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Young Mothers' Decisions to Use Marijuana: A Test of an Expanded Theory of Planned Behavior

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Abstract

The current study examines the Theory of Planned Behavior's (TPB) ability to predict marijuana use among young women who experienced a premarital pregnancy before age 18, using longitudinal data. The validity of the TPB assumption that all other variables work through TPB constructs is also tested. Indicators of four constructs that have been shown in the literature to be predictive of marijuana use -- persistent environmental adversity, emotional distress, adolescent marijuana use, drug use in the social network -- were tested as predictors of attitudes, norms, and self-efficacy, in a structural equation modeling framework. All paths from distal predictors were through the mediating TPB constructs, in accordance with the tenets of the model. Implications of these findings for the TPB model and for understanding factors that lead to marijuana use are discussed.

Keywords

Theory of Planned Behavior; adolescents; marijuana use; decision-making

Introduction

Marijuana remains widely available and continues to be the most commonly used illegal drug in the U.S. among both adolescents and young adults. Although marijuana use among adolescents has declined slightly, nearly 16% of 8th grade students, 23% of 10th grade students, and 42% of 12th grade students in the U.S. report having tried marijuana (Johnston, O'Malley, Bachman, & Schulenberg, 2006). Perhaps as a consequence of its widespread usage, along with concern and some evidence that it may be a "gateway" to harder drug use (Kandel, 1975), numerous studies have been conducted in an attempt to understand causes and consequences of marijuana use (e.g., Brown, Flory, Lynam, Leukefeld, & Clayton, 2004; Greenfield & O'Leary, 1999). Substance use among pregnant and parenting adolescent women is of particular concern because of its potential effects on both the mother and her child, but surprisingly little is known about substance use among these high-risk young women (Morrison, Golder, Keller, & Gillmore, 2002). Some studies have shown that, compared to their peers, adolescent mothers have higher rates of substance use (Gilchrist, Gillmore, & Lohr, 1990; Gillmore, Gilchrist, Lee, & Oxford, 2006), but other studies have found no differences (Kokotailo, Langhough, Cox, Davidson, & Fleming, 1994; Pletsch, 1988). Studies have reported decreases in substance use during adolescent pregnancy (Gilchrist et al., 1990; Zuckerman et al., 1983), but at least one study, based on these data, found increases in substance use after birth of the baby (Gilchrist, Hussey, Gillmore, Lohr, & Morrison, 1996).

Newcomb (1996) has suggested that early transitions to adulthood may have adverse consequences for later adult role functioning. Adolescent mothers have already made an early transition to adulthood by virtue of their early assumption of the adult role of parent. Although many adolescents experiment with marijuana, most “outgrow” this use in early adulthood (Bachman et al., 2002; Yamaguchi & Kandel, 1985). Adolescent mothers, however, may be at particular risk for continuing substance use into adulthood. Understanding the factors that predispose this special group of young women to substance use is the first step toward building effective intervention programs.

The Theory of Planned Behavior

The theory of planned behavior (TPB) is a social cognitive model of behavior that has been widely used to model substance use and other health-related behaviors. It is an extension of Fishbein and Ajzen’s (1975) theory of reasoned action (TRA), which posits that a volitional behavior (i.e., a behavior over which an individual has control), like using marijuana, is best predicted by the actor’s intention to perform the behavior. Intentions are thought to subsume motivational factors influencing a person’s behavior. They are predicted by the individual’s attitude toward the behavior (how favorable or unfavorable the behavior is perceived to be) and by his or her perception of social norms regarding the behavior (perceived expectations of others regarding the behavior). In an attempt to expand the scope of the theory of reasoned action to situations in which individuals may not have complete control over their behavior, Ajzen (1985) hypothesized that perceived behavioral control, in addition to attitude and perceived social norms, influences intentions and also behavior. This revised model is the TPB. Perceived behavioral control has been conceptualized as self-efficacy (Bandura, 1977; 1997) and controllability (Ajzen, 2002). In the literature there has been some debate about how best to conceptualize and measure perceived behavioral control. Some argue that self-efficacy and perceived control over a behavior are not identical constructs, and there is some empirical evidence to support this contention (Armitage & Conner, 2001). Recently Ajzen (2002) has suggested that self-efficacy and perceived controllability over a behavior are two related components of a higher order factor of perceived behavioral control. We include measures of self-efficacy and perceived behavioral control in our model. A schematic of the TPB model, including distal variables, is depicted in Figure 1.

These four proximal factors—intention, attitude, perception of social norms, and self-efficacy or perceived behavioral control—are said to be “sufficient” to explain behavior in the sense that all other variables influencing the behavior are hypothesized to affect behavior only indirectly through their effects on attitude, social norm, or self-efficacy. That is, attitude, norm and/or self-efficacy are presumed to mediate the effects of all other variables that might influence the decision to use marijuana (see Ajzen, 1985; Conner & Sparks, 1996; Fishbein, 2000).

The theories of reasoned action and planned behavior have been shown to have utility for increasing our understanding of a wide variety of health behaviors such as substance use, contraception, smoking, condom use, dieting, exercise, and others (for a review, see Armitage & Conner, 2001). Several studies have examined the theories’ ability to predict marijuana use among young people (Armitage, Conner, Loach, & Willets, 1999; Bearden & Woodside, 1978; Bentler & Speckart, 1979; Budd, Bleiker, & Spencer, 1983; Cook, Lounsbury, & Fontenelle, 1980; Laflin, Moore, Wise, & Hayes, 1994; McMillan & Conner, 2003; Yzer et al., 2004), and one study examined its utility for predicting marijuana use among adolescent mothers (Morrison et al., 2002). In each of these studies, the theories’ predictions were confirmed and the theories explained a non-trivial amount of the variance. Addition of perceived behavioral control to the theory of reasoned action model generally has been shown to improve prediction, especially in situations where individuals do not have

complete control (or think they do not) over the behavior (Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Ajzen, 1991; Armitage & Conner, 2001; Conner & Sparks, 1996; Godin & Kok, 1996). Moreover, the theory of planned behavior may be especially useful for explaining marijuana use because prior research has shown that it explains a larger proportion of the variance in drug use behaviors than in other health behaviors (Godin & Kok, 1996), and prior studies have found support for the model for predicting marijuana use (e.g., Armitage et al., 1999; McMillan & Conner, 2003).

An Expanded, Integrative TPB Model

Fishbein and Ajzen, in their original statement of the TRA (1975), proposed that the model variables should mediate the effects of all distal variables. Fishbein (2000) has restated this with respect to the TPB, proposing an expanded, integrative model (which also includes skills and environmental constraints as direct predictors of behavior). According to this model, there should be no direct paths from distal variables to intention or to behavior. This assumption that distal variables have only indirect, mediated effects on intention and behavior has rarely been tested. Most research based on the theories of reasoned action and planned behavior has not modeled the effects of distal factors associated with the behavior (e.g., O'Callaghan, Chant, Callan, & Baglioni, 1997), accepting the proposition that all distal variables work through attitude, norm and self-efficacy, without explicitly testing their effects.

Two regression-based studies of substance use report evidence for direct effects of distal variables. McMillan & Conner (2003) found, using regression, that descriptive norms (use by others in the social network) were significant predictors of intention to use marijuana, LSD, amphetamines, and ecstasy, after accounting for variance predicted by TPB variables. Yzer et al. (2004) constructed a measure of overall risk for marijuana use based descriptive norms and personal characteristics. The addition of this risk index significantly increased the percentage of variance accounted for by 5%. These results are provocative, but use regression analysis, a weaker tool than structural equation modeling for providing strong and specific tests of the effects and paths of distal variables. This study builds on their work, using structural equation modeling techniques and a longitudinal sample.

Direct effects for distal variables have been found in other areas, as well; most notably, sexual behavior. In two structural equation model tests of the sufficiency of the theory to predict initiation of adolescent sexual behavior, several distal variables had moderate to large direct paths to behavior: moral beliefs, perceived pressure to have sex, and family communication (Beadnell et al., 2007); and family disadvantage (Wells et al., 2007). In a prospective study of heterosexual men's sexual behavior, Beadnell et al. (2008) found substantial direct effects for pregnancy motivation and traditional gender role beliefs on monogamy, and direct effects of partner norm and use of other methods of birth control on using condoms with steady partners.

In this paper, we apply structural equation modeling techniques to modeling substance use behavior. The model tested here includes four recognized distal predictors of marijuana use: persistent environmental adversity, emotional distress, drug use in the social network, and prior drug use as an adolescent. Consistent with the sufficiency hypothesis, we specify an expanded model with all factors extraneous to the traditional TPB model exerting their effects indirectly through attitude, norm and/or self-efficacy (Figure 1). To the extent that this model is a good fit to the data, it supports the sufficiency of the TPB model to account for the effects of distal variables. Insofar as distal variables have direct paths to intention or behavior, it suggests that not all of the effects of distal variables are mediated by attitude, social norm, and self-efficacy.

Distal Variables

To test the ability of the TPB to account for the effects of distal variables on marijuana use, we chose four predictors with demonstrated relationships to marijuana use, either specifically among adolescents (drug use in the social network and adolescent drug use) or in general (environmental adversity and emotional distress). Each of these variables has been shown in multiple studies to have at least a concurrent relationship to marijuana use, making them a strong set of predictors with which to test the sufficiency of the model. In the absence of literature to suggest whether each distal variable affects attitude, norm, or self-efficacy, we include paths from each distal predictor to all three of these TPB mediating variables. Modeling the paths in this way provides a strong test in that it prevents errors in interpretation due to misspecification of the paths from distal predictors to intention and behavior.

Environmental adversity—In keeping with Bronfenbrenner's (1986) idea that human behavior cannot be well understood without attention to the context in which it occurs, we examine the effects of persistent environmental adversity on marijuana use. Scholars argue that factors like neighborhood conditions are not completely accounted for by individual-level factors (Furstenberg & Hughes, 1997; Jencks & Mayer, 1990), and that environmental adversity, particularly, is thought to increase the likelihood of drug use (Boardman, Finch, Ellison, Williams, & Jackson, 2001; Crum, Lillie-Blanton, & Anthony, 1996; Dembo, Allen, Farrow, Schmeidler, & Burgos, 1985). Even so, many adolescent mothers, despite considerable environmental adversity, make a successful transition to adulthood (Furstenberg, Morgan, & Brooks-Gunn, 1987; Oxford et al., 2005). At the same time, some adolescent mothers continue, and may even increase, their drug use following the birth of a baby (Gilchrist et al., 1996). Lacking is a clear understanding of the mechanisms through which environmental adversity influences drug use.

Emotional distress—Studies have shown a relationship between emotional distress and drug use, but whether drug use is a cause or consequence of emotional distress is a matter of debate (e.g., Hanna, Faden, & Dufour, 1994; Tschann, Adler, Irwin, & Millstein, 1994), and findings are inconsistent (cf. Brook, Whiteman, & Gordon, 1983; Johnson & Kaplan, 1990; Kandel, Davies, Karus, & Yamaguchi, 1986; Newcomb & Bentler, 1988). Aneshensel and Sucoff (1996) found a relationship between neighborhood adversity and emotional distress, leaving open the possibility that the effect of one may be a spurious effect of the other. In this study, we include both neighborhood adversity and emotional distress.

Drug use in the social network—Studies have consistently found a relationship between peer use of drugs and adolescent drug use (Hawkins, Catalano, & Miller, 1992). Whether this relationship is a result of selection (drug users choosing as friends those who also use drugs) or peer influence has not been fully resolved. However, recent longitudinal research showed that friends' use of alcohol led to increased use of alcohol, but adolescent use of alcohol did not lead to greater use among friends (Sieving, Perry, & Williams, 2000). Whether one chooses similar others as friends or friends influence one to use drugs, drug use in the social network can foster use (or continued use) through a variety of mechanisms including providing positive social norms for use (Donald & Cooper, 2001), or norms that are less prohibitive of drug use. Two recent TPB studies of marijuana and other illicit drug use have found direct effects of social network use (McMillan & Conner, 2003) or a construct that included social network use (Yzer et al., 2004) among college students.

Adolescent drug use—Although many adolescents "mature out" of substance use in adulthood, studies suggest that adolescent problem behaviors, including drug use, are related to adult use. Early drug use should shape attitudes about use, expose adolescents to social

norms about use, and affect self-efficacy to use or to abstain from use. Studies of substance use among teen mothers suggest that they may be more prone to persisting in substance use (Ebrahim & Gfroerer, 2003; Gillmore et al., 2006)

In summary, the major purpose of this paper is to test the sufficiency hypothesis that the factors not specified by the TPB exert their influence on marijuana use only indirectly, through their effects on attitude, norm, or self-efficacy. To this end, we examine an expanded model that includes four demonstrated distal predictors of marijuana use. In addition, we examine the utility of the TPB for predicting marijuana use in a high risk group, young adult women who gave birth as unmarried teenagers.

Method

Study Overview

The data for this analysis were derived from a longitudinal study assessing the natural history and correlates of drug and alcohol use among a community sample of pregnant and parenting adolescents. Unmarried pregnant adolescents, age 17 or younger, who planned to carry their babies to term, were recruited from public and private hospital prenatal clinics, public school alternative programs, and social service agencies within three urban counties surrounding a city in the northwestern United States. Recruitment procedures included advertising; thus, a conventional overall response rate could not be determined. However, approach-and-consent data were available from one site, a prenatal clinic in a large county hospital, and indicated that 75% of eligible adolescents agreed to participate. Thirty percent of respondents did not live with their parents or guardians and were not financially supported by them and so consented for their own participation; parent or guardian consent was obtained for all other participants. All procedures were approved by the Human Subjects Division at the institution where the research was conducted, and was carried out in accordance with universal ethical principles.

A sample of 240 pregnant adolescents were enrolled in the study and completed the initial interview between June, 1988 and January, 1990. Data were collected at 14 time points from pregnancy through 1 1/2 years postpartum. The study involved in-person interviews; telephone interviews were conducted when participants moved out of the study area. Each interview took approximately 1 1/2 hours to complete, and covered topics including life circumstances, relationships, parenting, drug and alcohol use, and psychosocial functioning. Respondents were paid for their participation, ranging from \$15 to \$50 based on the wave of data collection. Participants were assured of the confidentiality of their responses, and the project was granted a Federal Certificate of Confidentiality, to avoid subpoena regarding confidential information from study participants. To verify the accuracy of self-reported drug use, each participant was asked to provide a urine sample at every interview. A random sample was selected and analyzed at each time point. Comparisons of self-reported marijuana use to laboratory data yielded discrepancy rates of 1% to 7%, depending on the wave of data, for the waves included in the present analyses.

Study Participants

The sample for the present analyses consists of all 238 respondents in the original sample who were living at the time of the final collection point, omitting two of the 240 original respondents who died during the course of the study.

The marijuana use attitude, norm, intention, and self-efficacy variables were measured at 10 1/2 years postpartum for the present analyses. At this time point, the mean age of the sample was 27.37 years ($sd = 1.00$); 42% had never been married, 37% were currently

married, and 21% were separated or divorced. Forty-nine percent were non-Hispanic Caucasian, 27% were African American, and the remaining 24% were from other racial and ethnic groups, including Native American, Asian American, Latina, and those reporting mixed ethnicity. At 11½ years postpartum, when the outcome variable, marijuana use, was measured, 22% had not completed high school, 40% had solely a high school diploma or GED, and 38% had an advanced degree (vocational, associate, bachelor's, or master's degree). The majority (73%) of the women were parenting the child they were pregnant with when they entered the study.

Measures

Table 1 presents descriptive information for the variables included in the model. Marijuana use, the outcome variable, was measured at 11½ years postpartum. The TPB variables (attitudes, norm, intention, and efficacy) were measured at 10½ years postpartum. The expanded model variables were measured at various points from pregnancy through 9½ years postpartum, as explained further below.

Theory of Planned Behavior Variables—Attitude toward marijuana use was measured with three items. After the stem, “Using marijuana during the next six months would be...” were 5-point response scales anchored with very good to very bad, very pleasant to very unpleasant, and very helpful to very harmful. Higher scores indicated more positive attitudes.

Perceived social norm regarding marijuana use was assessed with two items. The first item was the standard TPB perceived social norm item; “What do most people who are important to you think about you using marijuana during the next six months?” The second measured the norms of their parents; “Whether or not you go along with them, other people may have opinions about whether or not you should use marijuana...What do your parents think about you using marijuana during the next six months?” Both items used the same 4-point response scale which ranged from 1 (think it is OK) to 4 (think I definitely should not). The items were reverse-coded so that higher scores indicated perceptions of more positive social norms about marijuana use.

Self-efficacy was measured with two items that captured two aspects of self-efficacy: likelihood (which we call self-efficacy, following from Bandura's (1977; 1997) formulation of self-efficacy), and ease of performing the behavior (which we call perceived control over use, following Ajzen's (2002) formulation). Our measures assessed perceived ability to abstain from marijuana use, rather than to use marijuana, based on elicitation interviews with the young mothers that suggested little variance in self-perceptions of ability to use marijuana; that is, almost all respondents reported being easily able to use marijuana if they chose to. Abstinence self-efficacy was measured with the item, “Regardless of whether you use marijuana, how likely is it that you could keep from using marijuana in the next six months if you wanted to?” Responses ranged from 1 (not at all likely) to 4 (extremely likely). Perceived control over use of marijuana was measured with, “If you decided not to use marijuana in the next six months, how easy or hard would it be for you to keep from smoking marijuana?” Responses ranged from 1 (very easy) to 5 (very hard).

Intention to use marijuana was measured with a single item: “How likely is it that you will use marijuana during the next six months?” The 5-point response scale ranged from 0 (very unlikely) to 4 (very likely); the midpoint was labeled “50/50 chance.” Higher scores indicated greater likelihood.

Expanded model variables—Environmental adversity indicators included measures of community violence and residential mobility. Community violence was assessed by an

adaptation of Richters and Salzman's measure (1990), which asked whether the respondent had witnessed, personally experienced, or had a close acquaintance who had experienced 14 types of violence such as being chased by gangs, beaten up or mugged, or attacked with a weapon in the previous six months. Three waves of data also included rape (sex due to threatened violence and sex due to physical force). The community violence variable was the mean of the scale, indicating the percentage of violent acts the respondent indicated she had experienced or been exposed to over four waves of data collection (from 5 years through 9½ years postpartum). Residential mobility was operationalized as the total number of interviews in which the respondent reported 2 or more household moves, from 6 months through 9½ years postpartum.

Emotional distress was measured by three subscales of the Brief Symptom Inventory (BSI; Derogatis, 1993). The BSI is a widely used, self-report symptom inventory developed to measure psychological symptomatology of community residents as well as psychiatric inpatients. Items are rated on a 5-point Likert scale, measuring distress from 0 to 4 (not at all to extremely). Mean scores were calculated for the depression (6 items), anxiety (6 items), and hostility (5 items) subscales. Emotional distress measures were taken from the 9½ year postpartum interview.

Adolescent marijuana use was assessed with two indicators. At the first interview, which occurred during pregnancy when all respondents were 17 years or younger, they were asked about their lifetime use of marijuana. Responses were 1 (never), 2 (once or twice), 3 (3 to 10 times), and 4 (more than 10 times). The second indicator was calculated as the greatest frequency of marijuana use reported by the respondent from the time of the birth of the study child through any interview in which she was less than 18 years old. Marijuana use frequency for this time period ranged from never (1) to every day (6).

Drug use in the social network was measured at 9½ years postpartum, and was indicated by two variables. The number of friends the respondent had who were current marijuana users was open-ended, and actual responses ranged from 0 to 5 friends. Current romantic partner's marijuana use was the frequency of marijuana use in the past 6 months, and could range from never (0) to every day (6). If the respondent did not have a current partner, she was given a score of 0 for current partner's marijuana use.

Outcome variable—Marijuana use, the outcome behavior variable, was assessed with two indicators: past month and past 6 month frequency of use. Respondents reported their frequency of marijuana use in the past 6 months as never (0), less than once a month (1), about once a month (2), less than once a week (3), about once a week (4), 2-5 times a week (5), every day or nearly every day (6), and more than once a day (7). Responses for frequency of marijuana use in the past month were never (1), once (2), 2-3 times (3), once a week (4), 2-5 times a week (5), and every day or nearly every day (6).

Missing data—Because the level of missing for most variables was small and/or did not appear to be systematic, the assumption that it is missing at random was considered plausible (Little & Rubin, 2002). Because the cumulative loss of participants that would have occurred due to listwise deletion biases estimates (Schafer & Graham, 2002), we used maximum likelihood estimation to include all cases (Dempster, Laird, & Rubin, 1977).

With one exception, missing data on individual indicators ranged from 0 to 15%, with an average of 8%. A single variable, perceived control over use of marijuana, was not included in the initial version of the interview, and therefore was missing for half of the respondents (n = 129). Comparisons of respondents with full data and those with data missing indicated

that the groups did not significantly differ in age, race, financial independence status, education, or history of marijuana use.¹

Results

We designed analyses to test an expanded TPB model to predict marijuana use. Our major goal was to determine whether the effects of distal factors that are known correlates of marijuana use are mediated by attitudes, social norms, and self-efficacy. Structural equation modeling (SEM) using Mplus 5.1 (Múthen & Múthen, 2007) was used to estimate the model depicted in Figures 1 and 2. The estimation procedure used was a weighted least squares parameter estimation that calculates robust standard errors, and a mean- and variance-adjusted chi-square test statistic (WLSMV, Múthen & Múthen, 2007). This method was appropriate in this case, in which there were some ordinal scaled indicators, and the presence of some skewness and kurtosis (Kline, 2004). Fit was considered acceptable when the Comparative Fit Index (CFI; Bentler, 1990) and the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973) were at least .95, the Residual Mean Squared Error Approximation index (RMSEA; Browne & Cudeck, 1993) was less than .06 (Yu, 2002), and the Weighted Root Mean Square Residual (WRMR) was less than 1.0 (Yu, 2002). Fit based on Chi-square was considered acceptable if the Chi-square statistic divided by the degrees of freedom were less than 3 (Kline, 2004).

We first examined a measurement model, using confirmatory factor analysis. In this, all latent constructs were free to vary; one indicator per construct was fixed to define the scales of the indicators. The measurement model fit the data well: $\chi^2_{(31df)}$ was 44.05, with a CFI of .957, TLI of .969, RMSEA of .042, and WRMR of .521. Table 1 presents factor loadings and test statistics, and Table 2 presents the intercorrelations among the latent factors. Intercorrelations among the variables used in the models are shown in Appendix A.

We then examined the structural model, for which Figure 1 shows a schematic. Correlations between each pair of distal variables were freed, as were those between attitude, norm, and efficacy. We estimated (freed) and constrained (fixed to 0) paths to be consistent with the TPB: among TPB variables, paths were estimated from attitude, norm and self-efficacy to intention, and from intention and self-efficacy to behavior. Hypothesized paths were estimated from each of the distal variables to all three hypothesized mediating variables from the TPB (attitude, social norm, and self-efficacy). Paths from the distal variables to intention and behavior were constrained, since the TPB states that their effects should be entirely mediated by attitude, norm, and self-efficacy. Fit was acceptable, with a $\chi^2_{(33df)}$ of 49.285, CFI of .946, TLI of .964, RMSEA of .046, and WRMR of .565. The fit of the model omitting non-significant paths is similar, with χ^2 of 47.559, CFI of .952, TLI of .968, RMSEA of .043, and WRMR of .599. The resulting model, shown in Figure 2, explained 92% of the variance in intention to use marijuana and 70% of the variance in marijuana use at 11.5 years postpartum.

Because the model fit was good, and to avoid capitalizing on chance in making modifications to an acceptable model (MacCallum, Roznowski, & Necowitz, 1992), we accepted this as the correct model. Examination of the modification indices confirmed that

¹In addition to the two respondents who died prior to the final data collection point, seven formally dropped out, and eight others did not complete the final interview. Because a reasonable person might question whether the inclusion of these lost respondents changed the results, analyses were also run using the subset of respondents who completed the final wave of data collection ($n = 223$), to confirm that including those respondents did not substantively change the results. It did not; the only difference between the analyses was that two paths from environmental adversity that were marginally significant in analyses using the full sample became very slightly larger and significant when using the reduced sample.

we had not overlooked any additional paths, not hypothesized by the TPB, from the distal variables directly to intention or behavior.

Discussion

Prediction of behavior and the sufficiency of the TPB model

As expected, the TPB proved a powerful model for predicting marijuana use among these high risk young adult women. The majority of the variance in marijuana use (70%) was accounted for by intention measured one year earlier. The structural equation model of marijuana use included significant paths only as specified by the theory: Attitude and self-efficacy predicted intention, and intention predicted marijuana use. The examination of distal factors, selected based on their relationship with substance use as suggested by existing research, indicated that their effects operated indirectly through their relationships with the TPB constructs. The longitudinal nature of the data strengthens these findings.

The percentage of variance accounted for is considerably higher than what is typically found for prediction of behavior, even in studies in which intention and behavior are measured at the same time. In a review of 185 studies, Armitage and Conner (2001) reported average squared multiple correlations (R^2 s) for behavior of .31, based primarily on studies without a time lag between intention and behavior. Why is prediction so much higher in this instance? In comparison to many of the behaviors and situations in which the TPB has been applied, marijuana use during adulthood may be a stable and thoughtfully-chosen behavior in this community sample of young adult mothers. That is, many applications of the TPB deal with behaviors that are difficult to implement (e.g., condom use, quitting smoking), involve adolescents who are novices with regard to the behavior, or both. In contrast, the young mothers in our sample, who were in their mid-twenties at the measurement of TPB variables, may have established patterns and opinions, and have fit their marijuana use (or non-use) comfortably into their social context. Two other recent TPB studies of marijuana use, both based on college student samples (Armitage, Conner, Loach, & Willets, 1999; McMillan & Conner, 2003) also reported higher-than-average prediction of behavior.

Two paths proposed by the theory, from social norm to intention and from self-efficacy to behavior, were not significant. This is not inconsistent with the theory. As Fishbein and Ajzen have emphasized since their original statements of the TRA (Fishbein & Ajzen, 1975), intentions vary in the extent to which they are attitudinally or normatively controlled. Some behavioral intentions are based primarily on attitude, one's own affective response; others are based primarily on social expectations. Consider and contrast, for example, your intentions with regard to eating chocolate (primarily based on your liking or disliking of chocolate, and very little on whether others think you should eat them) and your intentions to wait patiently in line at the movies (primarily based on a social norm of queuing, and very little on your enjoyment of lines).

Similarly, self-efficacy is a potential predictor of intention and behavior, but the failure of self-efficacy to predict one or the other, or both, may reflect a lack of relevance with regard to the particular behavior under consideration. Most of our respondents had fairly high self-efficacy; that is, they were fairly confident that they would not use marijuana if they chose to abstain. Self-efficacy affected their intentions, but did not affect their behavior directly. It is possible that this finding is an artifact of measurement, since the assessment of efficacy was not in accordance with the compatibility principle of the TPB (Ajzen, 1988). We focused on efficacy to not use marijuana, within a model predicting marijuana use. Sayeed, Fishbein, Hornik, Cappella, & Ahern (2005) similarly found results unresponsive of the model using abstinence self-efficacy and marijuana use intentions among an adolescent sample. Our results might also have been influenced by our sample: the community sample

of young mothers represented a wide range of substance use, with the majority reporting no or low levels of nonproblematic use of marijuana. For the most part, their substance use was volitional. In another sample, such as a sample of people who felt they were addicted to marijuana, one might find a direct path to behavior, reflecting the effects of a non-intentional compulsion to use.

The major goal of the study was to test the “sufficiency hypothesis;” that the factors not specified by the TPB exert their influence on marijuana use only indirectly through their effects on attitude, norm, or self-efficacy. We examined the effects of four variables that have been demonstrated to have associations with marijuana use in previous research, as well as in this study. All of the effects of these predictors were mediated by model variables, as specified by the TPB; the model with only these paths provided a good fit, and there were no indications that the addition of direct paths would improve the model. In this, the present study differs from some other recent tests of this sufficiency assumption. Two recent studies of substance use did find evidence for direct effects of distal variables in predicting marijuana and other substance use. As noted earlier, McMillan & Conner (2003) found that substance use in the social network was a significant predictor of intention to use substances, after accounting for variance predicted by TPB variables, and Yzer et al. (2004) found that their measure of overall risk significantly increased the percentage of variance accounted for in marijuana use.

Taken together with the findings reported here, this suggests that the TPB is “sufficient” in some, but not all cases. The next step in development of this influential model should be to begin to explicate the behaviors and situations for which the effects of distal variables have direct effects and the ones in which they do not. A possible moderator is the extent to which the behavior is limited or facilitated by the behavior of others. The TRA was designed as a model of individual, volitional behavior. The TPB model, with the addition of self-efficacy, is somewhat less individual, insofar as one’s perceptions of self-efficacy may include understanding of real limitations on one’s choices. Nonetheless, when we apply these theories to behaviors that are primarily social, we violate a basic premise of the models. (Indeed, this is part of what prompted Fishbein (2000) to propose an integrated model that includes skills and environmental constraints to the TPB.) Thus, in studies of marijuana use, we find small or, in the study reported here, no direct effects of distal variables; marijuana use or non-use is essentially an individual behavior. In contrast, in prediction of sexual interactions, where one’s own preferences are only one component of the ultimate decision about the behavior, we find larger effects of distal predictors. Further research on extended models to the range of decisions to which the TRA and TPB have been applied – e.g., consumer choices, eating and exercising, blood donation, contraceptive use – would shed light on this hypothesis.

Routes of influence among distal predictors

Each of the distal predictors was associated with attitude toward marijuana use. Young women who had used marijuana in adolescence, and whose friends had used marijuana, had more positive attitudes toward using. Marginally ($p = .06$), those who experienced more environmental adversity also had more positive attitudes.

Contrary to our expectations, the path from emotional distress to attitude was significant and negative. This is inconsistent with a hypothesis of marijuana use as self-medication, and with other research that has found positive or no relationship between emotional distress and marijuana use (Chen & Kandel, 1998; Repetto, Zimmerman, & Caldwell, 2008). It is quite possible that this result is an artifact and represents a suppression effect (MacKinnon, Krull, & Lockwood, 2000). Supporting this interpretation is the positive sign of the bivariate correlation between emotional distress and attitude ($r = .117$, ns, Table 2) and the small

positive correlations among the indicators that form these two latent constructs, which range from .03 to .16 (Appendix A). Alternatively, it could be that individuals who are suffering from emotional distress are unable to make positive evaluations. The model does not suggest that emotional distress will be related to marijuana use, but that it will be related to favorable (or unfavorable) attitudes regarding use. This finding may also be due to the inclusion of environmental adversity in the model. Like Aneshensel and Sucoff (1996), we found a strong relationship between environmental adversity and emotional distress. Insofar as environmental adversity is the more relevant predictor, and emotional distress has served as a proxy for environmental adversity in some studies, the relationship of distress to marijuana use found in other studies may be spurious, not causal. Social norm was not a significant predictor of intention in the structural model. For these young women, intention to use marijuana was predicated primarily on their attitudes and self-efficacy. As discussed above, this finding does not represent a disconfirmation of the TPB model, but tells us that this behavior, in this instance, is not primarily under normative control.

Limitations

As with all research, there are limitations to the study that bear mentioning. The study sample is a unique population, young urban US women who became premaritally pregnant before age 18. Applying the model to marijuana use among other populations could yield different findings, and these results should not be over-generalized.

The measurement of complex distal variables is difficult, and ours are not ideal. In particular, the effects of environment are complex and hard to disentangle, and measurement of neighborhood variables is in its infancy and evolving. Our construct of persistent environmental adversity contains aspects of both family and neighborhood disadvantage; ideally, one would like to separate these effects. The measure of community violence included personally experienced violence, as well as violence among close relationships and within the community. In one study that compared effects of neighborhood and family disadvantage on early sexual behavior (Wells et al., 2007), only family effects were significant, demonstrating that different levels of environment may influence behavior differently.

We were not able to construct a latent measure of intention, a key variable in these analyses, and our measure is one that some might characterize as a behavioral expectation, rather than as an intention. We would point out, however, that Ajzen and Fishbein (1980) suggest that a range of ways of asking intention are acceptable. Also, in other TRA and TPB research conducted by this team we have found measurement of intention to be robust across differences in wording; that is, items whose stems begin "I intend..." and "How likely is it..." are highly correlated (cf., Beadnell et al., 2007).

Overall, the findings of this study support the sufficiency of the TPB to explain the roles of distal predictors of substance use behavior. This is particularly noteworthy in that the distal predictors used here are based on data drawn from a wide range of prior time points, including some representing. Future research should continue to integrate the social cognitive factors of the TPB with distal, sociological factors known to be associated with the behaviors studied, to understand the ways in which cognitions mediate the effects of history and environment in the prediction of human behavior.

Acknowledgments

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Appendix A

Intercorrelations among measured variables

Construct	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
Environ'l adversity	1 Neigh'd violence													
	2 Frequent moves	.35												
Adolescent use	3 Pre-pregnancy use	.13	.24											
	4 Maximum use	.08	.15	.48										
Emotional distress	5 Depression	.34	.25	.24	.18									
	6 Anxiety	.34	.31	.21	.12	.74								
	7 Hostility	.22	.28	.26	.18	.64	.62							
Network use	8 Boyfriend use	.10	.12	.29	.20	.19	.21	.25						
	9 Nmbr. friends using	.05	.03	.13	.14	.11	-.02	.08	.44					
Attitude	10 Using is good	.09	.12	.26	.17	.10	.03	.11	.26	.24				
	11 Using is helpful	.08	.08	.27	.17	.10	.04	.16	.35	.33	.70			
	12 Using is pleasant	.22	.13	.28	.16	.06	.06	.12	.33	.27	.58	.58		
Social norm	13 Important people	.11	.13	.12	.08	.03	.04	.15	.34	.26	.50	.49	.48	
	14 Parents	.09	.16	.15	.08	.04	-.01	.14	.29	.19	.46	.47	.46	.76
Self-efficacy	15 Could abstain	-.15	-.14	-.23	-.15	-.04	-.10	-.10	-.21	-.22	-.38	-.30	-.47	-.33
	16 Could stop	-.04	-.17	-.18	-.27	-.07	-.14	-.05	-.35	-.59	-.37	-.37	-.58	-.29
Intention	17 Likely to use	.16	.09	.29	.18	.05	.06	.10	.27	.29	.62	.52	.65	.55
Behavior	18 Freq. past 6 months	.27	.14	.38	.22	.04	.01	.17	.31	.25	.54	.52	.63	.45
	19 Freq. past month	.21	.12	.42	.21	-.03	-.03	.15	.34	.26	.56	.54	.63	.46

Coefficients are statistically significant if greater than .13 ($p < .05$).

n = 238

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Figure 1.
The Theory of Planned Behavior indicating the hypothesized role of external variables

pregnancy to 9¹/₂ years post-partum10¹/₂ years post-partum11¹/₂ years post-partum **Figure 2.**

Standardized coefficients for structural model predicting marijuana use from distal and TPB variables

* $p < .05$; # $p = .06$

non-significant paths from distal variables not shown in figure:

Adolescent Use to Social Norm = $-.046$ and to Self-efficacy = $-.155$

Emotional Distress to Social Norm = $-.149$ and to Self-efficacy = $+.244$

Environmental Adversity to Self-efficacy = $-.303$

Bivariate correlations among latent variables are shown in Table 2

Table 1

Means, standard deviations, and factor loadings of latent and measured variables

Latent variable/indicator	Measurement time points*	Mean	SD	Standardized Factor Loading	t-Statistic**
Persistent environmental adversity					
Mean community violence	5 to 9½ years pp	.06	.09	.609	9.32
Frequent moves	½ to 9½ years pp	2.76	1.99	.579	8.13
Emotional distress					
Depression	9½ years pp	.65	.74	.833	19.94
Anxiety	9½ years pp	.58	.68	.807	15.94
Hostility	9½ years pp	.69	.78	.793	16.30
Adolescent marijuana use					
Lifetime use reported at pregnancy	pregnancy	2.90	1.21	.864	7.37
Greatest frequency prior to age 18	birth to age 18	1.76	1.28	.552	5.29
Drug use in the social network					
Number of friends using in the past month	9½ years pp	.43	.85	.605	8.47
Boyfriend/partner use in past 6 months	9½ years pp	.65	1.57	.722	8.15
Attitude toward marijuana use					
Good/bad	10½ years pp	1.71	1.02	.768	20.94
Pleasant/unpleasant	10½ years pp	2.08	1.28	.844	20.07
Helpful/harmful	10½ years pp	1.81	.91	.764	20.13
Perceived social norm					
Parents	10½ years pp	1.51	.81	.791	18.82
People important to respondent	10½ years pp	1.58	.91	.960	23.28
Marijuana use self-efficacy					
Abstinence efficacy	10½ years pp	3.73	.68	.731	13.57
Perceived control over use	10½ years pp	4.50	1.00	.846	12.50
Marijuana use					
Frequency in past 6 months	11½ years pp	.87	1.84	.987	72.28
Frequency in past month	11½ years pp	1.62	1.37	.997	72.28
Measured variable					

	Measurement time points [*]	Mean	SD	Standardized Factor Loading	t-Statistic ^{**}
Intention to use marijuana in the next 6 months	10½ years pp	.69	1.26		

*
pp = post-partum
**
all *ps* < .01

Table 2

Intercorrelations among latent factors.

	1	2	3	4	5	6	7
1. Environmental adversity							
2. Emotional distress	.594**						
3. Adolescent use	.363**	.343**					
4. Drug use in network	.185	.251*	.371**				
5. Attitude	.280**	.117	.427**	.540**			
6. Social norm	.233*	.103	.171	.471**	.726**		
7. Self-efficacy	-.305*	-.112	-.364**	-.546**	-.643**	-.392**	
8. Marijuana Use	.253**	.100	.364**	.469**	.740**	.463**	-.710**

Notes:

*
 $p < .05$ **
 $p < .01$,
one-tailed

n = 238