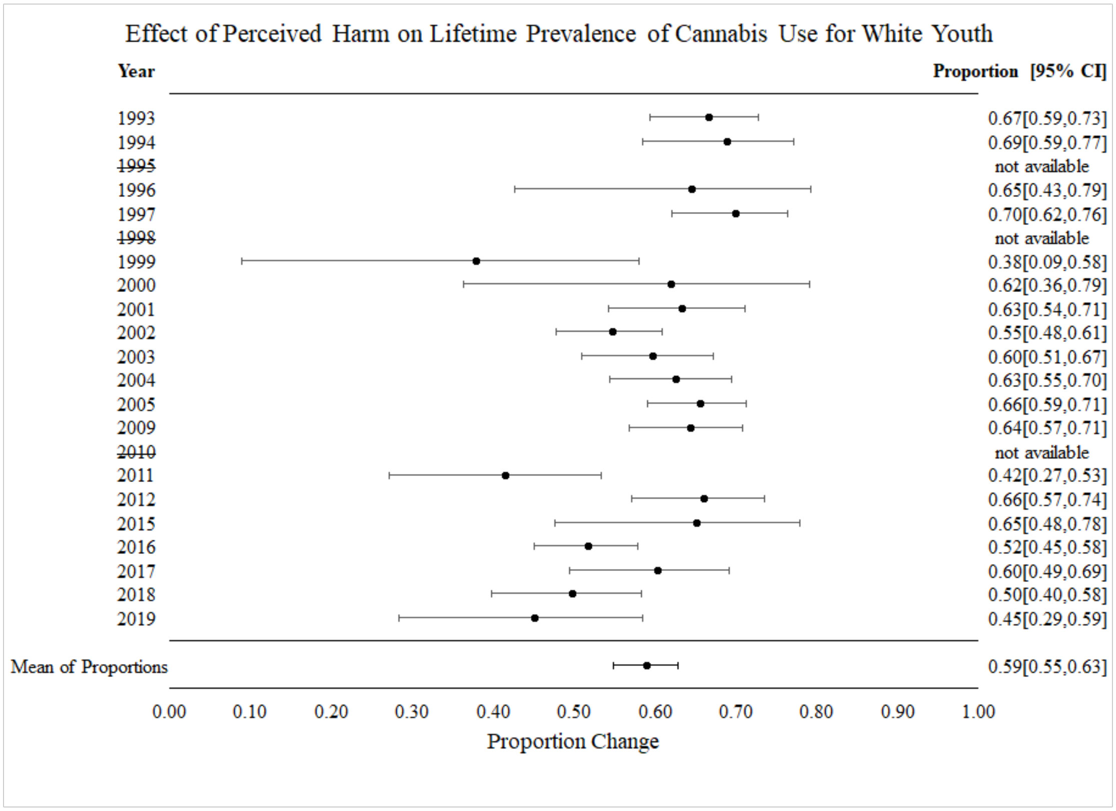
Note: Sample sizes for each year: 1993, n = 1095; 1994, n = 296; 1995, n = 229; 1996, n = 288; 1997, n = 861; 1998, n = 487; 1999, n = 284; 2000, n = 462; 2001, n = 293; 2002, n = 836; 2003, n = 1039; 2004, n = 466; 2005, n = 656; 2009, n = 694; 2010, n = 625; 2011, n = 815; 2012, n = 218; 2017, n = 1012; 2018, n = 1013; 2019, n = 834

APPENDIX P

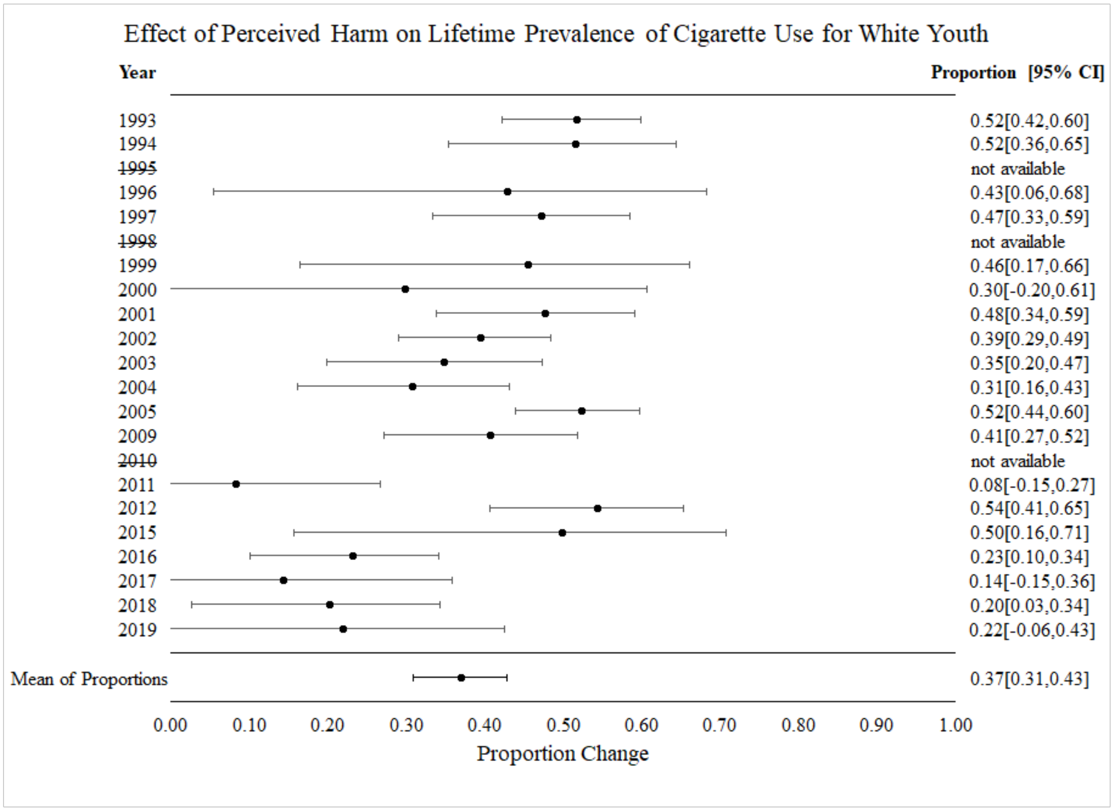
Aim 3: Effects of Perceived Harm for White Youth by Year



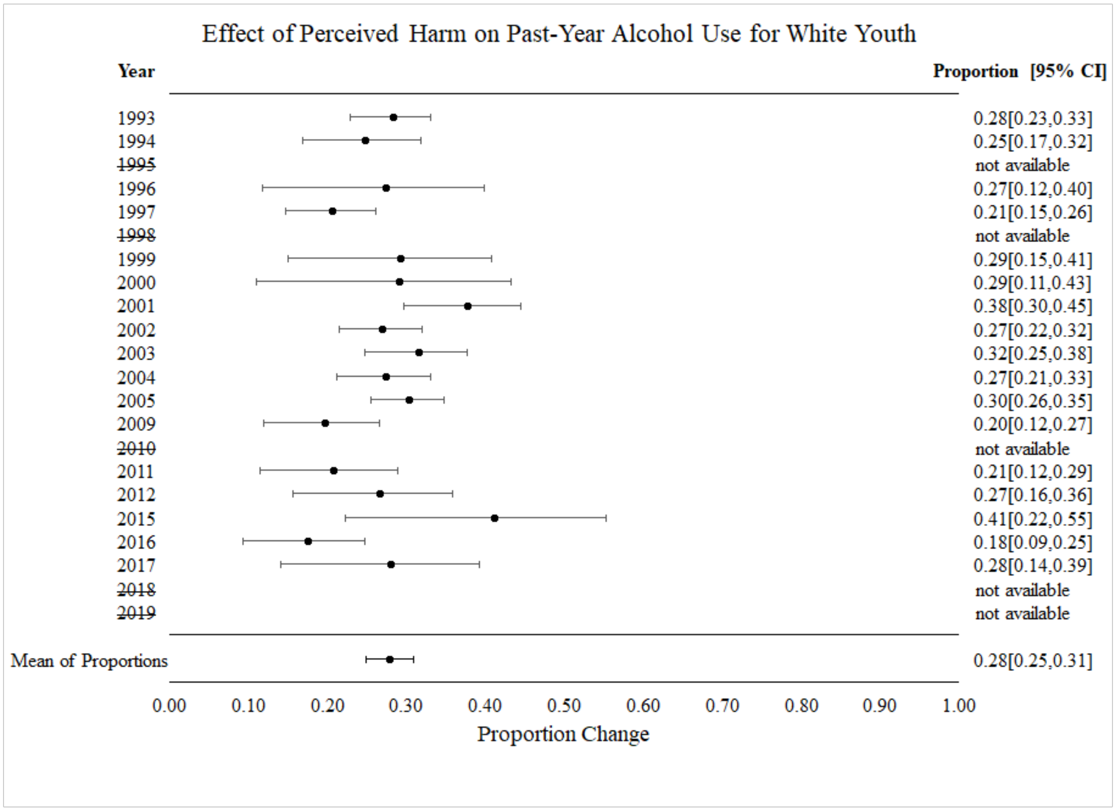
Note: Sample sizes for each year: 1993, n = 1100; 1994, n = 475; 1996, n = 140; 1997, n = 713; 1999, n = 149; 2000, n = 89; 2001, n = 603; 2002, n = 1250; 2003, n = 601; 2004, n = 655; 2005, n = 1077; 2009, n = 742; 2011, n = 349; 2012, n = 442; 2015, n = 111; 2016, n = 974; 2017, n = 442



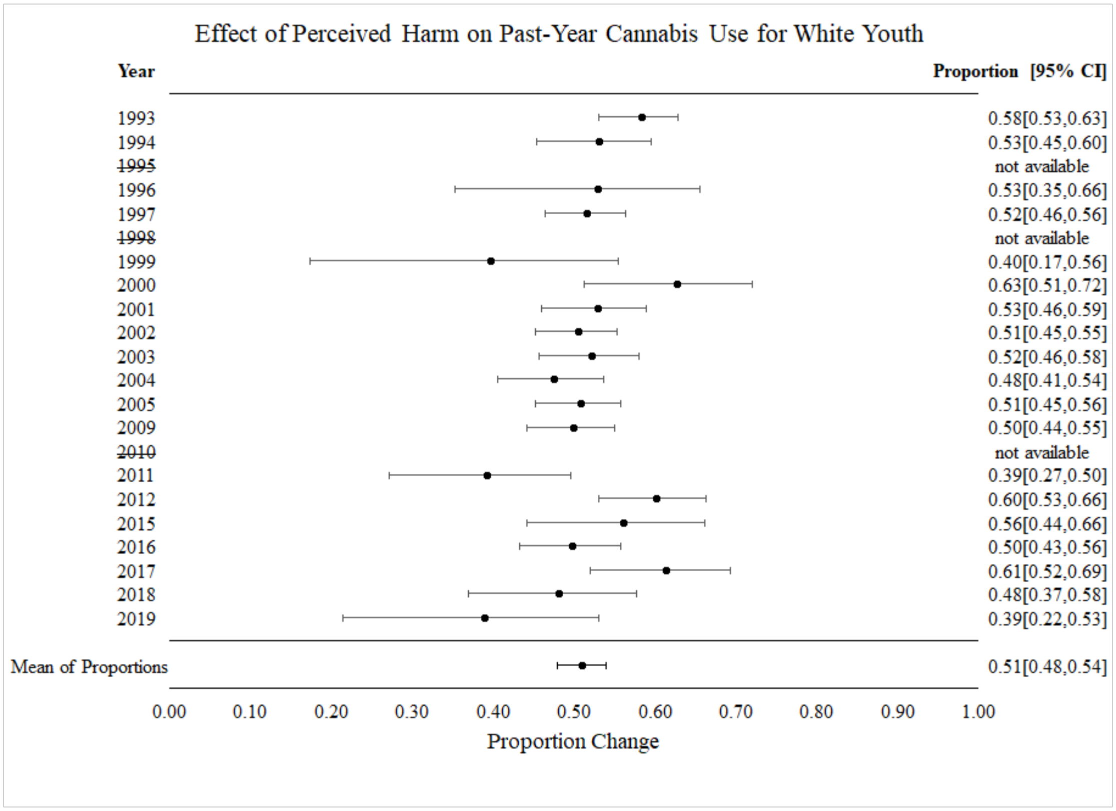
Note: Sample sizes for each year: 1993, n = 939; 1994, n = 411; 1996, n = 117; 1997, n = 654; 1999, n = 122; 2000, n = 81; 2001, n = 521; 2002, n = 1036; 2003, n = 512; 2004, n = 528; 2005, n = 942; 2009, n = 677; 2011, n = 261; 2012, n = 386; 2015, n = 111; 2016, n = 975; 2017, n = 442; 2018, n = 558; 2019, n = 197



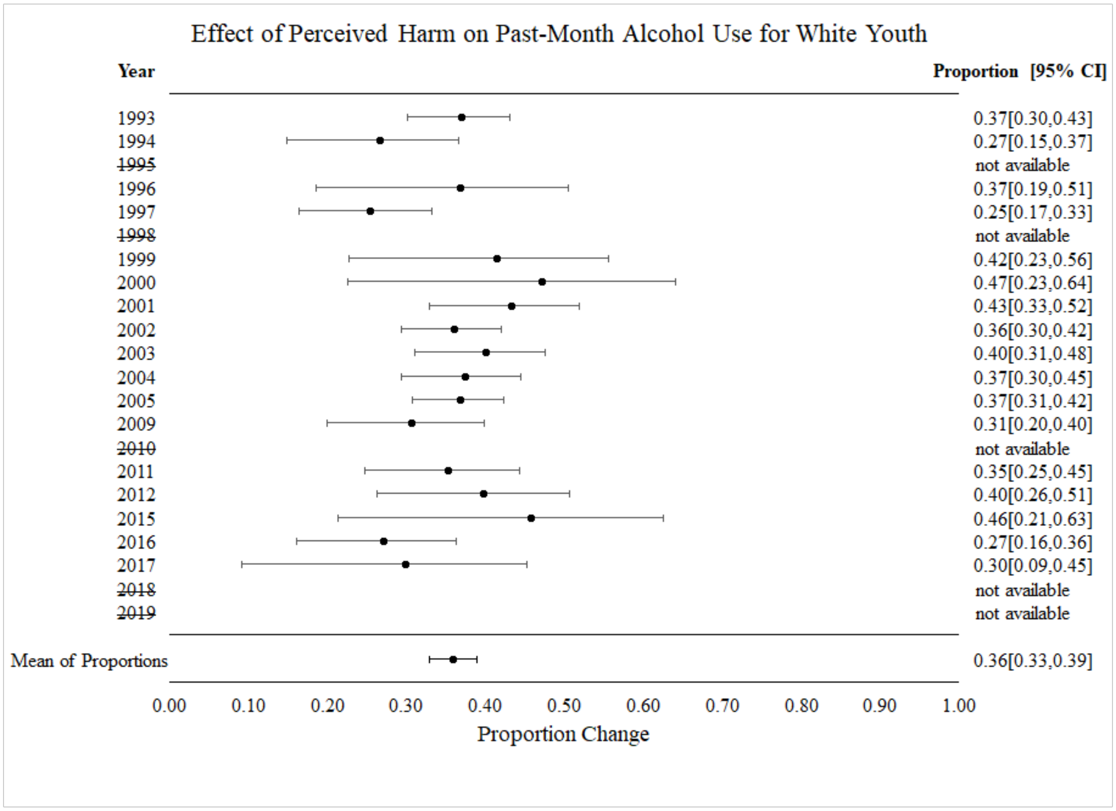
Note: Sample sizes for each year: 1993, n = 868; 1994, n = 364; 1996, n = 113; 1997, n = 604; 1999, n = 121; 2000, n = 75; 2001, n = 459; 2002, n = 904; 2003, n = 448; 2004, n = 463; 2005, n = 847; 2009, n = 666; 2011, n = 250; 2012, n = 375; 2015, n = 111; 2016, n = 977; 2017, n = 443; 2018, n = 562; 2019, n = 198



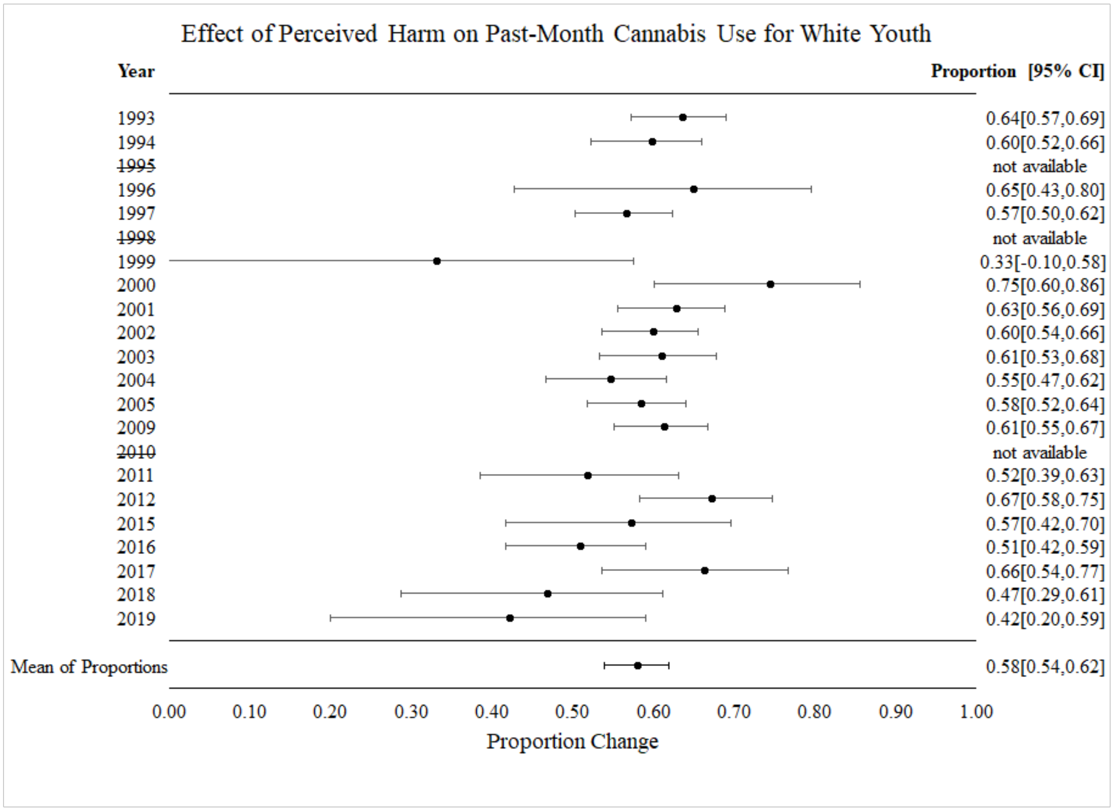
Note: Sample sizes for each year: 1993, n = 1086; 1994, n = 468; 1996, n = 137; 1997, n = 704; 1999, n = 147; 2000, n = 88; 2001, n = 598; 2002, n = 1238; 2003, n = 593; 2004, n = 648; 2005, n = 1065; 2009, n = 730; 2011, n = 347; 2012, n = 433; 2015, n = 111; 2016, n = 974; 2017, n = 442



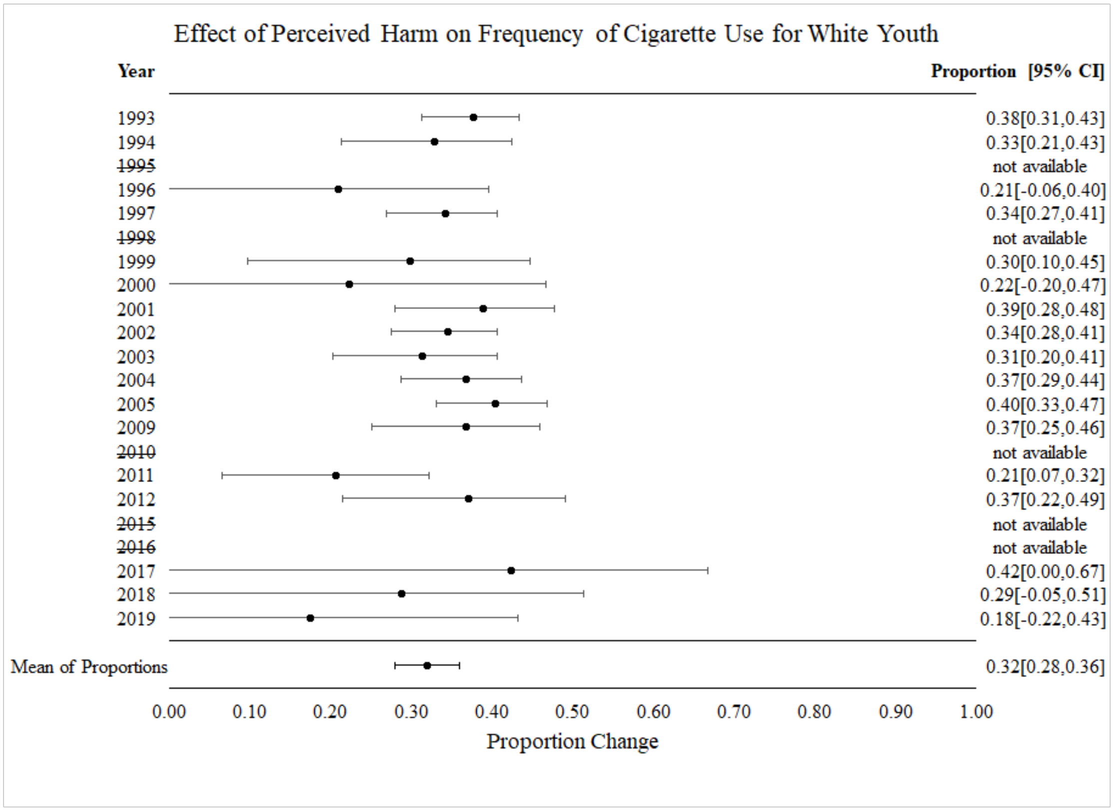
Note: Sample sizes for each year: 1993, n = 937; 1994, n = 408; 1996, n = 117; 1997, n = 656; 1999, n = 122; 2000, n = 81; 2001, n = 521; 2002, n = 1036; 2003, n = 512; 2004, n = 528; 2005, n = 940; 2009, n = 677; 2011, n = 260; 2012, n = 386; 2015, n = 111; 2016, n = 974; 2017, n = 442; 2018, n = 559; 2019, n = 197



Note: Sample sizes for each year: 1993, n = 1089; 1994, n = 473; 1996, n = 137; 1997, n = 702; 1999, n = 147; 2000, n = 86; 2001, n = 599; 2002, n = 1238; 2003, n = 596; 2004, n = 645; 2005, n = 1066; 2009, n = 735; 2011, n = 348; 2012, n = 432; 2015, n = 111; 2016, n = 973; 2017, n = 442



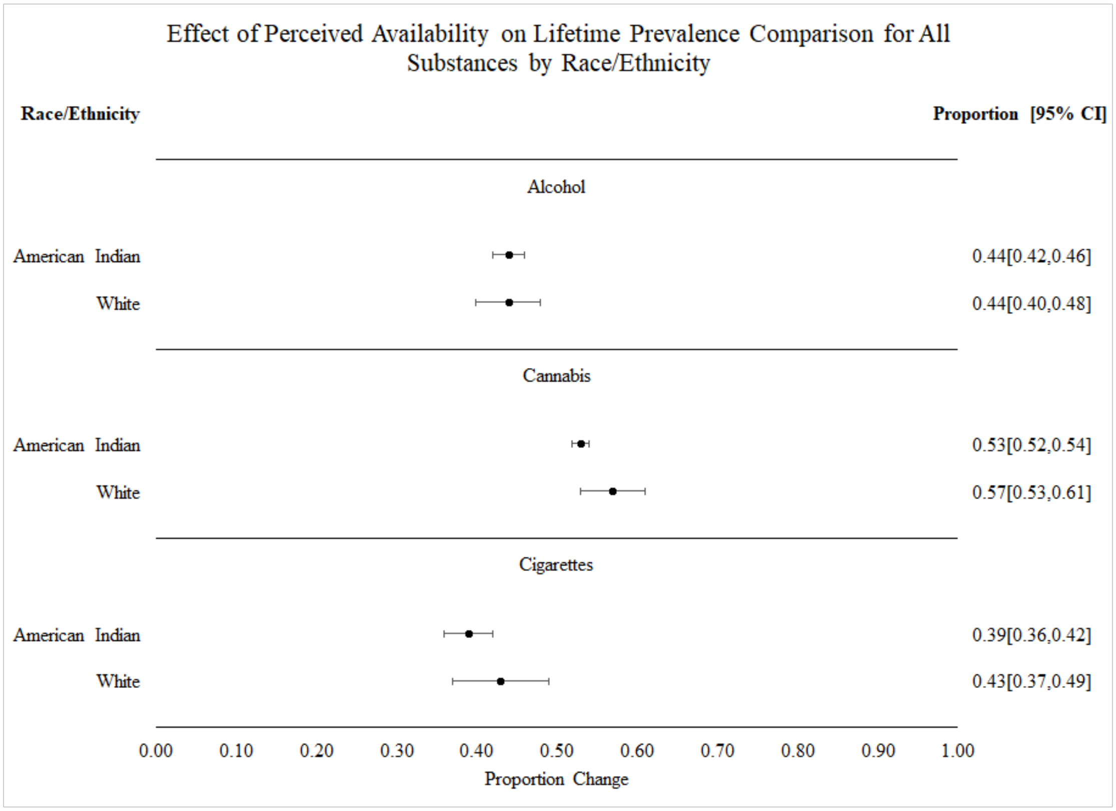
Note: Sample sizes for each year: 1993, n = 939; 1994, n = 411; 1996, n = 117; 1997, n = 654; 1999, n = 122; 2000, n = 81; 2001, n = 520; 2002, n = 1036; 2003, n = 511; 2004, n = 528; 2005, n = 942; 2009, n = 677; 2011, n = 261; 2012, n = 386; 2015, n = 111; 2016, n = 975; 2017, n = 442; 2018, n = 559; 2019, n = 197

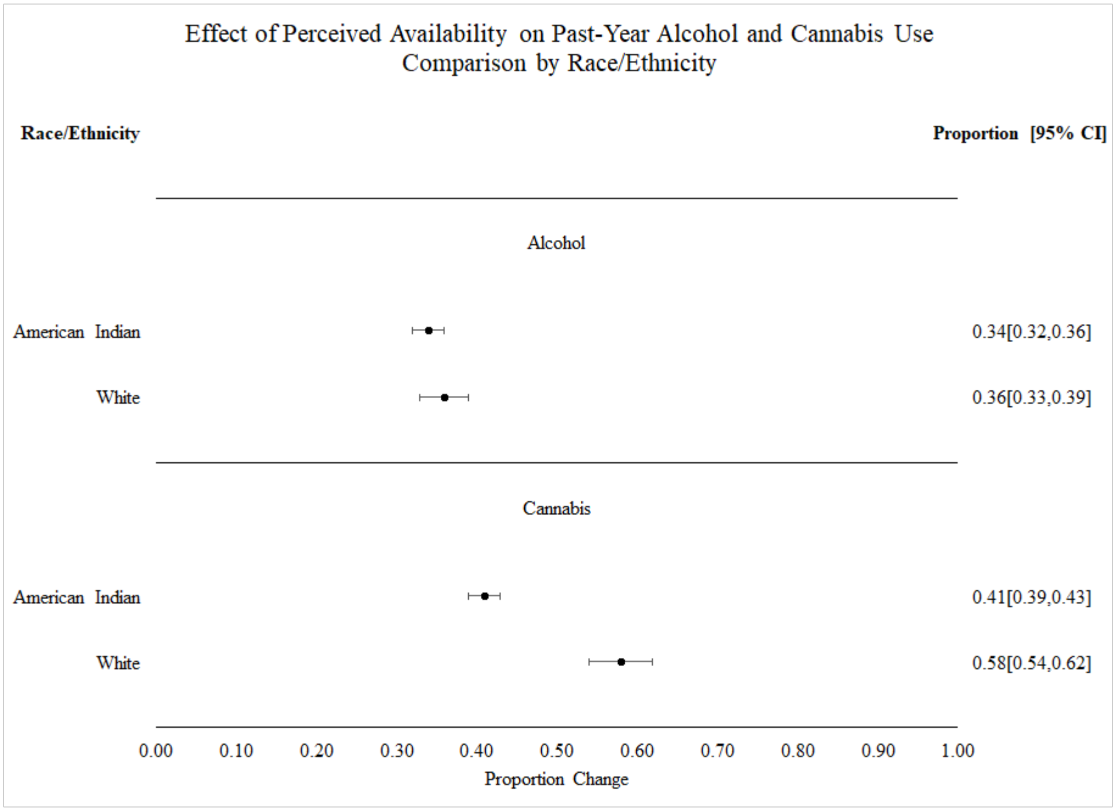


Note: Sample sizes for each year: 1993, n = 960; 1994, n = 413; 1996, n = 120; 1997, n = 651; 1999, n = 129; 2000, n = 82; 2001, n = 508; 2002, n = 1013; 2003, n = 505; 2004, n = 529; 2005, n = 948; 2009, n = 670; 2011, n = 253; 2012, n = 377; 2017, n = 443; 2018, n = 562; 2019, n = 198

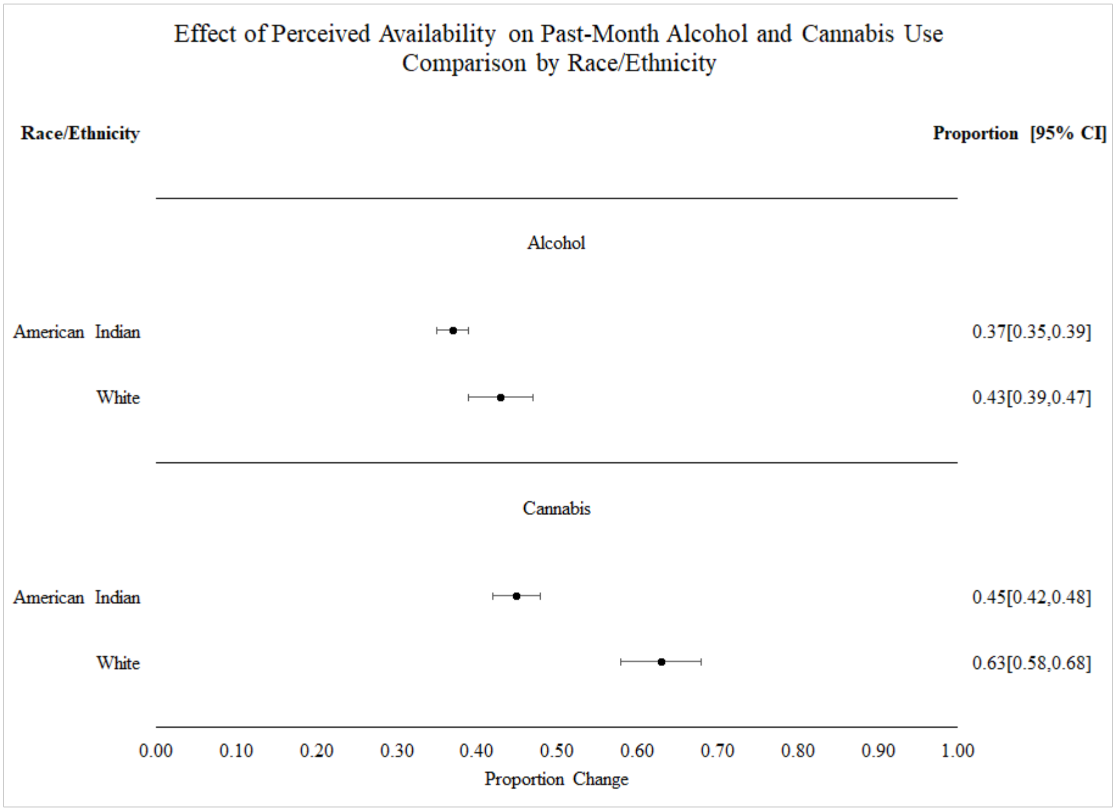
APPENDIX Q

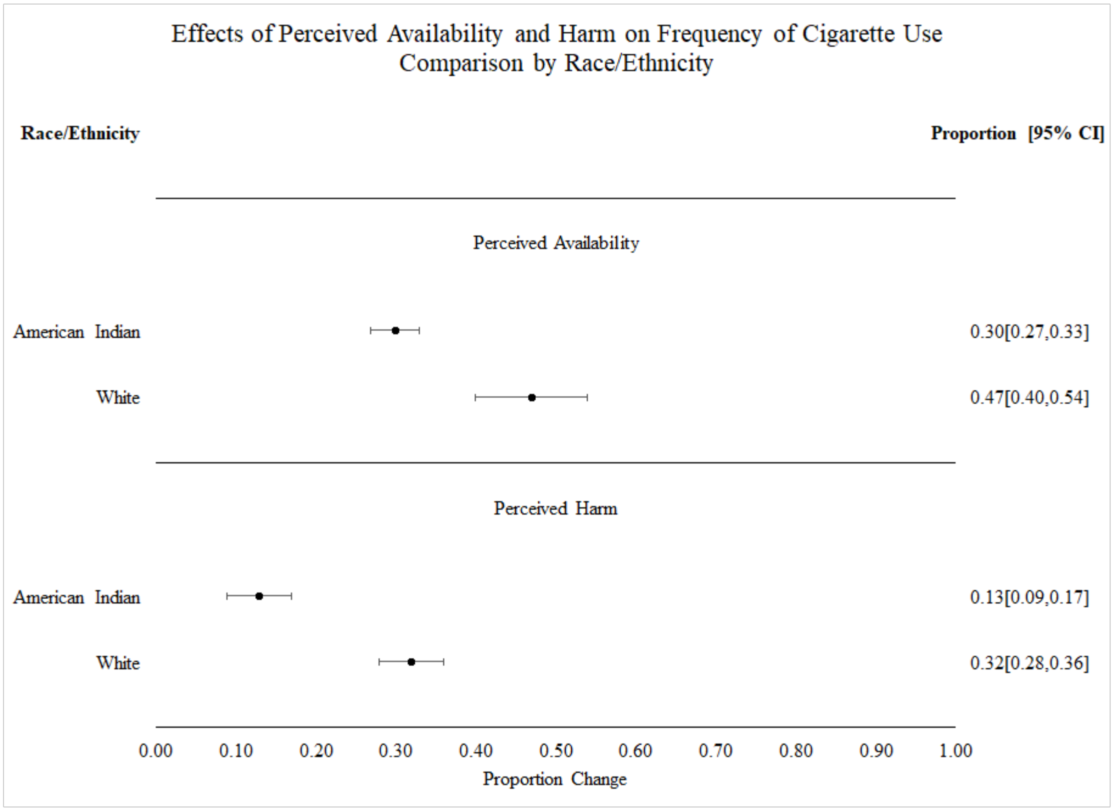
Aim 3: Comparisons of Effects for Perceived Availability and Perceived Harm for All Substances by Race/Ethnicity

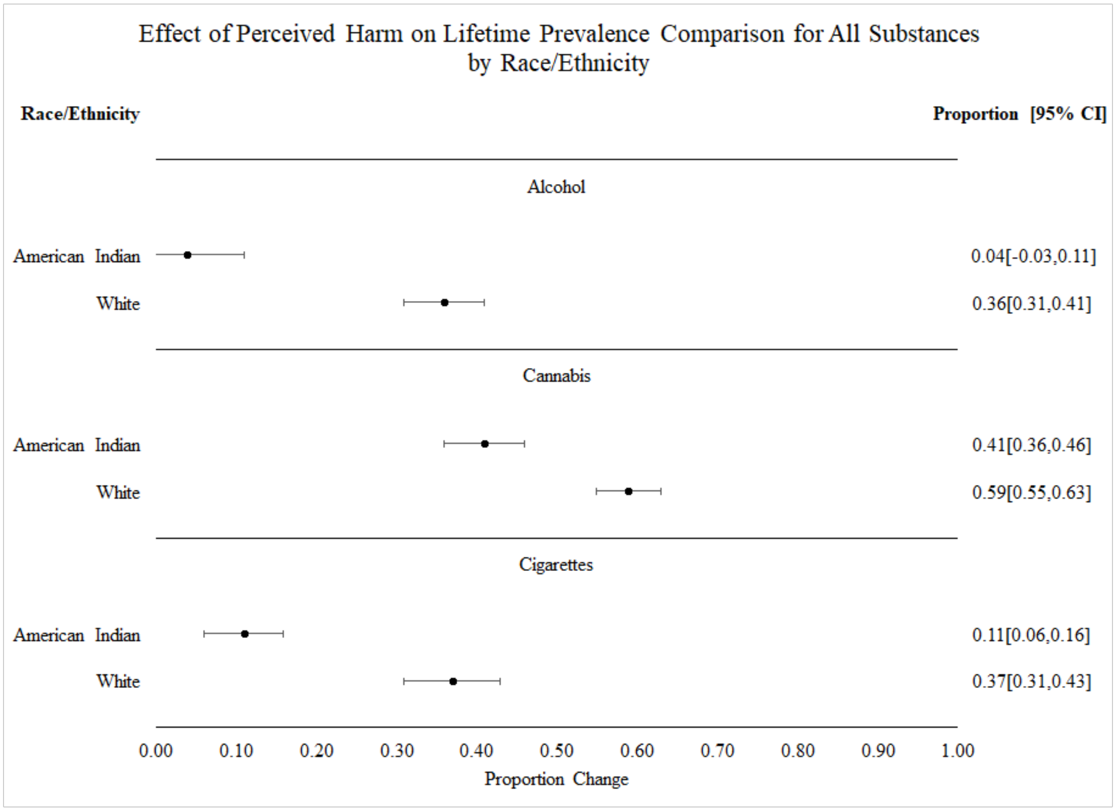

Effect of Perceived Availability on Lifetime Prevalence Comparison for All Substances by Race/Ethnicity
Race/Ethnicity
Proportion [95% CI]
Alcohol
American Indian
0.44[0.42,0.46]
White
0.44[0.40,0.48]
Cannabis
American Indian
0.53[0.52,0.54]
White
0.57[0.53,0.61]
Cigarettes
American Indian
0.39[0.36,0.42]
White
0.43[0.37,0.49]
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Proportion Change

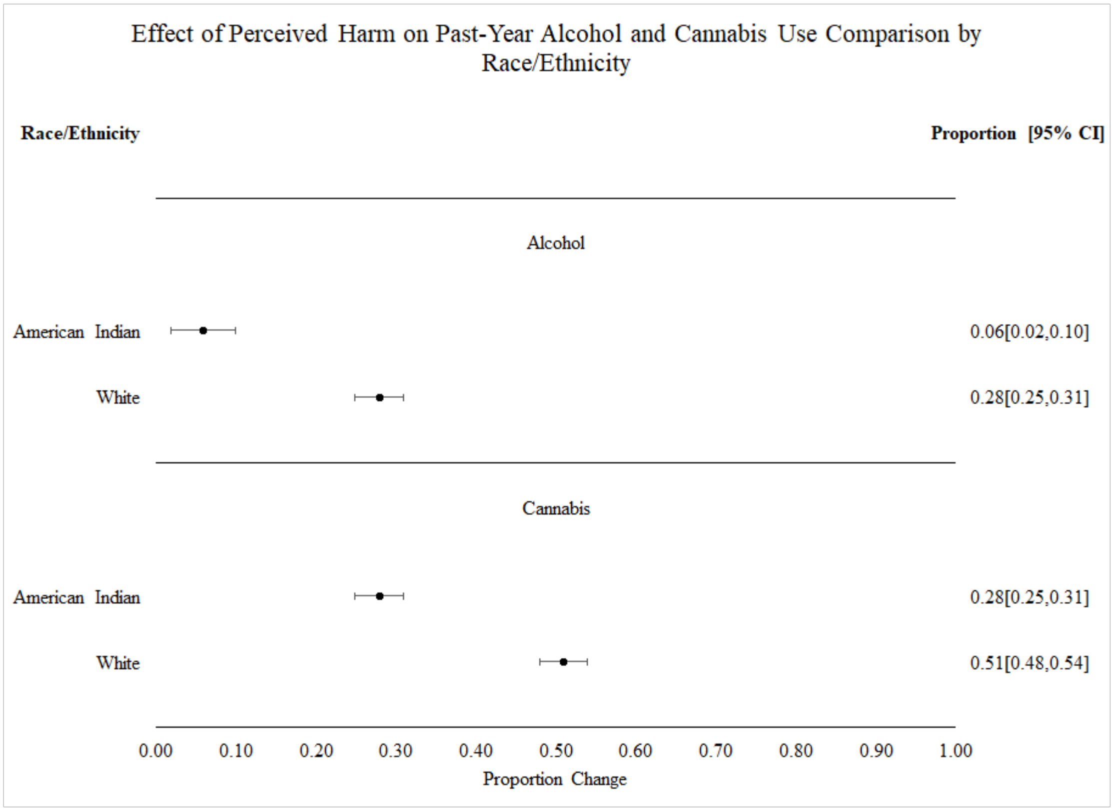


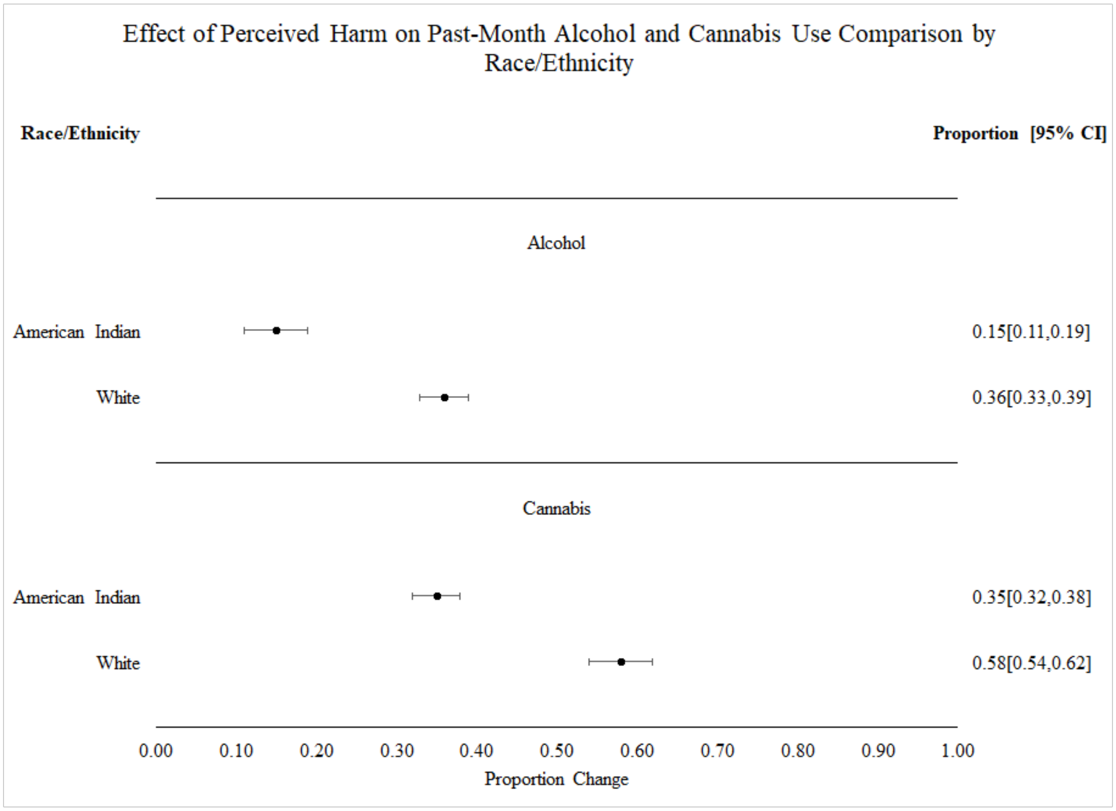
Effect of Perceived Availability on Past-Year Alcohol and Cannabis Use
Comparison by Race/Ethnicity
Race/Ethnicity
Proportion [95% CI]
Alcohol
American Indian
0.34[0.32,0.36]
White
0.36[0.33,0.39]
Cannabis
American Indian
0.41[0.39,0.43]
White
0.58[0.54,0.62]
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Proportion Change


Effect of Perceived Availability on Past-Month Alcohol and Cannabis Use
Comparison by Race/Ethnicity
Race/Ethnicity
Proportion [95% CI]
Alcohol
American Indian
0.37[0.35,0.39]
White
0.43[0.39,0.47]
Cannabis
American Indian
0.45[0.42,0.48]
White
0.63[0.58,0.68]
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Proportion Change


Effects of Perceived Availability and Harm on Frequency of Cigarette Use
Comparison by Race/Ethnicity
Race/Ethnicity
Proportion [95% CI]
Perceived Availability
American Indian
0.30[0.27,0.33]
White
0.47[0.40,0.54]
Perceived Harm
American Indian
0.13[0.09,0.17]
White
0.32[0.28,0.36]
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00
Proportion Change


Effect of Perceived Harm on Lifetime Prevalence Comparison for All Substances by Race/Ethnicity
Race/Ethnicity
Proportion [95% CI]
Alcohol
American Indian
0.04[-0.03,0.11]
White
0.36[0.31,0.41]
Cannabis
American Indian
0.41[0.36,0.46]
White
0.59[0.55,0.63]
Cigarettes
American Indian
0.11[0.06,0.16]
White
0.37[0.31,0.43]
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00
Proportion Change


Effect of Perceived Harm on Past-Year Alcohol and Cannabis Use Comparison by Race/Ethnicity
Race/Ethnicity
Proportion [95% CI]
Alcohol
American Indian
0.06[0.02,0.10]
White
0.28[0.25,0.31]
Cannabis
American Indian
0.28[0.25,0.31]
White
0.51[0.48,0.54]
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Proportion Change


Effect of Perceived Harm on Past-Month Alcohol and Cannabis Use Comparison by Race/Ethnicity
Race/Ethnicity
Proportion [95% CI]
Alcohol
American Indian
0.15[0.11,0.19]
White
0.36[0.33,0.39]
Cannabis
American Indian
0.35[0.32,0.38]
White
0.58[0.54,0.62]
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Proportion Change