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## Trends in typologies of concurrent alcohol, marijuana, and cigarette use among US adolescents: An ecological examination by sex and race/ethnicity



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### ABSTRACT

Substance use during adolescence is a public health concern due to associated physical and behavioral health consequences. Such consequences are amplified among concurrent substance users. Although sex and racial/ethnic differences in single-substance use have been observed, the current literature is inconclusive as to whether differences exist in the prevalence of concurrent use. The current study used data from the 2011–2014 National Survey on Drug Use and Health to examine typologies (single and concurrent patterns) of alcohol, marijuana, and cigarette use among current adolescent users age 12–18 by sex and race/ethnicity. Participants were 14,667 White, Hispanic, African American, Asian, and Native American adolescents. The most common typology was alcohol only, followed by concurrent use of alcohol and marijuana. Weighted prevalence estimates indicated that adolescent females were more likely to be current users of alcohol only, whereas male adolescents were more likely to belong to all other typologies. Compared to Whites, racial/ethnic minorities had larger proportions of marijuana only users and were generally less likely than or equally likely to be concurrent users. One exception was for African American adolescents, who were more likely to be alcohol and marijuana users than their White counterparts. Results suggest that concurrent substance use is common among U.S. adolescents, making up over 40% of past-month use, but typologies of use vary by sex and race/ethnicity. Preventive interventions should consider all typologies of use rather than only single substance exposures and address patterns of use that are most pertinent to adolescents based on sex and race/ethnicity.

### 1. Introduction

Alcohol, marijuana, and cigarettes are the most commonly used substances among school-aged adolescents in the United States, with current national data indicating annual prevalence rates of 24%, 13%, and 13% respectively among individuals age 12–17 (Miech et al., 2016). To date, most of the research on risk for substance use disorders (SUDs) among adolescents has examined each substance in isolation. However, substance use often occurs concurrently, with 11–15% of adolescents reporting past-year use of alcohol, marijuana and cigarettes (A + M + C; Tomczyk et al., 2016). Moreover, the Substance Abuse and Mental Health Services Administration (SAMHSA, 2015c) documented that 51% of binge drinkers age 12–17 report past-month cigarette use, compared to 2% of same-aged non-drinkers. Similarly, 30% of binge drinkers and 56% of cigarette users in the past month report marijuana use in the same period (SAMHSA, 2015c).

Examining concurrent substance use—or the use of two or more substances within a specified time period—during adolescence is critical, as adolescents who engage in concurrent use are at increased risk

for negative health and social consequences compared to those who are single-substance users. For example, concurrent users of alcohol and cigarettes (A + C) are more likely to use illicit drugs, experience social consequences, engage in delinquency, have poorer health, and more treatment utilization than single-substance users (Hoffman et al., 2001; Johnson and Richter, 2002). The increased risk posed by concurrent A + C use also persists into adulthood, predicting more deviant and violent behavior, greater problems related to substance use, and a greater likelihood of arrest by age 29 compared to those adolescents who use alcohol only (AO) by late adolescence (Orlando et al., 2005).

Similar results have been found among concurrent alcohol and marijuana (A + M) and marijuana and cigarettes (M + C) users. Specifically, compared to adolescent AO users, A + M users report higher rates of substance use (Chun et al., 2010), psychological distress (Conway et al., 2013; Kelly et al., 2015a), and behavioral problems (Shillington and Clapp, 2002). Moreover, compared to AO use, A + M use during adolescence is associated with greater risk for SUD (Green et al., 2016; Moss et al., 2014), high-school non-completion, and having a criminal record in young adulthood (Green et al., 2016; Kelly et al.,

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2015b). Although studied less than A + M use, M + C use during adolescence has also been associated with more severe consequences than single substance use, including greater psychological distress and respiratory problems (Ramo et al., 2012). Among adolescents, M + C use has been found to be more strongly associated with depression, other psychiatric disorders (Boys et al., 2003), and neurocognitive deficits than marijuana only (MO) use or cigarette only (CO) use (Jacobsen et al., 2007). M + C users are also less likely to be involved in prosocial activities (e.g., sports) and report academic achievement (Suris et al., 2007). Yet, when comparing all typologies of use, the greatest risk for health and functional consequences has been found among youth who engage in concurrent use of all three substances. A + M + C use is associated with higher levels of psychological distress (Kelly et al., 2015a), school non-completion (Kelly et al., 2015b) and SUD in adulthood relative to single- and dual-substance use (Moss et al., 2014).

Researchers have also documented differences in single and concurrent patterns of substance use based on sex and race/ethnicity. In general, male adolescents report higher rates of daily alcohol, marijuana, and cigarette use than female adolescents (Lanza et al., 2015; Miech et al., 2016). As for concurrent use, the most consistent sex effect has been found for occasional concurrent users (i.e., lifetime users of alcohol, marijuana and cigarettes, with little recent concurrent use), who are more likely to be female than male (Connell et al., 2010; Gilreath et al., 2014; Gilreath et al., 2015). However, findings have been mixed regarding sex differences in the frequent/recent use of alcohol, marijuana and cigarettes. Gilreath et al. (2014) and Gilreath et al. (2015) found that males were more likely to be frequent/current users of A + M + C than females, whereas Connell et al. (2010) found the opposite sex effect. Sex differences have also been equivocal regarding M + C use (Ramo et al., 2012); whereas some studies have found that male adolescents are more likely to be M + C users than females (Guxens et al., 2007; Victoir et al., 2007), others have found the opposite sex effect (Lanza et al., 2015; Suris et al., 2007), or no sex effect (Aung et al., 2004).

Racial/ethnic differences in adolescent substance use have also been observed. Asian, Hispanic, and African American youth, in general, report lower rates of 30-day use of alcohol, marijuana, and cigarette use than their White peers (Miech et al., 2016; Wallace et al., 2002; Wallace et al., 2003). Conversely, Native American adolescents tend to report higher rates of marijuana and cigarette use than White and other racial/ethnic minority adolescents, and report rates of alcohol use comparable to those of White adolescents (Wallace et al., 2002; Wallace et al., 2003).

Prevalence of concurrent use has been found to hold a similar pattern for Asian adolescents, who show less A + M (Collins et al., 1998; Lanza et al., 2010) A + C (Hoffman et al., 2001), and M + C use than White and other racial/ethnic minority adolescents (Ramo et al., 2012). However, findings regarding racial/ethnic differences in concurrent use have been mixed for Hispanic, African American and Native American youth. Some researchers have noted no difference in substance use typology between White and Hispanic adolescents (Lanza et al., 2010), whereas several others have suggested that Hispanic youth are more likely to be concurrent substance users than Whites (Connell et al., 2009; Gilreath et al., 2014; Gilreath et al., 2015). Among African American adolescents, several studies have documented a lower prevalence of concurrent substance use compared to White adolescents (Connell et al., 2009; Gilreath et al., 2015; Lanza et al., 2010; Tomczyk et al., 2016). However, when examining typology of concurrent use, researchers have found variability in risk between African American and White adolescents. For example, African American adolescents have been found less likely to be concurrent users of A + M (Chung et al., 2013; Lanza et al., 2010; Terry-McElrath et al., 2013) and A + C than their White counterparts (Orlando et al., 2005), but more likely to be users of M + C (Aung et al., 2004; Ramo et al., 2012; Vaughn et al., 2008; Young and Harrison, 2001). Lastly, research examining

differences in concurrent substance use between Native American adolescents and adolescents of other racial/ethnic groups are sparse, with equivocal findings. For example, a study comparing adolescents from two Native American tribes to nationally-representative data found that adolescents in one tribe had similar patterns of use to the national population, whereas adolescents in the other tribe were more likely to be past-year concurrent substance users than the national population (Whitesell et al., 2006).

Thus, although sex and racial/ethnic differences in adolescent substance-use typologies have been documented, conclusions are indefinite (see Appendix A, Table 1). The variability in results in the current literature may be due to differences in the sample (e.g., age, region, racial/ethnic composition), operationalization of substance use (which ranges from past two weeks to lifetime use), methodology (e.g., mixture modeling versus population estimates), and the typology of concurrent use examined (Conway et al., 2013; Tomczyk et al., 2016). Only one study to date has examined membership in all possible classes of single and concurrent use of alcohol, marijuana, and cigarettes based on sex and race/ethnicity. Among adolescents under age 16, Moss et al. (2014) found that male adolescents were most likely to be lifetime A + M users, whereas females were most likely to be CO users. The researchers also found that African American adolescents were more than twice as likely to belong to the lifetime MO typology than any other typology, whereas Whites were least likely to have engaged in lifetime MO use. White adolescents were most likely to have engaged in typologies characterized by single or concurrent alcohol and cigarette use (i.e., AO, CO, A + C, A + M + C), whereas African American and Hispanic adolescents were more likely to have engaged in typologies characterized by marijuana use (i.e., MO, M + C, A + M, A + M + C). However, this study was limited in that it excluded Native American and Asian American adolescents, and sex and race/ethnicity comparisons were conducted within-group rather than comparing differences between groups.

Thus, the current study seeks to expand this work by documenting the national prevalence of substance-use typologies (both single and concurrent) among current adolescent users and comparing prevalence rates across sex and race/ethnicity. Specifically, data from the 2011–2014 National Survey on Drug use and Health (NSDUH) will be utilized to examine the following: 1) the 30-day prevalence of single and concurrent patterns of adolescent use of alcohol, cigarettes and marijuana by age, sex, and race/ethnicity; and 2) racial/ethnic and sex differences in the prevalence rates of various typologies of adolescent substance use.

## 2. Material and methods

### 2.1. Data and sample

Data were compiled from public-use data files from the 2011–2014 NSDUH (SAMHSA, 2012, 2013, 2014, 2015b), a series of population surveys providing annual nationwide data on substance use patterns in the United States. NSDUH interviews are administered by computer-assisted personal interviewing and audio computer-assisted self-interviewing for illegal drug use and other health-related behaviors (see SAMHSA (2015a) for more detailed survey methodology). Over the 4-year period, 224,096 responses were obtained from subjects who were 12 or older. These represented an average annual US population, ages 12 and older, of 261,292,647. For the current analysis, we only considered participants aged 12–18 years who reported past 30-day use of alcohol, tobacco or marijuana and identified as non-Hispanic White, Hispanic, non-Hispanic African American/Black, non-Hispanic Asian, or non-Hispanic Native American/Alaska Native. Participants who endorsed past-30-day use of illicit drugs other than marijuana were also excluded (n = 883). There were 14,667 participants who met these criteria, representing an average annual population of 5,841,802. The size of the population represented by the sample was computed by taking account of NSDUH survey designs over the study period.

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