Perceived Cannabis Use Norms and Cannabis Use among Adolescents in the United States

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Abstract

Due to changes in cannabis policies, concerns about cannabis use (CU) in adolescents have increased. The population of nonwhite groups is growing quickly in the United States. We examined perceived CU norms and their association with CU and CU disorder (CUD) for White, Black, Hispanic, Native-American, Asian-American, Native Hawaiian/Pacific Islander (NH/PI), and mixed-race adolescents. Data were from adolescents (12–17 years) in the 2004–2012 National Surveys on Drug Use and Health (N=163,837). Substance use and CUD were assessed by computer-assisted, self-interviewing methods. Blacks, Hispanics, Native-Americans, and mixed-race adolescents had greater odds of past-year CU and CUD than Whites. Among past-year cannabis users (CUs), Hispanics and Native-Americans had greater odds of having a CUD than Whites. Asian-Americans had the highest prevalence of perceived parental or close friends' CU disapproval. Native-Americans and mixed-race adolescents had lower odds than Whites of perceiving CU disapproval from parents or close friends. In adjusted analyses, adolescent's disapproval of CU, as well as perceived disapproval by parents or close friends, were associated with a decreased odds of CU in each racial/ethnic group, except for NHs/PIs. Adolescent's disapproval of CU was associated with a decreased odds of CUD among CUs for Whites (personal, parental, and close friends' disapproval), Hispanics (personal, parental, and close friends' disapproval), and mixed-race adolescents (personal, close friends' disapproval). Racial/ethnic differences in adolescent CU prevalence were somewhat consistent with adolescents'

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reports of CU norm patterns. Longitudinal research on CU health effects should oversample nonwhite adolescents to assure an adequate sample for analysis and reporting.

Introduction

Concerns about cannabis use (CU) and its potential adverse health effects have increased (Volkow et al., 2014). Nationally, approximately 13% of adolescents aged 12–17 used cannabis in the past year (SAMHSA, 2014a). To date, 23 states and Washington DC have legalized marijuana for medical use, and four states allow recreational use. The direct impact of cannabis-related policies on adolescent CU is a topic of current investigation (Choo et al., 2014; DuPont and Lieberman, 2014). The Monitoring the Future (MTF) study shows a continued pattern in recent years of a decline in perceived risk of CU and an increase in CU prevalence among 8th, 10th, and 12th graders, while the prevalence of cigarette and alcohol use has declined (Johnston et al., 2014). When considering the number of days of substance use in the past year, on average cannabis-using adolescents used cannabis more frequently than adolescent users of other substances that used alcohol or other drugs (Wu et al., 2011a). CUD is the primary substance use problem among adolescents in the clinic setting (Wu et al., 2011b); 89% of adolescent facilities admissions reported by the national Treatment Episode Data Set (TEDS) involving CU (SAMHSA, 2014b).

CU among adolescents is a particular concern. CU may impair short-term memory, judgment and motor coordination, potentially interfering with learning, relationships, or driving skills (increasing injuries or deaths) (Brady and Li, 2014; Volkow et al., 2014). Chronic CU among adolescent-onset CUs (e.g., earlier onset, longer duration of use) is associated with increases risk for addiction, altered brain development, low intelligence quotient, or poor educational outcomes (Gruber et al., 2014; Meier et al., 2012; Volkow et al., 2014). Although the mechanisms are inherently difficult to determine, interactions among early CU and substance-related problems (greater exposure to cannabis or other substances; coexisting mental or medical problems) may contribute to the likelihood of experiencing poor health or education outcomes (Gruber et al., 2014; Meier et al., 2012; Volkow et al., 2014). Preventing or reducing CU in adolescents is critical.

Changes in state laws on medical or recreational cannabis use may contribute to changes in adolescents' access to cannabis and CU norms (e.g., more tolerant of CU, less perceived disapproval of CU) (Friese and Grube, 2013; Thurstone et al., 2011). Messages about medical cannabis legalization or discrimination of CU may reflect liberal community norms regarding CU in general, and research data suggest that CU norms in the community (e.g., parents', peers' approval) are related to adolescent CU (Friese and Grube, 2013). Prior research on college students shows that perceived friends' approval of alcohol use (social norms) is associated with an increased likelihood of alcohol use (Larimer et al., 2004; Lee et al., 2007). Similarly, perceived parental or friends' approval of CU is associated with an

elevated CU prevalence among college students (Neighbors et al., 2008; Labrie et al., 2011). While CU norms among adolescents are understudied, prior studies suggest that adolescents' perceptions of their parents' or peers substance use or norms may influence adolescents' substance use (Fisher and Bauman, 1988; Iannotti and Bush, 1992; Iannotti et al., 1996). CU norms may be influenced by community's drug use level or norms (e.g., family, peers'), adolescents' substance use, and cannabis availability (Bahr et al., 2005; Bandura, 1977; Donohew et al., 1999; Iannotti and Bush, 1992; Iannotti et al., 1996; Sieving et al., 2000). Drug use norms of a proximal reference group (e.g., close friends) is associated with adolescents' intention towards substance use (Olds et al., 2005). Additionally, self-reports of peers' drug use norms were found to be reliable and strongly correlated with youth's own drug use behaviors (Flom et al., 2011). In a study of 180 heavy CUs who participated in a treatment trial, perceived close friends' approval of CU was positively associated with CU (Walker et al., 2011). Taken together, adolescent's perceived CU norms appear to be an important correlate of CU.

The population of minority groups is growing quickly in the United States (Humes et al., 2011). Partly due to immigration-related increases in racial/ethnic diversity and inter-racial marriage, the population of nonwhites and mixed-race individuals has risen substantially (Lee and Bean, 2004; Wang 2012). The population of foreign-born individuals rose from 14 million in 1980 to 40 million in 2010 (Grieco et al., 2012). Between 2000 and 2010, the total United States population increased by 9.7% (a 5.7% increase among single-race Whites), compared with an increase of 43.3% among Asian-Americans, 35.4% among NHs/PIs, 32.0% among mixed-race individuals (2 races), 18.4% among Native-Americans, ad 12.3% among Blacks (Humes et al., 2011). The overall Hispanic population size increased by 43.0% (Humes et al., 2011). The growth in the population size indicates a mounting burden in behavioral healthcare needs. Minority groups on average have poorer access to behavioral healthcare than Whites, due to culture-related stigma or attitudes towards behavioral health treatment, language or financial barriers, immigration-related concerns, and lack of culturally or linguistically congruent providers and interventions (Edwards et al., 2010; Grieco et al., 2012; Ida et al., 2012; Masson et al., 2013; National Center for Health Statistics, 2012; Novins et al., 2011).

In conjunction with changes in cannabis policies, the increase in the CU prevalence among students in the MTF study indicates the need to examine CU norms and CU for nonwhite adolescents. The MTF reports have not tracked CU and related measures for Native-Americans (American Indians, Alaska Natives), Asian-Americans, NHs/PIs, and mixed-race adolescents (Johnston et al., 2014). Findings from United States high school seniors in 2001–2011 MTF datasets reveal a disturbing trend in vehicle driving after CU: in 2011, more high school seniors reported driving after CU in the past 2 weeks (12.4%) than after using alcohol (8.7%) or drugs other than marijuana (3.0%) (O'Malley and Johnston, 2013). Blacks had greater odds than Whites of driving after CU (O'Malley and Johnston, 2013). Another study of individuals aged 12 years suggest that CU problems are more prevalent in nonwhites than whites (Wu et al., 2014). The TEDS reports combine Asian-Americans and NHs/PIs as a group and omit mixed-race individuals (SAMHSA, 2014b). In the 2014 TEDS report, cannabis generally accounts for greater treatment admissions for nonwhite groups (Black 28.2%, Hispanic, 22.8%, Asian-American/NH/PI 21.2%, Native-American 13.2%)

than Whites (12.7%) (SAMHSA, 2014b), indicating a pattern of CU problems among nonwhite groups.

To address the limitation of sample size for these groups, we analyzed public-use datasets from 2004–2012 National Surveys on Drug Use and Health (NSDUH). These survey years use the same questions to assess adolescents' CU norms and CU, permitting the analysis of the pooled sample to generate population-based estimates for CU norms and CU. We examined whether adolescents' perceived CU norms (adolescent's, close friends', and parental disapproval of CU) differed by racial/ethnic group, and determined whether CU norms were associated with CU in the sample and with CUD among past-year CUs. Due to a lack of research on comparing CU norms for various racial/ethnic groups, we stratified the analysis by race/ethnicity to provide CU norms and CU estimates for each group.

2. Methods

2.1. Data source

The NSDUH is a national survey designed to provide ongoing estimates of drug use and disorders in the United States (SAMHSA, 2013). The survey uses multistage area probability sampling methods to select a representative sample of the civilian, non-institutionalized population aged 12 years. Target populations include residents of households from all 50 states (including shelters, rooming houses, and group homes) and civilians residing on military bases. The design oversamples people aged 12–25. Due to a large sample size in recent surveys, there was no need to oversample racial/ethnic groups, as was done before 1999. The NSDUH's annual sample of respondents was considered representative of the United States general population aged 12 years. NSDUH is the only ongoing national survey that includes consistent CUD assessments to allow analysis of CUD for understudied minority groups.

NSDUH respondents were interviewed in their home for about an hour. They were assured that their names would not be recorded and their responses would be kept strictly confidential, and all study procedures and protections were carefully explained. Respondents' demographics were assessed by computer-assisted personal interviews. Other survey questions were assessed using an audio computerassisted self-interviewing method to increase respondents' reports of substance use and sensitive behaviors (Turner et al., 1998). The latter was designed to increase honest reports of substance use by allowing respondents to either read the questions on a computer screen or listen to the questions read aloud by the computer through headphones, and then enter their responses directly into the computer.

Due to small samples of Native-Americans, Asian-Americans, NHs/PIs, and mixed-race individuals, we pooled public-use datasets from the 2004–2012 NSDUH to detect racial/ethnic differences in CU norms, CU, and CUD. These years used similar designs and allowed pooled analyses of the same variables (SAMHSA, 2005, 2013). Weighted response rates of household screening and interviewing for these years were 86–91% and 73–77%, respectively. About 18,000–19,000 adolescents aged 12–17 were included in the annual public-use dataset; the pooled sample included 98,067 Whites, 22,492 Blacks, 28,230

Hispanics, 5055 Asian-Americans, 708 NHs/PIs, 6768 mixed-race individuals, and 2517 Native-Americans (N=163,837).

2.2. Study variables

Demographics—Self-reported race and ethnicity were assessed separately. The NSDUH defined seven mutually exclusive racial/ethnic groups: non-Hispanic White; non-Hispanic Black; non-Hispanic Native-American (American Indians, Alaska Natives); non-Hispanic Asian-American; non-Hispanic Native Hawaiian/Pacific Islander; mixed-race (2 races); and Hispanic. The dataset did not distinguish between specific racial/ethnic groups of mixed-race individuals, the majority of which were White in combination with another race (Black 20%, Asian-American 18%, Native-American 16%, other 19%) in the 2010 census (Humes et al., 2011). We included adolescents' age, sex, and family characteristics (family income, government assistance status), as well as residential location (county type) in the adjusted analysis to account for their potential confounding effects on CU estimates (Duncan et al., 2014; Duncan et al., 2002; Wilson and Donnermeyer, 2006; Pedersen et al., 2013). Government assistance included participation in any government assistance programs (supplemental security income, food stamps, cash assistance).

CU norms—The 2004–2012 NSDUHs used consistent assessments to evaluate adolescent's perceived CU norms. Each adolescent was queried regarding whether he/she disapproves peers of his/her age trying marijuana or hashish once or twice, whether the adolescent perceives close friends' disapproval of his/her trying marijuana or hashish once or twice, and whether the adolescent perceives strong parental disapproval of his/her trying marijuana or hashish once or twice; the responses were dichotomized.

CU and CUD—Standard questions about use and Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) CUD (abuse or dependence) (American Psychiatric Association, 2000) were assessed via an audio computer-assisted self-interviewing method. CU was defined as any self-reported use of marijuana or hashish. We examined past-year CU and CUD to reflect recent or active use. For logistic regression analyses of past-year CU, we examined correlates of CU 2 days/year to focus on adolescents with a tendency of using cannabis repeatedly (Kelly et al., 2014).

Other behavioral health—Adolescents' past-year tobacco use (cigarettes, chewing tobacco, snuff, dip, cigars, or pipe tobacco), past-year alcohol use, and history of major depressive episode (MDE) were included as control variables, due to their association with CU (Volkow et al., 2014). Questions assessing adolescent MDE were based on DSM-IV criteria and were adapted from the National Comorbidity Survey-Adolescent (Kessler et al., 2005). An adolescent with a lifetime MDE was defined by whether he/she had 5 of nine symptoms for MDE in the same two-week period in his/her lifetime, in which at least one of the symptoms was a depressed mood or loss of interest or pleasure in daily activities. MDE is among the most prevalent mental conditions among adolescents (Wu et al., 2011b) and is the only DSM-IV (non-addictive) mental health variable systematically assessed by NSDUH for adolescents. We used updated public-use datasets released in 2013, as they permitted

pooled analyses of MDE variables from 2004–2012. Prior survey variables are not comparable for the pooled analysis.

2.3. Data analysis

We examined racial/ethnic differences in sociodemographics and behavioral health. We determined the CU and CUD prevalence in the sample. We then explored whether there were differences in CU norms by survey year and race/ethnicity. We conducted logistic regression analyses to determine the strength of associations between CU norms and CU for each racial/ethnic group. Among past-year CUs, we examined whether CU norms were associated with CUD. We summarize adjusted results (controlled for age, sex, family income, government assistance, county type, MDE, tobacco use, alcohol use, survey year) to lessen their confounding effects on estimated associations. All analyses considered NSDUH's complex designs (weighting, clustering) (RTI, 2012). All results are weighted except for sample sizes (unweighted N).

3. Results

3.1. Demographics and behavioral health prevalence (Table 1)

Compared with Whites, there was a higher proportion of young adolescents aged 12–13 in the mixed-race and Hispanic groups. Compared with Whites (13.83%), higher proportions of nonwhite groups (except for Asian-Americans, 14.36%) received government assistance (26.74–44.09%). The Native-American group had the highest proportion of individuals residing in non-metropolitan areas; other nonwhite groups had a higher proportion than Whites of residing in large metropolitan areas.

Mixed-race adolescents had the highest prevalence of lifetime MDE (16.95%), while Asian-Americans (10.91%) and NHs/PIs (10.69%) had a lower prevalence of MDE than Whites (13.20%). Native-Americans had the highest prevalence of past-year tobacco use (30.67%), followed by Whites (22.57%) and mixed-race adolescents (20.57%). Whites had the highest prevalence of past-year alcohol use (33.40%). Native-Americans (21.86%) and mixed-race adolescents (18.15%) had a higher prevalence of past-year CU than Whites (14.22%), Hispanics (13.29%), Blacks (12.72%), NHs/PIs (11.90%), and Asian-Americans (5.36%). A small proportion of adolescents only used cannabis once in the past year (ranging from 0.85% among Asian-Americans to 2.10% among mixed-race adolescents). After excluding adolescents who only used cannabis once (ranging from 5.4% among NH/PI CUs to 16.0% of Asian-American CUs), the prevalence of CU (2 days/year) ranged from 20.20% among Native-Americans to 4.51% among Asian-Americans. Native-Americans (6.67%) and mixed-race adolescents (5.09%) had a higher prevalence of past-year CUD than others (Hispanics 3.72%, Whites 3.62%, NHs/PIs 3.37%, Blacks 2.82%, and Asian-Americans 1.21%). There were no significant racial/ethnic differences in the conditional CUD prevalence among past-year CUs (White 25.43%, Black 22.14%, Hispanic 27.96 %, Native-American 30.50%, NH/PI 28.34%, Asian-American 22.54%, mixed-race 28.02%).

3.2. Racial/ethnic differences in CU and CUD (Table 2)

To adjust for confounding influences (age, sex, family income, government assistance, county type, MDE, tobacco use, alcohol use, survey year) on estimated associations, we conducted logistic regression analyses to determine racial/ethnic differences in CU and CUD. Asian-Americans had lower odds of CU (2 days/year) than Whites, while Blacks, Hispanics, Native-Americans, and mixed-race adolescents had greater odds of CU (2 days/year) than Whites. Blacks, Hispanics, Native-Americans, and mixed-race adolescents also had greater odds of CUD than Whites. Among past-years CUs, Hispanics and Native-Americans had greater odds of having a CUD than Whites. There was a slight increase in odds of CU (2 days/year) in 2010–2012 compared with its prevalence in 2004.

3.3. Perceived CU norms (Table 3)

There were few yearly differences in adolescents' perceived disapproval of CU (eTable 1). Overall (annual average), Asian-Americans (87.85%) and Blacks (80.77%) reported a higher prevalence of personal disapproval of CU than Whites (79.61%), while mixed-race adolescents (76.38%) reported a lower prevalence of personal disapproval than Whites. Mixed-race adolescents (85.4%) and Native-Americans (83.24%) reported a lower perceived parental disapproval of CU than Whites (88.51%). Mixed-race adolescents (76.41%) and Blacks (78.44%) reported a lower prevalence of perceived close friends' disapproval of CU than Whites (80.17%).

Adjusted for survey year, Asian-Americans were approximately twice as likely as Whites to report personal, parental, or close friends' disapproval of CU, whereas mixed-race adolescents and Native-Americans had lower odds than Whites of reporting personal, parental, or close friends' disapproval of CU. Compared with Whites, Blacks were more likely to report personal disapproval, but less likely to report close friends' disapproval, and Hispanics were more likely to report parental disapproval of CU.

3.4. Association between CU norms and CU (Table 4)

Controlling for survey year, logistic regression analyses showed that adolescent's personal disapproval, parental disapproval, and close friends' disapproval were each associated with lower odds of CU (2 days/year) in each racial/ethnic group. Controlling for survey year, age, sex, family income, government assistance, county type, MDE, tobacco use, and alcohol use, all adolescent's personal, parental, and close friends' disapproval variable remained significant, except for parental disapproval among NHs/PIs.

3.5. Association between CU norms and CUD among CUs (Table 5)

Among past-year CUs, we conducted adjusted logistic regression analyses to determine whether CU norms were associated with CUD, controlling for age, sex, family income, government assistance, county type, MDE, tobacco use, alcohol use, and survey year. Among White (n=14,037) or Hispanic (n=3988) CUs, adolescent's personal, parental, and close friends' disapproval was associated with lower odds of CUD. Among mixed-race (n=1203) CUs, personal and close friends' disapproval was associated with lower odds of CUD. Among Black (n=3033) CUs, adolescent's personal disapproval was associated with lower odds of CUD. Due to a smaller sample size of Asian-American (n=313) and NH/PI

(n=108) CUs, we report adjusted odds ratio (OR), controlling for survey year. Among Asian-American CUs, personal disapproval of CU was associated with decreased odds of CUD. CU norm variables were not associated with CUD among NH/PI or Native-American (n=592) CUs.

4. Discussion

This study presents new national estimates of CU norms and their associations with CU and CUDs among adolescents from seven racial/ethnic groups. Findings have implications for research and intervention in the growing nonwhite populations. *First*, a higher proportion of nonwhites had a lower family income (<$50,000) and resided in a large metropolitan area than Whites. *Second*, Blacks, Hispanics, Native-Americans, and mixed-race adolescents were more likely than Whites to use cannabis (2 days/year), while Asian-Americans were less likely than Whites to use cannabis. *Third*, Asian-Americans were more likely than Whites to report disapproval of CU (personal, parental, or close friends' disapproval), while mixed-race adolescents (personal, parental, or close friends' disapproval), Native-Americans (parental or close friends' disapproval), and Blacks (close friends' disapproval) were less likely than Whites to report disapproval of CU. *Finally*, adolescents' disapproval of CU and perceived disapproval by parents or close friends were associated with decreased odds of CU (all racial/ethnic groups except for NH/PI) and CUD among CUs (Whites, Hispanics).

4.1. What this study adds to our knowledge

Perhaps the most concerning potential effects of cannabis policies are those for adolescents, as early-onset CU or a longer duration of CU may enhance vulnerability to addiction and psychiatric disorders in later life among vulnerable individuals (Hurd et al., 2014; Volkow et al., 2014). Moreover, the 2014 TEDS report shows that as many as seven in eight adolescent admissions to addiction treatment facilities involved CU (SAMHSA, 2014b). While causality remains unclear, there have been concerns about the potential impact of cannabis policies on influencing CU norms, CU, and exposure (Friese and Grube, 2013; Levy, 2013; Monte et al., 2014; Thurstone et al., 2011). Similar to data from students in the MTF study (Johnston et al., 2014), this analysis reveals an increase in the CU prevalence in household samples of adolescents in 2010–2012 versus 2004. The MTF has not tracked past-year CUD, and its reports focus on Whites, Blacks, and Hispanics. This analysis adds national estimates for understudied adolescents by showing that Blacks and Hispanics, as well as Native-Americans and mixed-race adolescents were more likely than Whites to use cannabis (2 days/year). Native-Americans and mixed-race adolescents also had a higher CUD prevalence than Whites. Similarly, addiction treatment data from TEDS found a higher proportion of cannabis-related admissions for nonwhites than Whites (SAMHSA, 2014b). Collectively, future longitudinal research on the health effects of CU should oversample nonwhite adolescents to assure an adequate sample size for analysis and reporting.

There are important racial/ethnic differences in CU norms. The data suggest that adolescents had low odds of using cannabis when they perceived disapproval of CU by their parents or close friends (Bachman et al., 1998; Stryker, 2003). Asian-Americans had the highest prevalence of perceived disapproval of CU and the lowest prevalence of past-year CU and CUD. Community-level drug-use activities, stigmatization towards drug use, or perceptions

of CU norms (parents' or peers') may influence adolescents' attitudes towards CU or actual use (Duncan et al., 2014; Friese and Grube, 2013; Palamar, 2012, 2013). The low level of CU approval in Asian-Americans may be related to their generally low prevalence of drug use in the United States, as well as their culturally high-level stigma towards substance abuse (Fong and Tsuang, 2007; Wu and Blazer, 2014).

Consistent with their low odds of perceiving parental or close friends' disapproval of CU, mixed-race adolescents (18.15%) and Native-Americans (21.86%) had a higher prevalence of CU than other racial/ethnic groups (5.36–14.22%) and a higher CUD prevalence than Whites. On average, Native-Americans are younger, poorer, and less educated than the overall United States population, and are vulnerable to substance use and related problems due to health disparities, stressors, and a lack of culturally congruent treatments for substance use problems (Goodkind et al., 2010; Novins et al., 2011; US Census, 2014; Wu et al., 2011a). Substance misuse intervention needs among mixed-race individuals are also underrecognized because prior research has not typically collected mixed-race status. Recent electronic health records data and surveys suggest that mixed-race adults have a higher level of mental health care needs, substance use problems (especially marijuana), and human immunodeficiency virus infections than Whites (CDC, 2014; Wu et al., 2013a, 2013b, 2014). The perception of drug normality is related to substance use, and some mixed-race or Native-American adolescents may be slightly more likely than Whites to reside in a community where the level of drug use or perceived social norms for CU is higher than other communities (Duncan et al., 2014; Palamar, 2013; Swaim et al., 2013).

According to the theory of planned behaviors, a person's attitudes, norms (perceptions of approval or disapproval for using drugs), and perceived control (self-efficacy) may influence the intention of CU and actual use (Ajzen, 1991; Kam et al. 2009; Malmberg et al., 2012). The inverse association between adolescent's disapproval or perceived disapproval for CU by significant others and lower CU may be related to a higher level of adolescent's confidence in being able to refuse or avoid CU in tempting situations (Malmberg et al., 2012; Walker et al., 2011). Specifically, adolescents with negative attitudes towards CU or more disapproval of CU from their proximal social environments (parents, close friends) may have a higher level of refusal or a lower intention of using cannabis than those who perceive a higher level of CU acceptability (e.g., greater peer influence on CU) (Malmberg et al., 2012; Olds et al., 2005)

4.2. Limitations

Our study has several limitations. NSDUH uses cross-sectional designs to generate representative samples of the non-institutionalized population to provide population-based drug use estimates. Identified associations are estimates, not causality. NSDUH relies on respondents' self-reports, which are influenced by underreporting and memory errors. Additionally, analyses of associations among NHs/PIs are limited by a small sample size. Caution should be used when interpreting estimates for NHs/PIs. Health indicator data in the Healthy People report show that NHs/PIs and Native-Americans have greater health disparities than other racial/ethnic groups (National Center for Health Statistics, 2012). Here, the prevalence of CU and CUD among NHs/PIs are similar to those of Hispanics and

Blacks, emphasizing a need for drug use intervention research (Helm and Okamoto, 2013). Finally, although this study sought to provide population-based CU-related estimates for several understudied groups, it is important to note that each racial/ethnic group is heterogeneous in culture and language. In-depth research is needed to shed light on intra-ethnic group differences in CU and its norms, while taking into account their socioeconomic contexts.

NSDUH also has several strengths. The survey uses detailed probes to augment substance use assessments and includes comprehensive assessments of past-year CU in the national sample. NSDUH implements statistical computation and analysis weights to minimize response inconsistency and adjustment for nonresponse bias (SAMHSA, 2014a). The survey's large sample size provides the unique opportunity for comparing CU norms, CU, and CUD for understudied nonwhite groups. Finally, NSDUH's large sample size allows for generalizability, compared with studies of a smaller-scale.

4.3. Conclusion

This study not only reveals that several minority groups of adolescents (Black, Hispanic, Native-American, and mixed-race) are more likely than Whites to use cannabis, but it also demonstrates the challenge of studying prevention strategies and CU consequences. Adolescents' perceived CU norms (i.e., disapproval of use) are robustly associated with adolescents' CU prevalence across major racial/ethnic groups. Given the evolving and changing state laws in legalization of medical and recreational CU, community-based research is needed to evaluate contextual factors contributing to racial/ethnic variations in CU norms and CU and to help confirm whether perceived community CU norms reflect actual norms and CU in the community. Studies in alcohol use (mainly college students) suggest that norms-based interventions are promising in reducing consumption (Moreira et al., 2009; Perkins et al., 2010). For example, perceptions of peer approval of drinking are malleable with an information-based intervention (Prince and Carey, 2010). In light of an increased number of states that have allowed legalization of medical or recreational cannabis, CU norms among adolescents and nonwhite groups deserve research to inform norms-based interventions. The elevated prevalence of CU among nonwhite adolescents shows the need to monitor their CU prevalence plus CU related problems (e.g., CUD symptoms, cannabis-involved impaired driving, and academic or mental health problems) (Volkow et al., 2014). Prevention research on adolescent CU (e.g., screening and brief intervention), clinical trials of treatment for CUDs, as well as longitudinal studies of health effects of CU should consider oversampling minority adolescents to assure an adequate sample size of nonwhite groups for analysis and dissemination of the findings.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Abbreviations

CU	Cannabis use
MTF	Monitoring the Future Study
NSDUH	National Survey on Drug Use and Health
NH/PI	Native Hawaiians/Pacific Islanders

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HIGHLIGHTS

- There have been increased concerns about adolescent cannabis use (CU).

- We examines adolescent's perceived CU norms and CU in seven racial/ethnic groups.

- Four non-white groups had greater odds of CU and CU disorder than Whites.

- Adolescent CU is associated with adolescent's perceived CU norms.

- The possibility of reducing CU via changing community norms deserves study.

Table 1

Selected characteristics of adolescents aged 12–17 years (N=163,837)

Race/ethnicity	White	Black	Hispanic	Native Hawaiian/Pacific Islander	Asian-American	Native-American	Mixed-race
Unweighted (n)[a] Weighted	n=98,067 % (95% CI)	n=22,492 % (95% CI)[b]	n=28,230 % (95% CI)[b]	n=708 % (95% CI)[b]	n=5055 % (95% CI)[b]	n=2517 % (95% CI)[b]	n=6768 % (95% CI)[b]
Age in years							
12–13	31.49 (31.10–31.88)	32.21 (31.46–32.98)	33.62 (32.75–34.51)	30.21 (23.87–37.42)	30.80 (28.98–32.67)	36.33 (33.27–39.50)	33.95 (32.34–35.60)
14–15	33.99 (33.57–34.42)	33.52 (32.74–34.32)	33.86 (33.06–34.68)	38.09 (31.53–45.13)	35.56 (33.78–37.38)	33.36 (30.35–36.50)	34.00 (32.39–35.64)
16–17	34.52 (34.18–34.86)	34.26 (33.29–35.24)	32.51 (31.71–33.32)	31.69 (26.57–37.30)	33.65 (31.80–35.54)	30.31 (27.24–33.57)	32.06 (30.32–33.84)
Sex							
Male	51.11 (50.70–51.55)	50.66 (49.78–51.55)	51.54 (50.80–52.28)	48.60 (42.19–55.07)	51.31 (49.25–53.36)	51.34 (47.80–54.86)	49.15 (46.78–51.53)
Female	48.89 (48.47–49.30)	49.34 (48.45–50.22)	48.46 (47.72–49.20)	51.40 (44.93–57.81)	48.69 (46.64–50.75)	48.66 (45.14–52.20)	50.85 (48.47–53.22)
Total family income							
<$50,000	35.68 (35.17–36.19)	73.62 (72.67–74.55)	69.79 (68.66–70.89)	63.41 (58.28–68.25)	44.66 (42.43–46.92)	69.37 (66.09–72.46)	48.82 (46.88–50.76)
$50,000–$74,999	20.67 (20.33–21.03)	13.42 (12.89–13.96)	13.53 (12.84–14.26)	16.10 (12.67–20.24)	16.80 (15.46–18.23)	15.39 (12.91–18.25)	20.52 (18.69–22.47)
$75,000+	43.64 (43.10–44.19)	12.96 (12.33–13.63)	16.68 (15.86–17.52)	20.50 (17.03–24.46)	38.54 (36.42–40.69)	15.24 (13.02–17.77)	30.66 (28.76–32.64)
Government assistance, yes	13.83 (13.47–14.19)	44.09 (43.15–45.03)	28.54 (27.63–29.46)	28.95 (23.35–35.28)	14.36 (13.09–15.73)	41.88 (38.54–45.29)	26.74 (24.72–28.86)
County type							
Large metro	43.72 (43.01–44.43)	62.10 (60.80–63.38)	62.72 (61.47–63.95)	54.59 (47.99–61.03)	74.51 (72.46–76.46)	19.78 (16.60–23.40)	47.07 (44.90–49.26)
Small metro	45.65 (44.92–46.38)	32.27 (30.94–33.62)	33.82 (32.53–35.14)	41.56 (35.61–47.77)	24.15 (22.24–26.16)	44.99 (40.19–49.88)	46.74 (44.71–48.78)
Non-metro	10.63 (10.26–11.01)	5.63 (4.88–6.49)	3.46 (3.08–3.89)	3.85 (1.91–7.61)	1.34 (0.94–1.90)	35.23 (30.72–40.03)	6.19 (5.32–7.19)
Major depressive episode, lifetime	13.20 (12.95–13.46)	11.81 (11.28–12.36)	13.16 (12.68–13.65)	10.69 (8.49–13.37)	10.91 (9.78–12.16)	13.62 (11.53–16.03)	16.95 (15.29–18.75)
Past-year tobacco use	22.57 (22.21–22.93)	12.49 (11.98–13.03)	16.60 (15.94–17.29)	14.21 (10.61–18.77)	7.48 (6.40–8.73)	30.67 (27.66–33.86)	20.57 (19.04–22.20)
Past-year alcohol use	33.40 (33.05–33.76)	23.83 (23.06–24.61)	30.88 (30.19–31.59)	27.02 (21.98–32.73)	17.25 (16.01–18.56)	32.27 (29.24–35.46)	31.01 (29.35–32.72)
Past-year cannabis use, 1 day	14.22 (13.96–14.49)	12.72 (12.13–13.33)	13.29 (12.80–13.80)	11.90 (8.73–16.02)	5.36 (4.55–6.31)	21.86 (19.31–24.65)	18.15 (16.64–19.76)

Race/ethnicity	White	Black	Hispanic	Native Hawaiian/Pacific Islander	Asian-American	Native-American	Mixed-race
Unweighted (n)[a] Weighted	n=98,067 % (95% CI)	n=22,492 % (95% CI)[b]	n=28,230 % (95% CI)[b]	n=708 % (95% CI)[b]	n=5055 % (95% CI)[b]	n=2517 % (95% CI)[b]	n=6768 % (95% CI)[b]
Past-year cannabis use, 2 days	12.79 (12.52–13.05)	**11.46 (10.89–12.06)**	12.07 (11.61–12.55)	11.25 (8.15–15.33)	**4.51 (3.77–5.37)**	**20.20 (17.83–22.80)**	**16.05 (14.72–17.48)**
Past-year cannabis use disorder	3.62 (3.47–3.76)	**2.82 (2.53–3.13)**	3.72 (3.40–4.06)	3.37 (2.15–5.62)	**1.21 (0.85–0.73)**	**6.67 (5.29–8.37)**	**5.09 (4.32–5.98)**
Past-year cannabis use disorder in past-year cannabis users	25.43 (24.50–26.38)	22.14 (20.02–24.42)	27.96 (25.90–30.13)	28.34 (18.09–41.07)	22.54 (16.89–29.46)	30.50 (25.29–36.26)	28.02 (24.26–32.13)

[a] Sample size is unweighted; results are weighted estimates.

[b] Boldface: The estimate differed from the estimate among Whites (p<0.05). CI = confidence interval.

Table 2

Adjusted odds ratio (AOR) of past-year cannabis use (CU) and CU disorder (CUD) among adolescents aged 12–17 years (N=163,837)

AOR (95% CI)	CU 1 day[a]	CU 2 days[a]	CUD[a]	CUD among past-year CUs[a]
Race/ethnicity (vs. White)				
Black	**1.68 (1.55–1.81)**	**1.70 (1.56–1.85)**	**1.34 (1.16–1.54)**	1.03 (0.88–1.20)
Hispanic	**1.13 (1.05–1.22)**	**1.15 (1.07–1.24)**	**1.25 (1.12–1.40)**	**1.22 (1.08–1.38)**
Native Hawaiian/Pacific Islander	1.19 (0.75–1.88)	1.31 (0.79–2.17)	1.34 (0.75–2.38)	1.18 (0.63–2.23)
Asian-American	**0.65 (0.52–0.83)**	**0.62 (0.48–0.79)**	0.73 (0.51–1.07)	0.94 (0.65–1.35)
Native-American	**2.38 (1.97–2.87)**	**2.40 (2.00–2.87)**	**2.00 (1.53–2.62)**	**1.39 (1.03–1.87)**
Mixed-race	**1.79 (1.54–2.09)**	**1.68 (1.45–1.95)**	**1.52 (1.23–1.88)**	1.19 (0.96–1.48)
Age (vs. 12–13)				
14–15	**2.46 (2.27–2.66)**	**2.45 (2.24–2.69)**	**2.28 (1.92–2.70)**	**1.37 (1.13–1.67)**
16–17	**3.53 (3.28–3.80)**	**3.59 (3.29–3.92)**	**2.72 (2.29–3.22)**	**1.37 (1.13–1.67)**
Sex (vs. female)				
Male	**1.12 (1.06–1.18)**	**1.13 (1.07–1.19)**	**1.27 (1.18–1.37)**	**1.28 (1.18–1.38)**
Total family income (vs. $75,000+)				
<$50,000	**1.18 (1.11–1.26)**	**1.22 (1.14–1.31)**	**1.23 (1.12–1.34)**	**1.18 (1.07–1.30)**
$50,000–$74,999	1.04 (0.98–1.11)	1.05 (0.98–1.11)	1.08 (0.96–1.22)	1.09 (0.95–1.25)
Government assistance	**1.24 (1.16–1.32)**	**1.27 (1.19–1.36)**	**1.28 (1.14–1.42)**	**1.18 (1.05–1.32)**
County type (vs. large metro)				
Small metro	**0.83 (0.78–0.88)**	**0.82 (0.77–0.87)**	**0.91 (0.84–0.99)**	1.02 (0.94–1.12)
Non-metro	**0.51 (0.47–0.56)**	**0.51 (0.46–0.57)**	**0.58 (0.51–0.67)**	**0.82 (0.72–0.93)**
Major depressive episode, lifetime	**1.29 (1.21–1.37)**	**1.29 (1.21–1.38)**	**1.84 (1.70–2.00)**	**1.75 (1.61–1.91)**
Past-year tobacco use	**9.65 (9.20–10.11)**	**10.27 (9.81–10.75)**	**12.09 (10.74–13.60)**	**2.86 (2.57–3.18)**
Past-year alcohol use	**8.00 (7.50–8.54)**	**7.95 (7.43–8.50)**	**6.46 (5.60–7.45)**	**1.70 (1.48–1.95)**
Survey year (vs. 2004)				
2005	**0.80 (0.72–0.89)**	**0.78 (0.70–0.86)**	**0.83 (0.71–0.97)**	0.94 (0.80–1.11)
2006	**0.80 (0.72–0.89)**	**0.80 (0.72–0.89)**	0.85 (0.73–1.00)	0.95 (0.79–1.13)
2007	**0.80 (0.72–0.90)**	**0.80 (0.72–0.90)**	**0.79 (0.68–0.93)**	0.88 (0.75–1.03)
2008	0.92 (0.83–1.03)	**0.88 (0.79–0.99)**	0.93 (0.80–1.08)	0.97 (0.83–1.13)
2009	0.98 (0.88–1.10)	0.98 (0.87–1.10)	0.90 (0.77–1.06)	0.91 (0.76–1.07)
2010	**1.19 (1.05–1.34)**	**1.16 (1.03–1.31)**	1.03 (0.88–1.21)	0.94 (0.80–1.10)
2011	**1.29 (1.15–1.44)**	**1.26 (1.12–1.40)**	1.08 (0.93–1.27)	0.95 (0.81–1.12)
2012	**1.30 (1.16–1.45)**	**1.30 (1.16–1.46)**	1.02 (0.87–1.20)	0.90 (0.76–1.07)

[a] The adjusted logistic regression included all variables listed in the first column. Boldface: p<0.05

Table 3

Perceived cannabis use (CU) norms among adolescents aged 12–17 (N=163,837)

Social norms	Adolescent's disapproval of CU	Perceived parental disapproval of CU	Perceived close friends' disapproval of CU
Proportion (%) in each racial/ethnic group	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**
White	**79.61 (79.22–80.00)**	**88.51 (88.22–88.80)**	**80.17 (79.81–80.52)**
Black	**80.77 (80.04–81.47)**[a]	88.20 (87.66–88.73)	**78.44 (77.68–79.18)**[a]
Hispanic	80.17 (79.57–80.75)	89.40 (88.86–89.92)	80.14 (79.56–80.71)
Native Hawaiian, Pacific Islander	83.18 (77.31–87.77)	87.57 (84.00–90.44)	84.07 (79.64–87.68)
Asian-American	**87.85 (86.34–89.22)**[a]	94.09 (92.91–95.08)	89.44 (87.99–90.72)
Native-American	78.99 (76.15–81.57)	**83.24 (80.72–85.48)**[a]	77.48 (74.91–79.86)
Mixed-race	**76.38 (74.51–78.15)**[a]	**85.40 (83.92–86.76)**[a]	**76.41 (74.43–78.28)**[a]
Unadjusted Odds Ratio (OR)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Race/ethnicity (vs. White)			
Black	**1.08 (1.02–1.13)**	0.97 (0.91–1.03)	**0.90 (0.86–0.95)**
Hispanic	1.04 (0.99–1.08)	**1.09 (1.03–1.16)**	1.00 (0.96–1.04)
Native Hawaiian, Pacific Islander	1.27 (0.87–1.85)	0.91 (0.68–1.23)	1.31 (0.97–1.76)
Asian-American	**1.85 (1.61–2.13)**	**2.07 (1.70–2.51)**	**2.09 (1.81–2.42)**
Native-American	0.96 (0.82–1.13)	**0.64 (0.54–0.77)**	**0.85 (0.74–0.98)**
Mixed-race	**0.83 (0.75–0.92)**	**0.76 (0.67–0.86)**	**0.80 (0.72–0.89)**
Survey year (vs. 2004)			
2005	0.99 (0.92–1.06)	1.02 (0.94–1.10)	1.02 (0.95–1.10)
2006	1.06 (0.99–1.14)	1.05 (0.97–1.13)	1.06 (0.99–1.14)
2007	**1.11 (1.04–1.19)**	**1.11 (1.02–1.20)**	**1.12 (1.05–1.20)**
2008	**1.11 (1.03–1.20)**	**1.12 (1.04–1.22)**	**1.14 (1.06–1.22)**
2009	1.04 (0.96–1.12)	1.08 (0.99–1.18)	1.02 (0.95–1.09)
2010	1.03 (0.95–1.11)	1.02 (0.94–1.11)	1.00 (0.93–1.08)
2011	0.96 (0.89–1.03)	0.93 (0.86–1.01)	0.95 (0.89–1.03)
2012	1.00 (0.93–1.06)	0.97 (0.89–1.05)	0.96 (0.90–1.03)
Adjusted Odds Ratio (AOR)[b]	**AOR (95% CI)**	**AOR (95% CI)**	**AOR (95% CI)**
Race/ethnicity (vs. White)			
Black	**1.08 (1.02–1.13)**	0.97 (0.91–1.03)	**0.90 (0.86–0.95)**
Hispanic	1.04 (0.99–1.08)	**1.10 (1.03–1.17)**	1.00 (0.96–1.05)
Native Hawaiian, Pacific Islander	1.26 (0.87–1.84)	0.91 (0.68–1.23)	1.30 (0.97–1.76)
Asian-American	**1.86 (1.62–2.13)**	**2.08 (1.71–2.53)**	**2.10 (1.82–2.43)**
Native-American	0.96 (0.82–1.13)	**0.65 (0.54–0.77)**	**0.85 (0.74–0.98)**
Mixed-race	**0.83 (0.75–0.93)**	**0.77 (0.68–0.87)**	**0.81 (0.73–0.90)**

[a]The proportion in a group differed from the proportion among Whites.

[b]The logistic regression model adjusted for survey year. Boldface: p<0.05.

Table 4

Adjusted odds ratio (AOR) of past-year cannabis use (CU) 2 days in relation to adolescent's CU norms: stratified by race/ethnicity (N=163,837)

Logistic regression model of CU 2 days/ year	Adolescent's disapproval of cannabis use	Parental disapproval of cannabis use	Close friends' disapproval of cannabis use
Adjusted odds ratio	**AOR of CU (95% CI)**	**AOR of CU (95% CI)**	**AOR of CU (95% CI)**
Controlling for survey year			
Whites	**0.06 (0.06–0.07)**	**0.10 (0.10–0.11)**	**0.07 (0.06–0.07)**
Backs	**0.16 (0.14–0.18)**	**0.24 (0.22–0.27)**	**0.16 (0.14–0.18)**
Hispanics	**0.13 (0.12–0.14)**	**0.24 (0.21–0.27)**	**0.14 (0.12–0.15)**
Native Hawaiians, Pacific Islanders	**0.11 (0.05–0.22)**	**0.27 (0.12–0.60)**	**0.11 (0.05–0.24)**
Asian-Americans	**0.07 (0.05–0.10)**	**0.18 (0.11–0.28)**	**0.08 (0.05–0.12)**
Native-Americans	**0.18 (0.13–0.25)**	**0.27 (0.19–0.39)**	**0.23 (0.17–0.31)**
Mixed-race adolescents	**0.07 (0.06–0.09)**	**0.13 (0.10–0.17)**	**0.08 (0.06–0.10)**
Controlling for survey year, demographic, and other behavioral health[a]			
Whites	**0.18 (0.16–0.19)**	**0.21 (0.19–0.23)**	**0.18 (0.17–0.19)**
Backs	**0.31 (0.26–0.36)**	**0.40 (0.33–0.48)**	**0.29 (0.25–0.34)**
Hispanics	**0.25 (0.22–0.28)**	**0.33 (0.28–0.38)**	**0.24 (0.21–0.28)**
Native Hawaiians, Pacific Islanders	**0.20 (0.06–0.60)**	0.48 (0.19–1.23)	**0.28 (0.10–0.80)**
Asian-Americans	**0.21 (0.14–0.31)**	**0.22 (0.11–0.42)**	**0.23 (0.14–0.39)**
Native-Americans	**0.30 (0.21–0.44)**	**0.38 (0.24–0.60)**	**0.38 (0.25–0.57)**
Mixed-race adolescents	**0.18 (0.14–0.25)**	**0.30 (0.21–0.42)**	**0.18 (0.14–0.24)**

[a]Each adjusted model controlled for age, sex, family income, government assistance, county type, major depressive episode, tobacco use, alcohol use, and survey year; the adjusted mode of Native Hawaiians/Pacific Islanders did not include survey year due to a small sample size. Boldface: p<0.05.

Table 5

Adjusted OR of past-year **cannabis use disorder** (CUD) in relation to adolescent's CU norms among past-year CUs: stratified by race/ethnicity (N=23,274)

Logistic regression model of CUD	Adolescent's disapproval of CU	Parental disapproval of CU	Close friends' disapproval of CU
Adjusted odds ratio	**AOR of CUD (95% CI)**	**AOR of CUD (95% CI)**	**AOR of CUD (95% CI)**
Controlling for survey year			
Whites	**0.60 (0.55–0.66)**	**0.75 (0.67–0.84)**	**0.70 (0.63–0.78)**
Backs	**0.63 (0.50–0.78)**	**0.69 (0.52–0.91)**	**0.69 (0.54–0.88)**
Hispanics	**0.68 (0.53–0.86)**	**0.74 (0.59–0.93)**	**0.67 (0.54–0.83)**
Native Hawaiians, Pacific Islanders	0.60 (0.20–1.81)	0.37 (0.08–1.60)	0.56 (0.15–2.13)
Asian-Americans	**0.34 (0.15–0.78)**	0.67 (0.23–1.94)	0.62 (0.29–1.34)
Native-Americans	0.68 (0.35–1.31)	0.78 (0.47–1.30)	0.88 (0.50–1.57)
Mixed-race adolescents	**0.43 (0.27–0.66)**	0.81 (0.50–1.32)	**0.41 (0.26–0.63)**
Controlling for survey year, demographic, and other behavioral health[a]			
Whites	**0.64 (0.58–0.71)**	**0.78 (0.70–0.87)**	**0.75 (0.67–0.83)**
Backs	**0.71 (0.56–0.91)**	0.85 (0.62–1.16)	0.79 (0.61–1.02)
Hispanics	**0.71 (0.56–0.92)**	**0.80 (0.64–0.99)**	**0.69 (0.56–0.86)**
Native Hawaiians, Pacific Islanders	…….[b]	…….[b]	…….[b]
Asian-Americans	…….[b]	…….[b]	…….[b]
Native-Americans	0.65 (0.36–1.19)	0.80 (0.51–1.26)	0.77 (0.45–1.31)
Mixed-race adolescents	**0.48 (0.32–0.72)**	0.88 (0.56–1.40)	**0.43 (0.28–0.67)**

[a] Each adjusted model controlled for age, sex, family income, government assistance, county type, major depressive episode, tobacco use, alcohol use, and survey year.

[b] The adjusted models of Native Hawaiians/Pacific Islanders and Asian-Americans were not done due to a small sample size. Boldface: p<0.05.