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Factors associated with early marijuana initiation in a criminal justice population

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HIGHLIGHTS

- Early marijuana initiation among adolescents is associated with negative outcomes.
- Criminal justice outcomes among high-risk adolescent marijuana users are unclear.
- Earlier marijuana initiation is associated with more criminal offenses as an adult.
- Men in the criminal justice population initiate marijuana before women.
- Race did not affect marijuana initiation age in this population.

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ABSTRACT

Purpose: Initiation of marijuana during adolescence is associated with negative outcomes and is more common among those with criminal justice involvement. We sought to determine demographics, psychosocial factors, mental health factors, and criminal outcomes associated with earlier age at first marijuana use in a criminal justice population.
Methods: Data from structured, in-person interviews of adults in a criminal corrections program were analyzed. Participants (689 men and women ages 19 and older) were recruited for a larger smoking cessation trial (2009–2013) as a volunteer sample by flyers at a community corrections site. 516 had smoked both nicotine and marijuana and were included in the analysis. We determined associations between self-reported age at first marijuana use and sex, race, income, educational attainment, history of abuse, family problems, psychiatric problems, criminal record, and age of nicotine and alcohol initiation.
Results: Of 516 participants, 68% were men, and 64.5% were Black. No participants were of Hispanic ethnicity. Average age of marijuana initiation was 15.1 years (*SD* 3.7 years). After linear regression, earlier age at marijuana initiation was associated with male sex and more criminal offenses (person/violent and court). Race and psychiatric problems were not associated with earlier marijuana initiation.
Conclusions: Earlier adolescent marijuana initiation is associated with more criminal offenses in a criminal justice population. Men initiate marijuana earlier than women. Adolescents at high risk of justice involvement may benefit from delayed initiation of marijuana, specifically men. Additional studies should examine prevention strategies for adolescent marijuana use that target those at highest risk.

1. Introduction

1.1. Statement of problem

Adolescents use marijuana at alarming rates. In 2014, 45% of high school students used marijuana in the past month, and one in ten used it on a daily or near-daily basis (Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2015). The average age of marijuana initiation is 14 years old (American Academy of Child and Adolescent Psychiatry,

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2013), and adolescents are more susceptible to the effects of marijuana than adults because of the rapid brain changes that occur during this developmental period (Squeglia, Jacobus, & Tapert, 2009). Thus, initiation of marijuana during adolescence is associated with heavier and more problematic marijuana use in adulthood (Chen, O'Brien, & Anthony, 2005; Chen, Storr, & Anthony, 2009), and has negative effects on cognitive development (Dahl, 2004), educational outcomes (Leatherdale, Hammond, & Ahmed, 2008), physical symptoms (Brook, Stimmel, Zhang, & Brook, 2008), mental health outcomes (Ellickson, Martino, & Collins, 2004), and increases risk of disordered use and addiction (Chen et al., 2009).

1.2. Background

Because "early initiation" of marijuana - defined by some as use prior to age 14 (Brook, Balka, & Whiteman, 1999) and others as age 16 or less (Pope, Gruber, Hudson, Cohane, Huestis, & Yurgelun-Todd, 2003) has many negative associations, researchers have investigated demographic, mental health, and socioeconomic factors associated with age at first marijuana use in the general population. There have been mixed results in studies examining sex differences in age at first marijuana use (Leatherdale et al., 2008; Chen & Jacobson, 2012; Doherty, Green, Reisinger, & Ensminger, 2008). Similarly, there have also been mixed results in studies examining racial differences in age of marijuana initiation (Chen & Jacobson, 2012; Clark, Doyle, & Clincy, 2013; Sartor, Agrawal, Lynskey, Duncan, Grant, Nelson, et al., 2013). However, studies have found that Black adolescents are more likely to use marijuana as their first substance (Sartor et al., 2013) and use for longer periods of time compared to other races (Finlay, White, Mun, Cronley, & Lee, 2012). The association between race and marijuana use likely differs by the sex of the adolescent (e.g. Black males and White females had higher lifetime marijuana use rates in one study) (Schepis, Desai, Cavallo, Smith, McFetridge, Liss, et al., 2011) and psychosocial characteristics such as maternal education level (Guerra, Romano, Samuels, & Kass, 2000), family cohesion (Doherty et al., 2008), and neighborhood income and racial composition (Cronley, White, Mun, Lee, Finlay, & Loeber, 2012.)

Marijuana use during adolescence may disrupt white matter connections between brain regions that are key in emotional regulation, which may lead to internalizing problems (Medina, Nagel, Park, McQueeny, & Tapert, 2007), poor impulse control (Dawes, Mathias, Richard, Hill-Kapturczak, & Dougherty, 2008), increased depressive and anxiety symptoms (Green & Ritter, 2000; Renard, Krebs, Le Pen, & Jay, 2014), and suicidal behaviors (Lynskey, Glowinski, Todorov, Bucholz, Madden, Nelson, et al., 2004). These effects are more salient for girls (Renard et al., 2014; Patton, Coffey, Carlin, Degenhardt, Lynskey, & Hall, 2002). Adolescent-onset marijuana use has also been associated with psychosis in adults of a certain genetic susceptibility (Caspi, Moffitt, Cannon, McClay, Murray, Harrington, et al., 2005).

In addition to emotional regulation, problems in neurocognitive functioning and academic achievement have been associated with early marijuana use (Leatherdale et al., 2008; Brook et al., 2008). Adolescent initiation of marijuana is predicted by poor school attitude as well as inadequate performance in school (van den Bree & Pickworth, 2005), delinquency, peer substance use (van den Bree & Pickworth, 2005; Kandel & Chen, 2000), deviant behaviors, lower educational achievement (Brook et al., 1999), and increased risk of being arrested for drug and property crime, which may be due to poorer education and lack of job opportunities (Green, Doherty, Stuart, & Ensminger, 2010). In fact, adolescents in the criminal justice system have a higher prevalence of drug use (Morris, Harrison, Knox, Tromanhauser, Marquis, & Watts, 1995) which is positively related to number of offenses and arrests (Sickmund & Puzzanchera, 2014). Childhood sexual and physical abuse has also been linked to earlier marijuana use (Bensley, Spieker, Van Eenwyk, & Schoder, 1999) and more substance-related problems (Simpson & Miller, 2002).

1.3. Age at marijuana initiation in the justice population

The few studies that have examined characteristics of adolescents in the criminal justice system mirror the studies with general adolescent populations, with mixed findings regarding racial and sex differences in marijuana initiation (Vaughn, Wallace, Perron, Copeland, & Howard, 2008; Prinz & Kerns, 2003). Prinz and Kerns describe a relationship between early initiation of substances and drug and violent offense charges in females only (2003). However, no control variables were included in the analysis and marijuana was not specifically assessed in regards to criminal outcomes.

1.4. Current study and hypotheses

Given the limited and mixed findings for marijuana initiation and use among adolescents in the criminal justice system, it remains important to understand these associations since delay of marijuana initiation may help in prevention of mental health and psychosocial outcomes including addiction and other delinquent behaviors. No studies were found to examine the association of age of marijuana initiation with adult criminal charges among a justice population. The current study was conducted to determine what demographic and psychosocial factors are associated with earlier age at first marijuana use in a high-risk criminal justice population. Our second aim is to examine mental health and criminal outcomes associated with earlier age at first marijuana use. We hypothesized that age of marijuana initiation would differ by race and gender, specifically with men and individuals of Black race having earlier age at first use. We also hypothesized that those with earlier marijuana use would have a higher prevalence of depression and anxiety, higher suicidality rating, and more adult legal charges, specifically those of greatest severity (i.e. violent offenses).

2. Material and methods

2.1. Study population

Adults involved in a criminal corrections program in Jefferson County, Alabama (the state's largest county) were recruited for a smoking cessation intervention via flyers posted at the county's community corrections program site. A total of 689 individuals signed informed consent and were assessed for initial eligibility with a baseline assessment. Only those who smoked cigarettes (89% of adults recruited) were allowed to participate in the study and were included in the final analysis. Because the prevalence of cigarette smoking remains high in the criminal justice population at 70–80% (Cropsey, Jones-Whaley, Jackson, & Hale, 2010), this sample was representative of the broader criminal justice population.

Eligible participants were adults age 19 or older currently under criminal justice supervision (e.g., parole, drug court, probation; reporting requirements similar across groups). For the purposes of this analysis, only data from the baseline assessment were used without applying any of the clinical trial exclusion criteria. Participants were compensated $20 for the baseline visit. More details on the study population and original study design can be found in a publication by Cropsey et al. (2015).

Of the 689 adults recruited for the original smoking cessation study and receiving a baseline assessment, 516 participants endorsed marijuana use and were considered eligible for the current analysis. Those excluded were those who had never used nicotine ($n = 78$) and those who denied past marijuana use ($n = 95$).

2.2. Data collection

Trained personnel performed a baseline assessment which included informed consents, self-report measures of demographics and smoking history, and semi-structured interviews to obtain information on

substance use, psychosocial factors, and criminal history. Baseline assessment data were collected between 2009 and 2013. The randomized trial from which the current study's data were collected was registered with ClinicalTrials.gov (NCT01257490) and received approval from the University at Alabama at Birmingham's Institutional Review Board.

2.3. Measures

Trained interviewers performed two structured interviews: the Addiction Severity Index (ASI) (McLellan, Luborsky, Woody, & O'Brien, 1980) and Mini-International Neuropsychiatric Interview (M.I.N.I.) v. 10 (Sheehan, Lecrubier, Sheehan, Amorim, Janavs, Weiller, et al., 1998). The ASI assesses psychosocial functioning across seven domains including General Information, Medical Status, Employment/Support Status, Drug/Alcohol Use, Legal Status, Family/Social Relationships, and Psychiatric Status in order to obtain overall severity profiles indicated by the interviewer.

Demographic information collected during interviews included date of birth, race, and sex. Of note, race gave the following options, of which the participant had to choose only one: White (not of Hispanic origin), Black (not of Hispanic origin), American Indian, Alaskan Native, Asian or Pacific Islander, Hispanic-Mexican, Hispanic-Puerto Rican, Hispanic-Cuban, and Other Hispanic. The participant was asked to identify a sex as "male" or "female".

Social variables obtained from the ASI for use in this analysis were education completed (recorded in years), net income (recorded as a sum of all sources of income in the past 30 days including employment, unemployment compensation, down payment assistance, pension or social security, family or friends, and illegal), Family problems in the past 30 days (recorded as yes/no) and Lifetime history of sexual or physical abuse (recorded as yes/no to the question "Has anyone ever abused you physically or sexually?"). Income information was coded as a continuous variable. Education information was categorized by investigators into two categories: less than a high school education or high school education/general education diploma (GED) or greater.

The following legal variables were obtained from the ASI interview and were based on self-report: number of arrests, person offenses, property offenses, drug offenses, and court offenses. Person offenses are also known as violent offenses and include robbery, assault, rape, homicide, and manslaughter. Property offenses include shoplifting, vandalism, burglary, larceny, and arson. Drug offenses include public intoxication, driving while intoxicated, and other drug-related charges. Examples of court offenses include parole violations and contempt of court. The number of arrests variable was obtained from a question that asks, "How many times in your life have you been arrested and charged with the following," and then lists multiple offenses. Thus, this variable includes arrests associated with charges and is a continuous variable (e.g. 0, 1, 2). Other offense variables were coded in a dichotomous fashion (i.e. Yes/No).

Psychiatric variables of interest were obtained from the validated Mini-International Neuropsychiatric Interview (M.I.N.I.) version 10, a widely-used psychiatric clinical and research tool with high sensitivity and specificity in detection of psychological disorders based on Diagnostic and Statistical Manual IV (DSM-IV-TR) criteria as well as suicide risk (Sheehan et al., 1998). The complete M.I.N.I. was given to each study participant by trained interviewers. After scoring, personnel indicated if the participant met criteria for a Depressive Disorder (including Major Depressive Episode or Major Depressive Episode with melancholic features), Anxiety Disorder (including Generalized Anxiety Disorder, Posttraumatic Stress Disorder, Obsessive Compulsive Disorder, Social Phobia, Specific Phobia, and Panic Disorder with or without agoraphobia), or Psychotic disorder (any current or lifetime history). Past month suicidality was also determined using the M.I.N.I. suicide risk scale. Suicide risk was scored on a scale from zero to 33, with those scoring higher being at higher risk of suicide anytime in the past month.

The main variable of interest was age at first use of marijuana. This variable was obtained during the Addiction Severity Index (ASI) interview. Interviewers were trained to ask specifically the age at first use of marijuana and length of time of use. To determine the independent contribution due to age of onset of marijuana as well as the high comorbidity of use between nicotine, alcohol, and marijuana (Kandel & Chen, 2000; Green et al., 2010; Cropsey, Linker, & Waite, 2008), age at first nicotine use and age at first alcohol use were included in the analysis. All participants were strongly encouraged by interviewers to give an exact age of first use. Of note, while most variables had complete data, only 499 of the 516 included in this study had used alcohol. Thus, 17 participants had no data on age at first alcohol use.

2.4. Data analysis

All study participants ($n = 516$) were analyzed in order to determine factors associated with earlier age at first use of marijuana. Correlations between age at first marijuana use and demographic, social, legal, substance use, and psychiatric variables were determined using Pearson Correlations. Variables displaying a significant correlation were included in a linear regression analysis to determine their association with earlier age at first marijuana use. Significance level was determined to be at the alpha <0.05 level. Of note, negative t-scores were possible given that some outcomes may have been associated with *younger* age at first marijuana use.

The current study population was stratified by race and sex in order to determine differences in age at first marijuana use: Black men, Black women, White men, and White women. Age at first use of marijuana was compared between the four groups using ANOVAs (without controlling for any other factors). Tukey's Honestly Significant Difference tests were utilized to describe the differences in age at first marijuana use between the four groups.

Table 1
Descriptive statistics ($n = 516$).

Variable	Result
Current age in years (mean, SD)	36.9 (11.1)
Years of age at first marijuana use (mean, SD)	15.1 (3.7)
Years of age at first nicotine use (mean, SD)	14.4 (3.9)
Years of age at first alcohol use (mean, SD)	14.2 (3.8)
Race[a]	
Black (n, %)	332 (64.5)
White (n, %)	183 (35.5)
Sex[b]	
Male (n, %)	351 (68.3)
Female (n, %)	163 (31.6)
Monthly income (mean in dollars, SD)	566.85 (732.64)
Education[c]	
Less than high school (n, %)	158 (30.8)
High school or greater (n, %)	355 (69.2)
Problems with family (n, %)[b,d]	148 (28.8)
Lifetime history of abuse	
Sexual abuse (n, %)[b]	93 (18.1)
Physical abuse (n, %)[b]	122 (23.7)
Psychiatric problems	
Depressive disorder (n, %)	109 (21.1)
Anxiety disorder (n, %)	121 (23.5)
Psychotic disorder (n, %)[e]	25 (4.8)
Suicide rating from M.I.N.I. (mean, SD)	1.0 (3.2)
Offenses[a,f]	
Person offenses (n, %)	135 (26.2)
Property offenses (n, %)	235 (45.6)
Drug offenses (n, %)	414 (80.4)
Court offenses (n, %)	261 (50.7)
Total number of arrests (mean, SD)[a]	10.1 (11.7)

[a] $n = 515$.
[b] $n = 514$.
[c] $n = 513$.
[d] Problems with family in past 30 days.
[e] Includes any lifetime history of psychotic disorder.
[f] Number of participants with any history of one or more of the listed offenses.

3. Results

The mean age of those included in the present study ($n = 516$) was 36.9 years ($SD = 11.1$ years) (Table 1). All participants were of Black or White race, typical of the demographics of Birmingham, Alabama. There were no participants of Hispanic ethnicity. Most of the participants were Black men. The average age of marijuana initiation was 15.1 years (*SD* 3.7

years). Nicotine and alcohol were initiated at earlier ages than marijuana: 14.4 years (*SD* 3.9 years) and 14.2 years (*SD* 3.8 years), respectively. Average total monthly income was $566.85 (*SD* $732.64), and most had at least a high school diploma or GED credential. More than one quarter of participants reported problems with family members in the past 30 days. Psychiatric problems were common with approximately one in five meeting criteria for a depressive disorder or an anxiety disorder. Drug offenses were the most common type of offense, and over one quarter of participants had been charged with at least one person/violent offense in the past. Our sample had low current suicide risk (Table 1).

Age at first use of marijuana was found to correlate with age at first nicotine use, age at first alcohol use, sex, total income, education level completed, suicide risk rating, number of arrests, person offenses, drug offenses, and court offenses in a statistically significant relationship (Table 2). Of note, race was not correlated with age at first marijuana use. Similarly, property offense history, family problems, physical abuse, sexual abuse, current depressive disorder, current anxiety disorder, and psychotic disorder were not statistically significantly correlated with age at first use of marijuana.

Linear regression analysis showed earlier age at first use of marijuana was associated with earlier age at first nicotine and alcohol use, male sex, greater number of person offenses, and greater number of court offenses (Table 3). Earlier age of marijuana initiation was also related to lower total monthly income and less completed years of education (but not statistically significant).

Black women initiated marijuana later than all other race/sex groups. Black women initiated marijuana at mean age of 16.3 years (*SD* 5.1 years) compared to 14.7 years (*SD* 3.1 years) in Black men (95% Confidence Interval of mean difference (0.32, 2.70)) and 14.8 years (*SD* 3.5 years) in White men (95% Confidence Interval of mean difference (0.06, 2.81)). There was no statistically significant difference between Black women (16.3 years (*SD* 5.1 years)) and White women (15.6 years of age (*SD* 3.8 years)) for age at first marijuana use. Similarly, there was no difference in age at first marijuana use between Black and White men. The difference in age at first use of marijuana between all men and White women was not statistically significant.

Table 2
Correlations between age at first use of marijuana and other drug use, demographic, social, psychiatric, and legal variables.

Measures	Pearson correlation coefficient for age at first use of marijuana
Age at first nicotine	0.43**
Age at first alcohol	0.42**
Race	0.00
Sex	0.15**
Total income	0.09*
Education completed	0.10*
Problems with family	0.01
Sexual abuse	0.01
Physical abuse	0.05
Anxiety disorder	−0.04
Depressive disorder	−0.05
Psychotic disorder	0.05
Suicide risk rating	−0.10*
Number of arrests	−0.11*
Person offenses	−0.18**
Property offenses	−0.08
Drug offenses	−0.11*
Court offenses	−0.15**

* $p < 0.05$.
** $p \leq 0.001$.

Table 3
Multiple linear regression analysis for age at first marijuana use.

Variable	Beta coefficient	T statistic	*P* value
Age at first nicotine	0.29	6.90	<**0.001**
Age at first alcohol	0.27	6.40	<**0.001**
Sex	0.12	3.20	**0.001**
Total income	0.07	1.91	0.06
Education completed	0.07	1.70	0.09
Suicide risk	−0.06	−1.49	0.14
Number of arrests	−0.03	0.61	0.54
Person offenses	−0.08	−2.05	**0.04**
Drug offenses	−0.06	−1.43	0.15
Court offenses	−0.10	−2.50	**0.013**

Bold formatting indicates P values of statistical significance.

4. Discussion

4.1. Early marijuana initiation and criminal offenses

When controlling for demographic, social, legal, psychiatric, and drug use variables, earlier age at first marijuana use was associated with more person and court offenses. This finding is supported by a prospective study that found early (prior to 16 years of age) and heavy marijuana use to be associated with adult drug and property offenses (Green et al., 2010). This association between early marijuana use and criminal behavior has also been seen in adolescent studies showing that adolescents with heavy marijuana use are at higher risk for future deviant behaviors (Kandel & Chen, 2000), specifically those with earlier age at substance use initiation (Zhang, Wieczorek, & Welte, 1997). However, one unique contribution from this study was the association between earlier age of initiation of marijuana and later violent offenses, even after controlling for alcohol and nicotine use, other criminal behaviors, psychiatric problems, and social factors. To our knowledge, our study is the first to find this association after controlling for other common comorbidities. This suggests an important target of a delay in initiation and progression of marijuana use in adolescence to assist in decreasing future violent crime charges.

4.2. Early marijuana initiation and sex

In a high-risk criminal justice population, being a male was associated with younger age at first use of marijuana. While adolescent studies have found varying effects of gender on marijuana initiation (Leatherdale et al., 2008; Chen & Jacobson, 2012; Doherty et al., 2008), the effect of sex on marijuana initiation in high-risk adolescent populations is not well-studied. One study among adolescents in a drug treatment program found no difference in age of marijuana initiation by sex (Bracken, Rodolico, & Hill, 2013). Our results indicate that men in a criminal justice population tend to use marijuana earlier than women after taking other social, psychiatric, substance use, and demographic variables into account. While the reason for this gender difference is unclear, men (specifically those of Black race) are less impacted by protective family factors (i.e. cohesion and parental rule-setting) compared to women (Doherty et al., 2008). In addition, study participants reported low monthly income (Table 1), a factor that influences early marijuana use among Black men more than other groups (Cronley et al., 2012).

4.3. Early marijuana initiation and race

Race (i.e. Black or White) did not affect age at first use of marijuana in our population, similar to findings by Prinz and colleagues in a criminal justice setting (2003) and in other general adolescent populations

(Chen & Jacobson, 2012; Clark et al., 2013; Sartor et al., 2013). However, Cronley and colleagues found that Black men had earlier age at first marijuana use than White men (2012). It is most likely that race did not affect marijuana initiation because it was analyzed separately from sex.

When taking both sex and race into account, Black women were found to have later onset of marijuana use compared to men of both races. While White women also were older than all men at first marijuana use, the effect was not statistically significant. Perhaps with more women participants, White women would have also achieved a statistically significant difference in age at first marijuana use compared to men. These findings reiterate the difference in marijuana initiation by sex, with women initiating marijuana later than men. While it is unclear if Black women initiate marijuana later than White women, Black women are more likely to use marijuana as their first substance (before alcohol and other drugs) (Sartor et al., 2013). More research should be done to investigate marijuana initiation among demographic groups in a justice population.

4.4. Early marijuana initiation and psychiatric and social variables

While age at first marijuana use in our sample was initially associated with suicide risk, it was no longer significant when considering other factors that are associated with age at first use. This finding may be due to the low report of suicidality in this sample. Also, in our sample, age at first use was not associated with later anxiety or depression. It is likely that we did not find the expected associations because we assessed only age at initiation of marijuana and did not examine frequency of marijuana use during adolescence and young adulthood, a factor associated with future anxiety and depression regardless of age of onset of first use (Hayatbakhsh, Najman, Jamrozik, Mamun, Alati, & Bor, 2007). Additionally, the association between early marijuana use and anxiety and depression may differ in a criminal justice population compared to the general population. In a high-risk justice population, other factors such as inadequate resources and low social support may be greater contributors to later depression, anxiety, and suicidality (Cutrona, Wallace, & Wesner, 2006). Our conflicting findings may also be due to the way we measured depression and anxiety, which was based on a rigorous DSM-IV semi-structured interview and not self-assessments of depressive or anxiety symptoms (Green & Ritter, 2000; Patton et al., 2002; Hayatbakhsh et al., 2007). Although marijuana use in adolescence has been associated with later psychosis (Caspi et al., 2005), age at first use of marijuana in this particular population was not associated with psychotic disorder. This association was difficult to assess given the low number of participants with psychotic disorder.

Age at first marijuana use in our population was not associated with history of physical abuse, sexual abuse, or past 30 day family problems. While childhood abuse has been associated with early marijuana use (Bensley et al., 1999), it was unclear if abuse reported by participants occurred during childhood or later in life.

4.5. Confounding variables

Low educational attainment has been associated with early marijuana use (Juon, Fothergill, Green, Doherty, & Ensminger, 2011), criminal justice involvement (Green et al., 2010), socioeconomic status, and parental supervision (Fothergill & Ensminger, 2006). Thus, education was included as a control variable. Parental substance use (Doherty et al., 2008), connectedness to school (Fothergill & Ensminger, 2006), family socioeconomic status (Cronley et al., 2012) and peer factors including peer substance use and deviance (Kandel & Chen, 2000) are important correlates and possible confounders linking marijuana initiation to negative adult outcomes. These variables were not available for inclusion in the analysis. Both attention deficit hyperactivity disorder (ADHD) and conduct disorder have been associated with problematic substance use and earlier substance initiation (Lee, Humphreys, Flory, Liu, & Glass, 2011; Arias, Gelernter, Chan, Weiss, Brady, Farrer, et al., 2008; Disney, Elkins, McGue, & Iacono, 1999; Cropsey et al., 2008). However, no data on conduct disorder or ADHD were available to include in the analysis.

Participants were assessed for lifetime history of antisocial personality disorder (ASPD), a psychiatric disorder related to conduct disorder (American Psychiatric Association, 2013), of which 76 participants (14.7%) answered positively. ASPD was not included as a covariate in this study because it cannot be diagnosed prior to adulthood (American Psychiatric Association, 2013). Also, our outcome variable, criminal offenses, is a criterion for ASPD and associated with the disorder (American Psychiatric Association, 2013; Friedman, Kramer, Kreisher, & Granick, 1996); therefore including it would confound our results.

5. Limitations

This study has multiple limitations. Our study was performed among an adult community corrections population in the southern United States and included only Black and White participants who smoked tobacco. Thus, the findings cannot be generalized to the non-criminal justice population or to groups of greater geographic and demographic diversity. Another limitation was the retrospective nature of recall of first use of marijuana among adults already involved in the legal system. Concordance between self-report of substance use and biochemical verification (e.g. urine drug screen) has been found to be lower among criminal justice populations and those of low socioeconomic status (Clark, Zyambo, Li, & Cropsey, 2016). However, some researchers have shown that age at first use is more accurately reported by adults compared to adolescent responders (Johnson & Mott, 2001). Similarly, criminal offense histories were self-reported by participants leading to the concern that offenses would be minimized. We were unable to assess criminality in a more objective manner. In the few studies available on concordance in offense reporting, a small number (approximately 10–20% of offenders in two studies) underreport offenses (Heckert & Gondolf, 2000; Kroner, Mills, & Morgan, 2007). Thus, it is unlikely that underreporting of offenses affected our results.

All data including age at first use of marijuana, nicotine, and alcohol, were self-reported from adults during structured interviews. The effects of early marijuana initiation are best assessed by interviewing adolescents and following them in a prospective manner. We also excluded those who had only smoked marijuana without comorbid tobacco use, a subpopulation with potentially different risk factors and associated outcomes that should be studied in the future. Despite these limitations, our findings assist in expanding knowledge on risk factors for future negative social and legal outcomes for adolescents at risk of criminal justice involvement.

6. Conclusions

Among individuals in the criminal justice system, earlier age at first use of marijuana is associated with multiple negative criminal outcomes including more violent offenses in adulthood. While race does not seem to affect age at initiation of marijuana, adolescent men tend to begin marijuana earlier than women in a criminal justice population. Since justice populations comprise the most vulnerable and high-risk of the adolescent population, efforts can be made to improve health for adolescents and young adults in the justice system by prevention or delay of initiation of marijuana, a task that may prove more challenging in coming years due to increasing availability of marijuana. Improvements in identification of early and heavy marijuana use among adolescents in high-risk populations can improve future outcomes.

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Contributors

R.J.S. and V.L.K. crafted the study question with design input and guidance by C.B.C. and K.L.C. R.J.S. and V.L.K. performed literature searches and provided summaries of research studies. C.B.C. and K.L.C. performed the statistical analyses. R.J.S. and V.L.K. together wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript. Of note, K.L.C. had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Conflict of interest

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