THE INFLUENCE OF MARIJUANA EXPECTANCY CHANGE ON DRUG USE IN ADOLESCENCE

Maleeha Haroon

A thesis submitted to the faculty at the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Arts in the Department of Psychology (Clinical Psychology) in the College of Arts & Sciences.

Chapel Hill
2016

Approved by:

Andrea M. Hussong

Susan T. Ennett

Mitchell J. Prinstein

ABSTRACT

Maleeha Haroon: The influence of marijuana expectancy change on drug use in adolescence
(Under the direction of Andrea Hussong)

The current study examined whether change in marijuana outcome expectancies

following initial marijuana use mediated the risk conveyed by early marijuana use on future

substance use behaviors. Additionally, the study investigated whether the peer context moderated

this pathway. The study utilized a longitudinal data set to examine responses from 1,685

adolescents. Results indicated that both initiation of marijuana use and positive change in

marijuana expectancies predicted more frequent future marijuana use and that marijuana

expectancy change was a significant mediator of the relation between initiation of marijuana use

and future marijuana use. Marijuana expectancy change was also a significant mediator of the

relation between initial marijuana use and future expectations of using other drugs. The peer

context also emerged as a significant mediator of the relation between marijuana use initiation

and marijuana expectancy change. Potential explanations and implications of these findings are

considered.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Adolescent substance use is widespread in the United States, with marijuana being the most commonly used illicit drug. In recent national surveys, 45% of 12th graders report having ever used marijuana, and trends over the last five years indicate significant increases in past-year and past-month marijuana use among 8th, 10th, and 12th graders (Johnston, O'Malley, Bachman, & Schulenberg, 2014). The increasing prevalence of marijuana use among young adolescents is concerning, as early-onset cannabis use is a significant risk factor for other drug and related problems (Lynskey et al., 2003). Studies on adolescent drug use have consistently shown a temporal progression of use such that the use of alcohol and cigarettes precedes the use of marijuana that precedes the use of other illicit drugs (Collins, 2002; Ellickson et al., 1992; Graham et al., 1991a; Kandel, Yamaguchi, & Chen, 1992; Kandel and Yamaguchi, 2002). In general, the earlier and more regular an adolescent's marijuana use, the more likely he or she is to progress to other illicit drug use (see Hall & Lynskey, 2005 for a review).

Whereas early marijuana use initiation is a risk factor for later drug use, the factors underlying this association are unclear. The observed temporal sequencing of drug use may suggest a causal role of marijuana in the progression towards future use, such that use of marijuana in and of itself causes some change that confers risk for future use of other drugs. Possible mechanisms by which marijuana may effect change include biological (e.g. psychopharmacological), social, and cognitive factors. However, some researchers have suggested that marijuana itself may not play a causal role in conferring risk for future drug use. Rather, certain individuals may have a general propensity towards drug use that is conferred

1

through genetic or early environmental factors. Under this model, use of drugs is simply a facet of personality and opportunities for use, and the observed temporal progression of use is due to the relative availability of substances early in the sequence as opposed to later in the sequence (e.g., Morral, McCaffrey, & Paddock, 2002). Therefore, the use of one drug, such as marijuana, would not confer any additional risk for use of another drug later on.

The question of whether marijuana use plays a causal role in the continuation of drug use is of interest from a public health perspective, as policy makers must decide on appropriate targets for prevention initiatives. Should marijuana use confer additional risk for future drug use, then interventions to prevent or forestall marijuana use initiation are warranted; however, if youth who use marijuana are just as likely to progress to other drug use whether they use marijuana or not, efforts to curb marijuana use specifically may not be as efficacious. Retrospective studies of twins discordant for early marijuana use suggest that although common predisposing genetic and shared environmental factors do confer risk for lifetime drug use, those who use marijuana early carry additional risk for later use of other illicit drugs that cannot be attributed to these shared genetic and environmental factors alone (Lynskey et al., 2003; Lynskey, Vink, & Boomsma, 2006). Such results suggest that non-shared environmental factors that are related to early marijuana use experience play a role in the progression from early marijuana use to other drug use. As such, continued investigation of the role of marijuana use, in particular, as a causal factor in the progression of drug use is warranted.

A possible explanation for the risks conferred by early marijuana use is that initial pleasurable experiences with marijuana directly encourage further marijuana use and experimentation with other illicit substances. Cognitive models of drug use experimentation suggest that the decision to use drugs is based on the perception of its costs and benefits

(Bauman, Fisher, & Koch, 1989). Pleasurable initial experience with marijuana may serve to change the perception of the risk and benefits of marijuana as well as other illicit drug use, such that the experience of using marijuana may contribute to the propensity to use other drugs in the future.

A potential framework for understanding this trajectory of marijuana use initiation and drug use progression is that of expectancy theory. Expectancy theory posits that individuals develop expectations for the outcomes of substance use that predict future substance use behaviors. These expectations for outcomes of substance use can initially arise from personality, family, and peer factors. As an individual gains experience with drug use, expectations for use continue to change (Brown, 1993). Expectancy theory thus defines expectancies themselves as useful explanatory mechanisms that result from an individual's personality and social context as well as his or her direct experience with drug use, in turn shaping cognitions that influence subsequent drug use behaviors.

In the current study, I will use an existing longitudinal dataset to examine whether marijuana use expectancies may be useful in explaining the association between initial marijuana use experiences and later substance use. More specifically, I will examine whether a change in marijuana outcome expectancies following initial marijuana use mediates the risk conveyed by early marijuana use for future substance use behaviors. The current study will also assess how an adolescent's peer context may moderate these changes in expectancies about marijuana during the time of use onset.

The Expectancy Theory Framework

One of the most widely used explanatory constructs relating cognitive processes to alcohol and drug use is expectancy theory (see Goldman, Del Boca, & Darkes, 1999).

Expectancy theory posits that individuals develop beliefs—or expectations—about a drug's effects over the life course. Individuals can hold a combination of expectations for drug use; some may be positive, whereas others may be negative. Positive expectations for the effects of a drug are posited to motivate individuals to initiate and maintain drug use based on the desire to attain the positive outcomes associated with the drug. Negative expectations for use, on the other hand, are posited to inhibit use initiation and continuation of drug use behaviors. This theoretical framework is based on social learning theories that posit that individuals engage in behaviors based on beliefs about a behavior's reinforcing effects (Bandura, 1977).

Drug outcome expectancies are typically conceptualized in two ways. One conceptualization is that positive and negative expectancies are relatively independent dimensions that are reflected across different domains of outcome expectations (e.g., social, cognitive, sexual, and relaxation/stress reduction outcomes; Brown, Chistiansen, & Goldman, 1987). These positive and negative expectancies function as differential predictors of various behaviors. For example, negative expectancies are generally protective against frequent alcohol consumption whereas positive expectancies are predictive of increased alcohol use (Lee, Greely, & Oei, 1999). Research on alcohol expectancies has suggested that positive and negative expectancy dimensions are only weakly correlated, and can therefore be thought of as independent dimensions that differentially predict use (Leigh & Stacy, 1993). Thus, separate analysis of positive and negative expectancy dimensions is of importance, as positive and negative expectancies might change without necessarily influencing one another.

However, expectancy measures that assess broad positive and negative dimensions have been criticized for failing to account for individual judgments about the relative desirability of various drug outcomes (e.g., Fromme, Stroot, and Kaplan, 1993). The outcomes that are

4

determined to be "desirable" are often included in positive expectancy subscales, whereas those determined to be "undesirable" are broadly grouped into negative expectancy subscales. Individual differences in judgments of the desirability of each of these outcomes could lead to differential predictive utility of positive and negative expectancy subscales. For example, an individual may expect a particular "positive" outcome to occur if he or she drinks alcohol, but if that positive outcome is only a little bit desirable to the individual, it may not be a strong predictor of drinking behavior. It may even be that this positive outcome is not desirable to the individual at all; therefore, though the individual expects the outcome to occur, it will not be predictive of future behavior. Further, it may be that the balance of desirable versus undesirable expectancies as determined by an individual is more predictive of drug use than the overall levels of positive and negative expectancies independently. A single strongly undesirable negative outcome expectancy may be more predictive of future behavior than multiple slightly desirable positive outcome expectancies, for example. Thus, even if positive and negative outcome expectancies are independent of one another, weighing of the desirability vs. undesirability of outcomes may occur.

Individual judgments of the desirability of drug use outcomes are captured in the subjective expected utility (SEU) conceptualization of drug use expectancies. SEU is defined as the degree to which the consequences of behavior, such as drug use, are expected to vary overall along a continuum of desirable-undesirable outcomes (Bauman, Fisher, Bryan, & Chenoweth, 1984). Individuals can endorse how desirable or undesirable they find consequences or outcomes on SEU questionnaires. As such, these questionnaires take into account that purported positive and negative effects of drugs are not considered equally desirable or undesirable by all. SEU can also be assessed as a unidimensional construct by summing or averaging across consequences

and determining if an individual perceives the benefits of use as outweighing the costs (or vice versa). In this way, SEU measures of expectancies can take into account the relative balance of desirable vs. undesirable expectancies. This differential can be used to assess whether the presence of one type of expectancy over the other is important in predicting future behaviors. A general hypothesis is that as the overall SEU becomes more desirable, a behavior is more likely (Bauman, Fisher, Bryan, & Chenoweth, 1985).

As expectancies for drug use have been shown to reliably predict future drug use behaviors, it is of interest to examine how expectancies develop. Prior to initiating drug use, individuals do not have any direct experience from which they can form expectations for drug effects. However, expectancy theorists suggest that individuals may also form expectations for drug use via indirect experiences, such as knowledge of family and peer experiences with drugs or exposure to media messages about drugs. These indirect experiences are hypothesized to play a central role in the development of expectancies before drug use onset. These initial expectancies—desirable or undesirable—may then be used to predict initiation of use.

Expectancy theorists anticipate that direct experience with drug use alters the initial expectancies individuals hold prior to initiating drug use. Expectancies may therefore change considerably during the period when individuals are just beginning to gain experience with drug use. These changed expectancies may in turn serve as a predictor of future continued drug use. For example, if an adolescent begins to see the outcomes and consequences of drug use as more desirable than undesirable, he or she is predicted to escalate drug use. After numerous direct experiences with the drug, expectancies are posited to become more concrete and fixed. These expectancies may still be predictive of future behaviors, but behaviors will no longer contribute to changes in expectancies.

Expectancy Change as a Mediating Mechanism

The majority of the literature on expectancies has been concerned with alcohol use. Relatively few studies explore tobacco expectancies, and still fewer have explored the expectancy concept in relation to marijuana and hard drug use. Thus, the bulk of what we know about the relationship between expectancies and substance use is based in the alcohol literature. Nonetheless, existing studies do provide preliminary evidence that marijuana and other drug outcome expectancies are predictive of drug use intentions and behavior, consistent with expectancy theory.

As has been reliably found in the alcohol expectancy literature (see Jones, Corbin, & Fromme, 2001 for a review), those who have never used marijuana generally hold greater negative expectancies for marijuana use, whereas more frequent marijuana use is associated with greater positive expectancies and lower negative expectancies (Aarons, Brown, Stice, & Coe, 2001; Boys et al., 1999; Schafer & Brown, 1991; Willner, 2001). Those who used marijuana occasionally showed positive and negative expectancy levels in between those of the non-users and most frequent users (Willner, 2001). These results suggest that negative expectancies may forestall initiation of use, whereas once use has begun, positive expectancies may influence the maintenance and escalation of use. However, the cross-sectional nature of these studies limits the conclusions that can be drawn from these findings.

Few prospective longitudinal studies of marijuana expectancies are found in the literature. In one prospective study of high-risk adolescents aged 12-18, adolescents with higher negative expectancies for marijuana were less likely to use marijuana over the course of two years and were more likely to cease marijuana use. Adolescents with lower negative expectancies for use were more likely to continue use. Positive expectancies were not a

7

significant predictor of use patterns. Higher negative expectancies are therefore a potential protective factor against marijuana use (Aarons et al., 2001). Another prospective longitudinal study assessed expectancies among 6th-8th grade youth using a multidimensional SEU conceptualization that assessed subjective costs and benefits of marijuana use on separate scales. Expectations about the undesirable effects of marijuana use were found to be a significant predictor of future use, such that those with higher expectations about the costs of marijuana use were less likely to initiate use after one year. However, this was only predictive for older students in the sample (8th graders and not 6th and 7th graders). The perceived benefits (or desirable effects) of marijuana were not predictive of future use at any grade level (Bailey & Hubbard, 1990).

Though negative and positive expectancies and perceived costs and benefits of marijuana use may not exactly align with one another, the results of the study by Aarons and colleagues (2001) and Bailey and Hubbard (1990) are consistent in that the negative or undesirable expectancies were found to have more utility than positive or desirable expectancies in predicting marijuana use behaviors. However, to my knowledge, no prospective longitudinal studies using a unidimensional SEU conceptualization of marijuana outcome expectancies have been conducted. Thus, the relative weighing of desirable vs. undesirable consequences as a prospective predictor of marijuana use has yet to be assessed. It is possible that assessing overall desirability or undesirability of use (e.g. a unidimensional SEU construct) may give a more integrative view of the process by which adolescents decide to use. For example, an adolescent who holds that there are both desirable and undesirable consequences of marijuana use may be at greater risk for future drug use than an adolescent who holds only undesirable expectations for

marijuana use. In this case, positive or desirable expectations for use may still play a significant predictive role.

Further, whereas current studies provide evidence that expectancies are predictive of initiation and continued use of marijuana, none have examined the potential change in expectancies across the use-initiation period, when theory predicts that expectancies may be in flux. Understanding whether marijuana expectancies change before and after initiation of marijuana use is key to determining whether expectancies can serve as a mechanism by which initial marijuana use changes future drug use trajectories. To assess the posited transactional influences of expectancies and marijuana use on one another across the initiation period, a longitudinal examination focused on the period of marijuana use initiation is needed. Moreover, the transactions between expectancies and marijuana use remain unstudied because previous studies assessed expectancies as predictors of marijuana use, but marijuana use was not examined as a predictor of later expectancies.

Though longitudinal studies of expectancies around the period of use initiation are lacking in the marijuana literature, many studies in the alcohol literature have focused on the change in expectancies during the early use period (ex. Aas, Leigh, Anderssen, & Jakobsen, 1998; Bauman, Fisher, Bryan, & Chenowith, 1983; Smith, Goldman, Greenbaum, & Christansen, 1995). Smith and colleagues (1995) and Aas and colleagues (1998) examined the reciprocal relationships between alcohol expectancies and alcohol use across adolescence. Both studies found reciprocal relationships between expectancies and alcohol use at earlier timepoints in their studies, when many adolescents were making the transition into drinking. Specifically, initial positive expectancies increased the probability of initiating alcohol use, and initial experiences with alcohol reinforced and heightened these positive expectancies for use.

Smith and colleagues (1995) found that the heightened positive expectancies following initiation of alcohol use continued to predict future use, leading to overall increased frequency of alcohol use. Consequently, individuals who began with more positive expectancies for alcohol showed rapid escalation of alcohol use, and their use patterns diverged quickly from their peers with lower positive expectancies. Smith and colleagues also found that at later timepoints, expectancies continued to predict drinking behaviors, but drinking behavior no longer predicted changes in expectancies. This suggests that expectancies may be more labile in the early stages of alcohol use, with drinking experiences becoming less influential in expectancy development as drinking behavior is continued and maintained. Changes in expectancies around the period of initial use onset may therefore be most useful in understanding subsequent escalation of use. After this period, expectancies for use may stabilize (Stacey, Newcomb, & Bentler, 1991; Sher, Wood, Wood, & Raskin, 1996).

If the development of marijuana expectancies parallels that of alcohol expectancies, initial marijuana use experience may lead to increased positive expectancies for marijuana. This, in turn, could lead to a subsequent escalation of marijuana use. A recent study by Skenderian and colleagues (Skenderian, Siegel, Crano, Alvaro, & Lac, 2008) would appear to offer preliminary support for this prediction. In this study, adolescents who had not initiated marijuana use were assessed on their marijuana expectancies and intentions to use marijuana at baseline and one year later. Changes in expectancies were significantly associated with changes in intentions to use, such that an overall increase in positive expectancies for marijuana was associated with positive changes in intentions to use. This association was strongest amongst adolescents who became users over the course of this one year interval, suggesting that expectancy changes that result from use experience may play a stronger role in determining future behavior than expectancy

10

changes that come from less direct sources. However, this study did not specifically seek to examine the effect of marijuana use initiation on marijuana expectancies, and the researchers only examined behavioral intentions to use, rather than including a measure of use itself as an outcome. Therefore, though the study is a step towards understanding how marijuana expectancies may change around the period of initial use experience, further studies specifically examining the reciprocal relationship between expectancies and use are needed.

The present investigation will expand on these findings by examining whether changing marijuana expectancies around the period of initial use serve as a mediator of the relationship between the initial marijuana use and future drug use intentions as well as behaviors. Whereas this hypothesized mediational pathway is consistent with expectancy theory, it has not been empirically tested in the literature. In the alcohol literature, a number of studies provide evidence for expectancies to partially mediate various risk factors (see Leventhal & Schmitz, 2006 for a review). Stacey, Newcomb, and Belter (1995) found that polydrug use predicted later cocaine use, and that this was partially mediated through expectancies (specifically, expected positive consequences for cocaine use). Hine and colleagues (2002) found that current tobacco use predicted future use, and that this was partially mediated through negative affect control and weight control expectancies (though not general expectancies). Such studies provide evidence for expectancy mediation of such use pathways. Accordingly, *the first objective of the current study is to assess whether a change in marijuana expectancies functions as a partial mediator of the relationship between marijuana use initiation and future marijuana use.*

Expectancies as a Mechanism for Progression to Other Drug Use

Changes in marijuana outcome expectancies around the period of initial use experience may help to explain trajectories of future marijuana use. However, it is possible that changes in

expectancies could also explain how marijuana might confer risk for future use of other illicit substances. Studies suggest that initial marijuana use experiences can lead to greater positive expectancies for future marijuana use. This change in thinking about marijuana might also change thoughts about—and expectancies for—other drugs. It is possible that use of any type of substance may influence expectancies for other types of substances down the temporal change of use (i.e., use of alcohol and tobacco might influence expectations for marijuana use, and marijuana use may influence expectations for other drugs downstream in the temporal chain). However, marijuana may be particularly important in changing the cognitions about other types of drugs due to the perception of the substance within larger society. In most areas, marijuana is classified as an illicit substance (as compared to alcohol, which is age-regulated, but licit). Given this grouping of drugs, perhaps positive experiences with marijuana in particular might change expectancies for harder drugs. Adolescents may expect more desirable and/or less undesirable effects of marijuana as well as other drugs after experience with marijuana use. These changed expectations for harder drug use might then lead to increased intentions to use harder drugs as well as use of harder drugs if the opportunity arises. In this way, marijuana use may increase the likelihood that an adolescent will progress to other drug use.

Willner (2001) provided preliminary evidence for such a cross-drug expectancy mechanism in a cross-sectional study of adolescents. Adolescents who used alcohol more frequently had significantly greater positive expectancies for cannabis use, even if they had never used cannabis before. The cross-sectional nature of this study precludes conclusions about the causal relationship between alcohol use and cannabis expectancies. However, the findings provide some foundation for the hypothesis that experience with drugs at an earlier stage of use can influence expectancies for other, harder drugs, which may eventually lead to using harder

drugs in the future. To my knowledge, no other studies have examined whether use of one type of drug can change expectations for another type of drug, either cross-sectionally or longitudinally.

In the current investigation, I will prospectively examine whether change in marijuana expectancies after initial marijuana use will predict an increase in intentions to use harder drugs and/or an increase in the actual use of drugs. This will give preliminary insight into the hypothesis that changes in expectancies may mediate the progression to the use of other drugs. *Therefore, a second objective of the present investigation is to examine whether positive changes in marijuana use expectancies will lead to increased intentions to use harder drugs and increased frequency of harder drug use.* However, because marijuana expectancies are more specific to use of marijuana, and because the base rates of illicit drug use amongst adolescents is low (see Johnston, O'Malley, Bachman, & Schulenberg, 2014), *I expect that the change in marijuana expectancies following initial marijuana use will be more strongly predictive of increased future marijuana use than increased use or intentions to use other illicit drugs.*

Peer Attitudes as a Moderator of Marijuana Outcome Expectancies

Expectancy theorists posit that direct experience plays a more significant role in expectancy formation once drug use has begun. However, indirect factors may continue to play a role in expectancy formation through their interaction with direct experience with drug use. Of the indirect environmental factors that may contribute to an adolescent's drug use experience, the peer context may be most salient; studies on adolescent drug use have found that peer modeling and peer attitudes towards use are especially predictive of drug use behaviors during adolescence (Aseltine Jr, 1995; Huba & Bentler, 1980; Johnson, Marcos, & Bahr, 1987; Newcomb & Bentler,

13

1986). The peer context may thus play a moderating role in expectancy development across the period of drug use initation.

The peer context is often conceptualized as an entryway into adolescent substance use through peer influence mechanisms, as supported by data showing strong associations between the substance use behaviors of adolescents and their peers; however, peer selection processes may also explain a large portion of the correlation between adolescent and peer substance use measures (see Bauman & Ennett, 1996, for a review). Though the relative contributions of each of these processes to initiation and continuation of substance use is a subject of ongoing research, it is nonetheless evident that peers may exert influence on one another once friendships have been formed (e.g., Osgood et al., 2013). Within friendship groups, adolescents may be susceptible to peer influence through many mechanisms that reinforce or reward the adolescent for adherence to peer norms and attitudes (see Brechwald & Prinstein, 2011, for a review).

Peer drug use attitudes and behaviors may play a clear role in expectancy formation, as peers' indirect experiences with use may influence an adolescent's own expectations of what outcomes of use will be like (e.g., Wood et al., 2001). However, the rewarding or reinforcing effects of conformity to the peer group may also play a role in moderating changes in drug use expectancies as an adolescent gains experience with drug use. If an adolescent's drug expectancies are shaped by his or her own subjective experience with a drug, it may be important to consider how his or her peer context shapes the subjective experience of drug use. Specifically, adolescents within a peer group that is highly approving of marijuana and drug use may have a much more positive subjective experience when initiating use. Initiation of use may occur within a positive context (i.e. among a group of close peers), which may increase the rewarding nature of drug use. Further, the adolescent may feel rewarded for having initiated use

by achievement of a higher social status within his or her friend group, or feel more aligned with the identity of his or her friend group. These positive effects related to the peer context may lead to more positive and desirable expectations for use. In contrast, if an adolescent initiates when his or her close peers are not approving of use, he or she may not experience these additional positive outcomes of use. In this way, the peer context may play a role in the way drug outcome expectancies change around the period of initial use experience.

In the current study, I propose to examine whether peer attitudes towards marijuana use play a moderating role in expectancy formation after marijuana use initiation. Therefore, *a third objective of the present investigation is to prospectively test whether close peer approval of marijuana use strengthens the relationship between initial marijuana use and the change in marijuana outcome expectancies.* I expect that when adolescents perceive their close peers as relatively more approving of marijuana use, there will be a greater increase in desirable marijuana expectancies.

The Current Study

The current study builds on existing literature on the risks of early marijuana use initiation in a number of ways. It is the first prospective longitudinal study to examine marijuana outcome expectancies as a mediator of the relationship between initial marijuana use experience and later drug use patterns. The study will also assess adolescents' perception of the overall desirability/undesirability of marijuana use by using a unidimensional SEU construct. This method of conceptualizing marijuana expectancies has not yet been used in prospective studies. The use of this SEU construct may shed light on the process by which adolescents decide to escalate drug use, as it captures how adolescents might weigh the subjective costs and benefits of use. Additionally, whereas marijuana use expectancies have been shown to be predictive of

marijuana use in adolescent samples, the present study is novel in its prospective examination of the reciprocal relationship between marijuana use experience and marijuana expectancies across the period of initial use onset. The study will also examine the role of close peers' attitudes towards marijuana use in moderating the relationship between marijuana use experience and marijuana outcome expectancies. The present study will test three hypotheses, which are depicted in a conceptual model in Figure 1.

Hypothesis 1: The change in marijuana outcome expectancies following initial marijuana use will partially mediate the relationship between marijuana use initiation and future marijuana use.

Hypothesis 2: The level of close peers' approval of marijuana use will moderate an individual's change in expectancies following initiation of use. When close peers disapprove of marijuana use, there will be a smaller increase in marijuana expectancies. When close peers approve of marijuana use, there will be a greater increase in marijuana expectancies following initiation of use.

Hypothesis 3: The change in marijuana expectancies following use onset will predict increased frequency of marijuana use as well as increased expectation of future use of other illicit drugs and increased frequency of actual use of other illicit drugs. However, the expectancy change will predict increased frequency of marijuana use more strongly than it will predict increase in expectation for use of other illicit drugs or increased frequency of use of other illicit drugs.

METHODS

Data from two linked studies of the same sample—*The Context of Adolescent Substance Use* and *Violence Against Peers, Dates, and Self*—were used to test these hypotheses. The studies were funded by the National Institute on Drug Abuse (R01 DA13459, granted to Dr. Susan Ennett) and the Centers for Disease Control and Prevention (R49 CCV423114, granted to Dr. Vangie Foshee) and were designed to prospectively examine the development of and relationships between adolescent risk behaviors, as well as the contribution of individual and contextual attributes (such as an adolescent's social network) to the development of those behaviors. Collectively, the study is referred to as the Context/Linkages study.

Participants

The Context/Linkages study consists of data from adolescents in three North Carolina Counties (Counties 1, 2, and 3). All schools in these counties with grades 6-12 were included in the study (i.e., middle schools, high schools, K-8, and alternative schools). The school systems were in primarily rural counties with higher proportions of African Americans than the United States (Ennett et al., 2006). Seven waves of data collection were conducted in two of the three counties surveyed (with the third completing five waves of data collection). At Wave 1, adolescents were in grades 6, 7, and 8; at Wave 7, they were in grades 10, 11, and 12. For the first six waves, data collection occurred every six months (Spring 2002-Fall 2004). The seventh wave was collected one year after wave six (Fall 2005). At each wave, all adolescents in the targeted grade levels were eligible for the study, excepting those in self-contained classrooms for

Exceptional Children (EC) and those with insufficient English language reading skills to complete the questionnaire in English.

At the outset of data collection, 5,220 6th, 7th, and 8th adolescents from 13 schools participated. This comprised 88.4% of eligible adolescents within participating schools. Eligible adolescents did not participate due to parental refusal of adolescent participation (9.5%), adolescent refusal to provide written assent (1.1%), and absence from school on data collection day (.9%). Four adolescent questionnaires were also lost due to administrative error (.1%) (Ennett et al., 2006). Students in each grade who were not initially part of the study were also recruited to participate in each subsequent wave; thus, adolescents were continually added to the study as it progressed. There were N=5060 adolescents who completed the study at Wave 2, N=5059 at Wave 3, N=5017 at Wave 4, N=4676 at Wave 5, N=2775 at Wave 6, and N=2406 at Wave 7. The relatively steeper attrition rate at Waves 6 and 7 was due to the fact that County 1 Schools did not participate in school-based data collection at these two timepoints.

Analysis Sample

To address study hypotheses, I restructured the seven-wave data set that is organized around assessment interval to a three-timepoint data set organized around the timing of marijuana use initiation (for those who do so and matched controls for those who do not). To construct this data set, I first created a dataset that contained all adolescents who initiated marijuana use during the study. Initiators were identified by an answer of 'yes' to the question 'Have you <u>ever</u> used marijuana (also called weed, reefer, pot, grass, herb, sinsernilla, smoke, hash, Thai stick, or blunts) in your life?' at any wave. To capture changes in marijuana use expectancies, only initiators who had a prior time point where they did not endorse lifetime marijuana use were included in the "initiators" group for this study. To redefine the longitudinal

structure of the data, I defined the first timepoint (Time 1) in the analysis sample as the timepoint directly preceding the wave at which the adolescent first reported lifetime marijuana use (subsequently labeled as Time 2). The third timepoint (Time 3) for the analysis sample was the wave following the adolescent's first 'yes' response to the lifetime marijuana use item.

Note that adolescents who reported initiating use prior to inclusion in the study were excluded from the analysis sample. Moreover, to be included in the initiators group for the analysis sample, adolescents must have completed questionnaires for a timepoint before and after marijuana use initiation (i.e. must have had non-missing data for the lifetime marijuana use item at Time 1 or Time 3). Adolescents who recanted and answered 'no' to the lifetime marijuana use item at Time 3 after responding 'yes' at Time 2 were still considered to have initiated and were included in the sample. This decision was made based on the literature on the recanting of earlier reported drug use by young adults that suggests that recanting may be related to the desire to edit or underreport socially undesirable behavior as opposed to simply being an indicator of a false or inaccurate report at the earlier time point (Fendrich & Rosenbaum, 2003; Percy, McAlister, Higgins, McCrystal, & Thornton, 2005).

A control sample of adolescents who had not initiated marijuana use was also selected from the full sample and matched to the initiator group based on cohort (grade level during which they began the study), gender (male/female), race/ethnicity (Caucasian, African American, and Hispanic/Latino groups), and highest parent level of education (less than college vs. some college and above). Demographic characteristics chosen for matching were based on information regarding substance use trends gathered from the most recent Monitoring the Future (MTF) survey results (Johnston et al., 2014). As rates of substance use initiation (including marijuana use) increase with age and grade level, initiators and non-initiators were matched on cohort to

19

control for these effects. Race and ethnicity differences have also been noted in marijuana and drug use (though differences vary by grade level; Johnston et al., 2014). Lastly, parental education was included as a control variable because students with the lowest levels of parental education report higher rates of marijuana use than those at the highest levels (though this effect does decline with increasing grade level; see Johnston et al., 2014). Participants who had missing data for any of these demographic variables were dropped from the sample (n=3).

In order to be eligible for selection as a matched control participant, certain inclusion criteria were necessary. Inclusion criteria for controls were that they (1) had no missing data on demographic variables used to create groups and (2) had at least three consecutive waves of data with no missing data on lifetime marijuana use. For initiators, onset groups were defined by which three consecutive waves contributed to the analysis (i.e., defined as Time 1 to Time 3 beginning with wave 1 for group 1, wave 2 for group 2, wave 3 for group 3, or wave 4 for group 4). Similarly, controls could potentially belong to more than one onset group (e.g., if they had non-missing data for waves 1-5, they could belong to onset group 1, 2 or 3). To facilitate matching, controls were assigned to one of four "onset" groups. Controls who were only eligible for one onset group (e.g., only had three non-missing waves of data for the lifetime marijuana use variable) were automatically assigned to their corresponding onset group. After accounting for these controls, controls that were eligible for multiple onset waves were randomly selected into an onset group using the SURVEYSELECT procedure in SAS 9.3. The number of controls selected for each of these onset groups was determined by the number of initiators in each onset group (i.e. the number of controls was selected to match the number of initiators in each onset group).

Finally, I created an overall grouping variable for each participant based on cohort membership (3 levels), gender (2 levels), race (3 levels), parent education (2 levels), and onset timepoint (4 levels), yielding a total of 144 groups. Selection of controls for the analysis sample occurred within each of these groups according to a set of rules. First, if more controls than initiators were in a group, then controls were randomly selected into the group to match the number of initiators in the group using the SURVEYSELECT procedure in SAS 9.3. This comprised the majority of cases. Second, when the number of controls was less than or equal to the number of initiators in a given group, all controls were included in the analysis sample. If there were no controls to match an initiator group, none were able to be included in the final sample.

The final sample included 874 initiator adolescents and 843 control adolescents, making a full sample of N=1,717 adolescents. Chi-square analyses showed that the initiator and control samples did not significantly differ on matched demographic characteristics of cohort, race, gender, and parental education level (all $ps > .05$). In the final sample, 53% of participants were male; 31% were from the youngest study cohort (began study in 6th grade), 37% from the middle cohort (began study in 7th grade), and 32% from the oldest cohort (began study in 8th grade); 56% were Caucasian, 41% were African American, and 3% were Hispanic/Latino; and 58% reported that the highest level of education a parent had obtained was at least some college. The mean age of the sample at Time 1 was 13.28 (SD=1.18) and the mean age at Time 3 was 14.49 (SD=1.35).

Procedure

Parents were notified about the study by a letter mailed or sent home with students each fall. Parents could refuse their child's participation by returning a signed form or by calling in to

a toll-free study number. Contact information for parents was obtained each academic year from the participating school systems. Students enrolling mid-year were consented for the spring data collection. Adolescents provided written assent for participation at each wave of data collection.

Data collection days were scheduled for each school in advance. At least one make up day for absentee students was scheduled for each wave at each school. Trained data collectors followed a written protocol for describing the study, obtaining assent, and giving instructions for completing the questionnaires. Adolescents completed the self-administered questionnaire in classrooms or larger group settings (e.g., cafeteria) in approximately one hour. Teachers stayed in classrooms to help maintain order, but did not answer questions about the study or walk around the classroom. To ensure privacy, data collectors spread the students around the classroom and instructed students not to talk with each other. Students put their questionnaires in envelopes before returning them to the data collectors.

Measures

Demographic variables. Adolescents reported on sex, age, race/ethnicity, family structure, and parent education. Sex was coded such that the reference group was female (i.e., 0=female; 1=male). In order to assess ethnicity, adolescents were asked if they were of Hispanic or Latino origin ('yes,' 'no,' or 'I don't know'). They were then also asked to report their race as 'White,' 'Black or African-American,' 'American Indian or Native American,' 'Asian or Pacific Islander,' 'Multiracial (mixed race),' 'Other,' or 'Don't know.' Race/ethnicity was then collapsed into four categories (White, Black, Latino, or Other) and dummy coded for each category with White as the reference group. Those in the 'other' category were dropped from the analysis, as this group was relatively small. As such, only three of the four race/ethnicity categories were used for the matching procedure (White, Black/African-American, and Latino).

To determine parent education, adolescents were asked about the highest level of education of their mother and father. The highest level of education among either parent was then used. For the purposes of the matching procedure, two levels of the education demographic variable were used: less than college (1) and some college and above (2).

Lifetime Marijuana Use. Adolescents were asked to respond to the question 'Have you <u>ever</u> used any of the following in your life?' with respect to various categories of drugs. Responses to these questions were dichotomous (0=No; 1=Yes). Marijuana use initiation was determined by a response of 'Yes' to the subcategory 'Marijuana (also called weed, reefer, pot, grass, herb, sinsernilla, smoke, hash, Thai stick, or blunts)' under this question.

Marijuana Expectancies. Adolescents were asked to respond to the prompt 'Do you believe that smoking marijuana one or more times a week would bring you:'. Seven response options were given, including 'Only good things' (coded as 6), 'Much more good than bad', 'A little more good than bad', 'About equal good and bad', 'A little more bad than good', 'Much more bad than good' and 'Only bad things' (coded as 0). For adolescents who initiated marijuana use over the course of the study, a change score for this item was computed by subtracting the response at the assessment prior to marijuana use initiation (Time 1) from the response to the item at the assessment when adolescents first self-reported marijuana use initiation had occurred (Time 2). This served as a measure of expectancy change, with positive change scores indicating positive expectancy changes and negative change scores indicating negative expectancy changes (and a change score of 0 indicating no change across time).

Peer Attitudes Towards Marijuana Use. Adolescents were asked to report on the attitudes of their close peers towards alcohol, marijuana, and drugs. Peer tolerance of marijuana use was assessed by adolescent response to the item, 'In general, how do you think [your five closest

friends] would feel if you smoked marijuana?' Four response categories could be endorsed for this item: 'Like it a lot' (coded as 0), 'Like it some,' 'Dislike it some,' and 'Dislike it a lot' (coded as 3). Peer attitudes towards marijuana use at Time 1 (prior to marijuana use initiation) were examined as a moderator of the relationship between marijuana use initiation and change in marijuana expectancies.

Adolescent's Level of Marijuana Use. In order to assess whether adolescents showed an escalation of marijuana use following marijuana use initiation, the frequency of marijuana use in the past 3 months was examined. Adolescents responded to the following prompt: 'During the past 3 months, about how many times have you used marijuana?' Five response categories were coded from 0-4: 'none,' '1-2 times,' '3-5 times,' '6-9 times,' and '10 times or more.' A maximum reported frequency of use score between Time 2 and Time 3 was used as an outcome variable. These variables were combined to take into account that the Time 2 measurement may have occurred relatively close to the time of marijuana use initiation or some months after marijuana use was actually initiated (as each wave of data collection was six months apart). Thus, Time 2 and Time 3 measurements of marijuana use frequency could represent "future marijuana use" for marijuana use initiators.

Expectations for Use of Other Drugs. Expectations for use of other drugs were assessed by the prompt 'Three months from now, do you think you will be using … other hard drugs' (i.e., meaning other than marijuana). Four response categories to this item could be endorsed: 'Definitely not' (coded as 0), 'Probably not,' 'Probably will,' and 'Definitely will' (coded as 3). As with 3-month frequency of marijuana use, a maximum of this variable between Time 2 and Time 3 was used as the outcome variable.

Lifetime Other Drug Use. In order to assess whether adolescents show a progression to use of other illicit drug use following marijuana use initiation, lifetime use of other hard drugs was examined. Adolescents were asked to respond to the question 'Have you <u>ever</u> used any of the following in your life?' with respect to various categories of drugs. Responses to these questions were dichotomous (0=No; 1=Yes). Hard drug use initiation was determined by a response of 'Yes' to the subcategory: 'other hard drugs (cocaine, LSD, Ectasy, heroin, or other).' Because the base rate of other drug use in the sample was so low, there was not enough power to compare control and marijuana initiator groups on this variable in a full path analysis. Instead, expectation to use other hard drugs in the future was used as the sole outcome variable for Hypothesis 3, and a follow-up sensitivity analysis was performed among the marijuana use initiator group.

RESULTS

Bivariate correlations between variables included in the study model are presented in Table 1. Though the final analysis sample consisted of 1,717 adolescents, there was modest to moderate missingness on planned analysis variables. In total, 136 adolescents had missing data on the expectancy difference variable, the peer attitudes variable, the 3-month marijuana use frequency variable, or the expectation of future drug use variable. In order to assess whether this missing data would have a significant impact on planned analyses, t-tests were performed to compare participants with one or more missing variables to the rest of the sample on outcome variables. Participants who were missing on one or more study variables did not differ significantly from those who had no missing data on the outcomes of peer approval of marijuana use ($t(100.73) = -1.04$, $p = 0.30$), 3-month marijuana use ($t(132.17) = -1.82$, $p = .07$), or expectation of future use of other illicit drugs ($t(144.86) = -1.15$, $p = 0.25$). However, participants who were missing on study variables did appear to differ significantly from those who had no missing data on the outcome of marijuana expectancy change, such that the mean of the expectancy difference variable was significantly larger among the participants with missing data than participants with non-missing data ($t(1628) = -1.93$), $p = 0.05$). Because of this significant finding, two types of analyses were run for all hypotheses. In the first analysis, data among the final sample was assumed to be missing at random and addressed using full information-maximum likelihood (FIML) procedures using Mplus Version 6.1 (Muthén & Muthén, 2010). In the second, a sensitivity analysis was conducted in which all models were re-

estimated with listwise deletion. Results of this sensitivity analysis showed no differences in significance of all findings; thus, results using the full sample are discussed below.

Hypothesis 1: A path analysis estimated in Mplus Version 6.1 was used to test the hypothesis that the change in marijuana expectancies following initial marijuana use would mediate the relationship between marijuana use initiation and future marijuana use. The marijuana use frequency variable was regressed on the expectancy change variable as well as the initiator status variable and expectancy change was regressed on initiator status. Prior to conducting this analysis, the outcome variables of change in marijuana expectancies, three month frequency of marijuana use, and future intentions to use other drugs were examined for violations of distributional assumptions of normality. Expectancy change and frequency of marijuana use appeared to be slightly skewed (skew > 1.0), though kurtosis was within adequate ranges (< 2.0). In order to account for possible non-normality among variables, robust maximum likelihood estimation was used in Mplus. Robust standard errors and Satorra-Bentler chi-squares (when appropriate) are given for all outcomes.

The model explained a significant amount of variance in future frequency of marijuana use ($R^2 = 0.40, p < .001$). Marijuana use initiation status was a significant predictor of expectancy change ($b* = 0.42, p < .001$), such that initiators showed a greater amount of expectancy change in the 'desirable' direction as compared to controls. Marijuana use initiation status was also predictive of future marijuana use ($b* = 0.43, p < .001$), such that those who initiated use at Time 1 were more likely to report a higher frequency of marijuana use in the future. Expectancy change also significantly predicted future marijuana use ($b* = 0.32, p < .001$), such that a positive change in marijuana expectancies predicted an increase in future marijuana use. In line with Hypothesis 1, the indirect path from marijuana use initiation to future marijuana

use through expectancy change was significant ($b^* = 0.13$, $p < .001$). The direct effect of marijuana use initiation remained significant after accounting for the indirect effect of marijuana expectancy change ($b^* = 0.43$, $p < .001$), indicating that the effect of marijuana use initiation on future marijuana use was only partially mediated through expectancy change.

Hypothesis 2: Multiple linear regression was used to explore the moderating effects of peer approval of marijuana use on expectancy change following marijuana use onset. Again, prior to performing the analysis, assumptions of multivariate normality and linearity as well as homoscedasticity and normality of residuals were checked. No violations of assumptions of homoscedasticity, or linearity were observed. However, histograms and Q-Q plots revealed some evidence of non-normality of residuals, particularly towards the tail ends of the distribution. Therefore, robust maximum likelihood estimation was used in Mplus for the purposes of this analysis.

Regression analysis indicated that peer approval did not significantly predict marijuana expectancy change above and beyond the effect of marijuana use initiation ($b^* = -0.002$, $p > .05$). However, the interaction between peer approval and marijuana use initiation status was significant ($b^* = -0.08$, $p = 0.04$; see Table 2). Additionally, the Preacher online interaction tool was used to further probe this interaction. Probing of the simple slopes for this interaction followed procedures outlined by Aiken and West (1991). Findings indicated that those who initiated use and had less approving peers showed a greater positive expectancy change than those who initiated use and had highly approving peers. For the control group, expectancy change did not differ across levels of peer approval (see Figure 4).

To better understand how the interaction predicts the change in expectancies variable, I also probed the effects by comparing marijuana expectancies at Time 1 (the wave before

initiation) and Time 2 (the wave of initiation) across four groups of adolescents that included initiator adolescents with high peer approval, initiator adolescents with low peer approval, control adolescents with low peer approval, and initiator adolescents with high peer approval. A factorial ANOVA was run using SAS 9.3. Post-hoc Tukey was used to probe the differences between the four adolescent groups. Results indicated that at Time 1, initiator adolescents with high peer approval had significantly higher marijuana expectancies than all other adolescent groups. The control adolescents with low peer approval had significantly lower marijuana expectancies than all other groups. The two remaining groups (initiators with low peer approval and controls with high peer approval) did not differ from one another. At Time 2, both initiator groups (high and low peer approval initiators) differed from both of the control groups (both high and low peer approval non-initiators). The control groups did not differ from one another (see Figure 3). This pattern suggests that peer approval may play a role in determining expectancies prior to use initiation (as evidenced by the low Time 1 expectancies among both initiator and control low peer approval groups), but that peer approval may not be a factor once marijuana use has been initiated (hence the difference between the low peer approval initiators vs. low peer approval controls at Time 2).

Hypothesis 3: A path analysis estimated in MPlus 6.1 was used to test the hypothesis that the change in marijuana expectancies following use onset would predict increased frequency of marijuana use as well as increased expectation of future use of other illicit drugs. Again, to account for possible non-normality among outcome variables, robust maximum likelihood estimation was used. To determine whether change in expectancies was a stronger predictor of subsequent marijuana use versus expectation of other hard drug use, pathways from expectancies to each of the two outcomes were constrained to be equal and a nested chi-square test was

performed to compare the fit indices for this constrained model versus a model in which these pathways were allowed to be free.

Contrary to expectations, the Wald Test of Parameter Constraints revealed that change in marijuana expectancies did not predict future marijuana use more strongly than future expectations of using other drugs (($\chi^2(1, N = 1717) = 1.190, p > .05$). This suggests that change in marijuana expectancies was not differentially predictive of these two outcomes; rather, it was a significant predictor of both. Interestingly, however, marijuana use initiation status was significantly more predictive of future marijuana use than future expectations of using other drugs (($\chi^2(1, N = 1717) = 235.78, p < .001$).

The path model predicting future expectation of using other illicit drugs explained a significant amount of variance in expectations to use other illicit drugs in the future ($R^2 = 0.26, p < .001$). Marijuana use initiation status was a significant predictor of future expectations to use other illicit drugs ($b* = 0.14, p < .001$), such that those who initiated use at Time 1 were more likely to report higher expectations of using other drugs in the future. Marijuana expectancy change also significantly predicted future expectations to use other drugs ($b* = 0.44, p < .001$), such that a positive change in marijuana expectancies predicted heightened expectations to use other illicit substances in the future. In line with Hypothesis 3, the indirect path from marijuana use initiation to future expectations to use other illicit drugs through expectancy change was significant ($b* = 0.18, p < .001$). The direct effect of marijuana use initiation remained significant after accounting for the indirect effect of marijuana expectancy change ($b* = 0.14, p < .001$), suggesting that the effect of initiation of marijuana use on future expectations to use other drugs was only partially mediated by change in marijuana use expectancies.

A follow-up regression analysis was conducted among only the initiator sample (N=874) in order to determine whether marijuana expectancy change would predict lifetime hard drug use, rather than intentions to use, at timepoints 2 and 3. Because the base rate of hard drug use was low in the overall sample, only the marijuana initiator group was used for the purposes of this analysis. The lifetime hard drug use item was regressed on the expectancy difference variable in order to determine if expectancy change from Time 1 to Time 2 significantly predicted progression to hard drug use. Cross tabulations were run on the initiator group to ensure that adolescents had not already initiated hard drug use at Time 1; i.e. that the analysis was predicting initiation of drug use. Only seven adolescents had a response of 1 ('yes') to the lifetime hard drug use item at Time 1; these adolescents were dropped from the analysis (for a total N=867). The overall regression was significant ($R^2 = 0.11$, $p < .001$) and marijuana expectancy change emerged as a significant predictor of lifetime hard drug use ($b* = .33$, $p < .001$).

DISCUSSION

The current study examined whether changes in marijuana outcome expectancies mediated the relationship between marijuana use initiation and future illicit drug use and whether the peer context moderated this pathway. Results of the study indicated that, as expected, marijuana use initiation was significantly related to both future use of marijuana and future intentions to use other illicit drugs. Further, change in marijuana outcome expectancies was a significant mediator of these relationships. Peer approval also moderated the relation between initiation of marijuana use and change in marijuana outcome expectancies such that higher versus lower peer approval of marijuana use prior to use initiation was associated with a lower magnitude of expectancy change after use initiation among the group of adolescent initiators; expectancy change did not differ across levels of peer approval among non-initiators.

The finding that marijuana expectancy change is a significant predictor of future marijuana use corroborates findings from earlier work by Skendarian and colleagues (2008), who found that positive changes in marijuana expectancies prospectively predicted positive changes in intentions to use marijuana. Skendarian et al. also found that the positive relationship between expectancy change and intentions to use was stronger among those who had initiated marijuana use over the course of the study period. However, the study did not hypothesize or test a possible meditational role of outcome expectancies in the relationship between initiation of use and future use. The current study is the first to prospectively examine how marijuana expectancies may specifically change around the period of use initiation and to empirically test if these changes mediate the link between initial and future use. As such, the findings of the present study

constitute a novel contribution to the literature. The current study also offered an extension of the current literature in that it assessed whether changes in marijuana expectancies could also mediate the relationship between marijuana use initiation and other illicit drug use. Previous cross-sectional research has found that alcohol use is related to marijuana expectancies in adolescence, such that adolescents who had never used marijuana held more positive and less negative marijuana expectancies with increasing levels of self-reported alcohol use (Willner, 2001). However, to my knowledge, no studies have assessed how marijuana use may be related to other illicit drug expectancies, or if changes in one type of drug use or drug expectancy may be related to changes in other drug expectancies longitudinally. Though the current study did not directly assess whether changes in marijuana expectancies predicted changes in other drug expectancies, the finding that changes in marijuana expectancies were a significant mediator of the relationship between marijuana use initiation and both intentions to use other illicit drugs as well as lifetime use of other illicit drugs suggests that changes in marijuana expectancies are predictive of more than just future marijuana use. A change in other drug expectancies (along with marijuana expectancies) following marijuana use initiation may underlie the finding that marijuana expectancy change was a significant mediator in the model. Thus, these results suggest that changes in marijuana expectancies may in fact influence expectancies for other drugs, such that expectancies for other drugs also become more positive or desirable following marijuana use. This in turn may have lead to increased intentions to use other illicit drugs and increased reported lifetime use of other drugs following marijuana use initiation.

Further, results indicated that changes in marijuana expectancies did not differentially predict future marijuana use versus future intentions of using other illicit drugs; that is, marijuana expectancies were equally predictive of future marijuana and future drug use outcomes. In

contrast, marijuana use initiation was a stronger predictor of future marijuana use as compared to future intentions to use other drugs. Not all adolescents who try marijuana will progress to future drug use; however, marijuana use initiation is a significant risk factor for progression to other drug use (as explicated by Kandel and colleagues' work regarding the Gateway Hypothesis; see Kandel, 2002). The factors that place certain adolescents at risk for further progression of drug use are a subject of interest for identification and risk prevention efforts. The results of the current study provide evidence that changing cognitions following marijuana use initiation may be a particularly salient factor in determining whether or not an adolescent will progress to other drug use. Specifically, adolescents whose perceptions of marijuana and other drug use become much more positive after drug experimentation may be those who are most at risk for further progression of drug use. Thus, it may not be marijuana use per se that leads to other drug use; rather, it is the changes in cognitions that accompany experimentation with marijuana that may be a stronger indicator of future risk. More studies are needed to explicitly determine whether marijuana use initiation might lead to positive changes in other illicit drug expectancies along with marijuana expectancies, and whether this cross-drug expectancy change might be useful in explaining the relationship between marijuana use and progression to other drug use.

In the current study, peer approval of marijuana use prior to marijuana use initiation was not found to be a significant predictor of marijuana expectancy change. However, the interaction between peer marijuana approval and marijuana use initiation was significant. Adolescents who had low peer approval of marijuana use and initiated use across the study period had a greater magnitude of positive marijuana expectancy change as compared to control adolescents as well as the initiator adolescents with high levels of peer approval. However, overall, the adolescents who initiated marijuana use and also had high levels of peer approval held the most desirable

34

expectancies for marijuana both before and after initiation of use; i.e. their expectations for the effects marijuana still became more positive after their direct experience of marijuana use initiation, though the magnitude of their expectancy change was not quite as great as those of the initiators whose peers were not approving of use.

One interpretation of this finding is that direct experience with marijuana is more powerful in shaping cognitions as compared to the effects of the peer context; in other words, the effect of peer disapproval may no longer be protective against use once use has been initiated. However, this interpretation is based on the assumption that the peer approval variable used was an accurate measurement of a peer influence process. In the current model, peer attitudes towards use were measured prior to marijuana use initiation as a way of assessing an adolescent's peer context before marijuana initiation had occurred. However, due to the timing of these measurements, it is possible that the peer context of these adolescents changed around the time of use initiation. As such, it may be important to consider whether adolescents changed peer groups between measurement waves—possibly moving to select other peers whose views and beliefs were more consistent with their own. If this is the case among the group of initiator adolescents with low levels of peer approval, the interpretation that peer influences are not important once marijuana use had been initiated may not be accurate.

Additionally, adolescent perceptions of peer attitudes towards substance use are often biased to reflect an adolescent's own attitudes of views (ex. Iannotti & Bush, 1992). Therefore, adolescent reports of their close peers' approval of marijuana use may have been a reflection of their own views about marijuana use, rather than a truly accurate account of their peers' views. In such a case, adolescents might report low levels of peer approval prior to initiation of use because they themselves are not interested in use. An examination of whether peer groups

changed around the time of use initiation and an examination of whether reported peer attitudes towards use changed along with an adolescent's own attitudes towards use would be warranted to make a more accurate interpretation of the role of the peer context in moderating expectancy change.

Though the current study offers initial evidence that marijuana expectancies act as a mechanism by which marijuana use initiation influences future trajectories of drug use, several limitations of the study should be noted. First, though future marijuana use was prospectively predicted in the model, only past-3 month marijuana use frequency at one future timepoint was assessed in the model. This may be indicative of future trajectories of marijuana use following initiation; however, the study did not directly test patterns of use across multiple future timepoints. Future studies that continue to measure use across time are needed to make definitive statements about future trajectories of such initiator adolescents, and to determine whether reciprocal use-expectancy change truly predicts long-term use trajectories. Such studies may also incorporate more fine-grained measurements of marijuana use that take into account measurements aside from raw frequency counts.

Second, because the base rate of hard drug use at this age range is quite low, the model was not able to compare the utility of marijuana expectancies in predicting use of other drugs for initiators vs. non-initiators. The path analysis assessing the meditational role of marijuana expectancies in predicting intentions to use other hard drugs provides preliminary evidence in support of this pathway; however, more research is needed to make a definitive statement. Studies among high-risk youth or studies that continue to assess drug use further into the future may be needed to make a definitive assessment in this regard.

Third, as previously discussed, the results of the study offer support for the hypothesis that initiation of marijuana use may lead to changes in expectancies for drugs other than just marijuana, which may underlie the finding that marijuana expectancy changes predict future intentions and behaviors for other illicit drugs. However, as there was no measure of other drug expectancies included in this study, this hypothesized mechanism has yet to be directly tested.

Finally, as previously noted, there are limitations to the interpretation of the role of the peer context in moderating the association between initial marijuana use and change in marijuana outcome expectancies. The timing of measurement of peer attitudes as well as the use of a self-report item of peer attitudes may have resulted in an inaccurate estimate of the role of peer influence in moderating changes in marijuana outcome expectancies across the use initiation period. Studies that are able to examine the peer context of adolescent drug initiators at the specific time of drug use onset would be ideal for an in-depth understanding of the role of the peer context during this period. Further, other assessments of peer attitudes and use, such as use of a peer's own report of attitudes, would allow for more accurate assessment of how peer attitudes influence an adolescent's behavior.

Future research may expand on the findings of the current study in a number of ways. First, continued examination of whether expectancies for one type of drug might lead to changes in expectancies for other types of drugs is warranted. As the progression of drug use in "stages" is a consistent finding within the substance use literature, it would be of interest to examine whether each stage of progression in drug use is associated with a positive change in expectancies for the next substance down the chain of progression. Such a longitudinal pattern would give evidence for the effect of drug use experience on cognitions regarding drug use, which may be a significant predictor of future drug use behaviors.

Second, given that drug expectancy change following initiation of drug use can predict continued future drug use, reducing the magnitude of these changes in expectancies that follow use initiation may be useful in preventing future drug use. Intervening on expectancies themselves may be beneficial; however, an understanding of other factors that may moderate expectancy changes following drug use initiation could also aid in developing better interventions. As not all adolescents who initiate use of a substance progress to the next stage of drug use (i.e. adolescents who initiate alcohol use will not necessarily progress to marijuana use; adolescents who initiate marijuana use may not progress to cocaine use), adolescents who exhibit greater amounts of positive expectancy change may be the most at risk for progression to future drug use. Understanding why some individuals may demonstrate large changes in drug expectancies following use initiation whereas others do not show such increases would help to both identify adolescents who are most at risk following initiation of use and allow for intervention on these moderating factors.

Potential factors that may be related to the magnitude of expectancy change include the subjective experience of using the drug (positive vs. negative vs. neutral experience) may play a role in how much expectancies change with use. The current study posited that peer attitudes might play a role in expectancy change with use, perhaps via changing the subjective experience of use (e.g., adolescents with peers who do not approve of use may have a more negative subjective experience of use than adolescents with peers who are approving of use). However, given that the results of the current study did not support this hypothesis, many other considerations (both related and unrelated to the peer context) remain open for exploration. The current findings do not preclude any potential moderating influence of peers; rather, one possibility for future research might involve alternative measures of the peer context that more

directly assess peer attitudes and are closer in time to the period of marijuana use initiation. Another potential moderator of interest might be an adolescent's own personality characteristics, such as impulsivity or sensation seeking. Taking into account an adolescent's temperament or personality might allow for an understanding of drug use trajectories that combines both a "gateway theory" perspective (i.e. that marijuana use itself plays a causal role in future drug use) and a "general propensity" perspective (i.e. that certain individuals are predisposed to drug use). Adolescents who have these predisposing personality risk factors may demonstrate different patterns of change in expectancies following use initiation, such that their expectations for use become much more desirable as compared to adolescents who do not have these personality characteristics.

Finally, the measurement of expectancies themselves may be of interest for future studies involving drug expectancies as a longitudinal predictor of use. The use of a unidimensional subjective expected utility (SEU) construct as a measure of expectancies was a unique feature of the current study. Prior studies on marijuana expectancies have tended to separate expectancies into separate positive and negative dimensions (ex. Aarons, Brown, Stice, & Coe, 2001; Boys et al., 1999; Schafer & Brown, 1991; Willner, 2001); or, if using a subjective expected utility construct, into separate cost and benefit dimensions (ex. Bailey & Hubbard, 1990). Findings from these studies have generally suggested that positive or desirable expectancies are not prospectively predictive of marijuana use, whereas negative or cost expectancies are prospectively protective against use. In the current study, the SEU construct captured a balance of desirable and undesirable outcomes, rather than one or the other, and was significantly predictive of future use.

A possible interpretation of this finding is that if negative or undesirable expectancies are more important than positive or desirable expectancies in predicting future use, this will simply be taken into account in an overall unidimensional expectancy scale. It may be that expectancies do not become positive after use; rather, they simply become less negative. The relatively low overall means of the expectancy variable after use initiation may corroborate this interpretation (see Figure 4). However, it is also possible that this unidimensional SEU conceptualization of expectancies provides differential predictive utility as compared to multidimensional scales. Multidimensional scales do not take into account that various positive and negative expectancies may be more or less important to a particular individual; as such, it is possible that such scales do not fully capture the underlying decision making process that takes place when an individual is presented with the opportunity to use drugs. Individuals answering a unidimensional expectancy item can mentally engage in their own decision making processes when reporting whether or not they perceive the overall outcome of use as a net positive or net negative. Further research may be warranted to investigate whether a unidimensional scale, such as the item used in this study, affords differential prediction of behavior as opposed to the more traditionally used multidimensional expectancy constructs. Such research may shed light on the cognitive process underlying an adolescent's decision-making with regards to substance use, which may in turn have implications for prevention efforts that target drug outcome expectancies.

In conclusion, the current study examined the changes in marijuana outcome expectancies across the period of marijuana use initiation, and tested a possible meditational role of expectancies in the progression to future drug use. Results offered preliminary evidence that expectancies are an important mechanism by which early experiences with marijuana use confer risk of progressing to continued use of marijuana and other types of illicit drug use. Further

studies are needed to corroborate and expand on the findings of the current study. In particular, future research should determine whether changes in marijuana expectancies reliably predict trajectories of future drug use, whether marijuana use can lead to changes in expectancies for drugs other than marijuana, and what factors could moderate changes in marijuana and drug expectancies during the period of initial use initiation and experimentation.

Table 1**:** Correlation matrix of predictor and outcome variables

	1	2	3	4	5
1. Marijuana use initiation status	1.00				
2. Expectancy Change (T2-T1)	**0.43*****	1.00			
3. T1 Peer Approval of Marijuana Use	**0.23*****	0.04	1.00		
4. Future Marijuana Use (Max 3-Month Frequency at T2-T3)	**0.55*****	**0.5*****	**0.17*****	1.00	
5. Expectation of Future Drug Use (Max at T2-T3)	**0.31*****	**0.49*****	**0.07****	**0.48*****	1.00

** p < .01 *** p < .001

Table 2**:** Hypothesis 2 – Regression of marijuana expectancy change on marijuana initiation status and peer approval

Predictors	B^* (SE)
Marijuana use initiation status	**0.43 (0.19)***
Peer Approval	-0.002 (0.03)
Initiation Status*Peer Approval	**-0.08 (0.04)***
R^2	**0.19 (0.02)***

$* p < .05 ** p < .01 *** p < .001$; all coefficients standardized estimates

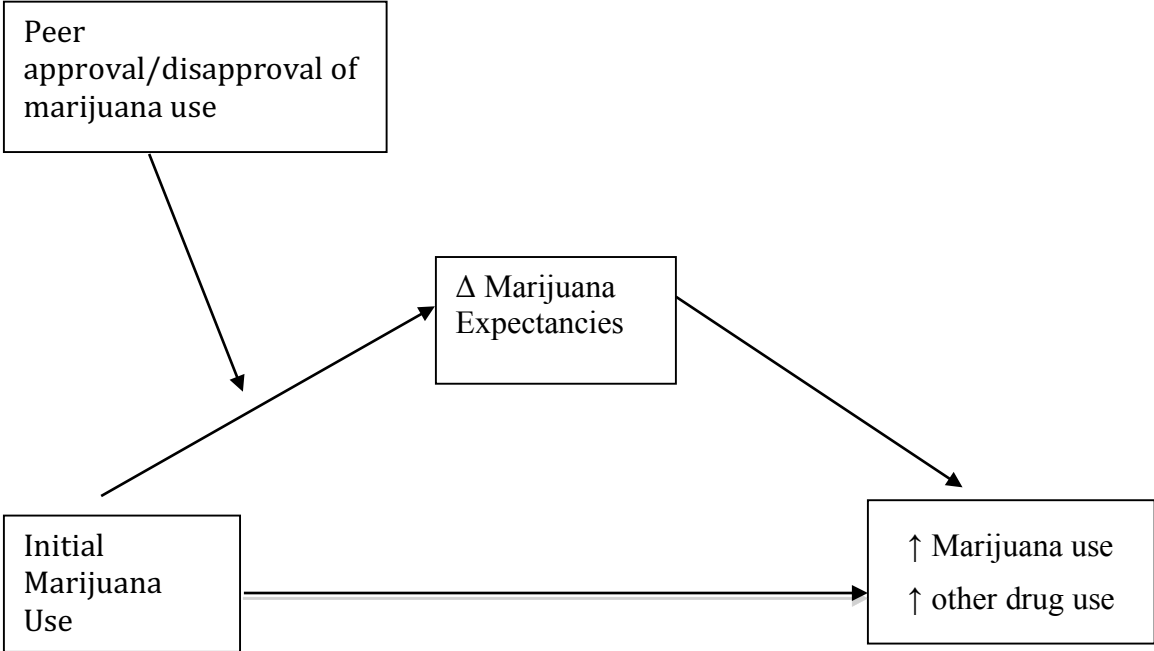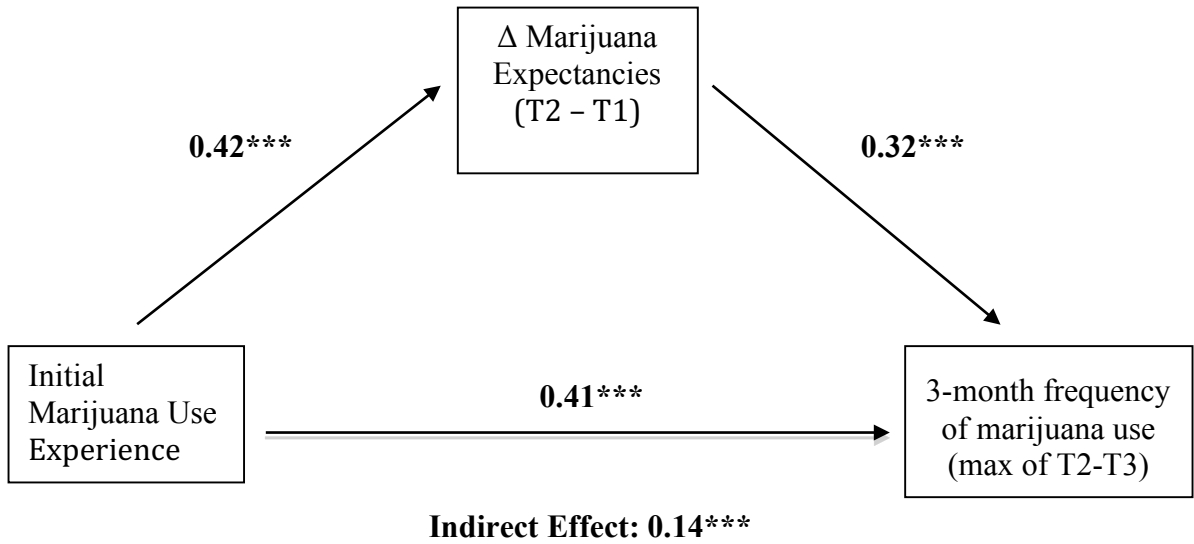Figure 1: Hypothetical Model for Progression of Adolescent Substance Use

Figure 2: Marijuana expectancy change mediates relationship between marijuana use initiation and future marijuana use

Note: *** = p < .0001; all coefficients are standardized estimates

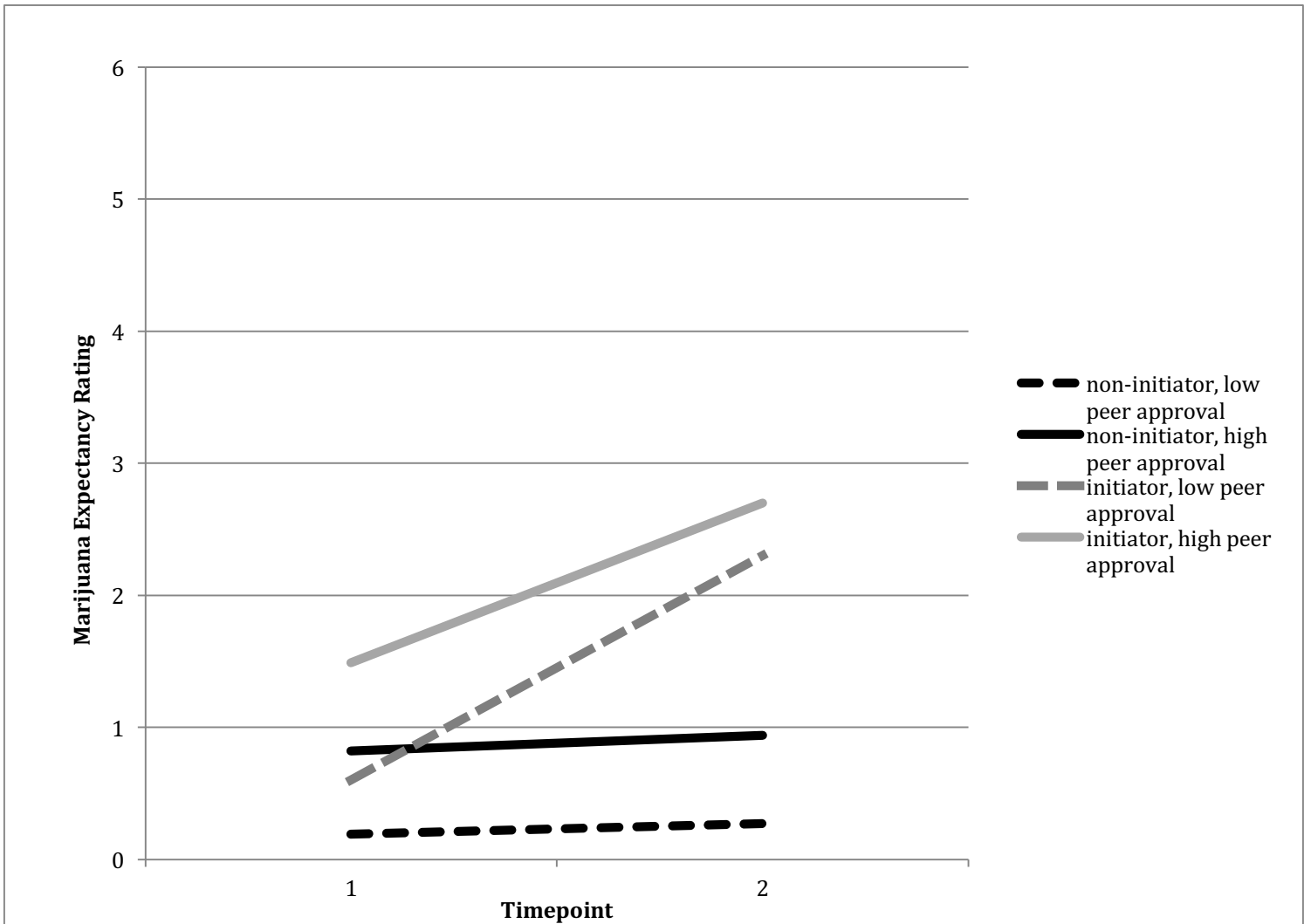Figure 3: Marijuana Use Initiation and Peer Approval Interaction

Figure 4: Peer Approval Moderates the Interaction Between Marijuana Use Initiation and Marijuana Expectancy Change
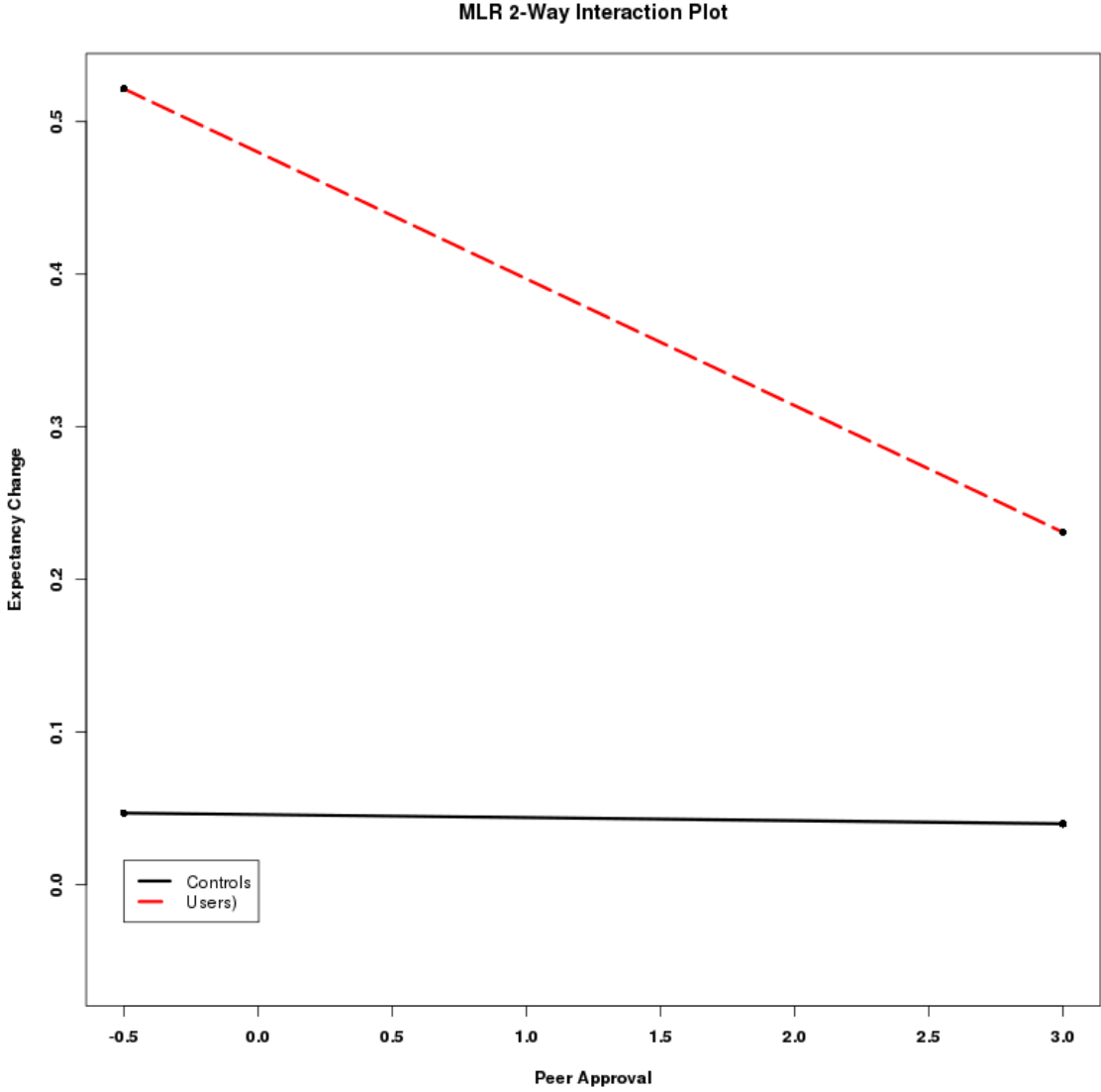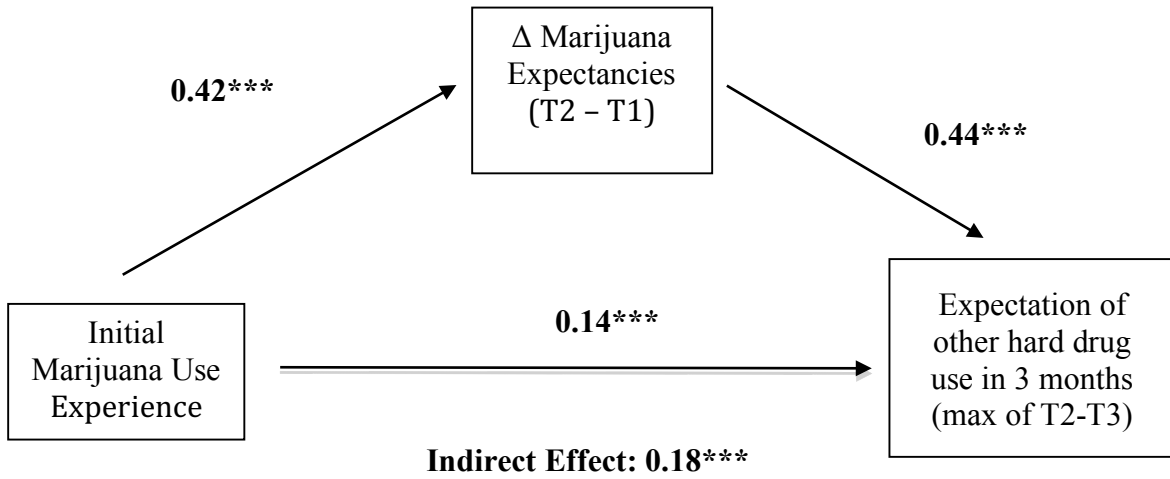
Figure 5: Marijuana expectancy change mediates relationship between marijuana use initiation and expectations of future hard drug use

Note: *** = p < .0001; all coefficients are standardized estimates.

REFERENCES

Aas, N.H., Leigh, B. C., Anderssen, N., & Jakobsen, R. (1998). Two-year longitudinal study of alcohol expectancies and drinking among Norwegian adolescents. *Addiction, 93*(3), 373-384. doi:10.1046/j.1360-0443.1998.9333736.x

Aarons, G. A., Brown, S. A., Stice, E., & Coe, M. T. (2001). Psychometric evaluation of the marijuana and stimulant effect expectancy questionnaires for adolescents. *Addictive Behaviors, 26*(2), 219-236. doi:10.1016/S0306-4603(00)00103-9

Aiken, L.S., & West, S.G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA, US: Sage Publications, Inc.

Aseltine Jr, R. H. (1995). A reconsideration of parental and peer influences on adolescent deviance. *Journal of health and social behavior, 36*, 103-121. doi:10.2307/2137219

Bailey, S. L., & Hubbard, R. L. (1990). Developmental variation in the context of marijuana initiation among adolescents. *Journal of health and Social Behavior*, 58-70. doi:10.2307/2137045

Bandura, A. (1977). Social learning theory.

Bauman, K. E., & Ennett, S. T. (1996). On the importance of peer influence for adolescent drug use: Commonly neglected considerations. *Addiction, 91*(2), 185-198. doi: 10.1046/j.1360-0443.1996.9121852.x

Bauman, K. E., Fisher, L. A., Bryan, E. S., & Chenoweth, R. L. (1984). Antecedents, subjective expected utility, and behavior: A panel study of adolescent cigarette smoking. *Addictive Behaviors, 9*(2), 121-136. doi:10.1016/0306-4603(84)90050-9

Bauman, K. E., Fisher, L. A., Bryan, E. S., & Chenoweth, R. L. (1985). Relationship between subjective expected utility and behavior: A longitudinal study of adolescent drinking behavior. *Journal of Studies on Alcohol and Drugs, 46*(01), 32. doi:10.15288/jsa.1985.46.32

Bauman, K. E., Fisher, L. A., & Koch, G. G. (1989). External Variables, Subjective Expected Utility, and Adolescent Behavior with Alcohol and Cigarettes. *Journal of Applied Social Psychology, 19*(10), 789-804. doi: 10.1111/j.1559-1816.1989.tb01222.x

Boys, A., Marsden, J., Griffiths, P., Fountain, J., Stillwell, G., & Strang, J. (1999). Substance use among young people: the relationship between perceived functions and intentions. *Addiction, 94*(7), 1043-1050. doi:10.1046/j.1360-0443.1999.94710439.x

Brechwald, W. A., & Prinstein, M. J. (2011). Beyond homophily: A decade of advances in understanding peer influence processes. *Journal of Research on Adolescence, 21*(1), 166-179. doi:10.1111/j.1532-7795.2010.00721.x

Brown, S. A. (1993). Drug effect expectancies and addictive behavior change. *Experimental and Clinical Psychopharmacology, 1*(1-4), 55. doi:10.1037/1064-1297.1.1-4.55

Brown, S. A., Christiansen, B. A., & Goldman, M. S. (1987). The Alcohol Expectancy Questionnaire: An instrument for the assessment of adolescent and adult alcohol expectancies. *Journal of Studies on Alcohol and Drugs, 48*(05), 483. doi:10.15288/jsa.1987.48.483

Brown, S. A., Creamer, V. A., & Stetson, B. A. (1987). Adolescent alcohol expectancies in relation to personal and parental drinking patterns. *Journal of Abnormal Psychology, 96*(2), 117. doi:10.1037/0021-843X.96.2.117

Brown, S. A., Goldman, M. S., & Christiansen, B. A. (1985). Do alcohol expectancies mediate drinking patterns of adults? *Journal of Consulting and Clinical Psychology, 53*(4), 512. doi:10.1037/0022-006X.53.4.512

Brown, S. A., Goldman, M. S., Inn, A., & Anderson, L. R. (1980). Expectations of reinforcement from alcohol: Their domain and relation to drinking patterns. *Journal of consulting and Clinical Psychology, 48*(4), 419. doi:10.1037/0022-006X.48.4.419

Casswell, S., Gilmore, L. L., Silva, P., & Brasch, P. (1988). What children know about alcohol and how they know it. *British Journal of Addiction, 83*(2), 223 – 227. doi:10.1111/j.1360-0443.1988.tb03985.x

Christiansen, B. A., Goldman, M. S., & Inn, A. (1982). Development of alcohol-related expectancies in adolescents: Separating pharmacological from social-learning influences. *Journal of consulting and Clinical Psychology, 50*(3), 336. doi:10.1037/0022-006X.50.3.336

Christiansen, B. A., Smith, G. T., Roehling, P. V., & Goldman, M. S. (1989). Using alcohol expectancies to predict adolescent drinking behavior after one year. *Journal of consulting and clinical psychology, 57*(1), 93. doi:10.1037/0022-006X.57.1.93

Collins, L. M. (2002). Using latent transition analysis to examine the gateway hypothesis. *Examining the gateway hypothesis: Stages and pathways of drug involvement*, 254-269. doi:10.1017/CBO9780511499777

Ellickson, P. L., Hays, R. D., & Bell, R. M. (1992). Stepping through the drug use sequence: longitudinal scalogram analysis of initiation and regular use. *Journal of abnormal psychology, 101*(3), 441. doi:10.1037/0021-843X.101.3.441

Ennett, S. T., Bauman, K. E., Hussong, A., Faris, R., Foshee, V. A., Cai, L., & DuRant, R. H. (2006). The peer context of adolescent substance use: Findings from social network analysis. *Journal of Research on Adolescence, 16*(2), 159-186. doi:10.1111/j.1532-7795.2006.00127.x

Fendrich, M., & Rosenbaum, D. P. (2003). Recanting of substance use reports in a longitudinal prevention study. *Drug and alcohol dependence, 70*(3), 241-253. doi:10.1016/S0376-8716(03)00010-3

Fisher, L. B., Miles, I. W., Austin, S. B., Camargo, C. A., & Colditz, G. A. (2007). Predictors of initiation of alcohol use among US adolescents: findings from a prospective cohort study. *Archives of Pediatrics & Adolescent Medicine, 161*(10), 959-966. doi:10.1001/archpedi.161.10.959

Fromme, K., Stroot, E. A., & Kaplan, D. (1993). Comprehensive effects of alcohol: Development and psychometric assessment of a new expectancy questionnaire. *Psychological Assessment, 5*(1), 19-26. doi:10.1037/1040-3590.5.1.19

Goldman, M. S., Del Boca, F. K., & Darkes, J. (1999). Alcohol expectancy theory: The application of cognitive neuroscience. In K.E. Leonard & H.T. Blane (Eds*.), Psychological theories of drinking and alcoholism* (203-246). New York, NY: The Guilford Press.

Graham, J. W., Collins, L. M., Wugalter, S. E., Chung, N. K., & Hansen, W. B. (1991a). Modeling transitions in latent stage-sequential processes: a substance use prevention example. *Journal of Consulting and Clinical Psychology, 59*(1), 48. doi:10.1037/0022-006X.59.1.48

Graham, J. W., Marks, G., & Hansen, W. B. (1991b). Social influence processes affecting adolescent substance use. *Journal of Applied Psychology, 76*(2), 291. doi:10.1037/0021-9010.76.2.291

Hall, W. D., & Lynskey, M. (2005). Is cannabis a gateway drug? Testing hypotheses about the relationship between cannabis use and the use of other illicit drugs. *Drug and alcohol review, 24*(1), 39-48. doi:10.1080/09595230500126698

Hine, D. W., McKenzie-Richer, A., Lewko, J., Tilleczek, K., & Perreault, L. (2002). A comparison of the mediational properties of four adolescent smoking expectancy measures. *Psychology of Addictive Behaviors, 16*(3), 187–195. doi:10.1037/0893-164X.16.3.187

Huba, G. J., & Bentler, P. M. (1980). The role of peer and adult models for drug taking at different stages in adolescence. *Journal of Youth and Adolescence, 9*(5), 449-465. doi:10.1007/BF02087681

Johnson, R. E., Marcos, A. C., & Bahr, S. J. (1987). The role of peers in the complex etiology of adolescent drug use. *Criminology, 25*, 323-340. doi:10.1111/j.1745-9125.1987.tb00800.x

Johnston, L. D., O'Malley, P. M., Miech, R. A., Bachman, J. G., & Schulenberg, J. E. (2014). *Monitoring the Future national survey results on drug use: 1975-2013: Overview, key findings on adolescent drug use.* Ann Arbor: Institute for Social Research, The University of Michigan, 84pp.

Jones, B. T., Corbin, W., & Fromme, K. (2001). A review of expectancy theory and alcohol consumption. *Addiction, 96(*1), 57-72. doi:10.1046/j.1360-0443.2001.961575.x

Kandel, D. B. (2002). *Stages and pathways of drug involvement: Examining the gateway hypothesis*. Cambridge University Press.

Kandel, D. B., Yamaguchi, K., & Chen, K. (1992). Stages of progression in drug involvement from adolescence to adulthood: further evidence for the gateway theory. *Journal of Studies on Alcohol and Drugs, 53*(5), 447. doi:10.15288/jsa.1992.53.447

Kandel, D. B., & Yamaguchi, K. (2002). Stages of drug involvement in the US population. In D.B. Kandel (Ed.), *Stages and pathways of drug involvement: Examining the gateway hypothesis* (65-89). New York, NY: Cambridge University Press.

Kendler, K. S., Jacobson, K. C., Prescott, C. A., & Neale, M. C. (2003). Specificity of genetic and environmental risk factors for use and abuse/dependence of cannabis, cocaine, hallucinogens, sedatives, stimulants, and opiates in male twins. *American Journal of Psychiatry, 160(*4), 687-695. doi:10.1176/appi.ajp.160.4.687

Kendler, K. S., & Prescott, C. A. (1998). Cannabis use, abuse, and dependence in a population-based sample of female twins. *American Journal of Psychiatry, 155*(8), 1016-1022. doi:10.1176/ajp.155.8.1016

Kraus, D., Smith, G. T., & Ratner, H. H. (1994). Modifying alcohol-related expectancies in grade-school children. *Journal of Studies on Alcohol and Drugs, 55*(5), 535. doi:10.15288/jsa.1994.55.535

Lee, N. K., Greely, J., & Oei, T. P. (1999). The relationship of positive and negative alcohol expectancies to patterns of consumption of alcohol in social drinkers. *Addictive Behaviors, 24*(3), 359-369. doi:10.1016/S0306-4603(98)00091-4

Leigh, B. C., & Stacy, A. W. (1993). Alcohol outcome expectancies: Scale construction and predictive utility in higher order confirmatory models. *Psychological Assessment, 5*(2), 216. doi:10.1037/1040-3590.5.2.216

Lynskey, M. T., Heath, A. C., Bucholz, K. K., Slutske, W. S., Madden, P. A., Nelson, E. C., ... & Martin, N. G. (2003). Escalation of drug use in early-onset cannabis users vs co-twin controls. *JAMA, 289*(4), 427-433. doi:10.1007/s10519-005-9023-x

Lynskey, M. T., Vink, J. M., & Boomsma, D. I. (2006). Early onset cannabis use and progression to other drug use in a sample of Dutch twins. *Behavior Genetics, 36*(2), 195-200.

Mahon, J. M., & Jones, B. T. (1993). Negative expectancy in motivation. *Addiction Research & Theory, 1*(2), 145-155. doi:10.3109/16066359309035331

Miller, P. M., Smith, G. T., & Goldman, M. S. (1990). Emergence of alcohol expectancies in childhood: A possible critical period. *Journal of Studies on Alcohol and Drugs, 51*(4), 343. doi:10.15288/jsa.1990.51.343

Morral, A. R., McCaffrey, D. F., & Paddock, S. M. (2002). Reassessing the marijuana gateway effect. *Addiction, 97*(12), 1493-1504. doi:10.1046/j.1360-0443.2002.00280.x

Murray, R. M., Morrison, P. D., Henquet, C., & Di Forti, M. (2007). Cannabis, the mind and society: the hash realities. *Nature Reviews Neuroscience, 8*(11), 885-895. doi:10.1038/nrn2253

Muthén, L. K., & Muthén, B. O. (2010). Mplus statistical modeling software (Version 6.1). Los Angeles: Muthén & Muthén.

Newcomb, M. D., & Bentler, P. M. (1986). Substance use and ethnicity: Differential impact of peer and adult models. *The Journal of Psychology, 120*(1), 83-95. doi:10.1080/00223980.1986.9712618

Osgood, D. W., Ragan, D. T., Wallace, L., Gest, S. D., Feinberg, M. E., & Moody, J. (2013). Peers and the emergence of alcohol use: Influence and selection processes in adolescent friendship networks. *Journal of Research on Adolescence, 23*(3), 500-512. doi:10.1111/jora.12059

Percy, A., McAlister, S., Higgins, K., McCrystal, P., & Thornton, M. (2005). Response consistency in young adolescents' drug use self-reports: a recanting rate analysis. *Addiction, 100*(2), 189-196. doi:10.1111/j.1360-0443.2004.00943.x

Reese, F. L., Chassin, L., & Molina, B. S. (1994). Alcohol expectancies in early adolescents: Predicting drinking behavior from alcohol expectancies and parental alcoholism. *Journal of Studies on Alcohol and Drugs, 55*(3), 276. doi:10.15288/jsa.1994.55.276

SAS Institute Inc. (2010). SAS documentation, Version 9.2. Cary, NC: SAS Institute Inc.

Schafer, J., & Brown, S. A. (1991). Marijuana and cocaine effect expectancies and drug use patterns. *Journal of Consulting and Clinical Psychology, 59*(4), 558. doi:10.1037/0022-006X.59.4.558

Sher, K. J., Wood, M. D., Wood, P. K., & Raskin, G. (1996). Alcohol outcome expectancies and alcohol use: a latent variable cross-lagged panel study. *Journal of abnormal psychology, 105*(4), 561. doi:10.1037/0021-843X.105.4.561

Skenderian, J. J., Siegel, J. T., Crano, W. D., Alvaro, E. E., & Lac, A. (2008). Expectancy change and adolescents' intentions to use marijuana. *Psychology of Addictive Behaviors, 22*(4), 563. doi:10.1037/a0013020

Smith, G. T., Goldman, M. S., Greenbaum, P. E., & Christiansen, B. A. (1995). Expectancy for social facilitation from drinking: the divergent paths of high-expectancy and low-expectancy adolescents. *Journal of abnormal psychology, 104*(1), 32. doi:10.1037/0021-843X.104.1.32

Stacy, A. W., Newcomb, M. D., & Bentler, P. M. (1991). Cognitive motivation and drug use: a 9-year longitudinal study. *Journal of Abnormal Psychology, 100*(4), 502. doi:10.1037/0021-843X.100.4.502

Stacy, A. W., Newcomb, M. D., & Bentler, P. M. (1995). Expectancy in mediational models of cocaine use. *Personality and Individual Differences, 19*(5), 655-667. doi:10.1016/0191-8869(95)00100-K

Sussman, S., & Dent, C. W. (1999). Brief report one-year prospective prediction of marijuana use cessation among youth at continuation high schools. *Addictive behaviors, 24*(3), 411-417. doi:10.1016/S0306-4603(98)00048-3

Trudeau, L., Lillehoj, C., Spoth, R., & Redmond, C. (2003). The role of assertiveness and decision making in early adolescent substance initiation: mediating processes. *Journal of Research on Adolescence, 13*(3), 301-328. doi:10.1111/1532-7795.1303003

Vangsness, L., Bry, B. H., & LaBouvie, E. W. (2005). Impulsivity, negative expectancies, and marijuana use: A test of the acquired preparedness model. *Addictive behaviors, 30*(5), 1071-1076. doi:10.1016/j.addbeh.2004.11.003

Willner, P. (2001). A view through the gateway: Expectancies as a possible pathway from alcohol to cannabis. *Addiction, 96*(5), 691-703. doi: http://dx.doi.org/10.1080/09652140020039062

Wood, M. D., Read, J. P., Palfai, T. P., & Stevenson, J. F. (2001). Social influence processes and college student drinking: The mediational role of alcohol outcome expectancies. *Journal of Studies on Alcohol and Drugs, 62*(1), 32. doi:10.15288/jsa.2001.62.32

Yuan, K. H., & Bentler, P. M. (2000). Three likelihood-based methods for mean and covariance structure analysis with nonnormal missing data. *Sociological methodology, 30*, 165-200. doi:10.1111/0081-1750.00078