ABSTRACT

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| Title of Thesis: | A COMPREHENSIVE LONGITUDINAL TEST OF THE ACQUIRED PREPAREDNESS MODEL FOR MARIJUANA USE AMONG ADOLESCENTS |
| | Andrew Lee Ninnemann, Master of Science, 2016 |
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The acquired preparedness model (APM) proposes that drug expectancies mediate the influence of disinhibited personality traits on substance use. The APM provides a useful theoretical basis for the study of marijuana use initiation with a particular emphasis on marijuana-relevant outcome expectancies regarding the function of marijuana use. This prospective study sought to examine how different expectancies about the use of marijuana may mediate the relation between trait disinhibition and eventual marijuana use. To our knowledge, our study is the first to perform a longitudinal examination of the APM as it relates to marijuana use as well as the first to examine this theoretical process across middle adolescence. We found no support for the APM among the higher-order domains of positive or negative marijuana expectancies. Second, among our exploratory analyses, we failed to find support for any of the lower-order domains of marijuana expectancies as a mediator between disinhibition and marijuana use.

A COMPREHENSIVE LONGITUDINAL TEST OF THE ACQUIRED PREPAREDNESS
MODEL FOR MARIJUANA USE AMONG ADOLESCENTS

by

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**Introduction**

Over 100 million Americans have experimented with marijuana, with 22.2 million Americans aged 12 and older having used it in the past 30 days [Substance Use and Mental Health Administration (SAMHSA), 2015]. Among adolescents, marijuana use is associated with a number of deleterious consequences, including cognitive deficits and psychiatric disorders (Hall & Degenhardt, 2013; Lynskey, Coffey, Degenhardt, Carlin, & Patton, 2003; Semple, McIntosh, & Lawrie, 2005). Earlier age of marijuana use onset has been associated with the later development of substance use disorders (Lopez-Quintero et al., 2011). Further, adolescent-onset cannabis use that continues during and beyond adolescence has been associated with deficits in neuropsychological functioning, even after cessation of cannabis use (Meier et al., 2012). In sum, marijuana use during adolescence has been shown to contribute to a variety of physical and mental health problems, both in the short-term and long-term.

Even though cannabis is associated with these harmful consequences in adolescence, marijuana remains the most commonly used illicit drug by adolescents over the age of 12 (SAMHSA, 2015). Research has indicated that the majority of adolescents initiate marijuana use after the age of 13 (Kosterman, Hawkins, Guo, Catalano, & Abbott, 2000), indicating that for most adolescents, high school presents a period associated with marijuana use initiation. Indeed, lifetime rates of adolescent marijuana use have been found to increase from 30% in 9th grade to 49% in 12th grade [Centers for Disease Control and Prevention (CDCP), 2014]. Moreover, research has shown that the transition from marijuana use initiation to regular marijuana use commonly occurs within 3 years (Wittchen et al., 2008). By grade 12, approximately 28% of adolescents are classified as current marijuana users (CDCP, 2014).

Given the deleterious personal, social, and economic consequences associated with cannabis use during adolescence, the high levels of marijuana use initiation and escalation during high school, and the rapid transition from initiation to regular use, developing effective prevention and intervention strategies during this developmental period is an important public health goal. While a number of prevention programs have been developed to reduce adolescents' use of drugs broadly and marijuana specifically, rates of cannabis use among high schoolers have increased since 2007, while rates of perceived risk from marijuana use have steadily decreased (Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2016), suggesting a need for more effective prevention and early intervention programs. Many existing prevention and early intervention programs can be or are informed by the underlying processes that lead to the initiation and escalation of marijuana use. Among well-known risk factors for this process, disinhibited personality traits and beliefs about marijuana use outcomes (e.g., marijuana expectancies) have been shown to be strongly predictive of marijuana use (Hayaki et al., 2010). Recent theoretical models have integrated these personality (e.g., behavioral disinhibition) and learning (e.g., expectancies) risk factors, contributing to our understanding of their individual and combined influences on marijuana use and marijuana related problems.

**The Acquired Preparedness Model**

The acquired preparedness model (APM) is one such model that integrates these two risk factors as a means of understanding what might contribute to eventual substance use. The model proposes that drug expectancies mediate the influence of disinhibited personality traits on substance use (Smith & Anderson, 2001). The personality traits relevant to the APM model are those associated with behavioral disinhibition or behavioral undercontrol, including, for example, impulsivity and sensation seeking, which constitute related but distinct constructs. The

APM proposes that behaviorally disinhibited individuals are more likely to learn the positively reinforcing components of maladaptive behaviors than the punishing components (Smith & Anderson, 2001). Research has shown that individuals with high levels of trait disinhibition tend to focus on positive alcohol cues in their environment, while ignoring the punishing components (McCarthy, Miller, Smith, & Smith, 2001; Patterson and Newman, 1993). When this trait combines with drug-specific learning, behavioral disinhibition is thought to lead to the development of more positive drug expectancies and less negative drug expectancies. Drug outcome expectancies have been implicated in social learning and cognitive models of addictive behavior (e.g., Brandon, Herzog, Irvin, & Gwaltney, 2004, Witkiewitz and Marlatt, 2009) and are broadly differentiated into the higher order factors of negative expectancies (e.g., expectations of marijuana use resulting in negative physical feelings) and positive expectancies (e.g., expectations of marijuana use resulting in negative affect reduction) (Aarons, Brown, Stice, & Coe, 2001; Connor, Gullo, Feeney, & Young, 2011). Positive drug expectancies include elements of both positive and negative reinforcement, while negative drug expectancies are focused specifically on the punishing components of the drug.

The APM posits that the formation of more positive and less negative expectancies occurs because these individuals are more likely to seek reward, including drug-specific learning related to reward. Thus, a personality risk factor such as impulsivity may influence the development of positive drug expectancies via mechanisms like selective attention to positive experiences with the drug as a result of modeled behavior, a discounting of the negative consequences associated with the drug, an inability to learn from punishment as it relates to the drug, and a focus on positive aspects of the drug in ambiguous situations (Corbin et al., 2015). For example, someone who drank excessively, had meaningful conversations with close friends,

and experienced a severe hang over would, according to this model, be more likely to encode the rewarding components of this experience and less likely to encode the negatives. The APM as proposed does not distinguish between whether an individual with this 'acquired preparedness' is more likely or prone to seek out environments or contexts where there is more opportunity for drug-related learning, if these individuals are simply more selectively attentive to the positive aspects of drug use, or both.   These expectancies, then, are hypothesized to predict the onset of substance use and, eventually, substance use related problems. In this way, the APM integrates learning models, which posit substance use results from modeling and experience, with personality models, which suggest personality traits influence learning processes that then predict behavior (Anderson, Smith, & Fischer, 2003).

Since the APM was proposed, there have been an accumulating number of studies conducted to examine the validity of the model as it relates to substance use, with the majority of studies examining alcohol use and focusing solely on positive expectancies as a possible mediator in this relationship. On average, results of these studies demonstrate support for the APM, finding that positive expectancies fully or partially mediate the relationship between trait disinhibition and alcohol use (Anderson, Smith, & Fischer, 2003; Barnow et al., 2004; Corbin, Iwamoto, & Fromme, 2011; Fu, Ko, Wu, Cheng, & Cheng, 2007; Kazemi, Flowers, Shou, Levine, & Van Horn, 2014; McCarthy, Kroll, & Smith, 2001a; McCarthy et al., 2001b; Settles, Cyders, & Smith, 2010; Settles, Zapolski, & Smith, 2014) and, to a lesser extent, alcohol related problems (Corbin et al., 2011; Fu et al., 2007). The majority of studies on the APM and alcohol, however, consisted primarily of samples of college students (Anderson et al., 2003; Corbin et al., 2011; Fu et al., 2007; McCarthy et al., 2001a; 2001b; Settles et al., 2010), with only one studying

a sample of 15 year olds (Barnow et al., 2004) and another focused on 11 year olds (Settles et al., 2014).

Some of these studies have also examined negative expectancies as a possible mediator between trait disinhibition and alcohol use or related problems. Results of this research has been more equivocal, with some studies demonstrating mediation by negative expectancies (Anderson et al., 2003) and others not (Corbin et al., 2011; Fu et al., 2007; Settles et al., 2014). These mixed findings are somewhat surprising, as Anderson and Smith (2001) theorized that negative expectancies would mediate the relationship between trait disinhibition and alcohol use and related problems because the theoretical underpinnings of the APM are based in the idea that those with higher levels of trait disinhibition are more likely to attend to the positives of substance use and less likely to encode the negatives. Theoretically, negative alcohol expectancies are a measure of awareness of the negative consequences of alcohol use and, as such, it is feasible that low levels of negative expectancies would be one pathway between disinhibition and substance use. Yet, given the equivocal findings, a more complex relationship may be at play.

While examinations of mediation by expectancies in the APM for alcohol use have consistently been the focus, some researchers have also examined whether differences exist based on sex or race/ethnicity. Results suggest that there is no support for differences in the APM for alcohol use due to sex and race/ethnicity. Research on marijuana use in adolescents, however, has found that the relations between disinhibition and marijuana use in adolescents vary by sex (Felton, Collado, Shadur, Lejuez, & MacPherson, 2015). In addition, differences have been found for marijuana use based on race/ethnicity, with African Americans (Johnston et al., 2016) demonstrating higher rates of use.

While a majority of studies on the APM have focused on alcohol use, more recent work has extended that work to other drugs, such as tobacco cigarettes (e.g., Doran et al. 2013), as well as other forms of risky behaviors, such as non-suicidal self-injury (Effinger, 2014). To date, three studies have investigated this model as it relates to cannabis use (Bolles, Earleywine, & Gordis, 2014; Hayaki et al., 2011; Vangsness, Bry, & LeBouvie, 2004). The APM provides a useful theoretical basis for the study of marijuana use initiation with a particular emphasis on marijuana-relevant outcome expectancies regarding the function of marijuana use.

**Marijuana Expectancies**

Various dimensions of expectancies have been found for marijuana use based on factor analytic methods (Schafer & Brown, 1991). For marijuana, the conceptual dimensions of positive expectancies include perceptual and cognitive enhancement, relaxation and tension reduction, and social and sexual facilitation, while negative expectancy constructs include cognitive and behavioral impairment as well as global negative effects of the drug (Schafer & Brown, 1991). A neutrally-valenced marijuana expectancy dimension that has been found is craving and physical effects (Schafer & Brown, 1991); however, other studies have found this dimension may fit well into the higher order construct of negative expectancies (Torrealeday et al., 2008). As with all drug expectancies, the separate dimensions of marijuana expectancies are highly dependent upon the hypothesized function and short and/or long-term effects of the drug.

Outcome expectancies may develop from a variety of both person and environmental factors influencing one's learning history, as well as from direct exposure to the drug stimuli themselves (Marlatt & Donovan, 2005). Research has shown that individuals who hold elevated positive cannabis expectancies are at greater risk for excess cannabis use and cannabis-related problems among adolescents (Alfonso and Dunn, 2007; Pederson et al., 2015) and emerging

adults (Harty, Pederson, Gnagy, Pelham, & Molina, 2015). In contrast, studies have found that in non-clinical and non-cannabis specific substance use samples of adolescents, negative expectancies have been found to be a protective factor associated with abstinence or reduced marijuana use (Aarons et al., 2001; Galen and Henderson, 1999; Schafer and Brown, 1991), while among a cannabis using sample, research has found that negative expectancies are associated with marijuana dependence severity (Connor et al., 2011; Johnson and White, 1989). Clearly, expectancies are related to marijuana use and may play a unique role in that use depending on the sample.

**Marijuana and the Acquired Preparedness Model**

Of the three studies applying the APM to marijuana use, results thus far have been equivocal. In a sample of male and female college students, Vangsness and colleagues (2005) found that negative, but not positive, expectancies mediated the relationship between impulsivity and marijuana use. In contrast, a study incorporating a large sample of adult cannabis users found that tension-reduction expectancies (i.e., a domain of positive expectancies) partially mediated the association between impulsivity and marijuana (Bolles et al., 2014). Notably, negative expectancies were not examined in this study. Other research with a community sample of young adult current female marijuana users found that positive and negative marijuana expectancies fully mediated the relationship between marijuana use frequency, marijuana related problems, and marijuana dependence (Hayaki et al., 2011).

There are a number of factors that may explain these seemingly discrepant findings. The sample of college students in the study by Vangsness and colleagues (2005) included a large proportion of marijuana naïve participants, whereas the other studies only included frequent marijuana users. The risk process for marijuana use may be different if one is examining

marijuana initiation versus maintenance, with negative expectancies serving a particularly protective function in the initiation phase of marijuana use (Hayaki et al., 2011), which may have implications for the APM. While research on alcohol use for the APM has generally shown consistent findings for the risk process during both initiation and maintenance, it is possible that the APM risk process is different among different classes of drugs. Importantly, all studies of the APM for marijuana were cross sectional in design and none included adolescents. This is notable because while the risk process for initiation of marijuana use continues into adulthood, it is arguably most relevant during adolescence and, in particular, high school, as adolescents show notable spikes in levels of marijuana initiation and use in grades 9-12. The nature of drug expectancies, which include the development of expectancies prior to first-hand experience with a drug, lend themselves well to the study of marijuana use initiation in adolescents.

**The Present Study**

The purpose of the present study was to test the APM in a diverse sample of adolescents with varied experience with marijuana. The study sought to further extend research on the APM in the following ways: (a) in contrast to previous APM studies of both alcohol and, to a lesser extent, marijuana use, which have not consistently incorporated both positive and negative expectancies into the study design, this study explicitly includes positive and negative expectancies; (b) this study provides the first longitudinal assessment of the APM for marijuana use, allowing for a more definitive understanding of the ordering of these variables temporally as it relates to the marijuana use risk process; (c) this study provides the first examination of the APM for marijuana use in a community sample of adolescents, which allows for greater illumination of the APM risk process during a developmental time of increased risk-taking propensity (Steinberg, 2008) and significant increases in marijuana use initiation. With this in

mind, the study had the following hypotheses: The effect of disinhibition on marijuana use will be positively associated with positive expectancies and in turn higher levels of marijuana use. In contrast, disinhibition will be inversely related to negative expectancies and, thus, lower levels of marijuana use. As an exploratory aim, we will also examine mediation among the different conceptual domains of marijuana expectancies (i.e., (a) cognitive and behavioral impairment, (b) relaxation and tension reduction, (c) social and sexual facilitation, (d) perceptual and cognitive enhancement, (e) global negative effects, and (f) craving and physical effects) to examine whether differences exist in the APM risk process based on the function or effect of marijuana. Given that each domain examines different effects, there may be differential risk processes due to these differing effects. Finally, based on extant research on marijuana use and disinhibition in adolescents, we hypothesized that the APM pathways for marijuana use would vary as a function of sex and race/ethnicity.

## Method

### Participants

Participants are adolescents and their caregivers who were enrolled in a longitudinal study examining HIV-related risk behaviors among youth. Participants in the current study consisted of 156 males and 121 females in the 9th grade and their caregivers. Adolescents were assessed annually for three years between grades 9 and 11. Adolescents were between the age of 14 and 17 at grade 10 ($M = 15.13$, $SD = 0.57$). The adolescent sample was 42.6% Caucasian, 30.3% African-American, 2.9% Latino, 1.4% Asian, 0.4% Native American, and 9.7% mixed ethnicity.

### Procedure

All study participants were approved by the University of Maryland institutional review board. Recruitment in the larger longitudinal study was aimed towards fifth and sixth graders who lived in a large metropolitan area in the Northeast United States. The sole inclusion criteria was proficiency in English. Recruitment methods included fliers and mailings to local community centers, schools, libraries, and Boys and Girls Clubs. Interested families who met inclusion criteria were asked to come to the university's campus, which was accessible by public transportation. Upon arrival at the university, caregivers provided informed consent and adolescents provided informed assent. At each assessment, adolescents completed all survey and computerized measures in a private room. Participants were compensated with prizes worth between $15 and $35, including gift cards and movies.

The larger longitudinal study started when participants were between the ages of 11-13. Data in the current study were recoded from wave-centered to grade-centered as a means of assessing children over time across grade level. All adolescents who participated in the initial wave of data collection were invited to participate in subsequent waves.

**Measures**

*Demographics.* At each assessment point, the caregiver completed a basic demographics questionnaire that included questions about their adolescent's age, current grade level, sex, and ethnicity.

*Trait Disinhibition*. Adolescents completed two self-report measures of disinhibition at time point 1 of the current study, while in grade 9. Consistent with previous approaches to measuring disinhibition (e.g., Felton et al., 2015), we created a composite score that aggregates a measure of impulsivity (Eysenck Impulsivity Subscale, version 7, EI-7; Eysenck, Pearson,

Easting, & Allsopp, 1985) and sensations seeking (Brief Sensation Seeking Scale, BSSS; Hoyle et al., 2002) as a means of assessing multiple facets of the construct of trait disinhibition.

Thus, self-reported impulsivity was measured using the EI-7, which has been done in previous studies with adolescents (e.g., Lejuez et al., 2007). The EI-7 subscale is operationalized as measuring rash impulsivity, which is defined as the tendency to act without considering negative consequences or awareness of risk (Miller, Joseph, & Tudway, 2004). The impulsiveness subscale consists of 19 items with "yes" and "no" response options. Example items on the impulsiveness subscale include, "Do you often long for excitement?" and, "Do you generally do and say things without stopping to think?" Items are coded a 1 or 0 depending on yes/no endorsement of an item. Possible scores on the scale range from 0 to 19, with higher scores reflecting higher levels of rash impulsivity. In previous research, this measure has demonstrated good internal consistency (Cronbach's alpha = .84; Eysneck et al., 1985) and evinced acceptable reliability in the current study (Cronbach's alpha = .74).

We assessed youth sensation seeking with the BSSS. The BSSS is an eight-item measure that asks the adolescents questions about themselves in relation to a variety of sensation-based experiences, such as enjoyment of exploring strange places and having new and exciting experiences. Adolescents are asked to report the extent to which they agree with each statement (0 = *strongly disagree* through 4 = *strongly agree*). BSSS scores were calculated by averaging all items. The BSSS has evidenced good reliability (Cronbach's alpha = .76) and validity among adolescents (Hoyle et al., 2002), and acceptable reliability in the current study (Cronbach's alpha = .75).

To create our composite score to assess for trait disinhibition, we first standardized scores on the EI-7 and the BSSS yielding z scores for each individual on both measures. We then

averaged the standardized scores for both measures to create the final score. This approach is consistent with statistical methods recommended by Stuart and Holtzworth-Munroe (2005).

*Marijuana Expectancies.* The Marijuana Effect Expectancy Questionnaire-Brief (MEEQ-B; Torrealday et al., 2008) is a 6-item self-report measure adapted from the longer Marijuana Effect Expectancy Questionnaire (MEEQ; Schafer & Brown, 1991) and validated with adolescents. The MEEQ-B was administered at each assessment time point. The MEEQ-B consists of a subscale of Positive Marijuana Expectancies and a subscale of Negative Marijuana Expectancies. The positive expectancies subscale consisted of three items, each of which assessed a separate construct, including the adolescent's belief about marijuana's ability to provide relaxation and tension reduction, social and sexual facilitation, and perceptual and cognitive enhancement. The negative expectancies subscale also consisted of three items, which assessed the adolescent's beliefs about marijuana's ability to create cognitive and behavioral impairment, negative effects, and craving and physical effects. Response options included: (1) disagree strongly, (2) disagree somewhat, (3) uncertain, (4) agree somewhat, (5) agree strongly.

As the goal of the MEEQ-B was to provide a brief assessment tool of marijuana expectancies, Torrealday and colleagues (2008) chose to use single items to represent each expectancy subscale of the original MEEQ. This resulted in positive and negative expectancy scales each being comprised of three items. With such brevity comes concerns regarding validity. With this in mind, in the original study the MEEQ-B demonstrated slightly lower internal consistencies (Cronbach's Alpha = 0.42 to 0.60) than those of the original MEEQ (Cronbach's Alpha = 0.59 to 0.76). In the current study, internal consistencies for the MEEQ-B were similar to or higher than the original study (Cronbach's Alpha = 0.47 to 0.85). Notably, lower Cronbach Alphas are more likely with shorter scales, such as the three item one used here

for positive and negative expectancies, and these internal consistencies are similar to those found in other adolescent expectancy measures (i.e., The Alcohol Expectancies Questionnaire-Adolescent; Brown, Christiansen, & Goldman, 1987).

*Marijuana Use*. The Youth Risk Behavior Surveillance System (YRBSS; Center for Disease Control and Prevention, 2002) is a self-report measure used to assess risky behaviors in youth. We used a modified version of the YRBSS to assess past year marijuana use at each assessment time-point. Response options were: (0) Zero; (1) Once; (2) A few times; (3) 1-3 times per month; (4) 1-3 times per week; and (5) Almost every day or more.

## Results

**Preliminary Analyses**

First, all variables were examined for univariate normality. Skew and kurtosis values of all primary variables were in the acceptable range, with the exception of the past year marijuana use variable at T1. This being the case, we transformed the data by taking the natural log of each marijuana use response at every wave and then reassessed the descriptive statistics. The distributions of the natural log marijuana use variables were in the acceptable ranges for skew and kurtosis ($\leq 3.0$) at each time-point and were used in the following analyses.

Descriptive statistics for T1 and T2 negative and positive marijuana expectancies, trait impulsivity, and sensation seeking; and T1, T2, and T3 past year marijuana use are reported in Table 1. Mean levels of impulsivity (Eysenck et al., 1985) and sensation seeking (Hoyle et al., 2002) were slightly lower than those found in original studies examining normative means among adolescents. In addition, we also examined bivariate correlations for all study variables (Table 2). Negative expectancies in grades 9 and 10 demonstrated significantly negative correlations with marijuana use in grades 9, 10, and 11. Impulsivity at grade 9 was significantly

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correlated with marijuana use at grade 11, but not with marijuana use at grades 9 and 10. Impulsivity at grade 10 was significantly correlated with marijuana use at grade 10, but was not correlated with marijuana use at grades 9 and 11. In addition, grade 9 sensation seeking was significantly correlated with grade 11 marijuana use, but not correlated with grade 9 and 10 marijuana use. In contrast, grade 10 sensation seeking was marijuana use at grades 10 and 11, but not at grade 9. As expected, impulsivity and sensation seeking were significantly correlated during grades 9 and 10.

**Examining Expectancies as a Mediator**

In order to test marijuana expectancies as a mediator of the association between trait impulsivity and past year marijuana use, we created path analysis models using M*plus* 6.0 (Muthen & Muthen, 1998-2010). Throughout these analyses, we utilized a full information maximum likelihood (FIML) estimation method to handle missing data. This approach is known to provide less biased parameter estimates than do other ad hoc approaches (e.g., listwise or pairwise deletion) and is more robust to deviations from normality in data (Little & Rubin, 1987). To examine the hypothesized relations between trait impulsivity, expectancies, and marijuana use, we tested a series of structural equation models (SEM). We assessed how well the model fit the data by examining the chi-squared statistic, the Comparative Fit Index (CFI; Bentler, 1990), the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973), the root mean square error of approximation (RMSEA; Steiger, 1990), and the standardized root mean-square residual (SRMR; Bentler, 1995). While nonsignificant chi-square values are an indicator of good fit, this fit index has been found to be highly sensitive to sample size (Kline, 2005). As a result, RMSEA, CFI, TLI, and SRMR values served as the primary indices of model fit in the following analyses. RMSEA values below .08 (Schweizer, 2010), CFI values above 0.93 (Byrne, 1994), TLI values

above 0.90 (Hu and Bentler, 1999), and SRMR values below 0.08 suggest good fit (Hu and Bentler, 1999).

**Model examining positive marijuana expectancies as a mediator**

We examined the hypotheses that marijuana expectancies would mediate the relation between trait disinhibition and marijuana use by testing a SEM (See Figure 1). We regressed T3 marijuana use on T2 positive marijuana expectancies and T1 trait disinhibition, controlling for prior levels of positive marijuana expectancies and marijuana use as well as sex and ethnicity/race. The model fit the data well: $\chi^2(2)=3.59$, $p=.17$; CFI=0.99; TLI=0.90; RMSEA=0.07 [90% C.I.=0.00-0.18]; and SRMR=0.01. See table 3 for path estimates of the model. Path estimates indicate that T1 composite disinhibition was not significantly associated with T2 positive marijuana expectancies, while T2 positive expectancies were not associated with T3 marijuana use.

Next, we examined the indirect effect of T1 trait disinhibition on T3 marijuana use via T2 marijuana use expectancies utilizing nonparametric bootstrapping, which offers a direct test of mediation (Preacher & Hayes, 2004; 2008). Unlike hypothesis testing utilizing parametric statistics, bootstrapping procedures do not assume normality, which reduces the likelihood of type 2 errors as compared to other statistical methods (Shrout & Bolger, 2002). The bootstrapping approach is computed by randomly drawing a large number of samples (e.g., n = 1000) from the data and calculating the products of the pathways "a" (trait impulsivity to marijuana expectancies) and "b" (marijuana expectancies to past year marijuana use). To test the significance of each pathway, we examined the total, direct, and indirect effects as well as tests of significance using the bootstrapping procedure. The indirect effect is considered significant if the confidence interval does not include zero. Results from our analyses indicate that the indirect

effect of T1 composite disinhibition on T3 marijuana use via positive marijuana expectancies was not significant.

**Model examining negative marijuana expectancies as a mediator**

In our second path model, we hypothesized T1 trait disinhibition would be inversely associated with T2 negative marijuana expectancies which, in turn, would be negatively associated with T3 marijuana use, controlling for prior levels of negative marijuana expectancies and marijuana use as well as gender and ethnicity/race (See Figure 2). The model fit the data well: $\chi^2(2)=0.38$, $p=0.82$; CFI=1.00; TLI=1.09; RMSEA=0.00 [90% C.I.=0.00-0.08]; and SRMR=0.00. Path estimates indicated that T1 composite disinhibition was significantly negatively associated with T2 negative marijuana expectancies, while T2 negative expectancies were not associated with T3 marijuana use.

We next examined the indirect effect. Results indicate that the indirect effect of T1 composite disinhibition on T3 marijuana use via negative marijuana expectancies was not significant.

**Exploratory analyses of domains marijuana expectancies as a mediator**

We also examined six additional structural models using each of the conceptual domains of marijuana expectancies as mediators between T1 trait disinhibition and T3 marijuana use. First, we examined the pathways related to the negative marijuana expectancies, which include: (1) expectancies for marijuana to create cognitive and behavioral impairment, (2) global negative effects, and (3) craving and physical effects. In contrast, positive marijuana expectancies consist of the domains of (1) relaxation and tension reduction, (2) social and sexual facilitation, and (3) perceptual and cognitive enhancement.

Each model of a domain of negative or positive marijuana expectancies demonstrated model fit in the acceptable range. Path estimates for each expectancy model are shown in Table 3. Testing the indirect effects of these models indicated that the indirect effect of T1 disinhibition on T3 marijuana use via each separate positive and negative expectancy domain were not significant after controlling for prior marijuana use and marijuana expectancy type as well as gender and race/ethnicity.

**Multigroup models: Examining gender and racial/ethnic differences**

We also examined differences in path analyses based on sex using a multigroup model that examined these relations among boys and girls separately. First, we tested a model in which paths were freely estimated in each group. Next, we constrained pathways to be invariant across groups, which allowed us to examine changes in the model fit based on the chi-square statistic. A significant perturbation of the model fit based on an additional model constraint would indicate that the paths are significantly different for boys and girls. In contrast, non-significant changes would indicate that the paths are not significantly different and model constraints should be retained for parsimony.

The change in chi-square between the unconstrained and constrained model was not significant for positive expectancies ($\Delta \chi^2 = 0.98$, $\Delta df = 2$, $p > .05$) or negative expectancies ($\Delta \chi^2 = 0.16$, $\Delta df = 2$, $p > .05$), suggesting that path estimates are not significantly different for boys and girls in either of the expectancy domains. A similar approach was used to investigate differences in path analyses based on race/ethnicity (white versus non-white). Results do not support that the path estimates were different for white and non-white youth among positive ($\Delta \chi^2 = 1.44$, $\Delta df = 2$, $p > .05$) or negative expectancy models ($\Delta \chi^2 = 0.85$, $\Delta df = 2$, $p > .05$).

This prospective study sought to examine how different expectancies about the use of marijuana may mediate the relation between trait disinhibition and eventual marijuana use. To our knowledge, our study is the first to perform a longitudinal examination of the acquired preparedness model (APM) as it relates to marijuana use as well as the first to examine this theoretical process across middle adolescence. Our results suggest a number of important findings for the marijuana use APM risk process among adolescents. First, we found no support for the APM among the higher-order domains of positive or negative marijuana expectancies. Second, among our exploratory analyses, we failed to find support for any of the lower-order domains of marijuana expectancies as a mediator between disinhibition and marijuana use. Finally, our study did not find evidence of sex or racial/ethnic differences in the mediational pathways. Our mediational results diverge from previous studies in a variety of ways. In this discussion, we review possible reasons why our results contrast those of previous studies, including: (1) variations in the age of the participant samples; (2) the phase of drug use (i.e., never use, initiation, maintenance); (3) type of drug, and (4) study design. Finally, we discuss these results in the context of avenues for future research as well as possible clinical implications of our findings.

**Review of Findings**

The first set of analyses tested the APM and examined positive and negative expectancies as a mediator between disinhibition and marijuana use. Contrary to hypotheses, we did not find support for higher-order (i.e., positive or negative expectancies) or lower-order expectancies (e.g., expectancies for perceptual and cognitive enhancement) as a mediator between disinhibition and marijuana use in our adolescent sample. These results are inconsistent with extant research on the APM risk process for marijuana use (Bolles et al., 2014; Hayaki et al.,

2011; Schafer & Brown, 1991; Vangsness et al., 2005). For instance, cross sectional research found that both positive and negative marijuana expectancies mediated the relationship between trait impulsivity and marijuana use as well as marijuana related problems in a sample of adult females who frequently used marijuana (Hayaki et al, 2011). In addition, Vangsness et al. (2005) found that negative, but not positive, expectancies mediated this relationship in a cross sectional study of college students, many of whom were naïve to marijuana use. Related to lower-order marijuana expectancies, in a cross sectional study, Bolles and colleagues (2014) found that expectancies for marijuana to provide tension reduction partially mediated the relationship between impulsivity and marijuana use in a large (N=5996) sample of adults recruited from a marijuana policy listserv. Our results clearly differ from the reviewed studies in that no higher order (i.e., positive or negative) or lower order expectancy mediated these relations among adolescents.

**Adolescents versus Adults**

There are a number of possible reasons why our mediational findings are not consistent with the extant literature. First, the reviewed studies of the APM for marijuana use all utilized adult samples, while ours consisted of a sample of individuals transitioning from middle to late adolescence. Results of these previous studies with adults for the APM for marijuana use all found support for the APM with regard to positive expectancies (Bolles et al., 2014), negative expectancies (Vangsness et al., 2005), or both (Hayaki et al., 2011). These differences may be due to the age of the samples utilized and subsequent age-related variations in the personality trait of disinhibition. For instance, the construct of disinhibition, including impulsivity and sensation seeking, has been shown to change over the course of adolescence, demonstrating linear and curvilinear changes across middle adolescence (Collado, Felton, MacPherson, &

Lejuez, 2014). In contrast, more stability in inhibitory control has been shown in adults as compared to adolescents (Williams, Ponesse, Schachar, Logan, & Tannock, 1999). In this way, impulsive personality traits may be more variable among adolescents than adults. As a result, our measures of disinhibition via sensation seeking and impulsivity with our adolescent sample may be less reliable, as the construct itself may be changing.

There is also research to suggest that the relation between disinhibition and substance use may be bidirectional in nature (Lejuez et al., 2010) over the course of adolescence and young adulthood, with disinhibition increasing the risk for and being altered by substance use. For instance, in a longitudinal study by Horvath and colleagues (2004), researchers found that sensation seeking measured in 9$^{th}$ or 10$^{th}$ grade predicted drug use at ages 19 and 20, and drug use measured in 9$^{th}$ or 10$^{th}$ grade predicted sensation seeking at 19 and 20. Similar results were found in a prospective study with college students, showing that sensation seeking was predictive of later heavy drinking and heavy drinking was predictive of later sensation seeking (Quinn, Stappenbeck, & Fromme, 2011). In this way, the relation between impulsivity and substance use, key variables in the APM, may be more complex than the posited unidirectional relationship of the APM, and may, in part, explain our null results.

**Never Use, Initiation, and Maintenance Phases of Use**

Another possible reason for our null findings may be due to differences that exist in positive and negative expectancies across the never use, initiation, and maintenance phases of marijuana use. Drug expectancies have been shown to change overtime, with evidence of specific changes in expectancies after first-hand experience with a substance (Doran, Schweizer, & Myers. 2011; George et al., 1995), suggesting the relationship between drug expectancies and substance use may not be stable. Indeed, some research suggests that the relation between

substance use and drug expectancies is bidirectional (Guller, Zapolski, & Smith, 2015). The different relations between expectancies, use, and developmental period may help us better understand the equivocal results in examinations of the APM for alcohol use with some cross-sectionals studies demonstrating mediation by negative expectancies (Anderson et al., 2003) and other longitudinal studies finding no mediational role (Corbin et al., 2011; Fu et al., 2007). Similarly, results of the few studies assessing the APM for marijuana use have also been mixed. One study found that disinhibition is related to less negative expectancies and, in turn, higher levels of marijuana use (Vangsness et al., 2005), while another found that disinhibition is positively related to negative expectancies and, in turn, lower levels of marijuana use (Hayaki et al., 2011). In addition, the Vangsness et al. (2005) study did not find mediation by positive expectancies, while the Hayaki et al. (2011) study did. However, explicit differences existed in the samples for which these relations were assessed, with Vangsness et al. (2011) examining a sample of primarily marijuana naïve college students, while Hayaki et al. (2011) included non-treatment seeking female marijuana smokers from the community.

Never users with low disinhibition may be more attuned to the negative consequences of use, which may provide a protective effect (Aarons et al., 2001; Vangsness et al., 2005), resulting in less marijuana use. In contrast, those high in disinhibition who have recently initiated use may be less aware of the negative consequences of use and use more marijuana as a result. Finally, those high in disinhibition who have used marijuana routinely for some time may be more aware of the negative consequences, resulting in less use overall. In our sample, where over 75% of the sample was naïve to use at grade 11, negative expectancies measured at grade 9 and 10 show significant negative associations with grade 9 and 10 sensation seeking, grade 10 impulsivity, and grades 9, 10, and 11 marijuana use. Given that the majority of the sample did

not use marijuana, these findings are consistent with other studies examining relations between disinhibition, expectancies, and marijuana use during the "never use" phase of development. In path analyses, our results also showed a significant negative association between grade 9 trait disinhibition and grade 10 negative expectancy effects, demonstrating further preliminary support for this idea.

It may be that those in the never use phase of marijuana use who are high in trait disinhibition may also have lower negative expectancies, but that there may not be a causal relationship between disinhibition and these negative expectancies. Unfortunately, neither the Hayaki et al. (2011) or the Vangsness et al. (2005) study assessed age of first use or amount of time using, making it difficult to draw conclusions as to these differences in their results.

Another possibility is that disinhibition measured in samples consisting of primarily naïve users may be more strongly inversely related to sensitivity to punishment (Behavioral Inhibition Systems; Carver and White, 1994) than positively related to reward (Behavioral Activation Systems). In preliminary support of this idea, Vangsness et al (2005) found no association between impulsivity and positive marijuana expectancies, but found a significant association between impulsivity and negative expectancies. Similarly, our path model found significant relations between grade 9 disinhibition and grade 10 negative, but not positive, expectancies. However, it is important to note that we did find significant correlations between grade 9 sensation seeking and grade 10 negative and positive expectancies. Given the equivocal findings regarding the role of negative expectancies in the APM, it would be prudent for future research on the APM for marijuana use to include assessments of inhibition that may be better equipped to detect those who attend to punishment and nonreward (Carver and White, 1994; Corbin et al., 2011). The null findings of the current study regarding the mediational role of

positive and negative expectancies notwithstanding, the results do not argue against bolstering

negative marijuana expectancies as a prevention/intervention approach because negative

marijuana expectancies measured at each wave were significantly inversely associated with

levels of marijuana use at grades 9, 10, and 11. The results do, however, suggest that this

approach may not be specifically suited to those high in disinhibition.

**Alcohol versus Marijuana**

A third reason for our null findings in the relations of the APM may be a function of the

type of drug being assessed. The APM risk process may be different between alcohol and

marijuana. A majority of the studies on the APM for both alcohol and marijuana have examined

positive expectancies as a mediator and very few have examined negative expectancies as a

mediator, with ours being the first to do so prospectively with marijuana use. Indeed, positive

expectancies (as compared to negative expectancies) have most consistently mediated the

relation between disinhibition and alcohol use in assessments of the APM among both adults

(Anderson et al., 2003; Corbin et al., 2011; Fu et al., 2007; Kazemi et al., 2014; McCarthy et al.,

2001a; McCarthy et al., 2001b; Settles et al., 2010) and adolescents (Barnow et al., 2004; Settles

et al., 2014), while this has only been the case for marijuana use among adults or regular users,

and not among adolescents or naïve users. This distinction between alcohol and marijuana for

mediation by positive drug expectancies may be due to differences in early social learning. For

instance, social learning theory (Bandura, 1977) would suggest that youth who have more

exposure to alcohol in their daily lives (parental use, media, advertising, et cetera) may develop

clearer expectations about how alcohol would affect them, particularly from a positive point of

view. Indeed, fathers' alcohol use behaviors have been shown to shape adolescent boys positive

alcohol expectancies, with sons of alcoholic fathers holding stronger positive alcohol

expectancies across middle to late adolescence (Handley and Chassin, 2009). Further, a recent systematic review found that exposure to alcohol advertising and media is consistently associated with increases in intentions to drink and actual drinking behavior among adolescents (Anderson, de Bruijn, Angus, Gordon, & Hastings, 2009). Alternatively, youth may be less likely to see adults in their lives using marijuana and may be presented with substantially less media and advertising for marijuana; as a result, they may not develop the same positive expectations resulting from marijuana use.

As our study is only the second to include negative expectancies for marijuana use and the first to do so with adolescents, the extent to which the development of negative expectancies may differ between alcohol and marijuana is not yet clear. Notably, in the United States (U.S.), alcohol is a federally legal drug for adults to use, whereas marijuana is a Schedule 1 (illegal) substance. Further, as of this writing, of the four states in the U.S. that have legalized non-medical use of marijuana, only two allow advertising of marijuana ("State-by-State Guide to Cannabis Advertising Regulations," 2016). In contrast, while highly regulated, advertising of alcohol is allowed in all U.S. states (Federal trade Commission, 2013). There may be potential difference in the negative expectations one develops and has about what may result from substance use based on these legal differences between alcohol and marijuana (Amonini & Donovan, 2006), but more research is needed to tease these possible differences apart.

**Study Design**

A fourth reason for our null findings may be due to the study design we used. For instance, all previous studies assessing mediation for the APM risk process in marijuana use which found positive relations between the variables utilized cross-sectional designs. There are a number of issues with examining meditational paths using cross-sectional data. Research has

shown that cross-sectional mediation analyses yield substantially biased estimates of longitudinal parameters, resulting in path estimates where the direct effect of X on Y, the indirect effect of X on Y through M, and the total effect mediated by M may be misleading (Maxwell & Cole, 2007). Further, mediation, by nature, consists of a causal process that occurs across time. Use of data from a single time point to assess mediation, then, results in an inability to determine directionality. Thus, in previous cross-sectional mediation studies (Bolles et al., 2014; Hayaki et al., 2011; Vangness et al., 2005) it may in fact be that expectancies are merely correlated with, but not causally related to impulsivity and marijuana use. Indeed, in our study, we found cross sectional relations between several of the trait disinhibition measures, positive and negative marijuana expectancies, and marijuana use.

**Sex and Racial/Ethnic Invariance**

We also examined whether the proposed mediational models differed as a function of sex and race/ethnicity. First, we found that the pathways do not differ significantly as a function of sex. Second, we found that model pathways did not differ significantly as a function of race/ethnicity. These results were not in line with our hypotheses surrounding variance of pathways by sex and race/ethnicity. The sex and racial/ethnic invariance of these pathways has not been previously studied in relation to the APM for marijuana use. It has, however, been studied in the APM for alcohol use, with results from studies with longitudinal designs, larger samples, and more statistical controls demonstrating sex invariance in college students (Corbin et al., 2011) and children (Settles et al., 2014), suggesting there may be similar mediational pathways of this model between sexes and races/ethnicities for alcohol use. Our findings are consistent with this body of research.

**Overview**

To review, there are a variety of possible explanations for our null findings with regard to the APM risk process for marijuana use. These include differences in the age groups studied samples, with all previous studies on the APM examining adult or young adult samples, while ours examined a sample of middle to late adolescents, which may result in different relations between the assessed variables. In addition, our findings may be explained by differences in the risk process between never users, those initiating use, and those who routinely use marijuana. Further, our null findings may be due to differences in the APM risk process as a function of the type or class of drug, with alcohol holding unique differences in social learning as compared to marijuana. Finally, our findings may be due to use of a longitudinal study design and differences in study design. Conversely, our findings were consistent with previous literature in that we found sex and racial/ethnic invariance in the assessed APM pathways.

**Clinical Implications**

The results of the current study may have important implications for adolescent marijuana prevention and treatment programs. Significant mediational results of studies assessing the APM for alcohol use suggest that expectancy challenge interventions may be an effective way to reduce initiation and progression of alcohol use behaviors. However, our null findings and the lack of significant paths between marijuana expectancies and marijuana use suggest that expectancy challenge paradigms may not be as well suited to marijuana. Instead, our results suggest that expectancies may highly correlate with use within time and may be an important construct to measure concurrently to marijuana use, but that marijuana expectancies may be less helpful as a predictor of use. With this in mind, it is important to consider other predictors of initiation and progression of substance use in youth. Various other processes that

confer risk for marijuana use include low parental responsiveness and household structure

(Baumrind, 1985), school truancy (Henry, Thronberry, Huizinga, 2009), children's externalizing

(Heavyrunner-Rioux & Hollist, 2010; Perkonigg et al., 2008; Wymbs et al., 2012) and

internalizing disorders and behaviors (Marmorstein, White, Loeber, & 2011; Tu, Ratner, &

Johnson, 2008), as well as peer substance use (Collins, Abadi, Johnson, Shamblen, & Thompson,

2011; Walker, Neighbors, Rodriguez, Stephens, & Roffman, 2011). Thus, risk for adolescent

marijuana use likely reflects an accumulation of transactions among these multiple risk factors.

**Future Directions**

The reviewed findings suggest a variety of directions for future research. Future studies

on the APM for marijuana use would be wise to utilize strongly validated measures of marijuana

expectancies, especially with adolescents, who have been shown to demonstrate less consist self-

report behaviors than adults (Brener, Billy, & Grady, 2003; Sibley et al., 2011). Our results

suggest that the APM risk process for marijuana may not apply as well to samples with a high

percentage of never users. As our sample represented a community sample and did not involve

recruitment of individuals at high risk for marijuana use initiation or problems, it may be prudent

for future studies assessing the APM risk process for marijuana in adolescents to assess this

process in those at particularly high risk of engagement in marijuana use. Research has shown at-

risk youth have a higher likelihood of engaging in substance use (Smith, Lizotte, Thornberry, &

Krohn, 1995) as well as have more negative consequences resulting from that use. Finally, future

research understanding the relationship between components of the APM process may be

informed by experimental designs, which would allow for stronger conclusions in terms of

causality. While our study is longitudinal in design, allowing for more confidence in the

temporal relationships between assessed variables, conclusions of causality are not possible

using this design. Experimental designs with adolescent humans are not feasible for substance

use specifically, but other research from animal models could inform processes surrounding the

formation of marijuana expectancies.

*Conclusions*

The current study is the first to examine the APM risk process for marijuana use

longitudinally in a sample of adolescents. Results of our study add to an already mixed body of

extant research on the APM. In contrast to research on the APM for alcohol use and related

problems in adolescents, our results suggest either that the APM risk process may not be

particularly relevant to this age group, suggesting that prevention and intervention efforts for

marijuana use among adolescents may be better suited to other factors in the marijuana use

process, or that we may not have been able to capture the APM risk process due to limitations in

our sample. These findings have implications for adolescent substance use prevention programs

and suggest that a focus on a wide variety of known risk factors may be best.

Table 1.

*Means and SDs for Key Study Variables*

| Factor  *M (SD)* | Grade 9 | Grade 10 | Grade 11 |
|---|---|---|---|
| Negative Marijuana Expectancies | 11.81 (2.79) | 11.71 (2.34) | |
| Positive Marijuana Expectancies | 8.91 (3.19) | 10.24 (2.85) | |
| Sensation Seeking | 16.25 (5.39) | 16.65 (5.84) | |
| Eysenck Impulsivity subscale, version 7 | 8.49 (4.31) | 7.97 (4.33) | |
| Past Year Marijuana Use | 0.12 (0.38) | 0.26 (0.51) | 0.41 (0.58) |

Table 2.

*Bivariate Correlations among Primary Variables*

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Grade 9 MEEQ-B Negative |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Grade 10 MEEQ-B Negative | .40** |  |  |  |  |  |  |  |  |  |  |  |
| 3. Grade 9 MEEQ-B Positive | .02 | -.23** |  |  |  |  |  |  |  |  |  |  |
| 4. Grade 10 MEEQ-B Positive | -.09 | -.26** | .41** |  |  |  |  |  |  |  |  |  |
| 5. Grade 9 BSSS | -.01 | -.27** | .22** | .24* |  |  |  |  |  |  |  |  |
| 6. Grade 10 BSSS | -.07 | -.24** | .28** | .25** | .79** |  |  |  |  |  |  |  |
| 7. Grade 9 EI-7 | -.03 | -.10 | .19** | .16 | .32** | .26** |  |  |  |  |  |  |
| 8. Grade 10 EI-7 | -.06 | -.18* | .23** | .14 | .31* | .40** | .68** |  |  |  |  |  |
| 9. Grade 9 marijuana use | -.19** | -.21** | .29** | .15 | .07 | .03 | -.00 | .03 |  |  |  |  |
| 10. Grade 10 marijuana use | -.23** | -.43** | .18* | .38** | .13 | .15* | .11 | .21** | .44** |  |  |  |
| 11. Grade 11 marijuana use | -.10 | -.30** | .32** | .43** | .20* | .29** | .17* | .18 | .32** | .70** |  |  |
| 12. Ethnicity | .05 | -.13 | .03 | .10 | .12 | .19* | -.08 | -.01 | -.14* | .06 | .09 |  |
| 13. Sex | -.08 | -.26** | .08 | .19* | .01 | .07 | -.01 | .09 | .18** | .15* | .06 | .03 |

*Note.* Marijuana use variable was transformed for interpretability; MEEQ-B = Marijuana Effect Expectancy Questionnaire-Brief; BSSS = Brief Sensation Seeking Scale; EI-7 = Eysenck Impulsivity subscale, version 7; Ethnicity is coded 1 = White, 0 = nonwhite; Sex is coded 0 = female, 1 = male.
*p < .05  **p .01

Table 3.

*Path Estimates between T1 Trait Disinhibition, T2 Marijuana Expectancies, and T3 Marijuana Use*

| | Trait Disinhibition, Grade 9 | | Marijuana Use, Grade 11 | |
|---|---|---|---|---|
| | Estimation | *SE* | Estimation | *SE* |
| Grade 10 Cognitive and Behavioral Impairment MJ Expectancy | -.13 | .10 | -.00 | .04 |
| Grade 10 Global Negative Effects MJ Expectancy | -.27* | .12 | -.06 | .04 |
| Grade 10 Craving and Physical Effects MJ Expectancy | -.02 | .08 | -.10 | .06 |
| Grade 10 Relaxation and Tension Reduction MJ Expectancy | .27* | .11 | .02 | .04 |
| Grade 10 Social and Sexual Facilitation MJ Expectancy | .05 | .10 | .09* | .04 |
| Grade 10 Perceptual and Cognitive Enhancement MJ Expectancy | .11 | .11 | .05 | .04 |
| Grade 10 MEEQ-P | .39 | .30 | .03 | .01 |
| Grade 10 MEEQ-N | -.45* | .21 | -.00 | .02 |

*Note.* MJ = marijuana; MEEQ-P = Marijuana Effect Expectancy Questionnaire-Brief, Positive Expectancies Subscale; MEEQ-N = Marijuana Effect Expectancy Questionnaire-Brief, Negative Expectancies Subscale * $p < .05$

Figure 1. Significant path estimates for mediation model of positive marijuana expectancies. Solid lines represent significant paths.
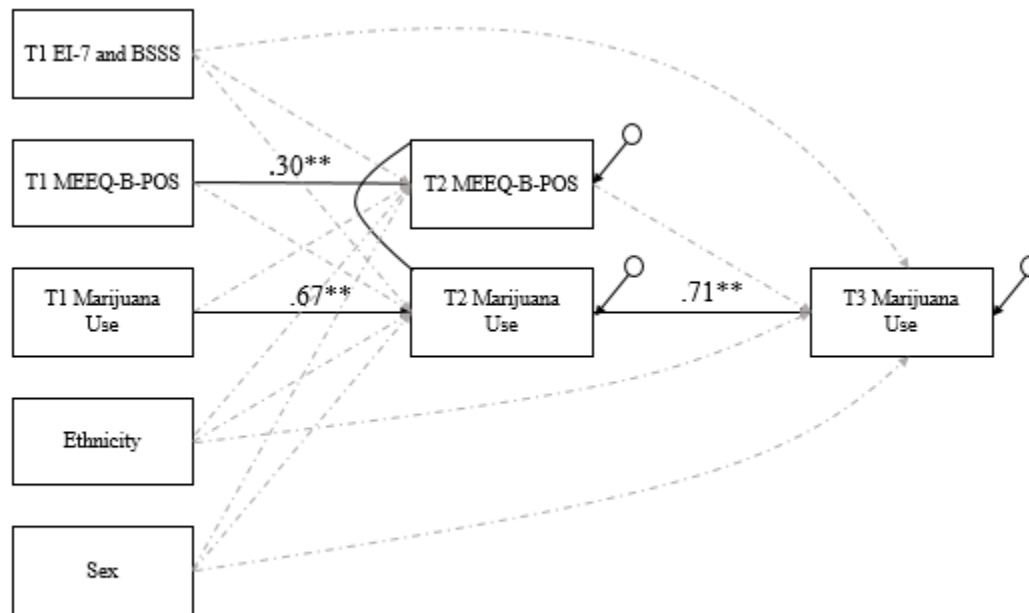


Note. MEEQ-B-POS = Marijuana Effect Expectancy Questionnaire-Brief, Positive Expectancies
Subscale; BSSS = Brief Sensation Seeking Scale; EI-7 = Eysenck Impulsivity subscale,
version 7, ***p < .001

Figure 2. Significant path estimates for mediation model of negative marijuana expectancies. Solid lines represent significant paths.
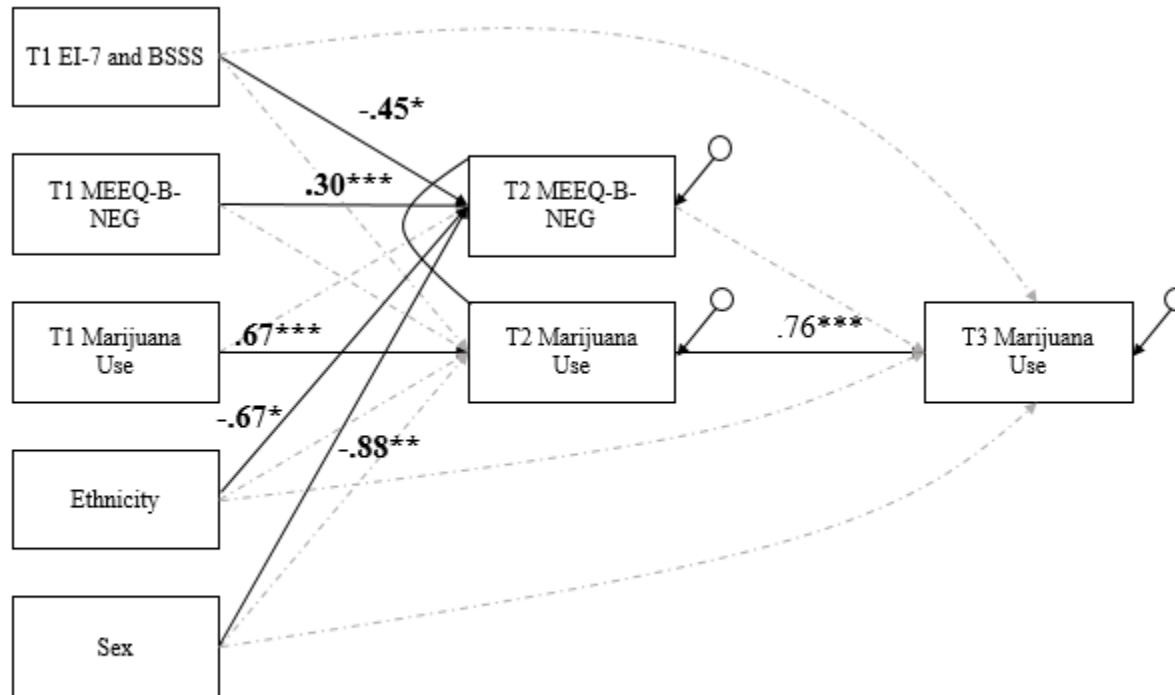


*Note.* MEEQ-B-NEG = Marijuana Effect Expectancy Questionnaire-Brief, Negative Expectancies Subscale; BSSS = Brief Sensation Seeking Scale; EI-7 = Eysenck Impulsivity subscale, version 7; *p < .05, **p < .01, ***p < .001

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