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GENDER DIFFERENCES IN ADOLESCENT MARIJUANA USE AND ASSOCIATED PSYCHOSOCIAL CHARACTERISTICS

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Abstract

Marijuana use in adolescents is associated with many adverse outcomes, including neurobiological and health consequences. Despite this, little is known about gender differences in the correlates of adolescent marijuana use. This study attempted to fill this gap by examining gender differences in the correlates of lifetime and past 30-day marijuana use. Data from a cross-sectional statewide survey of adolescent risk behavior participation in Connecticut were analyzed using chi-square and hierarchical logistic regression methodologies to examine the demographic, psychosocial and risk behavior correlates of adolescent marijuana use. Gender-by-trait interactions were tested with hierarchical logistic regression. Of the 4523 participants (51.8% female, 75.8% Caucasian), 40.4% endorsed lifetime marijuana use and 24.5% endorsed past 30-day marijuana use. Risk behavior participation, particularly other substance use, had the most robust associations with lifetime and past 30-day adolescent marijuana use; participation in extracurricular activities appeared protective. Gender interactions were observed for African-American, Asian or other race and participation in extracurricular activities; in these three cases, males had a greater likelihood of use. They were also observed for having a job (lifetime use only), with females having elevated odds, and past 30-day cigarette smoking (past 30-day use only), with males having elevated odds. Finally, there was preliminary evidence of a faster transition from initiation of marijuana use to regular use in females, as compared to males. These results indicate important gender differences in the correlates of marijuana use in adolescents, and these findings may facilitate the development of gender-informed prevention and early intervention programs for adolescent marijuana use.

Keywords

Cannabis; Adolescent; Gender Differences; Risk Behaviors

1. Introduction

Marijuana use among adolescents is recognized as a significant public health problem, with evidence indicating that its use produces significant neurobiological, psychosocial and health consequences (Bray, Zarkin, Ringwalt, & Qi, 2000; Georgiades & Boyle, 2007; Harvey, Sellman, Porter, & Frampton, 2007; Schneider, 2008). Estimates from two nationwide surveys, the Monitoring the Future (MTF) Surveys and the National Survey on Drug Use and Health (NSDUH), indicate that the prevalence of marijuana use among adolescents is exceeded only by the prevalence of alcohol or tobacco use (Johnston, O'Malley, Bachman, & Schulenberg, 2008; Substance Abuse and Mental Health Services

Administration, 2008). While use rates have declined since the late 1990s, data from the MTF indicated that nearly 42% of high school seniors had used marijuana at some point in their lives, with over 30% using in the past year and nearly 20% in the past month (Johnston, et al., 2008).

Given the relatively high rates of use, the risks associated with marijuana use by adolescents are particularly alarming. Adolescents who use marijuana regularly or heavily have higher levels of anxiety (Dorard, Berthoz, Phan, Corcos, & Bungener, 2008), depressive symptoms (Medina, Nagel, Park, McQueeney, & Tapert, 2007), suicidality (Pedersen, 2008) and externalizing behavior (Monshouwer, et al., 2006) than non-users. Marijuana use is also associated with an increased risk of developing psychotic symptoms in a dose-dependent fashion (Di Forti, Morrison, Butt, & Murray, 2007; Moore, et al., 2007) and with an increased chance of the later development of depressive, bipolar, or anxiety diagnoses (Wittchen, et al., 2007). Tobacco use (Georgiades & Boyle, 2007), nicotine dependence (Patton, Coffey, Carlin, Sawyer, & Lynskey, 2005) and other substance use diagnoses (Wittchen, et al., 2007) have been associated with adolescent marijuana use, and it may mediate the progression to heavier (e.g., cocaine) substance use (Fergusson, Boden, & Horwood, 2008), though this is not universally found (Tarter, Vanyukov, Kirisci, Reynolds, & Clark, 2006).

Furthermore, heavier levels of marijuana use are associated with poorer sleep (Bolla, et al., 2008), respiratory problems (Aldington, et al., 2007; Brook, Stimmel, Zhang, & Brook, 2008), cancer (Berthiller, et al., 2008) and a host of neurocognitive deficits, including attentional, learning, memory and intellectual functioning decrements (Brook, et al., 2008; Di Forti, et al., 2007; Fried, Watkinson, James, & Gray, 2002; Harvey, et al., 2007). Finally, regular adolescent marijuana use is associated with poorer school performance (Brook, et al., 2008; Leatherdale, Hammond, & Ahmed, 2008), deviant peer affiliation (Reboussin, Hubbard, & Ialongo, 2007) and school drop-out (Bray, et al., 2000). The adverse profile associated with adolescent marijuana use is compounded by indications that use of marijuana persists into young adulthood and beyond for most adolescent users (Patton, et al., 2007; Perkonig, et al., 2008). Together, the data indicate that understanding the characteristics of adolescent marijuana users is an important research and public health goal; such an understanding could be used to target at-risk individuals through prevention programs or early intervention.

One way to further this goal is to examine potential gender differences among adolescent marijuana users. Traditionally, female substance use and differences between male and female substance users have been understudied. Recent research has strongly indicated that male and female substance use are potentially different phenomena, with different motivations, use trajectories, consequences, barriers to treatment and patterns of relapse to substance use following abstinence (Brady & Randall, 1999; Walitzer & Dearing, 2006). Examination of gender differences in adolescent marijuana use is a particularly understudied area, underscoring the need for further investigations. Indeed, initial work indicates that male and female adolescents differ in terms of their use rates, trajectories and psychosocial correlates, among users.

For instance, males appear to be more likely to use marijuana, with the MTF indicating past year use among 29% of males and 24% of females; the NSDUH indicated that 17% of adolescent males and 15% of females had used marijuana over their lifetime (Johnston, et al., 2008; Substance Abuse and Mental Health Services Administration, 2008). Kandel and Chen (Kandel & Chen, 2000) found an earlier age of onset of marijuana use for males and found that males were more likely to be on a heavier use trajectory; it also appears the risk factors for the onset of marijuana use differ somewhat by gender (Guxens, Nebot, & Ariza,

2007). Furthermore, males appear to be more likely than females to become marijuana dependent in the first few years following initiation (Wagner & Anthony, 2007). Finally, Ridenour and collaborators (Ridenour, Lanza, Donny, & Clark, 2006) found that females tended to have shorter, but non-significant, intervals between onset of marijuana use and either first problem or cannabis dependence.

Few studies, however, have examined current users to evaluate potential gender differences in demographic or psychosocial characteristics in current adolescent users of marijuana. Pedersen and colleagues (Pedersen, Mastekaasa, & Wichstrom, 2001) examined the effects at 13 and 14 years of age of conduct problems on the initiation of marijuana use over an 18 month follow-up period. They found that baseline conduct problems promoted the likelihood of marijuana use initiation over the follow-up, with an especially pronounced effect in females. Furthermore, the type of conduct problems evidenced was important: for males, serious conduct problems were stronger promoters of initiation, but in females, covert or aggressive conduct problems were more robust.

Arguably, the most comprehensive study of gender differences in the correlates of adolescent marijuana use was conducted by Tu and collaborators (Tu, Ratner, & Johnson, 2008). They examined a sample of 8225 Canadian secondary school students participating in a cross-sectional survey. The authors found three gender differences: one, grade level in school was predictive of male frequent marijuana use (defined as 3 to 9 episodes of use in the previous 30 days), but not of frequent use by females; two, self-reported poor mental health increased the likelihood of either frequent or heavy use (10 or more episodes in the past 30 days) among females, but not among males; and three, Aboriginal ethnicity was associated with frequent or heavy use among males, but not females. It should be noted, however, that the authors did not test gender-based interactions, instead only noting when a factor was a significant main effect correlate in just one gender but not the other. While this method may identify particularly robust predictors, it is not as statistically powerful as testing for interactions with gender, assuming the implicit assumptions of testing for interactions are met.

Thus, this study attempted to further examine the gender-related correlates of current marijuana use through the use of a survey of high-risk behavior participation in Connecticut high school students. The correlates of lifetime and past month marijuana use were evaluated separately by gender and then evaluated for potential differences by gender (i.e., gender-by-correlate interactions) using chi-square and regression analyses. There were two primary aims of this study: one, to evaluate which demographic, psychosocial and risk behavior characteristics are associated with past month or lifetime marijuana use, separately for males and females; and two, to evaluate whether gender differences exist in the odds of marijuana use associated with the selected correlates. We hypothesized that adverse measures of health and functioning would be associated with marijuana use in both boys and girls. While gender differences were expected in the strengths of the associations, given the lack of prior research, *a priori* hypotheses were not made about the nature and direction of these gender-related differences in the associations with marijuana use. Based on data indicating a more rapid progression from initial use to problematic use of abused substances in females as compared to males, we additionally hypothesized that girls would demonstrate a more rapid transition from initial to regular use of marijuana.

2. Methods

The procedures and sampling design of this survey have been described in detail in Schepis et al. (2008); for further information, please refer there.

2.1 Study Procedures

All public high schools in Connecticut were invited to participate in the survey. To encourage participation, schools were offered a brief report detailing the prevalence of each risk behavior assessed. With participating schools, a passive consent procedure was developed. This procedure involved mailing letters to parents of all students in the school to inform them about the study and outline the procedure to deny permission for their child to take part in the study. In cases where a parent did not make contact to deny permission, permission was assumed. Prior to survey administration, a list of students who were denied permission to participate was compiled; those students were asked to quietly complete schoolwork while the survey was administered. All procedures were approved by the participating schools and the Institutional Review Board of the Yale University School of Medicine.

On the day of survey administration, research staff was on site to explain, distribute and collect surveys and to answer any participant questions. All students were instructed that participation was fully voluntary and that they could refuse to participate at any time. All data were double-entered, with random spot checks and examination of out-of-range responses to ensure accuracy. The sample obtained from this survey is demographically similar to the sample of CT adolescents aged 14–18 from the 2000 US Census.

2.2 Measures

The full survey was composed of 153 questions assessing demographics, substance use, and other risk behavior participation. Lifetime marijuana and past month marijuana use were the dependent variables. Potential correlates chosen fell into three domains: demographic, psychosocial and risk behavior correlates. Demographic variables included race/ethnicity (African-American, Caucasian, Hispanic/Latino and Asian/Other), gender, who the participant lives with (both parents, one parent or in another arrangement), average grades in school (As/Bs, Bs/Cs or Cs and below), and grade in school (9th, 10th, 11th or 12th). Participants were allowed to choose as many races/ethnicities as they felt applied to them. Psychosocial variables included whether the participant engages in extracurricular activities and whether the participant has a job. Finally, risk behaviors included past year gambling, past month cigarette use, past month alcohol use, past month binge alcohol use, lifetime nonmedical use of steroids, past year physical fighting, carrying a weapon in the past month, 2 or more weeks of depressed mood with anhedonia in the past year, and lifetime self-harm. Time from the age of initiation of marijuana use to age of regular use was examined using two items asking participants the age at which they began marijuana use and the age at which they began regular use, which was assessed by asking if participants considered themselves to be regular marijuana users. Answer choices for both items were: 8 or younger, 9–10, 11–12, 13–14, 15–16 or 17 years of age or older.

2.3 Data Analyses

Distribution characteristics of all variables were examined. Three sets of analyses were performed. First, chi-square analyses evaluated demographic, psychosocial and risk behavior correlates separately by gender. Second, hierarchical logistic regressions were used to calculate adjusted odds ratios (AORs) for past month or lifetime marijuana use, given presence of a specific correlate. Grade in school was controlled for, as older students were significantly more likely to use marijuana. These analyses were stratified by gender to evaluate effects in males and females separately. Finally, hierarchical logistic regressions were used to evaluate potential gender interactions. Again, grade in school was controlled for through entry in the first block of variables. In the second block, the specific correlate and gender were entered. In the third, the interaction term for the correlate and gender were entered. When not specifically listed, the significance level for all analyses was set at a *p*-

value below .05. Finally, the analysis of time from initiation of marijuana use to initiation of regular use used a Mann-Whitney U analysis with gender as the independent variable and difference in age category (listed above) endorsed for age of initiation and age of regular use initiation; only adolescents who had transitioned to regular marijuana use were included in these analyses.

3. Results

3.1 Demographic and Marijuana Use Characteristics

4523 adolescents participated in the survey, with 2124 males (47.0%) and 2345 females (51.8%). Fifty-four participants (1.2%) did not enter a gender and were not included in these analyses. Of participants, 1906 males (89.7% of males) and 2191 females (93.4% of females) completed the marijuana use section and were included in this study. Included participants had a mean age of 15.86 years ($SD = 1.26$); 10.2% were African-American, 14.0% were Hispanic/Latino, 18.3% were Asian or another ethnicity, and 75.8% were Caucasian. Participants were allowed to choose as many races/ethnicities as they felt applied to them, so data on racial/ethnic background will total to above 100%. Of participants with complete marijuana use data, 1655 participants (40.4%) endorsed lifetime marijuana use and 1004 participants (24.5%) endorsed past 30-day use (participants could be members of both the lifetime and past 30-day marijuana use groups); 2442 participants (59.6%) denied lifetime marijuana use. By gender, 854 females (39.0% of females) and 802 males (42.1% of males) endorsed lifetime marijuana use; 491 females (22.4% of females) and 513 males (26.9% of males) endorsed past 30-day use. Both of these are significant differences (lifetime: $\chi^2 = 4.07$, $p = .044$; past 30-day: $\chi^2 = 11.10$, $p < .001$).

3.2 Participants with Missing Data

Chi-square analyses revealed that participants excluded from analyses were more likely to be male ($\chi^2 = 19.96$, $p < .001$), African-American ($\chi^2 = 38.34$, $p < .001$) and Hispanic/Latino ($\chi^2 = 22.37$, $p < .001$); Caucasian participants were more likely to be included ($\chi^2 = 50.19$, $p < .001$). There was a trend level difference for younger participants to be more likely to have complete data ($F(1, 427.092) = 2.90$, $p = .089$). Also, participants without sufficient data were more likely to have ever used cigarettes ($\chi^2 = 37.48$, $p < .001$) or alcohol ($\chi^2 = 7.62$, $p = .007$) and were more likely to have used alcohol in a binge fashion ($\chi^2 = 5.78$, $p = .016$) in the past 30 days. No differences between were found in lifetime self-harm ($\chi^2 = 2.70$, $p = .109$) or in taking part in a physical fight in the past year ($\chi^2 = 1.55$, $p = .213$).

3.3 Characteristics Associated with Lifetime Marijuana Use, Stratified by Gender

For both male and female participants, self-reported grade in school, average grades and family structure were significant correlates. Across gender, 9th graders were significantly less likely than 11th or 12th graders to have used marijuana, and those with an A/B average in school were less likely to have used than those with a B/C average or Cs and below. Males and females differed slightly in the association of family structure and lifetime marijuana use: males in a two-parent household were less likely to have ever used than males in either a one-parent household or some other household (e.g., with grandparents); for females, those in a two-parent household were only less likely to use than those in a one-parent household. Notable gender differences were observed in the association of race with lifetime use. African-American males and Caucasian females were more likely to have ever used marijuana. Females of Asian or "Other" race were less likely to have used.

Across gender, taking part in extracurricular activities was associated with lower rates of lifetime use, whereas having a job was associated with a greater likelihood of ever using.

Furthermore, all risk behaviors were significantly associated with lifetime marijuana use. In all cases, participation in a risk behavior was associated with a greater likelihood of lifetime marijuana use. Data for demographic characteristics are listed in Table 1; data for psychosocial characteristics and risk behavior participation are in Table 2.

3.4 Characteristics Associated with Past 30-day Marijuana Use, Stratified by Gender

As seen with lifetime marijuana use, grade in school, average grades and family structure were significantly associated with past 30-day marijuana use across gender. For boys and girls, making an A/B average was associated with a lower risk of past 30-day marijuana use than was making a B/C average or Cs and lower. For boys, 9th graders were less likely to have used in the past 30 days than 12th graders, but for girls, 9th graders were less likely than 11th graders. As with lifetime marijuana use, males in a two-parent household were less likely to have used in the past 30 days than males in either a one-parent household or some other household, and females in a two-parent household were only less likely than those in a one-parent household. While no race- or ethnicity-based differences were observed in males, Caucasian females were more likely to have used in the past 30-days, whereas African-American and Asian/Other females were less likely.

Again, participation in extracurricular activities was protective against past 30-day marijuana use, and having a job was associated with a greater likelihood of use across genders. Also, participation in any risk behavior was associated with a greater likelihood of past 30-day marijuana use in both males and females.

3.5 Odds Ratios and Gender Interactions in Characteristics Associated with Lifetime Marijuana Use

Among characteristics associated with lifetime marijuana use, the highest AORs were seen for substance use: past 30-day smoking (boys = 16.05, girls = 17.03), alcohol use (boys = 7.94, girls = 8.99) and binge use (boys = 9.55, girls = 8.83) and lifetime steroid use (boys = 5.96, girls = 6.26). These were followed by other risk behaviors: carrying a weapon in the past 30 days (boys = 3.96, girls = 4.92), past-year fighting (boys = 3.73, girls = 3.24), lifetime self-harm (boys = 2.56, girls = 3.42), past-year depressed mood with anhedonia (boys = 2.36, girls = 1.78) and past-year gambling (boys = 2.20, girls = 1.66). Demographic and psychosocial characteristics were associated with both elevations in likelihood among male African-Americans (AOR = 1.57) or male Hispanic/Latino (AOR = 1.37) and female Caucasian (AOR = 1.70) participants, and were associated with protective effects for females of Asian or other descent (AOR = .67) and participation in extracurricular activities across genders (boys = .66, girls = .37).

Five gender interactions were observed, with three based on race or ethnicity and two on psychosocial characteristics. African-American males, but not females, were at greater odds of lifetime marijuana use (interaction $p = .002$); conversely, Caucasian females were at greater odds of lifetime use than were males (interaction $p < .001$). Being of Asian or other descent was protective for females, but it was not associated with male use (interaction $p = .050$). Furthermore, having a job elevated likelihood of lifetime use in females, but not males (interaction $p = .012$), and it appeared that females who participated in extracurricular activities were less likely than males who participated to ever use marijuana (interaction $p < .001$). No risk behaviors evidenced an interaction with gender, though there was a trend (interaction $p = .086$) for males with past year depressed mood and anhedonia to have greater odds of past year marijuana use than females. All data on AORs and gender interactions are presented in Table 3.

3.6 Odds Ratios and Gender Interactions in Characteristics Associated with Past 30-day Marijuana Use

A similar pattern of AORs emerged when examining past 30-day marijuana use. Substance users had the greatest likelihoods of marijuana use: past 30-day smokers (boys = 15.81, girls = 10.86), alcohol users (boys = 11.85, girls = 14.38) and binge users (boys = 13.18, girls = 10.38) and lifetime steroid users (boys = 5.83, girls = 7.38). The second highest set of AORs was seen with other risk behaviors: carrying a weapon in the past 30 days (boys = 3.57, girls = 4.39), past-year fighting (boys = 3.58, girls = 3.09), lifetime self-harm (boys = 3.14, girls = 2.88), past-year depressed mood with anhedonia (boys = 2.27, girls = 1.83) and past-year gambling (boys = 2.52, girls = 1.70). Having a job also was associated with an elevated likelihood of past-30-day marijuana use (boys = 1.34, girls = 1.99), whereas participation in extracurricular activities was associated with a decreased likelihood of use (boys = .57, girls = .40). No demographic characteristics in males were associated with an elevated AOR for past-30-day marijuana use, and in females, only Caucasian race was significantly associated (AOR = 1.92). Conversely, females of African-American (AOR = .61) or of Asian/other descent (AOR = .59) were at lower odds of use.

Five gender-by-characteristic interactions were found for past-30-day marijuana use. For African-American race, females were at lower odds of past-30-day use, but males had no significant association (interaction $p = .020$). Similarly, being of Asian/other descent was protective in females, but not in males (interaction $p = .012$). Females of Caucasian descent, however, were at greater odds of past-30-day marijuana use than males (interaction $p < .001$). Participation in extracurricular activities was associated with lower odds of use in both genders, but females may derive greater benefit (interaction $p = .032$). Conversely, past-30-day cigarette use was associated with elevated AORs in both genders, but males appear to have greater elevations in odds than females (interaction $p = .037$).

3.7 Time from Initiation of Marijuana use to Initiation of Regular Marijuana Use

Of participants, 500 males (26.2% of males) and 414 females (18.9% of females) endorsed regular marijuana use. The median age category for both initiation of use and initiation of regular use for males was at 13 or 14 years of age; for females the median age of initiation was 13 or 14 years of age, but the median age of female initiation of regular use was between the 13–14 and 15–16 categories. Mann-Whitney U analysis indicated the presence of a gender difference in time of transition from initiation to regular marijuana use (Mann-Whitney U = 94176.5, $Z = -2.662$, $p = .008$). Examination of the mean difference in transition indicated that males had a mean category difference of .53 from initiation to regular use (initiation mean = 4.49, regular use mean = 5.02), whereas females had a mean difference of .40 (initiation mean = 4.97, regular use mean = 5.37). Thus, it appears that females may have a quicker transition from initiation to regular marijuana use.

4. Discussion

Prior to reviewing the results of this investigation, readers should keep in mind that a large sample size, such as this one, can lead to significant differences between groups, even with smaller differences between them. The most robust differences are found at more stringent significance levels, such as a p level less than or equal to .001; when significance was only achieved at a .05 or .01 level, this will be noted in the Discussion.

Overall, the primary findings of this study are that marijuana use is associated with a broad range of adverse health measures in both adolescent girls and boys and that racial/ethnic and psychosocial characteristics are the main traits that evidence gender differences in associations with both lifetime and past 30-day marijuana use in adolescents. For both

marijuana use variables, African-American race, Caucasian race, Asian/other race and participation in extracurricular activities significantly interacted with gender. The most robust of these interactions appeared to be in gender differences in lifetime marijuana use among Caucasians, African-Americans and those participating in extracurricular activities (all p s < .002); strong evidence was also found for gender differences in past 30-day marijuana use in Caucasian participants (p < .001). African-American (p < .05) and Asian females appeared to be at lesser risk of marijuana use, whereas Caucasian females were at greater risk of use; females who participated in extracurricular activities appeared to derive greater protection from marijuana use than males who were involved in such activities. Also, having a job interacted with gender for lifetime marijuana use, with girls holding a job at greater risk for lifetime marijuana use (p < .05), and past-30-day cigarette use interacted with gender for past-30-day marijuana use, with male smokers at greater risk of marijuana use.

Data from this survey indicated that 40.4% of participants endorsed lifetime marijuana use and 24.5% endorsed past 30-day marijuana use. These rates are somewhat consistent with the findings of the Monitoring the Future series of studies, though the 30-day prevalence rates of this sample appear higher. In 2005, the same year as this survey was administered, 44.8% of 12th grade students and 34.1% of 10th grade students endorsed lifetime marijuana use; 19.8% of 12th grade students and 15.4% of 10th grade students endorsed past 30-day use. Furthermore, when examining the correlates of lifetime and past 30-day marijuana use in adolescents, our results were also generally consistent with other studies (e.g., Brook, et al., 2008; Georgiades & Boyle, 2007; Medina, et al., 2007; Patton, et al., 2005; Wittchen, et al., 2007), with all risk behaviors elevating the odds of concurrent marijuana use at a p value of less than .001, except for past year gambling in females (p < .01). The greatest elevations in odds were seen for the substance use variables, followed both the other risk behaviors. Demographic and psychosocial characteristics evidenced a more complex set of associations, with some traits elevating odds and some lowering odds. Finally, this study offers some evidence that female adolescents potentially had a faster transition from initiation of marijuana use to initiation of regular use.

It is somewhat difficult to compare our work with that of Tu and collaborators (Tu, et al., 2008), given that their focus was on frequency of use and our work focused on any lifetime or past 30-day use. Nonetheless, some potential areas of difference emerged. Tu et al. found that grade level was associated with frequent use in males only, whereas we found grade in school was associated with lifetime and past 30-day marijuana use across genders. Also, they found that poor self-reported mental health was associated with either frequent or heavy use in females only, whereas we found that past-year depressed mood with anhedonia was associated with greater likelihood of marijuana use across genders. Furthermore, it appeared that males, not females, had greater odds of lifetime use when they had experienced past-year depressed mood with anhedonia. It seems that the results of Tu and collaborators indicated only that certain subgroups of males were at greater risk for marijuana use, while we found that Caucasian females and those who have a job may be at greater risk as well.

Some of the differences in findings between this study and the work of Tu and colleagues may be explained by recent findings of gender differences in changes in rate of marijuana use among adolescents in Canada and the US. In both nations, overall decreases in past year use were found, but only US males appeared to have significant declines in past year use over the 4 year period from 2002 to 2006. Females did not evidence significant declines. In contrast, both male and female adolescents in Canada showed evidence of declines in past year marijuana use. Also, the sample examined by Tu and collaborators had higher 30-day marijuana use rates than this sample and included a significant subsample of Aboriginal participants (what would be called Native American or Alaskan Natives in the US). These

differences may have also contributed to the differences in findings. Future studies should attempt to clarify some of these potentially discrepant findings, perhaps through the inclusion of adolescents from different nations.

Five limitations of the current study should be noted. First, 9.4% of participants did not have sufficient data for inclusion in these analyses. Excluded participants were more likely to be African-American, Hispanic/Latino, male and had higher rates of lifetime substance use. These missing data could have introduced some degree of selection bias, which must be considered when interpreting the results. Also, given the self-report nature of the survey, some misreporting by participants could have occurred, potentially altering the results. Given the anonymous nature of the survey, however, any misreporting was likely to be small. Third, given the cross-sectional nature of the data, no causal inferences can be made. Future investigations should use longitudinal designs to allow for analyses of causality. Fourth, the use of categories to quantify age of initiation of marijuana use and age of initiation of regular use limits the conclusions that can be drawn from this data. Finally, while data was collected on family income, many participants endorsed “don’t know”, and no data was collected on parental occupation or education level. This prevented us from examining the influence of socioeconomic status (SES), which was a limitation. Future work should examine the importance of SES for marijuana use.

These findings have specific implications for clinicians and those developing prevention and early intervention programs. First, it appears that the presence of other risk behaviors is the most important characteristic to screen for in determining which adolescents are most likely to be current marijuana users. Users of other substances are at a particularly elevated likelihood of marijuana use, which is consistent with previous work (e.g., Wittchen, et al., 2007).

Second, encouraging extracurricular activity participation appears to be an important protective factor for both male and female adolescents, with likelihood of marijuana use reduced by almost half in females and over one-quarter in males. In young adults, avoidance of boredom appears to be a prominent motive for marijuana use (Lee, Neighbors, & Woods, 2007), and increasing prosocial activity engagement (for adolescents, this could include extracurricular activities) in adult substance users appears to be important for achieving abstinence (Rogers, et al., 2008); thus, future research should examine whether participation in extracurricular activities functions to prevent or limit marijuana use by increasing community engagement and/or preventing boredom. While this investigation found that extracurricular activity participation was associated with lower rates of marijuana use, the correlational nature of the research does not allow for causal inferences about the role of prosocial engagement by adolescents, including participation in extracurricular activities.

Third, it appears that race and ethnicity operate differentially in males and females, and screening should account for this. Female Caucasians are at elevated likelihood of use, but females of African-American ($p < .05$) or Asian/other descent appear to be protected; for males, African-American or Hispanic/Latino ethnicity was associated with greater odds of past-30-day use (both $p < .05$). Examinations of adolescent substance users (including marijuana users) indicate that peer influence and support may operate differently by ethnicity (Wills, Resko, Ainette, & Mendoza, 2004), which may explain some difference found here, given the importance of and gender differences in peer influence for substance use (Rienzi, et al., 1996). Other investigations indicate that levels of a variety of risk and protective factors differ by ethnicity in adolescents (Griffin, Scheier, Botvin, & Diaz, 2000), and the impact of specific factors such as parental involvement differ both by ethnicity and gender (Pilgrim, Schulenberg, O'Malley, Bachman, & Johnston, 2006). Finally, evidence suggests that cultural norms in Hispanic/Latino groups discourage female substance use

(Canino, 1994); similar norms may deter use in African-American females. Further investigation is needed, however, given that many of these results were found at less stringent (i.e., $p < .05$) levels of significance.

In all, these results indicate that gender interacts with specific racial/ethnic and psychosocial characteristics to influence lifetime and past 30-day marijuana use in adolescents. Risk behaviors, with other substance use in particular, appear to be associated with the greatest elevations in odds of marijuana use across genders. Extracurricular activity participation appears to be the most robust factor associated with decreased odds of marijuana use, in both males and females. It is hoped that future investigations will expand on these findings, creating a clear profile of adolescent marijuana users that can be used to inform the development of prevention and early intervention programs.

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Table 1
Demographic Characteristics of Participants versus Lifetime and Past 30-day Marijuana Use

Variable		Boys			Girls		
		N (%)	% Ever MJ Use	% Past 30-day MJ Use	N (%)	% Ever MJ Use	% Past 30-day MJ Use
African -American	Yes	204 (10.7)	50.5*	28.3	210 (9.6)	33.8	15.5
	No	1702 (89.3)	41.1	26.7	1981 (90.4)	39.5	23.1
Caucasian	Yes	1429 (75.0)	41.8	27.0	1688 (77.0)	41.9**	24.7**
	No	477 (25.0)	42.8	26.3	503 (23.0)	29.2	14.4
Hispanic/Latino	Yes	252 (13.9)	47.6	31.1	297 (14.1)	38.4	24.7
	No	1567 (86.1)	41.2	26.2	1808 (85.9)	39.2	21.9
Other/Asian	Yes	348 (18.3)	39.4	25.8	392 (17.9)	30.9**	15.4**
	No	1558 (81.7)	42.7	27.1	1799 (82.1)	40.7	23.9
Grade	9 th	585 (30.7)	30.4**	19.9**	652 (29.8)	26.4**	16.3**
	10 th	526 (27.6)	41.6	26.7	608 (27.8)	38.2	22.5
	11 th	496 (26.1)	48.2	28.0	577 (26.4)	47.8	26.4
	12 th	297 (15.6)	55.6	38.7	349 (16.0)	48.7	25.9
Grades	A/B	939 (50.5)	29.3**	17.8**	1365 (64.2)	30.5**	16.6**
	B/C	613 (33.0)	50.6	30.4	581 (27.3)	52.0	29.0
	C or below	307 (16.5)	65.1	48.0	179 (8.4)	58.1	41.0
Family Structure	2 Parents	1376 (73.2)	38.0**	23.2**	1508 (69.9)	34.8**	20.2*
	1 Parent	402 (21.4)	51.5	33.3	530 (24.6)	48.7	26.8
	Other	103 (5.4)	60.2	47.5	119 (5.5)	46.2	28.6

Notes: Bolded terms are significantly different ($p < .05$);

* = $p < .01$;

** = $p < .001$ (using chi-square analyses)

MJ = Marijuana

Participants were allowed to choose multiple ethnicities; thus, participants may be members of more than one ethnic group.

Table 2
Participant Psychosocial Characteristics and Risk Behavior Participation versus Lifetime and Past 30-day Marijuana Use

Variable		Boys			Girls		
		N (%)	% Ever MJ Use	% Past 30-day MJ Use	N (%)	% Ever MJ Use	% Past 30-day MJ Use
Extracurricular	Yes	1418 (74.4)	38.9*	23.5**	1678 (76.6)	33.3**	18.2**
Activities	No	488 (25.6)	51.2	36.4	513 (23.4)	57.5	36.0
Job	Yes	783 (41.9)	48.1**	32.3**	867 (40.3)	50.6**	30.0**
Past Year	No	1086 (58.1)	37.7	23.0	1286 (59.7)	30.9	16.8
	Yes	1724 (92.8)	43.6**	28.2**	1859 (87.9)	40.3*	23.5*
Gambling	No	133 (7.2)	27.1	14.0	256 (12.1)	30.5	15.7
Past 30-day	Yes	387 (20.3)	87.6**	73.8**	480 (21.9)	86.0**	60.2**
Cigarette Use	No	1519 (79.7)	30.5	14.9	1711 (78.1)	25.8	11.8
Past 30-day	Yes	869 (47.5)	67.1**	48.7**	1061 (49.6)	63.7**	40.9**
Alcohol Use	No	961 (52.5)	19.5	7.1	1077 (50.4)	15.5	4.6
Past 30-day	Yes	614 (33.8)	76.5**	59.9**	652 (30.6)	74.5**	52.1**
Binge Use	No	1202 (66.2)	24.3	9.8	1477 (69.4)	23.8	9.4
Lifetime	Yes	147 (8.4)	77.6**	63.0**	44 (2.2)	77.3**	65.1**
Steroid Use	No	1599 (91.6)	37.0	22.7	1997 (97.8)	37.2	20.5
Past Year	Yes	781 (56.7)	57.6**	39.3**	523 (24.7)	58.1**	37.7**
Fight	No	1024 (43.3)	29.4	16.6	1598 (75.3)	32.4	17.0
Past 30-day	Yes	588 (32.4)	61.4**	43.5**	192 (9.0)	71.4**	50.5**
Carried Weapon	No	1228 (67.6)	32.2	18.5	1940 (91.0)	35.5	19.3
Depressed	Yes	284 (16.4)	58.8**	41.0**	569 (27.4)	48.5**	29.9**
Mood	No	1448 (83.6)	38.0	23.5	1510 (72.6)	34.9	18.9
Lifetime	Yes	257 (14.6)	59.5**	46.3**	496 (23.6)	60.1**	36.7**
Self-Harm	No	1505 (85.4)	37.9	22.4	1607 (76.4)	31.9	17.4

Notes: Bolded terms are significantly different ($p < .05$);

* = $p < .01$;

**
= p .001 (using chi-square analyses);
MJ = Marijuana

Table 3

Association between marijuana use and demographic, psychosocial and risk behavior characteristics, adjusting for grade

Variable	Lifetime Marijuana Use			Past 30-day Marijuana Use		
	Boys AOR	Girls AOR	Interaction p value	Boys AOR	Girls AOR	Interaction p value
Is African-American	1.57 (1.17–2.11)	.81 (.59–1.09)	.002	1.13 (.82–1.58)	.61 (.41–.91)	.020
Is Caucasian	.90 (.72–1.11)	1.70 (1.37–2.11)*	<.001	.98 (.77–1.24)	1.92 (1.46–2.53)*	<.001
Is Hispanic/Latino	1.37 (1.05–1.80)	1.03 (.80–1.33)	.129	1.33 (.99–1.79)	1.21 (.90–1.61)	.698
Is Asian/Other	.93 (.73–1.19)	.67 (.52–.84)*	.050	1.00 (.76–1.31)	.59 (.44–.79)*	.012
Extracurricular Activities	.66 (.53–.81)*	.37 (.30–.45)*	<.001	.57 (.46–.72)*	.40 (.32–.50)*	.032
Has a Job	1.21 (.99–1.48)	1.84 (1.50–2.25)*	.012	1.34 (1.07–1.68)	1.99 (1.57–2.52)*	.115
Gambling (past year)	2.20 (1.47–3.28)*	1.66 (1.24–2.21)*	.255	2.52 (1.53–4.14)*	1.70 (1.19–2.42)	.223
Smoking (30-day)	16.05 (11.60–22.21)*	17.03 (12.84–22.59)*	.767	15.81 (12.06–20.73)*	10.86 (8.57–13.67)*	.037
Alcohol Use (30-day)	7.94 (6.40–9.85)*	8.99 (7.29–11.08)*	.449	11.85 (8.94–15.71)*	14.38 (10.49–19.71)*	.493
Binge Use (30-day)	9.55 (7.59–12.03)*	8.83 (7.12–10.95)*	.617	13.18 (10.24–16.96)*	10.38 (8.19–13.16)*	.116
Steroid Use (lifetime)	5.96 (3.97–8.94)*	6.26 (3.03–12.92)*	.930	5.83 (4.06–8.36)*	7.38 (3.87–14.09)*	.503
Fight (past year)	3.73 (3.04–4.58)*	3.24 (2.63–4.00)*	.351	3.58 (2.86–4.49)*	3.09 (2.47–3.87)*	.460
Carry Weapon (30-day)	3.96 (2.91–4.44)*	4.92 (3.52–6.68)*	.120	3.57 (2.86–4.47)*	4.39 (3.13–6.00)*	.239
Depressed Mood	2.36 (1.81–3.08)*	1.78 (1.46–2.17)*	.086	2.27 (1.73–2.97)*	1.83 (1.46–2.29)*	.232
Self-Harm (lifetime)	2.56 (1.94–3.37)*	3.42 (2.76–4.23)*	.117	3.14 (2.37–4.15)*	2.88 (2.22–3.49)*	.565

Notes: Bolded terms are significantly different ($p < .05$);

* = $p < .001$ (using regression analyses)

AOR = Adjusted Odds Ratio (adjusted for grade)