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Examining Factors That Contribute To Motives For Marijuana Use Among African American Adolescents

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EXAMINING FACTORS THAT CONTRIBUTE TO
MOTIVES FOR MARIJUANA USE
AMONG AFRICAN AMERICAN ADOLESCENTS

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EXAMINING FACTORS THAT CONTRIBUTE TO MOTIVES FOR MARIJUANA USE AMONG
AFRICAN AMERICAN ADOLESCENTS

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MEDICAL CLINICAL PSYCHOLOGY

ABSTRACT

Marijuana is the most frequently used illicit substance by adolescents in the United States. African American adolescents tend to use marijuana at higher rates and suffer from more severe consequences compared to Caucasian adolescents. Additionally, African American adolescents may be more vulnerable to psychosocial factors, such as depression, post-traumatic stress, and associating with substance using peers that may cause them to use marijuana for specific reasons. These vulnerabilities may contribute to African American adolescents using marijuana at a higher rate than their Caucasian counterparts. Thus, the main purpose of this study was to examine the contribution of mental health problems and associating with substance using peers to marijuana use motives among African American adolescents, and whether these motives in turn predict marijuana use.

The sample included 497 late adolescents and emerging adults (mean age 17.74, 52% female, 81% African American, 19% Caucasian), who participated in Wave 3 of the Birmingham Youth Violence Study. Results indicated that African American adolescents had higher rates of lifetime marijuana use and were more likely to report past 12-month

marijuana use in comparison to Caucasian adolescents. Regarding the factor analysis of the Marijuana Motives Measure among African American participants who endorsed past year marijuana use (N=141), a "modified" Marijuana Motives Measure, based on the theoretical 5-factor structure, but with some items removed, indicated the best fit. Path models, using the "modified" Marijuana Motives Measure, revealed that more depressive symptomatology predicted using marijuana for coping motives, which in turn predicted greater frequency of marijuana use in the past year among African American late adolescents. Also, affiliation with substance using peers predicted using marijuana for more enhancement and social motives. Finally, using marijuana for expansion motives predicted more frequent past year marijuana use and using marijuana for conformity motives predicted less frequent past year marijuana use. Results suggest that identifying motives for marijuana use may help improve therapeutic approaches to more effectively reduce marijuana use among late adolescents and emerging adults. Overall, this study contributed and expanded existing literature on adolescent marijuana use and suggested potential intervention strategies to decrease marijuana use in a high risk population.

Keywords: Marijuana, adolescence, motives, peer substance use, depression, PTSD

DEDICATION

This work is dedicated to my family and friends who have been extremely supportive during my journey.

But, especially, in loving memory my grandmother and father:

- Loette King, who I called "Big Mama", was constantly available to lend an ear, give me words of wisdom, and comfort me when I needed it the most, especially during my first year of graduate school, and

- Victohr Rivers, who always listened, shared my love for trying new foods, and provided humor to lighten up any moment

Also, to my mother, Vivian King, who has stayed up every night that I had a paper due, a test to study for, or a presentation to practice, and who has been the role model and support system I hope to be to others, and my brother, Robert King, Sr., who has been an inspiration to me my entire life. And last but not least, my loving fiancé, Christopher Murphy, who has remained patient and supportive throughout my education, and has given me a new perspective on life.

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CHAPTER 1

INTRODUCTION

Marijuana is the most frequently used illicit substance by adolescents in the United States (Meich et al., 2015). While substance use in general has declined among high school seniors, marijuana use has increased over the past 5 years (Lanza et al., 2015). In fact, almost half of 12th graders, 34% of 10th graders, and 16% of 8th graders report having used marijuana in their lifetime and about 6% of high school seniors are daily or near-daily marijuana users (Meich et al., 2015). Adolescent marijuana use is a concern because it is considered a precursor to other illicit drug use (Kandel, 2003; Patton et al., 2007). Indeed, 40% to 50% of adolescent marijuana users report using other illicit drugs (Meich et al., 2015).

Over the past 10 years, marijuana use has most notably increased among males and African American adolescents. Specifically, African American adolescents recently had a higher prevalence of marijuana use in the past year compared to Caucasian adolescents (13% vs. 8%) (Lanza et al., 2015). Also, African American youth tend to suffer from greater consequences of marijuana use (e.g., psychiatric disorders, arrests) than Caucasian adolescent users (Chen & Jacobsen, 2012); however, mechanisms that may underlie these relationships are unclear. Since the frequency and consequences of marijuana use are often related to adolescents' reasons for using marijuana (e.g. Fox et al., 2011; Simons et al., 1998) and these motives appear to vary by race (e.g., Buckner et al., 2016; Patrick et al., 2011b; Terry-McElrath, O'Malley, & Johnston, 2009), racial

differences in motives for using marijuana may explain racial discrepancies in the rates of marijuana use and severity of related consequences. Additionally, African American adolescents may be more vulnerable to psychosocial factors, such as depression, post-traumatic stress, and associating with substance using peers, that may cause them to use marijuana for specific reasons (e.g., to cope or to conform to peer pressure). These vulnerabilities may contribute to African American adolescents using marijuana at a higher rate than their Caucasian counterparts. Thus, the purpose of this study is to examine the contribution of mental health problems and associating with substance using peers to marijuana use motives among African American adolescents, and whether these motives in turn predict marijuana use.

Epidemiology of Adolescent Marijuana Use

Over the last decades, the first peak of adolescent marijuana use was noted in the 1970s, when 50% of high school seniors reported using marijuana within the past year (Lanza et al., 2015). Afterwards, marijuana use among adolescents decreased until it began to rise again in 1990s, which was considered the relapse period (Meich et al., 2015). While there has been a recent increase in past year marijuana use among adolescents, it is still lower than the historic peak of use in the 1970s. At the same time, today's rate of daily marijuana use among high school seniors is higher than it was at the end of the relapse period. In fact, the average rate of daily marijuana use over the past five years is the highest it has been in the last two decades (Meich et al., 2015).

The trends in marijuana use have closely followed trends in adolescents' attitudes and beliefs about marijuana use (e.g., perceived harmfulness and peer approval). After

the 1970s, media campaigns advertising the negative effects of frequent marijuana use likely contributed to greater perceptions of harm from marijuana use and perceived peer disapproval of marijuana use. Presently, fewer adolescents disapprove of marijuana use and have lower perceptions of risks associated with marijuana use, perhaps due to greater approval of marijuana use in the media (Meich et al., 2015). There are concerns that recent medical marijuana legalization in some U.S. states may promote greater use among adolescents. However, adolescent marijuana use did not appear to increase in states where its use was legalized based on data collected prior to 2011 (5 of the 10 states included in the Youth Behavior Risk Surveillance Study; Choo et al., 2014). However, it may be too soon to determine whether these policy changes affect the prevalence of adolescent marijuana use. Additionally, more recent legalization of marijuana use for recreational purposes for adults (e.g., in the states of Colorado, Oregon, and Washington) may have greater impact on adolescent marijuana use than legalization of its medical use.

Marijuana use also varies by gender. Younger adolescent males report slightly higher levels of marijuana use in the past year than females and these gender differences increase in later adolescence, with 8.5% of male 12th graders reporting daily marijuana use compared to only 3.3% of females (Meich et al., 2015). Additionally, marijuana use is related to socioeconomic background, with adolescents from low SES families reporting earlier initiation of marijuana use and higher levels of daily, past year, and lifetime marijuana use than adolescents with higher SES (Meich et al., 2015; Williams, et al., 2007). However, these SES differences are more prominent in early adolescence and typically disappear by the time adolescents are high school seniors (Meich et al., 2015).

Regarding racial/ethnic differences, there does not appear to be any differences between racial/ethnic groups in average age of marijuana use initiation (Chen & Jacobson, 2012; Meich et al., 2015), but historical trends in racial/ethnic differences in marijuana use prevalence are notable. Caucasian adolescents have generally reported the highest prevalence of marijuana use over the past 40 years, followed by Hispanic adolescents and African American adolescents (Meich et al., 2015; Tragesser et al., 2007). However, these trends have reversed over the past decade. In fact, multiple recent national studies have found that African American and Hispanic adolescents now report higher levels of marijuana use than Caucasian youth (Chen & Jacobson, 2012; Kann et al., 2014; Lee & Abdel-Ghany, 2004; Meich et al., 2015). Regarding annual marijuana use, prevalence tends to be highest among either Hispanic students or African American students, followed by Caucasian students (Kann et al., 2014; Meich et al., 2015). Similarly, nationally representative data from the Monitoring the Future study noted that daily marijuana use among African American and Hispanic high school seniors has been increasing in prevalence over the past decade, compared to steady prevalence among Caucasian high school seniors (Meich et al., 2015).

African American students also are more likely to continue using marijuana into adulthood and tend to use it more frequently than other racial/ethnic groups over time (Chen & Jacobson, 2012). Specifically, African Americans have the highest levels of marijuana use into their late 20s, with marijuana use declining later - around age 29 compared to age 25 for other racial/ethnic groups (Chen & Jacobson, 2012). Additionally, African Americans experience more negative consequences of marijuana use in adulthood (Brown et al., 2004; Chen & Jacobson, 2012; Gil, Wagner, & Tubman,

2004; Lee et al., 2010). For instance, African American adolescents who engage in marijuana use report more psychiatric disorders, hard drug use, and arrests in adulthood than Caucasians who report similar or higher levels of use (Brown et al., 2004; Gil, Wagner, & Tubman, 2004; Lee et al., 2010).

Adolescents are at Increased Risk for Marijuana Use

Multiple aspects of brain development in adolescence increases individuals' susceptibility to use psychoactive substances, including marijuana. First, pubertal development leads to increased secretion of estrogen and testosterone, which leads to greater concentration of dopamine receptors in the brain and easier activation of dopaminergic pathways that underlie the experience of pleasure (Steinberg, 2014; Tarter, 2002). Second, the nucleus accumbens, a small structure within the limbic system that plays a key part in the experience of pleasure, grows during the transition from childhood to adolescence, also contributing to greater sensitivity to pleasure at this time (Steinberg, 2014). These changes contribute to greater limbic system reactivity that makes adolescents more sensitive to social and emotional stimuli and rewards, such as peer approval (Bava & Tapert, 2010). In fact, simply interacting with peers is more rewarding for adolescents than adults or children when examining brain activity (Chein et al., 2011). Third, neural circuitry that is responsible for inhibiting behavioral responses is not yet fully developed in adolescence, which contributes to more impulsive behavior (Casey, Jones, & Hare, 2008). Given that adolescents spend more time with peers and less time with parents than younger children (Fuligni & Eccles, 1993), and that unsupervised time with peers increases the likelihood of engaging in risky behaviors (including substance

use) (Dishion & Tipsord, 2011), the combination of being more sensitive to social rewards and greater impulsivity make adolescents more vulnerable to substance use and other risky behavior in situations involving peers (Steinberg, 2014). Indeed, affiliation with marijuana-using peers is the strongest proximal predictor of adolescents' marijuana use (Kandel, 1985; Simons-Morton, 2007; Wills et al., 2006).

Negative Outcomes Associated with Adolescent Marijuana Use

Brain development during adolescence also makes youth more vulnerable to the negative effects of substances. For example, as the nucleus accumbens develops, it becomes more sensitive to the chemical properties of addictive substances, such as nicotine, alcohol, and marijuana; therefore, substance use experimentation during adolescence is more likely to lead to dependence (Stone et al., 2012). The effects of marijuana on the brain are due to tetrahydrocannabinol (THC), which is derived from Cannabidiol (THC-COOH) when heated. Unlike THC-COOH, THC can penetrate the blood-brain barrier, where it binds to CB1 and CB2 cannabinoid receptors (Pertwee, 2008).

CB1 receptors are highly concentrated in the frontal regions, hippocampus, basal ganglia, cerebellum, amygdala, and striatum; therefore these brain regions are more vulnerable to the effects of THC (Bava & Tapert, 2010). The chemical structure of THC mimics anandamide, which is a natural endogenous neurotransmitter (Ellgren et al., 2008). Unlike anandamide, however, exogenous cannabinoids, such as THC, disrupt the function of the endocannabinoid system through the down regulation of binding sites and desensitization of CB1 receptors, which can affect the process of strengthening and

pruning cortical neuronal networks within the prefrontal cortex (PFC; Bossong &

Niesink, 2010). As such, the effects of THC on the brain are strongest if marijuana use

begins in adolescence, when PFC is still developing (Volkow et al., 2014), thus rendering

adolescents more susceptible to the effects of marijuana than adults (Squeglia, Jacobus, &

Tapert, 2009).

The consumption of THC has been associated with decreased activity in the PFC

(Volkow et al., 2014) and reduced hippocampal volumes during adolescence (Yücel et

al., 2008). Additionally, THC consumption has been associated with reduced functional

connectivity in PFC regions responsible for executive functioning, such as decision

making and inhibitory control, and subcortical networks in the hippocampus important

for processing habits and routines (Volkow et al., 2014). Ingesting THC also has been

associated with impaired neural connectivity in the precuneus, a brain region important

for alertness and self-conscious awareness, and the fimbria, a key structure in learning

and memory (Volkow et al., 2014).

Consistent with these neural impairments, using marijuana during adolescence has

been linked to problems in neurocognitive functioning and poorer academic achievement

(Brook et al., 2008; Leatherdale, Hammond, & Ahmed, 2008). For instance, adolescents

who begin using marijuana earlier tend to have delays in learning and memory, lower

grades, and poorer executive functioning and processing speed (Brook, Stimmel, Zhang,

& Brook, 2008; Meier et al., 2012). Also, adolescents who initiate marijuana use at a

younger age are less likely to complete high school or continue their education post high

school (Chatterji, 2006). Additionally, frequent and persistent marijuana use has been

associated with decreased IQ scores by mid-adulthood (Meier et al., 2012).

Exposure to THC during adolescence has also been linked with impairments in the nucleus accumbens, which could increase sensitivity to other drugs (Ellgren et al., 2008), consistent with the claim that using marijuana often leads to the use of other illicit drugs (Kandel, 2003; Timberlake et al., 2007). Adolescents who engage in marijuana use, especially those who use marijuana earlier and more frequently, are at greater risk for abusing marijuana (Agrawal, Neale, Prescott, & Kendler, 2004), developing a marijuana or another drug addiction (Hall & Degenhardt, 2007; Lopez-Quintero et al., 2001), and engaging in other illicit drug use (Agrawal et al., 2004; Lynskey et al., 2003) than individuals who start using marijuana in adulthood. Substance abuse during adolescence also increases the risk of later being arrested for drug and property crimes (Green, Doherty, Stuart, & Ensminger, 2010).

In addition to neural effects underlying cognitive deficits and increased sensitivity to other drugs, THC consumption in adolescence is associated with reduced volume in the amygdala, brain region responsible for integrating emotions, emotional behavior, and motivation (Yücel et al., 2008). Marijuana use may also disrupt white matter connections between brain regions in the frontal lobe that are important for emotion regulation (Squeglia, Jacobus, & Tapert, 2009). These neural effects may contribute to internalizing problems, such as depression and anxiety (Green & Ritter, 2000; Medina et al., 2007; Renard, Krebs, Le Pen, & Jay, 2014), suicidal behaviors (Hyman & Sinha, 2009; Lynskey et al., 2004), poor impulse control (Dawes et al., 2008), externalizing disorders (McGee, Williams, Poulton, & Moffitt, 2000), and increased risk for schizophrenia in individuals who have an underlying vulnerability for psychosis (Chadwick, Miller, & Hurd, 2013; Henquet, Murray, Linszen, & van Os, 2005; Malone, Hill, & Rubino, 2010).

Motives for Using Marijuana

Individuals have different reasons or motives for using marijuana, leading to efforts to describe and develop measures of such motives (i.e. Johnston & O'Malley, 1986; Simons et al., 1998; Terry-McElrath et al., 2009). Johnston and O'Malley (1986) examined high school students' motivations to use marijuana using self-report data from the Monitoring the Future project between 1976 and 1984. They classified the most frequently reported motives for marijuana use as social/recreational reasons (e.g., to get high, to have a good time with my friends), coping with negative affect (e.g., because of anger or frustration, to relax), compulsive use (e.g., to get through the day, because I'm hooked), and drug effects (e.g., to decrease or increase the effects of another drug) (Johnston & O'Malley, 1986). Consequently, these motives for substance use have often been examined in later research on various substances (e.g., Patrick et al., 2011a, 2011b; Terry-McElrath et al., 2009). For marijuana specifically, Terry-McElrath and colleagues (2009) expanded Johnston and O'Malley's (1986) original categories and added miscellaneous motives (e.g., seek deeper insights). While their marijuana use motive measure was based on adolescent self-reports, its internal consistency has not been examined to date.

In another attempt to elucidate the motives for marijuana use among adolescents, Simons and colleagues (1998) developed a five-factor Marijuana Motives Measure based on Cooper's (1994) Drinking Motives Measure. The original Drinking Motives Measure includes four types of motives - enhancement (e.g., to get high), coping (e.g., to forget worries), social (e.g., to be sociable), and conformity (e.g., so others won't kid me about not drinking), and has good internal consistency and validity (Cooper et al., 1994).

Simons and colleagues (1998) retained the four original scales and added expansion

motives for marijuana use (e.g., to be more creative and original, expand awareness)

adapted from another instrument (Newcomb et al., 1988). The resulting five-factor

Marijuana Motives Measure is widely used and has shown good reliability and internal

consistency in several studies with predominately Caucasian adolescents, with

Cronbach's alpha ranging from .86 to .93 (e.g., Chabrol et al., 2005; Simons et al., 1998;

Zvolensky et al., 2007). It is unclear if this factor structure is generalizable to African

American adolescents or other racial/ethnic minorities. For instance, the internal

consistency of the same measure ranged from .62 to .95 for subscales in a sample of

African American young adults; therefore Buckner and her colleagues (2016)

recommended that the psychometric properties of this measure be examined in a

primarily African American sample.

A potential problem with the first Terry-McElrath and colleagues' (2009) measure

is that it groups multiple types of motives into broad categories. For instance, the

social/recreational motives include reasons that fall into several categories on the second

Marijuana Motives Measure: conformity (e.g., "to fit in"), enhancement (e.g. "to get

high"), and social motives (e.g., "to have a good time with my friends"). Consistent with

the structure of the Marijuana Motives Measure, these motives are often viewed as

conceptually distinct (e.g., conforming motives address the element of peer pressure,

whereas social motives include simply engaging in a behavior in a social setting, and

enhancement motives are not dependent on using marijuana with other people) and have

different correlates (Lee, Neighbors, & Woods, 2007; Simons et al., 1998; Zvolensky et

al., 2007). Additionally, some items in the "compulsive reasons" category could be

considered indicators of coping motives (e.g., "to get through the day"). Lastly, Terry-McElrath and colleagues' (2009) measure does not adequately address expansion reasons for using marijuana. It includes one item, "seek insight", under the "miscellaneous" category, but not a separate scale measuring expansion motives. Many marijuana users believe that smoking marijuana enables them to be more creative or more aware (Kamali & Steer 1976; Newcomb et al., 1988); therefore, it is important that this motive be explored in addition to other common motives.

<div align="center">Racial/Ethnic Differences in Marijuana Use Motives</div>

The few studies that have examined racial differences in marijuana use motives among adolescents used the motive measure developed by Terry-McElrath et al. (2009) based on students' data (Johnston & O'Malley, 1986). Terry-McElrath and colleagues (2009) found that Caucasian high school seniors were more likely to report social/recreational reasons for using marijuana than racial/ethnic minorities, whereas African American and Hispanic students were more likely to use marijuana for compulsive reasons, such as "to get through the day". In another study, Hispanic youth were more likely than Caucasian youth to use marijuana to experiment, and African Americans were more likely than Caucasian youth to use marijuana to get high (i.e., enhancement motives; Patrick et al., 2011b).

To date, only one study (Buckner et al., 2016) has examined racial differences in marijuana use motives using the Marijuana Motives Measure (Simons et al., 1998). This study found that African American adults reported using marijuana more for social reasons than Caucasians, but did not find any racial differences among other marijuana

use motives or concurrent marijuana use frequency. Also, they examined race as a moderator of the relationship between marijuana use motives and frequency of concurrent marijuana use, but did not find any racial differences in the links between motives and concurrent marijuana use (Buckner et al., 2016). However, these results may not replicate with younger youth, as other findings related to motives differ by age group (Anderson, Sitney, & White, 2015). Clearly, research examining racial differences in marijuana use motives in adolescence is needed.

<div align="center">Outcomes Associated with Marijuana Use Motives</div>

Studies suggest that some marijuana use motives are associated with greater frequency of use and more negative consequences than others. Specifically, using marijuana to cope with worries, to "relax" or because one is "hooked" has been associated with more frequent marijuana use (Patrick et al., 2011a; Simons et al., 1998). Also, adolescents who use marijuana to cope with negative affect have more cannabis dependence symptoms (Fox et al., 2011). In fact, using marijuana to cope was associated with cannabis use disorder severity in a sample of emerging adults, while using for social or enhancement reasons were not (Moitra et al., 2015). Additionally, using marijuana for coping motives is associated with poorer mental health, greater psychopathology, and more psychosocial distress among young adults, compared to those who use marijuana for social reasons (Brodbeck et al., 2007).

Although most research in this area has focused on coping motives, adolescents and adults who used marijuana for social motives also reported more frequent marijuana use and marijuana abuse/dependence symptoms concurrently and 10 years later

(Anderson, Sitney, & White, 2015; Bonn-Miller, Zvolensky, & Bernstein, 2007; Simons et al., 1998). Similarly, using marijuana for enhancement motives or to "get high" consistently predicted greater marijuana use among adolescents and emerging adults (Anderson, Sitney, & White, 2015; Bonn-Miller, Zvolensky, & Bernstein, 2007; Patrick et al., 2011a; Simons et al., 1998). By contrast, using marijuana for conformity motives or to "fit in" predicted less frequent use among emerging adults (Bonn-Miller, Zvolensky, & Bernstein, 2007; Mitchell et al., 2007; Patrick et al., 2011a; Zvolensky et al., 2007). Outcomes related to expansion motives are less consistent, with adolescents who use marijuana for expansion motives or "to seek insight" reporting less frequent marijuana use into adulthood (Anderson, Sitney, & White, 2015), but emerging adults reports of expansion motives was associated with using marijuana more frequently in adulthood (Bonn-Miller, Zvolensky, & Bernstein, 2007; Patrick et al., 2011a). These discrepancies may be due to the way expansion motives were measured or the age when these motives were assessed.

Factors that May Contribute to Marijuana Use Motives

Several factors may contribute to adolescents' motivation for marijuana use. In this study, we will focus on internalizing problems (symptoms of depression and post-traumatic stress disorder) and friends' deviant behavior, which may be most relevant for coping and social, enhancement, and conformity reasons, respectively.

Depressive Symptoms

Depressive symptoms are generally low in childhood but rise during adolescence (Thapar et al., 2012), with African American adolescents generally reporting more

symptoms of depression compared to Caucasian youth (Franko et al., 2005; Mrug, King, & Windle, 2016). Adolescents experiencing depressive symptoms are at higher risk for substance use and misuse because they are more likely to use substances to cope with their distress (Thapar et al., 2012). Because African American adolescents have more symptoms of depression than Caucasian adolescents, they may be more likely to use marijuana to cope than their Caucasian counterparts.

In young adults, greater endorsement of coping motives for marijuana use has been associated with greater depressive symptomatology, higher levels of negative affectivity, and anhedonic depressive symptoms, even after adjusting for other marijuana use motives (Mitchell et al, 2007; Moitra et al., 2015; Zvolensky et al., 2007). However, one study found that using marijuana to cope did not explain the relationship between depressive symptoms and more frequent marijuana use in young adults (Johnson et al., 2009). Also, limited research has examined the relationship between marijuana coping motives and depressive symptoms in adolescents, so it is unclear if the same relationships seen in young adults would translate to adolescents.

Post-traumatic Stress Disorder (PTSD) Symptoms

Adolescents are at higher risk for experiencing trauma than younger children (Finkelhor et al., 2015), with some of these youth experiencing significant reactions to trauma exposure, characterized by PTSD symptoms (Kaminer, Seeedat, & Stein, 2005). In order to cope with the trauma and PTSD symptoms, some adolescents may use substances, including marijuana (Brady & Donenberg, 2006; DeBillis, 2002; Kilpatrick et al., 2000; Lipschitz et al., 2003).

Exposure to traumatic events, such as physical and sexual assault or witnessing violence, has been consistently associated with earlier marijuana initiation, increased marijuana use, and risk for marijuana abuse among adolescents (e.g., Kilpatrick et al., 2000; Vermeiren et al., 2003), which may be explained by adolescents using marijuana to cope with PTSD symptoms (Kilpatrick et al., 2000). In fact, adolescents with more PTSD symptoms are more likely to use marijuana for coping rather than social, enhancement, or conformity motives (Bonn-Miller et al., 2007; Bujarski et al., 2012). Because African American adolescents are exposed to more traumatic events (e.g., exposure to violence; Finkelhor et al., 2015) and experience more PTSD symptoms than Caucasian adolescents (Andrews et al., 2015; Roberts et al., 2011), they may be at a greater risk for using marijuana for coping motives.

Peer Substance Use

Associating with peers who engage in various deviant behaviors (e.g., delinquency and substance use) peaks during adolescence and is one of the strongest predictors of adolescent substance use (Brook et al., 2001). Adolescents whose peers use substances (Kandel, 1985; Simons-Morton, 2007; Wills et al., 2006) are also more likely to engage in marijuana use. In fact, adolescents' peers tend to have stronger influence on adolescents' likelihood of using marijuana than their parents (Beal, Ausiello, & Perrin, 2001). Substance using peers may promote marijuana use through greater approval of marijuana use that fosters more favorable attitudes about marijuana use (Keyes et al., 2011; Yanovitzky, 2005).

Association with substance using peers may increase adolescents' motivation to use marijuana for social, conformity, or enhancement reasons (Terry-McElrath et al.,

2009; Patrick et al., 2011a). Because adolescents' behavior is strongly motivated by peer approval and fitting in with their peer group (Steinberg, 2004), they are likely to use marijuana to bond with peers who also use (social motives) and/or avoid teasing from friends who use marijuana (conformity motives) (Buckner, Zvolensky, & Schmidt, 2012). Items measuring social and conformity marijuana use motives directly refer to social settings that involve marijuana users and using marijuana to fit in with others, supporting the link between these motives and peer substance use. Additionally, observing peers using marijuana or hearing about their positive experiences with the drug may promote more positive expectations among adolescents, which may contribute to them using marijuana for enhancement motives.

Although *marijuana* use motives have not been examined in relationship to peer substance use, adolescents who associate with peers who use substances are more likely to use *alcohol* for conformity, social, and enhancement motives (York, 2013). Based on social learning theory, peers may influence adolescent alcohol use directly and indirectly (Kandel, 1985). Specifically, adolescents may be tempted to conform to avoid being negatively evaluated by their peers when they offer them a drink (i.e., direct influence) or engage in alcohol use to be accepted if alcohol use is perceived as highly valued in that social context (i.e., indirect influence) (Bosari & Carey, 2001). The role of peer substance use in enhancement motives may be explained by more positive attitudes and expectancies of alcohol use (Borsari & Carey, 2001), which contribute to stronger enhancement motives (York, 2013). Considering that a person's motives for alcohol and marijuana use share similarities (Simons, Correia, & Carey, 2000), findings from motive studies examining alcohol use may generalize to marijuana use.

Some studies have found that African American adolescents affiliate with more deviant/substance using peers (e.g. Mrug, Madan, & Windle, 2012), but others found no ethnic differences in peer substance use (e.g. Smith et al., 2014). African American young adults were found to be more likely to use marijuana for social motives when compared to Caucasian young adults (Buckner et al., 2016), perhaps because these individuals are more likely to spend time with others who are using marijuana. These individuals may also be at greater risk for using marijuana to fit in, or conform to their friends who use substances (Simons et al., 1998). Additionally, greater endorsement of enhancement motives in African American adolescents (Patrick et al., 2011b) may be related to associations with peers who also use substances (Borsari & Carey, 2001), but no studies have examined mediators of racial differences in motives for marijuana use on marijuana use.

Current Study

A wealth of epidemiological data has documented racial differences in adolescent marijuana use, with African American adolescents having higher rates of use. Although marijuana use motives have been linked with the frequency and consequences of marijuana use, many of these studies used predominately Caucasian samples. Thus, it is unclear if these findings would generalize to African American adolescents. Also, the factor structure of the widely-used Marijuana Motives Measure has not been validated in racial/ethnic minority populations, which may yield a different factor structure. Examining marijuana use motives in racial/ethnic minorities, such as African American adolescents, who are more vulnerable to substance use and its consequences, would help

tailor prevention and intervention programs to this specific ethnic group and thus improve their effectiveness. Additionally, there is limited research on factors that may contribute to specific marijuana use motives. Since symptoms of depression and PTSD, as well as associating with substance using peers, tend to be more common among African American adolescents than other racial groups, these factors may contribute to marijuana use motives in these adolescents. Identifying these factors would also inform substance use prevention and treatment efforts for youth in this racial group.

This study aims to (1) examine racial differences in marijuana use among late adolescents and emerging adults. Based on literature reviewed above, we hypothesize that African American adolescents will report greater frequency of marijuana use than Caucasian adolescents, but there will be no differences in age of initiation. Next, we will (2) examine the factor structure of the Marijuana Motives Measure in African American adolescents. We hypothesize that the factor structure may be different than shown previously in mostly Caucasian samples. With regards to African American adolescent marijuana users, this study will (3) examine the contributions of PTSD and depression symptoms, as well as substance using peers, to coping, social, conformity, and enhancement motives for marijuana use, and determine whether these motives, in turn, predict past year marijuana use. We expect that depressive and PTSD symptoms will predict using marijuana for coping motives, whereas affiliation with substance using peers will predict using marijuana for social, enhancement, expansion, and conformity motives (see Figure 1). In addition, we expect coping, social, enhancement, and conformity motives to predict greater marijuana use.
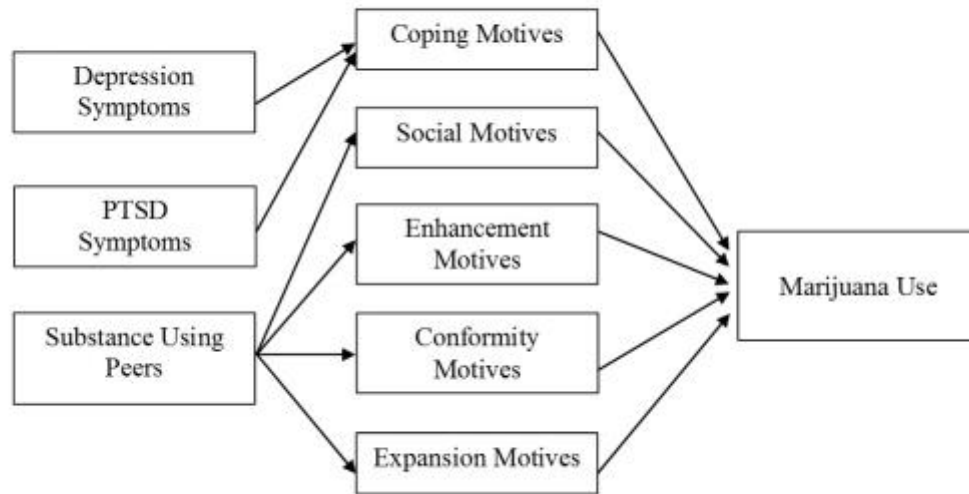
Figure 1. Hypothesized model of factors that contribute to marijuana use motives and marijuana use.

CHAPTER 2

METHOD

Participants and Procedures

This study includes 497 adolescents and emerging adults (age 16 to 24; M age = 17.7; 52% female, 81% African-American, 19% Caucasian) who participated in wave 3 of the Birmingham Youth Violence Study. Participants were originally recruited from 5th grade classrooms in 17 elementary schools in the Birmingham, Alabama area through a two-stage probability sampling process. In the first stage, schools were randomly selected based on probabilities designed to achieve a sample that would be representative of all students attending public schools in the Birmingham metropolitan area. In the second stage, all 5th grade students at selected schools were invited to participate. A total of 704 children and their primary caregivers completed individual interviews at Wave 1 (85% participation rate; M age 11.8) and 603 dyads completed interviews at Wave 2 (M age 13.2). At Wave 3, only the adolescents were interviewed (N=502; 83% retention from Wave 2; 71% retention from Wave 1). For this study, only African American and Caucasian adolescents were analyzed, which excluded 5 participants who identified as either "Hispanic or Latino/a" (N=3) or "Other" (N=2). Retained participants at Wave 3 included a greater percentage of African American youth (81% vs. 76%, $p<.001$) and females (52% vs. 48%, $p<.001$), and higher parent education attainment ($p>.05$) than those lost to follow up after Wave 1, but they did not differ on family income (p>.32).

Measures

All measures, except for demographic covariates, were collected at Wave 3.

Marijuana Use

Adolescents were first asked whether they ever used marijuana (yes/no). Those reporting any lifetime use were asked how old they were at first use and whether they used marijuana in the last 12 months (yes/no). Youth endorsing any past year use then indicated frequency of use in the last 12 months from 1 (a few times) to 7 (Everyday). The questions were adapted from the National Survey on Drug Use and Health (2003).

Marijuana Use Motives

Adolescents who endorsed any marijuana use in the last 12 months responded to the 25-item Marijuana Motives Measures (Simons et al., 1998). The items were rated from 1 (never) to 4 (almost always) and averaged for each 5-item subscale: coping motives (e.g., "I use marijuana to forget my worries"; $\alpha=.86$); enhancement motives (e.g., "I use marijuana because I like the feeling"; $\alpha=.90$); social motives (e.g., "I use marijuana because it makes social gatherings more fun"; $\alpha=.85$); conformity motives (e.g., "I use marijuana to fit in with the group I like"; $\alpha=.69$); and expansion motives (e.g., "I use marijuana because it helps me be more creative and original"; $\alpha=.90$).

PTSD Symptoms

Adolescents completed the 17-item Child PTSD Symptom Scale (Foa et al., 2001). The frequency of each symptom in the last two weeks was rated on a 4-point scale

ranging from 1 (not at all or only one time) to 4 (5 or more times per week/almost always). All items were averaged to yield a total PTSD score (α=.88).

Depressive Symptoms

Symptoms of depression were assessed with the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977). Youth reported the frequency of experiencing 20 depressive symptoms in the last two weeks on a scale ranging from 0 (rarely or none of the time) to 3 (all of the time). Items were recoded so that higher numbers indicate more frequent depressive symptoms and averaged (α=.84).

Peer Substance Use

Adolescents were asked about the number of friends who regularly used cigarettes, alcohol, and marijuana over the past 12 months, using 3 items ranging from 1 (none) to 6 (all) (Chassin et al., 1981). The items were averaged (α= .70).

Covariates

Adolescents' caregivers reported on their highest level of education completed, family income, and their child's date of birth, race/ethnicity, and gender during waves 1 and 2. Family income from Wave 2 was used in this study. If parents had missing family income at Wave 2, family income was obtained from Wave 1. Age at Wave 3 was computed from the date of Wave 3 interview and child's date of birth.

Data Analyses

Descriptive statistics and bivariate correlations were performed for all variables

using SPSS software. Racial differences in any lifetime marijuana use and past year use

were tested using logistic regressions. Racial differences in marijuana use initiation and

past 12-month marijuana use frequency were tested with ANCOVAs. All of these

analyses adjusted for current age, gender, and family income at wave 2. Next, exploratory

factor analyses (EFAs) were conducted to explore the factorial structure of the Marijuana

Motives Measure using only African American participants who reported any marijuana

use in the last 12 months (N=141). Factorability of the items was first examined with

item correlations, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO), and

the Bartlett's test of sphericity. Then, EFA was conducted using principal axis factor

extraction and oblique rotation. Multiple criteria were used to inform factor retention,

such as (a) eigenvalues > 1 (Kaiser, 1960), (b) the scree test (Cattell, 1966), (c) Horn's

parallel analysis (HPA; Horn, 1965), (d) Velicer's minimum average partial correlation

(MAP; Velicer, 1976), and (e) the factor model proposed by theory (Cooper, 1994;

Simons et al., 1998). Items were eliminated based on low factor loadings (<.35), low

communalities (≤.30), or cross-loadings across factors (>.40). Internal consistency of the

factors was examined using Cronbach's alphas. Following the EFA, confirmatory factor

analyses (CFAs) with maximum-likelihood (ML) estimation in Mplus version 7.11 were

conducted to compare alternative factor structures.

Then, the hypothesized model (Figure 1) was tested with path analysis in Mplus,

including only African American youth who endorsed using marijuana in the last year.

This model tested whether PTSD symptoms, depression symptoms and substance using peer affiliations uniquely predicted marijuana use through marijuana use motives (see Figure 1). Indirect effects were tested with bias-corrected bootstrapping (Preacher & Hayes, 2008). Missing data were handled with full information maximum likelihood and all paths were adjusted for adolescents' age at Wave 3, gender, and Wave 1 or Wave 2 family income.

CHAPTER 3

RESULTS

Aim 1 – Racial Differences in Marijuana Use

Preliminary Analyses

After supplementing Wave 1 data for missing demographics from Wave 2, only

one participant had missing data for family income. Regarding marijuana use variables,

228 (46%) reported ever using marijuana and from these 8 (3.5%) had missing data for

age of marijuana initiation. These 8 participants were excluded from the analysis on

marijuana initiation. Upon examination of univariate distributions of data, lifetime

marijuana use, age of marijuana initiation, past 12-month marijuana use, and frequency

of past 12-month marijuana use were positively skewed. Transforming these variables

using the recommended transformations (log10, square root, and 1/x) did not improve the

distributions; therefore, the original variables were analyzed. Age of marijuana initiation

had two outliers that were greater than 3.29 standard deviations above the mean. These

data points were truncated at 3.29 standard deviations above the mean.

Descriptive statistics for all variables are displayed in Table 1. Median parental

education was "some college" and median family income was $25,001 - $30,000. As

shown in Table 1, 46% of the sample reported ever using marijuana (lifetime marijuana

use). Among lifetime users, median age of marijuana use initiation was 15 years old and

69% reported using marijuana in the last 12 months. Among those who endorsed using

marijuana in the past 12 months, the median frequency of past 12-month marijuana use was once a week.

Correlations among all variables are also shown in Table 1. Parental education and family income were moderately correlated (r=.49, *p*<.001), therefore they were retained as separate variables. Lifetime marijuana use was more common in African American youth, older youth, and those with lower family income. Among lifetime users, younger age of marijuana initiation was associated with being male, older age, lower family income, and greater frequency of past 12-month marijuana use. Among past year users, higher frequency of use in past year was associated with being male and older age. Since parental education was not associated with any marijuana variables, parental education was not included as a covariate in main analyses.

Table 1

Descriptives and Correlations of Demographics and Marijuana use variables in the Full Sample (N=497)

Variable	M (SD) or %	2.	3.	4.	5.	6.	7.	8.	9.
1. African American	81%	.18***	.04	-.21***	-.34***	-.14**	-.05	-.11	.14
2. Age	17.74 (1.24)	--	-.01	-.17***	-.18***	-.11*	.19**	.04	.22**
3. Male Gender	47.9%		--	-.07	-.08	-.08	.22**	.08	-.21**
4. Parent Education Attainment	4.22 (1.70)			--	.49***	-.04	.10	-.07	-.15
5. Family Income	6.66 (3.91)				--	-.10*	.13*	-.03	-.09
6. Lifetime Marijuana use (yes)	45.9%					--	--	--	--
7. Age of Marijuana Initiation (N=220)	14.89 (2.43)						--	-.08	-.44***
8. Past 12-month Marijuana use (yes) (N=228)	31.6%							--	--
9. Frequency of Past 12-month Marijuana use (N=158)	3.92 (2.47)								--

*p<.05, **p<.01, ***p<.001

Note: Age of Marijuana initiation and past 12-month use was only reported by lifetime users and frequency of past 12-month marijuana use was only reported by adolescents, who endorsed past 12-month use. Parent mean parent education was "some college" and mean family income was $25,001-$30,001.

Main Analyses

Logistic regression adjusting for current age, gender, and wave 2 family income showed that African American and Caucasian adolescents differed on lifetime marijuana use (b=.63, *p*<.05, OR=1.88), with African American adolescents being 1.88 times more likely to report lifetime marijuana use (49% vs. 31%). Similarly, African American adolescents were 2.4 times more likely to report past 12-month marijuana use (b=.88, *p*<.05, OR=2.41; 71% vs. 55%). However, African American and Caucasian adolescents who used marijuana in their lifetime did not differ on age of marijuana use initiation $F(1,218)=0.47$, *p*=.50, with the average age of marijuana use initiation being 15 years old for both groups. Among adolescents who used marijuana in the past 12 months, frequency of use did not differ by ethnicity, $F(1,155)=2.18$, *p*=.14. On average, African American adolescents used marijuana once weekly, and the mean for Caucasian adolescents was 2-3 days each month.

Aim 2 – Examine the Factor Structure of the Marijuana Use Motive Measure

Preliminary analyses

Only African American participants who endorsed any past 12-month marijuana use were included in remaining analyses. This subsample included 141 adolescents (age range=16-24, mean age=17.9, SD=1.29, 53.2% male). Descriptive statistics for all items on the Marijuana Motives Measure are reported in Table 2. There were no missing data. A total of 22 univariate outliers (z>3.29) and 2 multivariate outliers (Mahalanobis distance>68) were identified. Univariate outliers were truncated to 3.29 standard deviations from the mean. The ratio of participants to variables (141:25, or 5.6:1) was

satisfactory. Examination of skewness and kurtosis revealed that many of the item

distributions deviated from a normal distribution; however, factor analysis is robust to

violations of normality (Gorsuch, 1983).

Table 2

Descriptive Statistics of Marijuana Motives Measure Items (N=141)

Variable	M	SD	Skewness	Kurtosis
Theoretical Coping Motives				
1. I use marijuana to forget my worries.	2.15	1.22	.40	-1.50
4. I use marijuana because it helps me when I feel depressed or nervous.	2.17	1.23	.39	-1.50
6. I use marijuana to cheer me up when I am in a bad mood	2.52	1.22	-.09	-1.57
15. I use marijuana because I feel more self-confident and sure of myself	1.74	1.09	1.16	-.17
17. I use marijuana to forget about my problems.	2.39	1.26	.06	-1.67
Theoretical Enhancement Motives				
7 I use marijuana because I like the feeling	3.00	1.12	-.78	-.82
9. I use marijuana because it is exciting	2.06	1.18	.56	-1.28
10. I use marijuana to get high.	3.14	1.05	-.92	-.47
13. I use marijuana because it gives me a pleasant feeling.	2.82	1.20	-.47	-1.34
18. I use marijuana because it is fun.	2.28	1.25	.22	-1.62
Theoretical Social Motives				
3. I use marijuana because it helps me enjoy a party.	2.23	1.22	.26	-1.57
5. I use marijuana to be sociable.	1.55	.97	1.55	.99
11. I use marijuana because it makes social gatherings more fun.	2.30	1.26	.18	-1.65
14. I use marijuana because it improves parties and celebrations.	2.37	1.30	.15	-1.71
16. I use marijuana to celebrate a special occasion with friends.	2.65	1.19	-.28	-1.44
Theoretical Conformity Motives				
2. I use marijuana because my friends pressure me to use it.	1.18	.54	3.47	12.59
8. I use marijuana so that others won't kid me about not using it	1.12	.51	4.67	21.94
12. I use marijuana to fit in with the group I like.	1.18	.62	3.58	12.30
19. I use marijuana to be liked.	1.23	.71	3.10	8.50
20. I use marijuana so I won't feel left out.	1.13	.52	4.39	19.66
Theoretical Expansion Motives				
21. I use marijuana to know myself better.	1.29	.77	2.68	6.06
22. I use marijuana because it helps me be more creative and original.	1.87	1.20	.94	-.83
23. I use marijuana understand things differently.	1.92	1.23	.78	-1.13
24. I use marijuana to expand my awareness.	1.77	1.14	1.07	-.51
25. I use marijuana to be more open to experiences.	1.73	1.09	1.15	-.24

Note: 1=Never, 2=Sometimes, 3=Often, 4=Almost Always

Main analyses – EFAs of Marijuana Motives Measure

Inspections of the bivariate correlation matrix indicated that there were several correlations exceeding .30. Additionally, Kaiser-Meyer-Olkin Measure of Sampling Adequacy was .90 ($\geq$.60) and Barlett's test of sphericity was significant (p<.001), suggesting that the correlation matrix was factorable. Since the factors were correlated, oblique rotation was used (Tabachnick & Fiddell, 2007). The Kaiser criterion (eigenvalues>1) suggested a 5-factor model. Visual analysis of the Scree plot suggested that a 4-factor would be the best fit for the data. However, Velicer's MAP correlation suggested a 2-factor model and HPA suggested a 3-factor model. Therefore, we examined all four suggested models. Results from the pattern matrix were interpreted, because its coefficients represent the unique relationships between factors and items that are not confounded by inter-factor correlations (Diel, Beal, & Berg, 2005).

5-factor model. The 5-factor model accounted for 58.84% of the variance. See Table 3 for a list of factor loadings using this model. Factor 1 was comprised of 6 items (Cronbach's α=.90), which consisted of five enhancement motive items and one social motive item (celebrate a special occasion with friends). Factor 2 was comprised of 7 items (Cronbach's α=.78), which included four conformity motive items, one social motive item (to be sociable), and one expansion motive item (to know myself better). Factor 3 was comprised of 4 items (Cronbach's α=.88) that were all coping motive items. Factor 4 was comprised of 5 items (Cronbach's α=.87), which consisted of four expansion motive items and one coping motive (because I feel more self-confident and sure of myself). Factor 5 was comprised of 3 items (Cronbach's α=.86) that were all

social motive items. No cross loadings were present. Interfactor correlations ranged from

.14 to .63, with factors 1 and 2 having the lowest correlation and factors 1 and 5 having

the highest correlation.

Table 3

EFA of 5-factor Model

Item	Factor				
	1	2	3	4	5
Theoretical Coping Motives					
1. I use marijuana to forget my worries.			.82		
4. I use marijuana because it helps me when I feel depressed or nervous.			.78		
6. I use marijuana to cheer me up when I am in a bad mood.			.63		
15. I use marijuana because I feel more self-confident and sure of myself.				-.38	
17. I use marijuana to forget about my problems.			.82		
Theoretical Enhancement Motives					
7. I use marijuana because I like the feeling.	.76				
9. I use marijuana because it is exciting.	.46				
10. I use marijuana to get high.	.77				
13. I use marijuana because it gives me a pleasant feeling.	.76				
18. I use marijuana because it is fun.	.57				
Theoretical Social Motives					
3. I use marijuana because it helps me enjoy a party.					-.53
5. I use marijuana to be sociable.		.50			
11. I use marijuana because it makes social gatherings more fun.					-.87
14. I use marijuana because it improves parties and celebrations.					-.71
16. I use marijuana to celebrate a special occasion with friends.	.40				
Theoretical Conformity Motives					
2. I use marijuana because my friends pressure me to use it.		.47			
8. I use marijuana so that others won't kid me about not using it		.54			
12. I use marijuana to fit in with the group I like.		.61			
19. I use marijuana to be liked.		.49			
20. I use marijuana so I won't feel left out.		.69			
Theoretical Expansion Motives					
21. I use marijuana to know myself better.		.46			
22. I use marijuana because it helps me be more creative and original.				-.90	
23. I use marijuana understand things differently.				-.74	
24. I use marijuana to expand my awareness.				-.83	
25. I use marijuana to be more open to experiences.				-.60	
Summary Statistics					
Eigenvalue	6.75	3.45	4.97	6.06	5.82
Percentage of total variance explained	37.18	9.14	5.90	4.40	2.22
Cumulative percentage variance	37.18	46.33	52.22	56.62	58.84

4-factor model. The 4-factor model accounted for 56.29% of the variance. See Table 4 for a list of factor loadings using this model. Factor 1 was comprised of 9 items (Cronbach's α=.92), which consisted of five enhancement motive items and four social motive items. Factor 2 was comprised of 7 items (Cronbach's α=.78), which included four conformity motive items, one social motive item (to be sociable), and one expansion motive item (to know myself better). Factor 3 was comprised of 4 items (Cronbach's α=.88) that were all coping motive items. Factor 4 was comprised of 5 items (Cronbach's α=.89), which consisted of four expansion motive items and one coping motive (because I feel more self-confident and sure of myself). No cross loadings were present. Interfactor correlations ranged from .10 to .53, with factors 2 and 3 having the lowest correlation and factors 1 and 4 having the highest correlation.

Table 4

EFA of 4-factor Model

Item	Factor			
	1	2	3	4
Theoretical Coping Motives				
1. I use marijuana to forget my worries.			.82	
4. I use marijuana because it helps me when I feel depressed or nervous.			.73	
6. I use marijuana to cheer me up when I am in a bad mood.			.65	
15. I use marijuana because I feel more self-confident and sure of myself.				-.36
17. I use marijuana to forget about my problems.			.81	
Theoretical Enhancement Motives				
7. I use marijuana because I like the feeling.	.76			
9. I use marijuana because it is exciting.	.72			
10. I use marijuana to get high.	.69			
13. I use marijuana because it gives me a pleasant feeling.	.72			
18. I use marijuana because it is fun.	.73			
Theoretical Social Motives				
3. I use marijuana because it helps me enjoy a party.	.72			
5. I use marijuana to be sociable.		.49		
11. I use marijuana because it makes social gatherings more fun.	.73			
14. I use marijuana because it improves parties and celebrations.	.75			
16. I use marijuana to celebrate a special occasion with friends.	.65			
Theoretical Conformity Motives				
2. I use marijuana because my friends pressure me to use it.		.48		
8. I use marijuana so that others won't kid me about not using it		.53		
12. I use marijuana to fit in with the group I like.		.61		
19. I use marijuana to be liked.		.49		
20. I use marijuana so I won't feel left out.		.70		
Theoretical Expansion Motives				
21. I use marijuana to know myself better.		.46		
22. I use marijuana because it helps me be more creative and original.				-.91
23. I use marijuana understand things differently.				-.75
24. I use marijuana to expand my awareness.				-.85
25. I use marijuana to be more open to experiences.				-.62
Summary Statistics				
Eigenvalue	7.78	3.35	4.74	6.21
Percentage of total variance explained	37.05	9.09	5.76	4.39
Cumulative percentage variance	37.05	46.14	52.90	56.29

3-factor model. The 3-factor model accounted for 51.40% of the variance. See Table 5 for a list of factor loadings using this model. Factor 1 was comprised of 10 items (Cronbach's α=.92), which consisted of five enhancement motive items, four social motive items, and one coping motive item (because I feel more self-confident and sure of myself). Factor 2 was comprised of 11 items (Cronbach's α=.86), which included all conformity and expansion motive items and one social motive item (to be sociable). Factor 3 was comprised of 4 items (Cronbach's α=.88) that were all coping motive items. No cross loadings were present. Factor correlations ranged from .21 to .53. Interfactor correlations ranged from .21 to .53, with factors 2 and 3 having the lowest correlation and factors 1 and 3 having the highest correlation.

Table 5

EFA of 3-factor Model

Item	Factor		
	1	2	3
Theoretical Coping Motives			
1. I use marijuana to forget my worries.			.83
4. I use marijuana because it helps me when I feel depressed or nervous.			.81
6. I use marijuana to cheer me up when I am in a bad mood.			.68
15. I use marijuana because I feel more self-confident and sure of myself.	.39		
17. I use marijuana to forget about my problems.			.80
Theoretical Enhancement Motives			
7. I use marijuana because I like the feeling.	.77		
9. I use marijuana because it is exciting.	.75		
10. I use marijuana to get high.	.69		
13. I use marijuana because it gives me a pleasant feeling.	.74		
18. I use marijuana because it is fun.	.75		
Theoretical Social Motives			
3. I use marijuana because it helps me enjoy a party.	.69		
5. I use marijuana to be sociable.		.54	
11. I use marijuana because it makes social gatherings more fun.	.78		
14. I use marijuana because it improves parties and celebrations.	.78		
16. I use marijuana to celebrate a special occasion with friends.	.65		
Theoretical Conformity Motives			
2. I use marijuana because my friends pressure me to use it.		.35	
8. I use marijuana so that others won't kid me about not using it		.47	
12. I use marijuana to fit in with the group I like.		.65	
19. I use marijuana to be liked.		.50	
20. I use marijuana so I won't feel left out.		.67	
Theoretical Expansion Motives			
21. I use marijuana to know myself better.		.60	
22. I use marijuana because it helps me be more creative and original.		.47	
23. I use marijuana understand things differently.		.38	
24. I use marijuana to expand my awareness.		.47	
25. I use marijuana to be more open to experiences.		.50	
Summary Statistics			
Eigenvalue	7.98	4.62	5.55
Percentage of total variance explained	36.86	8.88	5.66
Cumulative percentage variance	36.86	45.74	51.40

2-factor model. The 2-factor model accounted for 45.36% of the variance. See Table 6 for a list of factor loadings using this model. Factor 1 was comprised of 16 items (Cronbach's α=.93) that included all coping and enhancement motive items, four social motive items, two expansion motive items (to understand things differently and helps me be more creative and original). Factor 2 was comprised of 9 items (Cronbach's α=.81), which consisted of five conformity motive items, three expansion motive items, and one social motive item (to be sociable). In addition, 3 items presented with split factor loadings. In the case of split loadings, the item was attributed to the factor that yielded the higher factor loading. Interfactors were weakly correlated (r=.32).

Table 6

EFA of 2-factor Model

Item	Factor 1	Factor 2
Theoretical Coping Motives		
1. I use marijuana to forget my worries.	.55	
4. I use marijuana because it helps me when I feel depressed or nervous.	.56	
6. I use marijuana to cheer me up when I am in a bad mood.	.70	
15. I use marijuana because I feel more self-confident and sure of myself.	.48	
17. I use marijuana to forget about my problems.	.69	
Theoretical Enhancement Motives		
7. I use marijuana because I like the feeling.	.83	
9. I use marijuana because it is exciting.	.65	
10. I use marijuana to get high.	.71	
13. I use marijuana because it gives me a pleasant feeling.	.81	
18. I use marijuana because it is fun.	.76	
Theoretical Social Motives		
3. I use marijuana because it helps me enjoy a party.	.61	
5. I use marijuana to be sociable.		.55
11. I use marijuana because it makes social gatherings more fun.	.65	
14. I use marijuana because it improves parties and celebrations.	.76	
16. I use marijuana to celebrate a special occasion with friends.	.73	
Theoretical Conformity Motives		
2. I use marijuana because my friends pressure me to use it.		.36
8. I use marijuana so that others won't kid me about not using it		.46
12. I use marijuana to fit in with the group I like.		.65
19. I use marijuana to be liked.		.50
20. I use marijuana so I won't feel left out.		.67
Theoretical Expansion Motives		
21. I use marijuana to know myself better.		.49
22. I use marijuana because it helps me be more creative and original.	.50	
23. I use marijuana understand things differently.	.49	
24. I use marijuana to expand my awareness.		.43
25. I use marijuana to be more open to experiences.		.48
Summary Statistics		
Eigenvalue	8.58	4.50
Percentage of total variance explained	36.61	8.75
Cumulative percentage variance	36.61	45.36

Main analyses – CFAs of Marijuana Motives Measure

Results from confirmatory factor analyses assessing the fit of the theoretical 5-factor model (Simons et al., 1998), and the 5-, 4-, 3-, and 2-factor model structures suggested by the EFAs are provided in Table 7. Based on fit indicators, only the EFA 4- and 5-factor solutions fit well based on their RMSEA and SRMR (both ≤.08); however CFIs for all models were below the .95 cutoff (Matsunaga, 2010). At the same time, the EFA 5-factor model had CFI >.90, which some argue is acceptable fit (Marsh, Hau & Wen, 2004). Since the model fit of the theoretical 5-factor model was comparable to the EFA 5-factor model, a "modified" theoretical model was examined to increase external validity.   Tavakol and Dennick (2011) suggest that items should be discarded if they have poor inter-relatedness within constructs; therefore the "modified" theoretical model retained the items in scales based on the theoretical model, but eliminated items that reduced the internal consistency of each scale. Specifically, the item "I use marijuana because I feel more self-confident and sure of myself" was removed from the coping motives scale to improve the scale's reliability from α=.846 to α=.882; item "I use marijuana to be sociable" was removed from the social motives scale (α=.836 to α=.853); and item "I use marijuana to know myself better" was removed from the expansion motives scale (α=.884 to α=.906). The enhancement motives scale was not modified, because removing any item would decrease the internal consistency. The "modified" marijuana use motives scale that was utilized in the remaining analysis included 22 items. Based on fit indicators, the "modified" marijuana use motives scale demonstrated the best fit when compared to the EFA 5-factor model and the theoretical 5-factor model.

Specifically, the SRMR (.07) of the "modified" scale was less than the SRMR of the

theoretical and EFA 5-factor model, and the "modified" scale's CFI (.92) was closest to

the preferred CFI cutoff; therefore the "modified" marijuana use motives scale was

utilized in further path models.

Table 7

Fit Indices for CFA Models

Model	χ^2	df	RMSEA	SRMR	CFI	AIC	BIC
Theoretical 5-factor model (25 items)	536.91***	265	.09	.10	.87	8889.72	9140.37
5-factor model (25 items)	447.58***	265	.07	.08	.91	8800.39	9051.03
4-factor model (25 items)	498.45***	269	.08	.08	.89	8843.26	9082.11
3-factor model (25 items)	683.06***	272	.10	.09	.80	9021.87	9251.87
2-factor model (25 items)	901.86***	274	.13	.10	.69	9236.67	9460.78
Modified Theoretical model (22 items)	336.40***	199	.07	.07	.92	7826.19	8050.29

***p<.001

Aim 3 - Path Models Predicting Motives and Subsequent Past 12 Month Use

Preliminary analyses

Only the African American participants who endorsed past 12- month marijuana

use and completed the Marijuana Motives Measure (N=141) were included in the final

analyses. Upon examination of univariate distributions, the variables of depression and

PTSD symptoms, as well as peer substance use, were positively skewed. There was one

case with missing data for the peer substance use variable, but not outliers were present in

the data. The analysis utilized a Robust Maximum Likelihood (MLR) estimator, which

produces standard errors that are robust to non-normality, uses all available data, and

minimizes bias when data are missing at random (Bentler & Yuan, 1999; Muthén & Muthén, 2004).

Descriptive statistics for all variables are displayed in Table 8. Compared to youth who were not included in the analyses (all Caucasian adolescents and African American youth who did not use marijuana in the last year), the subsample of African American past-year marijuana users was slightly older (mean age=17.9 vs. 17.7), $F(1,495)=.43$, $p<.05$, and had lower median family income at \$20,001-\$25,000 vs. \$30,001-\$35,000, $F(1,494)=.00$, $p<.01$. Additionally, the subsample endorsed greater PTSD symptomatology (M=1.68 vs. 1.5), $F(1,492)=.30$, $p<.01$, as well as more substance using peers (M=3.16 vs. 1.93), $F(1,489)=21.98$, $p<.001$. The subsample did not differ on depression symptomatology, $F(1,494)=.96$, $p=.18$.

Correlations among all variables for this subsample are also shown in Table 8. Higher frequency of past 12-month use was associated with greater peer substance and with using marijuana for coping, social, enhancement, and expansion motives. Using marijuana for conformity motives was associated with higher family income. More depression symptomatology was associated with greater marijuana use for expansion motives and coping motives. Similarly, greater PTSD symptomatology was associated with using marijuana for more coping motives, but PTSD symptomatology was not associated with any other motive. Greater peer substance use was associated with using marijuana for social and enhancement motives. Since parental education was not associated with any marijuana variables, parent education was not included as a covariate in main analyses.

All "modified" marijuana use motives were positively associated with one another (r=.18 to .77, p<.001 to p<.05). Additionally, paired samples t-test revealed that enhancement motives were endorsed most frequently (M=2.66), followed by social motives (M=2.39), coping motives (M=2.31), expansion motives (M=1.82), and conformity motives (M=1.17). These comparisons were significant (all p<.001), except for the comparison between social and coping motives (p=.36).

Table 8

Descriptives and Correlations of Marijuana use and Motives in a Subsample of Marijuana Users (N=141)

Variable	M (SD)	2.	3.	4.	5.	6.	7.	8.	9.
1. Past 12-month Marijuana use	4.04 (2.45)	.10	.05	.37***	.42***	.05	.46***	.47***	.39***
2. PTSD Symptoms	1.68 (.56)	--	.60***	.06	.01	.07	.16	.28**	.08
3. Depression Symptoms	1.72 (.27)		--	.14	-.02	.05	.17*	.29**	-.05
4. Peer Substance Use	3.16 (1.35)			--	.18*	-.01	.14	.05	.20*
5. Enhancement Motives	2.66 (.98)				--	.24**	.56***	.53***	.77***
6. Conformity Motives	1.17 (.39)					--	.38***	.18*	.22**
7. Modified Expansion Motives	1.82 (1.03)						--	.47***	.52***
8. Modified Coping Motives	2.31 (1.06)							--	.49**
9. Modified Social Motives	2.39 (1.04)								--

*p<.05, **p<.01, ***p<.001

Main analyses

Path analyses adjusted for age, gender, and family income. Results of the path model depicted in Figure 2 revealed that greater depression symptomatology predicted using marijuana for more coping motives (β=.22, p<.05). However, greater PTSD

symptomatology did not significantly predict using marijuana for more coping motives (β=.11, p=.17). Association with more substance using peers predicted using marijuana for more enhancement motives (β=.15, p<.05) and social motives (β=.17, p<.05); however, this was not the case for conformity (β=.02, p=.83) or expansion motives (β=.10, p=.22).

Frequent marijuana use in the past 12 months was predicted by using marijuana for more expansion (β=.25, p<.01) and coping motives (β=.30, p<.001). However, using marijuana for conformity motives predicted less frequent marijuana use in the past 12 months (β=-.12, p<.05). With regard to indirect effects, only the indirect effect of depression symptoms on frequent marijuana use in the past 12 months through coping motives was significant (β=.07, p<.05).
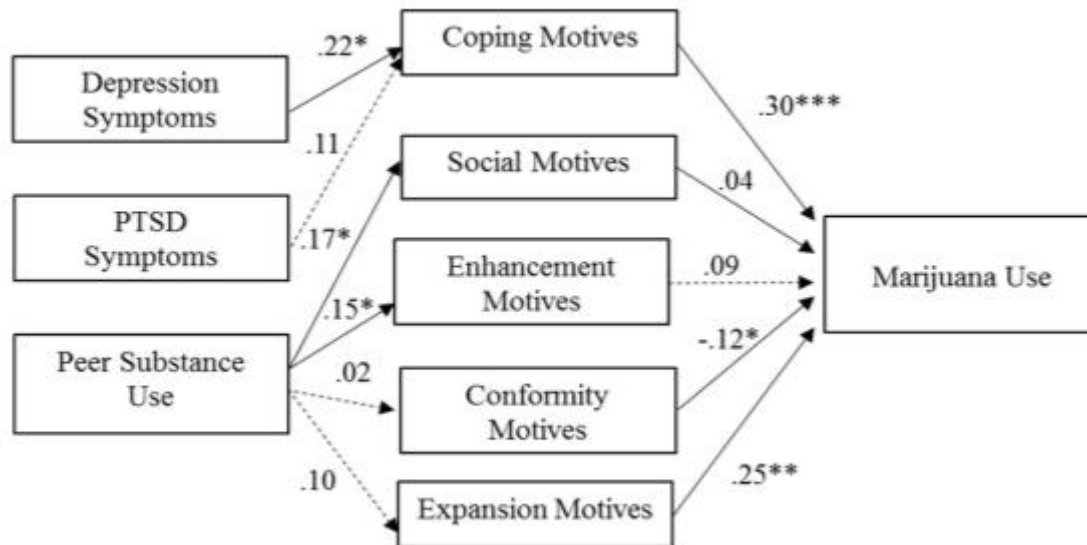

Figure 2. Path model of factors that contribute to marijuana use motives and past 12-month marijuana use.
*p<.05, **p<.01, ***p<.001

CHAPTER 4

DISCUSSION

This study examined racial differences in marijuana use among Caucasian and African American late adolescents and emerging adults. Additionally, this study examined the factor structure of the Marijuana Motives Measure (Simons et al., 1998) in a subsample of African American late adolescents and emerging adults. Finally, this study examined the contributions of PTSD and depression symptoms, as well as substance using peers, to coping, social, conformity, enhancement, and expansion motives for marijuana use, and determined whether these motives, in turn, predicted past year marijuana use in African American youth.

Results indicated that African American adolescents had higher rates of lifetime marijuana use and were more likely to report past 12-month marijuana use in comparison to Caucasian adolescents. Among lifetime marijuana users, the ethnic groups did not differ in age of marijuana use initiation or frequency of past 12-month marijuana use. Regarding the factor analysis of the Marijuana Motives Measure among African American marijuana users, a "modified" Marijuana Motives Measure, based on the theoretical 5-factor structure, but with some items removed, indicated the best fit. The "modified" model excluded items that lowered the internal consistency of each scale, but retained the theoretical factor scales to improve external validity and ease of interpretation. Path models revealed that more depressive symptomatology predicted

using marijuana for coping motives, which in turn predicted greater frequency of marijuana use in the past 12 months among African American late adolescents. Also, affiliation with substance using peers predicted using marijuana for more enhancement and social motives. Finally, using marijuana for expansion motives predicted more frequent past 12-month marijuana use and using marijuana for conformity motives predicted less frequent past 12-month marijuana use.

<div align="center">Racial Differences in Marijuana Use</div>

Rates of lifetime marijuana use and past 12-month use in the current sample were similar to those in national samples. For instance, 46% of late adolescents reported ever using marijuana in their lifetime in the current sample, which mirrors national rates in 12th grade students (45-50%) according to the most recent Youth Risk Behavior Surveillance and Monitoring the Future surveys (Kann et al., 2016; Meich et al., 2016). Also, the rate of past 12-month use in the current sample (32%) is comparable to national rates of annual marijuana use in late adolescents (35%; Meich et al., 2016).

As hypothesized, the prevalence of having ever used marijuana was higher among African American adolescents than Caucasian adolescents (49% vs. 31%), as in the national sample (46% vs. 35%; Kann et al., 2016). Similarly, African American adolescents in our sample were more likely to report using marijuana in the past 12 months when compared to Caucasian adolescents, which is consistent with racial differences in annual prevalence of marijuana use in the Monitoring the Future survey (Meich et al., 2016).

The average age of first marijuana use at 15 years old in the current sample is also consistent with estimates from national samples (e.g., National Longitudinal Study of Adolescent Health; Clark, Doyle, & Clincy, 2013). Congruent with our hypothesis and previous studies (Buckner et al., 2016; Chen & Jacobson, 2012; Meich et al., 2015), there were no differences between African American and Caucasian adolescents in age of marijuana initiation.

In the present sample, 22% of adolescents endorsed using marijuana at least once in the past month, similar to 21% of 12th grade students in a national sample (Meich et al., 2016). Likewise, frequency of daily marijuana use in the present sample (8%) was comparable to rates found in a national sample (6%; Meich et al., 2016). Among those who endorsed using marijuana in the past 12 months, median frequency of marijuana use was once weekly. Incongruent with our hypothesis, frequency of marijuana use in the past 12 months did not differ between African American and Caucasian adolescents; however this finding concurs with findings from recent national data, which indicated that past 30-day prevalence rates were similar between African American and Caucasian 12th grade students (Meich et al., 2016). Prevalence rates were historically higher for Caucasian late adolescents, but rates of marijuana use among African American adolescents have increased over time so now they use marijuana at comparable rates (Meich et al., 2015).

Factor Structure of Marijuana Motives Measure

EFA of the marijuana use motives measure suggested 2-, 3-, 4-, and 5-factor models, which were further analyzed using CFA. As suggested by the theoretical model,

a 5-factor solution accounted for the most variance and demonstrated that best fit; however, the items that comprised each scale of the EFA 5-factor solution were not congruent with the theoretical scales of the Marijuana Motive Measure. Specifically, one social motive item ("I use marijuana to celebrate a special occasion with friends") loaded on a factor that predominately consisted of enhancement motives. In the original study (Simons et al., 1998), the same item loaded with other enhancement motives in a 3-factor solution and failed to significantly load on any factor in a 5-factor solution as in other studies (Chabrol et al., 2005; Simons et al., 1998; Zvolensky et al., 2007). In the present study, another social motive item ("I use marijuana to be sociable") loaded on a factor that included predominately conformity motives, but also one expansion motive ("I use marijuana to know myself better"). Lastly, one coping motive item ("I use marijuana because it helps me feel more self-confident and sure of myself") loaded on a factor that comprised predominately expansion motives. Similarly, in the original study (Simons et al., 1998), the same coping motive item loaded on the social scale rather than the coping scale. In sum, the current study had similarities to the original study, such as the suggested 5-factor solution and specific items loading on factors incongruent with their theoretical intent. However, the current sample had a greater number of items that loaded on theoretically inconsistent factors.

Additionally, the scales suggested by the EFA 5-factor solution had acceptable internal consistency (alpha ranged from .78 to .89); however, the items that comprised factor 2, which had the lowest internal consistency, included items from three different theoretical scales (conformity, social, and expansion motives). Eliminating any of the items would have decreased the internal consistency of factor 2. However, retaining

scales that contained items that were incongruent would make interpretations of factor scales problematic and any further results using those scale could not be compared to those of other studies using the theoretical factor structure.

Despite these interpretation problems, the EFA 5-factor solution had an acceptable fit, whereas the theoretical 5-factor model did not reach criteria for an acceptable fit. To aid in interpretation and allow more meaningful comparisons to results of other studies that use the theoretical factor structure, a "modified" theoretical model was examined. This model started with the theoretical 5-factor structure but eliminated items that compromised internal consistency of each scale. In support of this approach, this model demonstrated the best fit when compared to all the other models. The "modified" theoretical model was comprised of 22 items instead of the original 25 items. The internal consistency of the subscales was acceptable to excellent, ranging from .69 (conformity motives) to .91 (expansion motives). Notably, the three items that were eliminated loaded on scales in the 5-factor EFA solution that were incongruent with their theoretical placement (to feel more self-confident and sure of myself, to be sociable, and to know myself better). The internal consistency of the "modified" scales was similar to those found in previous studies using the theoretical scales with young adult samples (i.e., α=.62 to .95; Buckner et al., 2016; α=.70 to .91; Zvolensky et al., 2007). However, internal consistency of these scales in the present sample was slightly lower compared to the theoretical scales in samples of late adolescents and emerging adults (i.e., α=.76 to .84; Chabrol et al., 2005, α=.86 to .93; Simons et al., 1998).

Sampling differences among studies may partly explain the differences in factor structures. For instance, other studies (e.g., Chabrol et al., 2005; Simons et al., 1998;

Zvolensky et al., 2007) included students recruited from college campuses, which may

have contributed to their similar findings in factor structure of the Marijuana Motives

Measures. College students represent a subset of late adolescents and emerging adults in

higher education who may have better insight into their behavior, which may translate to

more consistent endorsement of motives for marijuana use across distinct motive

categories.

Since previous studies that examined the factor structure of the Marijuana

Motives Measures likely included majority or all Caucasian late adolescents and

emerging adults (Chabrol et al., 2004; Simons et al., 1998, Zvolensky et al., 2007), racial

differences may also explain the difference in the factor structure of the Marijuana

Motives Measure. For instance, Simons and colleagues (1998) sample was 82%

Caucasian and 6% African American. Although race/ethnicity of participants was not

reported by Zvolensky and colleagues (2007), the sample was recruited from the

community and university in Burlington, VT. At the time of their study the city residents

included only about 13% African Americans (U.S. Census Bureau, 2006) and the

university's population had 1% African American students (University of Vermont,

2006), so the proportion of African American participants in the study was likely small.

Although no studies have examined racial differences in the factor structure of the

measure, racial differences have been found in the levels of specific motives for

marijuana use (Buckner et al., 2016; Patrick et al., 2011b; Terry-McElrath et al., 2009).

Buckner and colleagues reported similar internal consistency values of the Marijuana

Motives Measure in African American young adults (mean age= 21) to those in the

present sample; however, they did not examine the measure's factor structure.

Conversely, the 22-item "modified" marijuana motives measure may be more appropriate to use with all samples, regardless of race/ethnicity. Some of the items that were problematic in the current study (e.g. "I use marijuana to celebrate a special occasion with friends" and "I use marijuana because it helps me feel more self-confident and sure of myself") were also problematic with other samples (Chabrol et al., 2005; Simons et al., 1998; Zvolensky et al., 2007). However, previous studies have continued to utilize the Marijuana Motives Measure (Simons et al., 1998) with the proposed structure based on the Alcohol Motives Measure (Cooper et al., 1994), although their results may have suggested otherwise. Overall, these findings highlight the importance of assessing the validity and reliability of this measure across different populations defined by education level and race/ethnicity prior to conducting further analyses.

Factors that Contribute to Motives for Marijuana Use and Predict Past 12-month Use

Consistent with our hypothesis, late adolescents and emerging adults with more depressive symptoms were more likely to use marijuana for coping motives, which in turn predicted more frequent marijuana use in the last year. However, PTSD symptomatology did not significantly predict using marijuana for coping motives. These results suggest that depression symptomatology may be a more prominent predictor of using marijuana for coping reasons over PTSD symptoms.

These findings may be explained by greater reports of depression symptomatology as compared to PTSD symptomatology in our sample, which is consistent with the higher lifetime prevalence of Major Depressive Disorder (MDD) compared to PTSD in African American adults in national studies (10.4% vs. 8.7%;

Roberts et al., 2011; Williams et al., 2007). African American emerging adults tend to report higher rates of depression during the transition to adulthood in comparison to their Caucasian counterparts (Assari et al., 2015). Similarly, there is a higher prevalence of PTSD in African American adolescents and emerging adults than their Caucasian peers, which is explained by increased likelihood of trauma exposure (Andrews et al., 2015; Roberts et al., 2011).

Since the comorbidity of PTSD and MDD is larger in African American adults (58%) than in the general population (50%), there may be less clear distinction between depression and PTSD in this population (Benítez et al., 2014; Rytwincski et al., 2013). For instance, in the present subsample of African Americans, PTSD symptoms and depression symptoms were moderately correlated (r=.60, p<.001). Despite this positive association, PTSD and depression are distinct concepts that should be examined separately because they have different antecedents and consequences (Grant et al., 2008). Additionally, both PTSD and depression have unique symptoms that do not overlap. Specifically, symptoms of hyperarousal, hypervigilance, and flashbacks are unique to PTSD, while fatigue, lethargy, and appetite changes are unique to Major Depressive Disorder (Grant et al., 2008). Interestingly, both depression and PTSD symptoms were positively correlated with coping motives (r=.29 and .28, both p<.01). When depression symptoms were excluded from the model, PTSD symptoms were a significant predictor of using marijuana for coping motives (β=.23, p<.01) and the indirect effect of PTSD symptoms on frequency of marijuana use through coping motives was significant (β=.07, p<.05). Overall, these findings suggest that while PTSD symptoms are related to using

marijuana for coping motives, depression symptoms may be a more salient predictor for using marijuana for coping motives.

Furthermore, there may be a bidirectional relationship between depression symptomatology and marijuana use, which may explain why depression symptoms were a stronger predictor of using marijuana for coping motives in this cross-sectional study. Much research has shown that depressive symptoms can lead to using marijuana among adolescents (Degenhardt, Hall, & Lynskey, 2003; Diego, Field, & Sanders, 2003). However, previous literature has also suggested that the neural effects of marijuana use may contribute to internalizing problems, such as depression (Green & Ritter, 2000; Medina et al., 2007). A similar bidirectional relationship has not been described for marijuana use and PTSD symptoms.

As hypothesized, associating with substance using peers predicted using marijuana for more social and enhancement motives. Our findings are consistent with previous findings that adolescents are likely to use marijuana to bond with their peers who also use marijuana (e.g, social motives; Buckner et al., 2016). These findings are also similar to studies showing that adolescents who associated with deviant peers were more likely to use *alcohol* for enhancement and social motives (Bosari & Carey, 2001; Kuntsche et al., 2010; York, 2013). Prior to the current study, the relationship between associating with substance using peers and using marijuana for enhancement motives had not been examined.

Conversely, affiliation with substance using peers was not associated with using marijuana for conformity or expansion motives, which may be explained by lower endorsements of using marijuana for these motives in the current sample compared to

social, enhancement, and coping motives. Similar to previous studies, using marijuana for conformity motives was the lowest endorsed motive among adolescents and emerging adults (Buckner et al., 2016; Simons et al., 1998; Terry McElrath, et al., 2009; Zvolensky et al., 2007). The average endorsement of expansion motives in the present sample was significantly lower than in previous studies (M=1.82 vs. 2.02 to 2.20, both p<.05; Simons et al., 1998; Zvolensky et al., 2007).

The differential levels of endorsement for marijuana use motives are congruent with previous studies reporting that African American adolescents and emerging adults report more frequent use of marijuana for social, enhancement, and coping motives and less frequent use for conformity and expansion motives compared to their Caucasian peers (Buckner et al., 2016; Patrick et al., 2011b; Terry-McElrath et al., 2009). This could be explained by African American adolescents' tendency to be less susceptible to peer influences (conformity motives) compared to Caucasian adolescents (Gibbons et al., 2010). Also, African American adolescents maybe less likely to endorse expansion motives because they may not have the "luxury" to use marijuana to expand their awareness or be more creative. Specifically, African American adolescents tend to have more immediate stressors than their Caucasian counterparts (Wickrama, Noh, & Bryant, 2005); therefore, using marijuana for coping, social, and enhancement motives may be more relevant for them. These results suggest that associating with substance using peers may not lead to African American adolescents using marijuana for conformity or expansion motives; however, associating with substance using peers is still predictive of marijuana use for social and enhancement reasons.

Regarding marijuana use motives, only coping and expansion motives predicted more frequent use in past 12 months. Similarly, using marijuana for insight (i.e., expansion motives) and coping motives predicted more frequent past 12-month use in a national sample of late adolescents (Patrick et al., 2011a). Also, using marijuana for coping motives is one of the strongest predictors of marijuana use and use-related impairment (Buckner, 2013). By contrast, using marijuana for conformity motives significantly predicted less frequent marijuana use in the past 12 months in the present study, which is also consistent with previous research with late adolescents (Patrick et al., 2011a; Patrick et al., 2011b; Zvolensky et al., 2007). This finding could be explained by older adolescents being less reliant on their peers' approval of them engaging in marijuana use and tendency to use marijuana less for conformity motives as they age (Patrick et al., 2011b).

Incongruent with our hypothesis and previous literature, social and enhancement motives were not predictive of more frequent past 12-month marijuana use. These findings suggest that while substance using peers may influence African American adolescents to use marijuana for social and enhancement reasons, these influences may not translate to more frequent marijuana use. It may be that these adolescents only use when they are with their peers, so they use less frequently than those who use marijuana alone. While social motives did not contribute to using marijuana more frequently in this sample, others found that using marijuana for social motives contributes to greater marijuana impairment for African American young adults but not their Caucasian counterparts (Buckner et al., 2016). Thus, further research on the role of social motives in marijuana use among African American adolescents and adults is needed, and these

motives may be relevant in treatment settings. On the other hand, finding that enhancement motives did not predict more frequent past year use may indicate that these motives may not be as concerning as using marijuana for other motives, such as coping, social, and expansion.

Implications

Our findings suggest that the psychometric properties of the Marijuana Motives Measure (Simons et al., 1998) may differ in African American populations. While the Marijuana Motives Measure has good reliability and internal consistency, the structure of the scales may need modifications when examining the relationships between marijuana use motives and other variables. Therefore, future research with racial/ethnic minorities using this measure would benefit from conducting a CFA and make modifications if needed to improve the reliability and internal consistency of the measure before conducting main analyses.

Additionally, our findings suggest that depression symptomatology may be one of the driving forces behind using marijuana for coping motives, which in turn may lead to more frequent marijuana use. Thus, assessing for depressive symptoms prior to the start of treatment for marijuana use could be helpful in creating tailored treatment programs. If individuals demonstrate increased levels of depressive symptoms, targeting these symptoms as a part of the substance use interventions may be important to reduce marijuana use, particularly in African American late adolescents and emerging adults. Treatments that address depression and substance use concurrently have been studied extensively due to the high comorbidity of substance use and depression in adolescents

and young adults (Schuler, Vasilenko, & Lanza, 2015). There has been some evidence for adults having improved abstinence when their depression and substance use symptoms are addressed concurrently, in comparison to only receiving substance use treatment across inpatient and outpatient settings (Hesse, 2009). Also, adolescents with internalizing problems within an inpatient substance use treatment facility tend to report less substance use after receiving integrated therapy compared to those who only received substance use treatment (Tomlinson, Brown, & Abrantes, 2004). Additionally, outpatient cognitive behavior therapy (CBT) combined with motivational interviewing (MI) techniques has been shown to effectively decrease depression symptoms and marijuana use in adolescents and adults (Dennis et al., 2004; Kay-Lambkin et al., 2009). Lastly, including family members or contingency management could increase effectiveness of interventions that target both depression and marijuana use in adolescents (Kadden et al., 2007; Liddle et al., 2009; Stanger et al., 2009; Stanger et al., 2015).

In general, substance use treatments with integrative approaches and those that include family components are the most effective to decrease marijuana use in adolescents and adults with concurrent depressive symptoms. Coping skills often explain the improvements seen in integrated approaches to treat depression and marijuana use, highlighting the need to replace adolescents' use of marijuana for coping with stressors with more adaptive coping skills (Kadden et al., 2007; Litt, Kadden, & Stephens, 2005; Litt et al., 2008). While current substance use treatment policy recommends integrated approaches, they are not *required*; therefore, many substance abuse treatment programs focus on only one treatment approach (e.g., Motivational Interviewing), which may explain the high relapse rate of adolescents who complete substance use treatment

(Sussman, Skara, & Ames, 2008). Overall, universal requirements for integrated approaches to treat adolescent substance abuse may help curb the relapse rates and improve treatment outcomes of adolescent and emerging adult marijuana users.

Treatments addressing African American late adolescents and emerging adult marijuana use may also benefit from including components to address expansion motives for marijuana use, as using marijuana for these motives predicted more frequent past 12-month use in this study. Endorsing marijuana use for expansion motives indicates that the adolescent is using the substance to gain awareness, increase creativity, know himself/herself better, understand things differently, and/or be more open to experiences. These effects could also be achieved through mindfulness-based approaches (Chiesa & Seretti, 2014). Mindfulness is "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgementally to the unfolding of experience moment by moment" (Kabat-Zinn, 2003). Mindfulness-based approaches have been incorporated in some substance abuse treatment programs, decreasing negative affect that often triggers substance use and improving distress tolerance (Sinha, 2007).

Mindfulness-based interventions have been consistently effective in reducing marijuana use in adult populations; however there have been few studies focused on adolescents (Cohen, Wupperman, & Tau, 2013). One study aimed at improving sleep in adolescents post substance abuse treatment found that incorporating mindfulness meditation in their sleep intervention helped to reduce substance use (Britton et al., 2010), which indicates that mindfulness meditation may be a helpful component in treating adolescent marijuana use. Although current mindfulness-based approaches to substance use treatment typically do not highlight the utility of mindfulness to increase

creativity or know oneself better, these benefits could be emphasized when treating adolescents who use marijuana for expansion motives, which may reduce their use for these reasons. To my knowledge, no studies have been conducted on using mindfulness-based interventions to treat adolescent marijuana use. However, pilot studies have indicated that mindfulness-based interventions can improve well-being and decrease recidivism in at-risk populations (Himelstein, Saul, & Romeu, 2015), which may translate to substance use populations.

Finding that using marijuana for conformity motives predicted less frequent use may indicate that these users may not be as severe as users for other motives. While these adolescents have less frequent use, they still engage in some marijuana use, which is potentially harmful for African American users (Brown et al., 2004). Universal interventions that target adolescents should include components that provide adolescents and young adults with skills to resist pressure from peers to use marijuana, while reinforcing the negative consequences of marijuana use.

In summary, it appears that identifying motives for marijuana use may help improve therapeutic approaches to more effectively reduce marijuana use among late adolescents and emerging adults. Interventions that also address depressive symptoms (e.g., combining CBT and MI techniques) can be effective in reducing substance use in adolescents and adults, especially when they include family members and/or contingency plans. However, many youth with substance use problems do not access interventions due to financial and systematic barriers, such as treatment costs and lack of transportation (Sterling et al., 2010). Average weekly cost of outpatient substance abuse treatment for adolescents exceed $100, which may be costly for low income families (French et al.,

2002). Computer-based interventions may be a solution to combat these barriers to treatment access, as they have been an effective solution in other therapeutic contexts (Bickel, Christensen, & Marsch, 2011). A computer-based, therapist led intervention 'Self-Help for Alcohol and other drug use and Depression' (SHADE), which is a combination of CBT and MI, was shown to be just as effective as live interventions in reducing depression symptoms and marijuana use in a group of adults (Kay-Lambkin et al., 2009). Also, a marijuana use intervention via mobile devices has been identified as another technique to deliver services to late adolescent and emerging adults to reduce marijuana use (Shrier et al., 2014). These findings suggest that a computer- or mobile-based treatment could be a viable option for low-income African American adolescents, as it may be more convenient and financially feasible (Bickel, Christensen, & Marsch, 2011).

<p align="center">Limitations and Future Directions</p>

This study was limited by the uneven distribution of African American and Caucasian adolescents. While there were fewer Caucasian adolescents than African American adolescents in both the overall sample and in the subsample of marijuana users, our findings were congruent with racial differences found in national data (Meich et al., 2015; Meich et al., 2016). Because some analyses were restricted to past-year marijuana users, these parts of the study were limited by the small sample size, which reduced statistical power to detect weaker associations among variables in path models. Nevertheless, our sample size was comparable to those of previous studies that evaluated the factor structure of Marijuana Motives Measures and/or outcomes associated with the

measure (N=111 to 227; Buckner et al., 2016; Chabrol et al., 2004; Simons et al., 1998, Zvolensky et al., 2007). Future studies should replicate the present results using larger samples with even distributions of African American and Caucasian adolescents to explicitly test possible racial differences in factor structure of marijuana use motives.

Another limitation was relying on self-report for all measures, which may have biases and inflate associations due to common method variance. It would have been beneficial to obtain parents' or friends' reports of the participants' depression and PTSD symptoms and marijuana use, but parents were not invited to be interviewed during Wave 3. However, if these reports were available, previous research has shown that parents tend to underreport their child's psychological symptoms (Ehrlich, Cassidy, & Dykas, 2011; Weissman et al., 1987) and may also be less aware of the youths' substance use behaviors. Therefore, late adolescents and emerging adults are likely the most reliable reporters of their own psychological symptoms and marijuana use. Additionally, having friends' reports of their own behavior would have increased the accuracy of peers' engagement in substance use, because adolescents tend to overestimate their peers' involvement in substance use (Deuetsch et al., 2015). Future studies would benefit from using multi-informant measures to decrease biases caused by reliance on a single informant.

The cross-sectional design also represents a limitation, because the results cannot support causality. While the study sample is from a longitudinal study, PTSD symptoms and motives for marijuana use were only assessed during Wave 3. Having reports on these variables at each time-point would have allowed us to predict trajectories of marijuana use over time, which would directional interpretations of our findings.

However, reports of ever using marijuana were significantly lower during Waves 1 (1.4%) and 2 (4.6%), when adolescents were on average 11 and 13 years old, respectively, than in the current wave (46%). Thus, the sample sizes would have been insufficient even if motives for marijuana use had been assessed at those time points. Future studies should replicate this study using a longitudinal design to aid in making causal inferences, focusing on middle to late adolescence and/or emerging adulthood to achieve sufficient rates of marijuana use.

Finally, our results are limited to the sampled population of African American youth in a single urban location and may not generalize to youth from different ethnic groups and communities. However, concentrating on African American late adolescents and emerging adults has allowed us to examine a particularly high-risk group that uses marijuana at higher rates and suffers from more severe consequences than their Caucasian counterparts (Brown et al., 2004; Chen & Jacobson, 2012; Gil, Wagner, & Tubman, 2004; Kann et al., 2014; Lee et al., 2010; Meich et al., 2015). Future studies should replicate our findings with more diverse samples and across other geographic locations.

Conclusions

This study is the first to examine the factor structure of the Marijuana Motives Measure in African American late adolescents and emerging adults, who are at greater risk for lifetime marijuana use and negative consequences associated with use. We found that psychometric properties of the Marijuana Motives Measure (Simons et al., 1998) may differ in African American populations. Also, this study was the first to examine

marijuana motives as a mediator of the relationship between depression and PTSD symptoms and peer substance use and marijuana use frequency. Our findings suggest that depressive symptoms may be a more salient contributor to using marijuana for coping motives compared to PTSD symptoms, with coping motives in turn predicting more frequent past year use. Additionally, associating with substance using peers contributes to using marijuana for social and enhancement motives. Furthermore, our findings suggest that expansion motives predict more frequent past year use and conformity motives predict less frequent past year use.

Overall, this study contributed to the existing literature on racial differences in marijuana use, expanded the literature on the contributions of depression and PTSD symptoms to using marijuana for coping reasons in a high-risk population, and suggested potential intervention strategies to decrease marijuana use in African American late adolescents and emerging adults. Future studies with ethnic/minority populations should examine the factor structure of the Marijuana Motives Measure and modify the scales if needed before completing analyses using this measure. Future research should also examine racial differences using the Marijuana Motives Measure among adolescents, as it has been done in adult populations. Moreover, future research should examine the effectiveness of substance use interventions that specifically target motives for marijuana use in African American adolescents and emerging adults.

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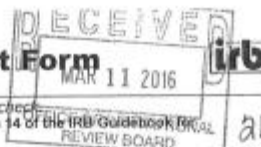
APPENDIX A

IRB APPROVAL FORM

LI4B   **Project Revision/Amendment Form**   **irb**

Form version: June 26, 2012

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In MS Word, click in the white boxes and type your text; double-click checkboxes to check/uncheck.
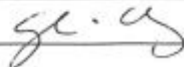- Federal regulations require IRB approval before implementing proposed changes. See Section 14 of the IRB Guidebook for Investigators for additional information.
- Change means any change, in content or form, to the protocol, consent form, or any supportive materials (such as the Investigator's Brochure, questionnaires, surveys, advertisements, etc.). See Item 4 for more examples.

1. Today's Date	3/11/16

2. Principal Investigator (PI)

Name (with degree)	Sylvie Mrug, PhD	Blazer ID	sylva
Department	Psychology	Division (if applicable)	
Office Address	HMB 195, zip 2100	Office Phone	5-9462
E-mail	smrug@uab.edu	Fax Number	5-2295

Contact person who should receive copies of IRB correspondence (Optional)

Name		E-Mail	
Phone		Fax Number	
	Office Address (if different from PI)		

3. UAB IRB Protocol Identification

3.a. Protocol Number	F080605013
3.b. Protocol Title	Birmingham Youth Violence Study (Gender and ethnicity in early substance use initiation)

3.c. Current Status of Protocol—Check ONE box at left; provide numbers and dates where applicable

☐	Study has not yet begun	No participants, data, or specimens have been entered.
☐	In progress, open to accrual	Number of participants, data, or specimens entered:
☐	Enrollment temporarily suspended by sponsor	

☐ Closed to accrual, but procedures continue as defined in the protocol (therapy, intervention, follow-up visits, etc.)

Date closed:	Number of participants receiving interventions:
	Number of participants in long-term follow-up only:

☒ Closed to accrual, and only data analysis continues

Date closed: 9/1/15	Total number of participants entered: 502

4. Types of Change

Check all types of change that apply, and describe the changes in Item 5.c. or 5.d. as applicable. To help avoid delay in IRB review, please ensure that you provide the required materials and/or information for each type of change checked.

☐ Protocol revision (change in the IRB-approved protocol)
In Item 5.c., if applicable, provide sponsor's protocol version number, amendment number, update number, etc.

☐ Protocol amendment (addition to the IRB-approved protocol)
In Item 5.c., if applicable, provide funding application document from sponsor, as well as sponsor's protocol version number, amendment number, update number, etc.

☒ Add or remove personnel
In Item 5.c., include name, title/degree, department/division, institutional affiliation, and role(s) in research, and address whether new personnel have any conflict of interest. See "Change in Principal Investigator" in the IRB Guidebook if the principal investigator is being changed.

   ☒ Add graduate student(s) or postdoctoral fellow(s) working toward thesis, dissertation, or publication
In Item 5.c., (a) identify these individuals by name; (b) provide the working title of the thesis, dissertation, or publication; and (c) indicate whether or not the student's analysis differs in any way from the purpose of the research described in the IRB-approved HSP (e.g., a secondary analysis of data obtained under this HSP).

☐ Change in source of funding; change or add funding
In Item 5.c., describe the change or addition in detail, include the applicable OSP proposal number(s), and provide a copy of the application as funded (or as submitted to the sponsor if pending). Note that some changes in funding may require a new IRB application.

☐	**Add or remove performance sites** In Item 5.c., identify the site and location, and describe the research-related procedures performed there. If adding site(s), attach notification of permission or IRB approval to perform research there. Also include copy of subcontract, if applicable. If this protocol includes acting as the Coordinating Center for a study, attach IRB approval from any non-UAB site added.
☐	**Add or change a genetic component or storage of samples and/or data component—this could include data submissions for Genome-Wide Association Studies (GWAS)** To assist you in revising or preparing your submission, please see the IRB Guidebook for Investigators or call the IRB office at 934-3789.
☐	**Suspend, re-open, or permanently close protocol to accrual of individuals, data, or samples (IRB approval to remain active)** In Item 5.c., indicate the action, provide applicable dates and reasons for action; attach supporting documentation.
☐	**Report being forwarded to IRB (e.g., DSMB, sponsor or other monitor)** In Item 5.c., include date and source of report, summarize findings, and indicate any recommendations.
☐	**Revise or amend consent, assent form(s)** Complete Item 5.d.
☐	**Addendum (new) consent form** Complete Item 5.d.
☐	**Add or revise recruitment materials** Complete Item 5.d.
☐	**Other (e.g., investigator brochure)** Indicate the type of change in the space below, and provide details in Item 5.c. or 5.d. as applicable. Include a copy of all affected documents, with revisions highlighted as applicable. ▶

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5. Description and Rationale

In Item 5.a. and 5.b., check Yes or No and see instructions for Yes responses.
In Item 5.c. and 5.d., describe—and explain the reason for—the change(s) noted in Item 4.

☐Yes ☒No	**5.a.** Are any of the participants enrolled as normal, healthy controls? If yes, describe in detail in Item 5.c. how this change will affect those participants.
☐Yes ☒No	**5.b.** Does the change affect subject participation, such as procedures, risks, costs, location of services, etc.? If yes, FAP-designated units complete a FAP submission and send to fap@uab.edu. Identify the FAP-designated unit in Item 5.c. For more details on the UAB FAP, see www.uab.edu/cto.

5.c. Protocol Changes: In the space below, briefly describe—and explain the reason for—all change(s) to the protocol.

▶ Vinetra King will conduct secondary analyses from this project for her dissertation titled "Racial Differences in Marijuana Use Motives Among Adolescents". These analyses fall under the original purpose of the study as described in the IRB approved HSP.

5.d. Consent and Recruitment Changes: In the space below,
(a) describe all changes to IRB-approved forms or recruitment materials and the reasons for them;
(b) describe the reasons for the addition of any materials (e.g., addendum consent, recruitment); and
(c) indicate either how and when you will reconsent enrolled participants or why reconsenting is not necessary (not applicable for recruitment materials).

Also, indicate the number of forms changed or added. For new forms, provide 1 copy. For revised documents, provide 3 copies:
• a copy of the currently approved document (showing the IRB approval stamp, if applicable)
• a revised copy highlighting all proposed changes with "tracked" changes
• a revised copy for the IRB approval stamp.
▶

Signature of Principal Investigator _____ Date 3/11/16

FOR IRB USE ONLY

☐ Received & Noted ☐ Approved Expedited* ☐ To Convened IRB

Shelly Blake-Headley, CIP   March 14, 2016
Signature (Chair, Vice-Chair, Designee)   Date

DOLA _5/27/15_

Change to Expedited Category Y / N / NA

*No change to IRB's previous determination of approval criteria at 45 CFR 46.111 or 21 CFR 56.111