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Individuality and Contextual Influences in Drug Dependence: A 15 year Prospective Longitudinal Study of Adolescents from Harlem

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Abstract

Objective—This 15 year longitudinal study investigated individual and contextual factors which predispose adolescents from a disadvantaged urban area to drug dependence in adulthood.

Methods—Adolescents were recruited from schools serving East Harlem in New York City. Of the 838 participants followed to adulthood, 59% were female, 55% African American and 45% Puerto Rican. Self-report data were obtained on externalizing and internalizing problems, substance use, and contextual influences across adolescence and young adulthood. Drug dependence was assessed in adulthood. Multivariate logistic regressions of drug dependence were performed on the whole sample and separately by gender.

Results—Each of the domains was associated with adult drug dependence. Although mean gender differences were found, most associations of risk factors with drug dependence did not vary significantly by gender.

Conclusions—Treating externalizing and internalizing problems, reducing substance use, and providing coping skills for adverse contextual influences in adolescence and young adulthood may reduce the likelihood of becoming drug dependent in adulthood.

Keywords

risk; drug abuse & exposure; disparities; longitudinal research

Introduction

Research on the psychosocial factors which predispose individuals to develop drug dependence is a vital component of drug abuse prevention efforts (Glantz & Colliver, 2002). We focus this study on individual and contextual risk factors with theoretical links to drug dependence including externalizing problems, internalizing problems, substance use, and elements of a disadvantaged urban environment.

The present study makes three contributions to the literature. First, as the study followed respondents longitudinally over more than twenty years from adolescence through the thirties, we can predict later drug dependence from individual risk factors across adolescence, late adolescence, and young adulthood. Second, because our sample is drawn from a socioeconomically disadvantaged neighborhood within New York City (Infoshare Online/Community Studies of New York, Inc., n.d.), we are well-positioned to examine the relative contributions and interrelationships of individual and contextual influences on drug dependence. Third, as the sample consists of a minority population of African Americans and Puerto Ricans that has been underrepresented in longitudinal research, we are able to consider racial/ethnic differences in the risk relationships, in addition to gender and age differences.

Externalizing behavior is a factor-analyzed construct created from responses to Achenbach's Child Behavior Checklist (Achenbach, 1991). The construct is characterized by actions in the external world such as delinquent and aggressive behavior and has been related to such adverse outcomes as financial difficulties (Colman et al., 2009), increased likelihood of heavy drinking (Englund, Egeland, Oliva, & Collins, 2008), and early mortality in adolescence and adulthood (Jokela, Ferrie, Kivimäki, 2009). Jessor's Problem Behavior Theory (Jessor, Donovan, & Costa, 1991) has frequently been cited to explain the association of externalizing problems with later substance dependence. The theory suggests that risk behaviors such as delinquency and substance use share contextual and personality risk factors. A number of researchers have related conduct problems in childhood and adolescence to illicit drug abuse and dependence in late adolescence and young adulthood (Flory, Milich, Lynam, Leukefeld, & Clayton, 2003; Fergusson, Horwood, & Ridder, 2007).

Internalizing is also a factor-analyzed construct from Achenbach's Child Behavior Checklist (Achenbach, 1991) extracted from three sub-scales: Withdrawal, Somatic Complaints, and Anxiety/Depression. In this paper we will focus on one of the three components, Anxiety/Depression. Internalizing problems have been linked to adverse outcomes such as alcohol dependence (Crum et al., 2008) and mental disorders (Colman, Wadsworth, Croudace, & Jones, 2007). The Self-Medication Hypothesis (Khantzian & Albanese, 2008) suggests that substance use is related to internalizing problems in that substance use serves to relieve or make a pre-existing "subjective state of distress" (such as anxiety or depressive mood) more tolerable. Several investigators (Woodward & Fergusson, 2001; Wittchen et al., 2007) found that anxiety and mood disorders in adolescence were related to illicit drug abuse and dependence from late adolescence through adulthood (but see Hayatbakhsh et al., 2008).

We also examine the role of substance use as a risk factor for later illicit drug dependence. Perkonig et al. (2008) reported that the concurrent use of multiple illegal substances in adolescence increases the likelihood of cannabis dependence in adulthood four-fold. Likewise, Palmer et al. (2009) found that earlier cigarette smoking predicted later cannabis use/dependence, and Grant et al. (2006) found that earlier regular drinking predicted later illicit drug dependence.

Research on contextual influences on individual well-being have found that residential location is a factor in the development of drug dependence (Swendsen et al., 2009). Residence in socioeconomically disadvantaged neighborhoods may influence psychological functioning and drug use through a number of mechanisms: an increase in a physiologic stress response (Boardman, Finch, Ellison, Williams, & Jackson, 2001), more opportunities to obtain drugs (Crum, Lillie-Blanton, & Anthony, 1996), and peer drug use (Oetting & Beauvais, 1986). Violent experiences (Lo, Kim, & Church, 2008), access to drugs (Von Sydow, Lieb, Pfister, Höfler, & Wittchen, 2002), and peer drug use (Scherrer et al., 2008) have each been related to drug use and/or dependence.

The present study is distinctive in that the risk factors for adult drug dependence will be addressed across a number of important developmental periods from early adolescence to young adulthood. By assessing an aggregate score for each of these risk factors across adolescence and young adulthood in this study, we expect to generate a broader picture of early influences on adult drug dependence than the assessment of a risk factor at one point in time can provide. Our own prior research (XXXX, 2007) on the relationship of trajectories of cigarette smoking to later illicit drug dependence documents the clinical significance of assessing substance use through young adulthood, as a reduction in frequency of cigarette smoking in this period has the potential to reduce the risk of illicit drug dependence to the level of non-smokers.

The present sample was selected from schools in the East Harlem neighborhood of New York City, a socioeconomically disadvantaged area in which, at the time of recruitment in 1990, 48% of all residents over 25 years of age had not graduated from high school and 38% earned an income that was below the poverty level (Infoshare Online/Community Studies of New York, Inc., n.d.). This neighborhood is well-suited for an investigation of the relationship of contextual risk factors to drug dependence.

The sample is also, due to its ethnic/racial composition and the participation of both males and females, well-designed for an investigation of demographic differences associated with the proposed risk relationships. Research that specifically compares Puerto Rican and African American participants on individual and contextual risk variables is limited. However, research groups have reported that Hispanic adolescents score higher than African American adolescents on internalizing problems (Anderson & Mayes, 2010; McLaughlin, Hilt, & Nolen-Hoeksema, 2007). With regard to gender, externalizing problems (Card, Stucky, Sawalani, & Little, 2008) and substance use problems (Johnston, O'Malley, Bachman, & Schulenberg, 2009), as well as violent experiences (Taylor, Esbensen, Peterson, & Freng, 2007), are more common among males than females in adolescence and young adulthood. Internalizing problems, on the other hand, have been reported more frequently by females (Mendelson, Kubzansky, Datta, & Buka, 2008). Few studies have examined gender differences in the relationships of risk factors to drug dependence, with mixed results. Wu et al. (Wu et al., 2010) found that anxiety had a stronger relationship to substance use for females than for males. Ho, Kingree, & Thompson (2007) found that the relationship of delinquency to marijuana use did not vary by gender.

Building on prior research, we hypothesize the following: 1) Externalizing and internalizing problems, substance use, and contextual variables in adolescence and young adulthood will each be related to drug dependence in adulthood. 2) Mean scores for each of the risk variables will differ by both race/ethnicity and gender; however the relationships of the risk variables to drug dependence will not vary according to these demographic variables.

Methods

Participants

The current analyses use data from The XXXX Study, a long-term follow-up of a large sample of African American and Puerto Rican adolescents who were enrolled in 7th to 10th grade at 11 representative schools in the East Harlem neighborhood of New York City in 1990. The XXXX Study spans 20 years and includes the distinct developmental periods of early/middle adolescence, late adolescence, young adulthood and early adulthood.

The four waves of data used in these analyses are referred to as Time 1, Time 2, Time 3, and Time 4 (T1, T2, T3, T4). Data collection at each of these waves took place in 1990 (T1: mean age 14.1 years, standard deviation (S.D.) 1.3 years), from 1994 – 1996 (T2: mean age 19.2 years, S.D. 1.5 years), from 2000 – 2001 (T3: mean age 24.5 years, S.D. 1.4 years), and from 2004 – 2006 (T4: mean age 29.2 years, S.D. 1.7 years).

Self-report questionnaires were administered in schools at T1, and a combination of in person and phone interviews and mailed questionnaires were used at later waves. The effects of the interview mode ($F=2.45$, $p=0.09$), two interactions between the interview mode and gender ($F=0.84$, $p=0.43$), another two interactions between the interview mode and race/ethnicity ($F=2.16$, $p=0.12$), and three interactions among the interview mode, gender, and race/ethnicity ($F=1.16$, $p=0.33$) were not significantly associated with drug dependence.

The Institutional Review Boards of the Mount Sinai School of Medicine and New York University School of Medicine approved the study's procedures for data collections. When data were collected from minors, the parents were sent study information and asked to respond within a set period of time if they objected to their children's participation, and the minors provided written informed assent in their classrooms. For participants 18 and older, informed consent was obtained. A Certificate of Confidentiality was obtained from the National Institute on Drug Abuse.

Follow-up sampling procedures at the third wave of data collection were altered to ensure that, despite a budget influenced reduction in sample size, participants with a history of problem behavior were retained. However, an effort was made at T4 to find those respondents who were not seen at T3. Chi-square and *t* tests used to compare the 838 adults with data at Time 1 (T1) and (T4) with the 495 who participated at T1 but not at T4 demonstrated no significant differences on T1 rebellion ($t=0.7$), T1 delinquency, ($t=0.1$), T1 depressive mood ($t=1.0$), and T1 smoking ($t=0.48$). Anxiety was not assessed at T1. The percentage of males at T1 was 56%, which was significantly higher than the percentage of males at T4, 41% ($\chi^2 = 30.1$, $p < .01$, $df=1$).

The present analyses use data from the 838 participants seen at T4 (59% female; 55% African American, 45% Puerto Rican). Of the T4 participants, 71 percent provided data at all four time points, and the remaining 29 percent provided data at three of the four time points.

Psychosocial Measures

The independent variables used in this study are presented in Table 1. They are grouped into demographic variables and the domains of externalizing behavior, internalizing behavior, substance use, and contextual risk factors. The measures have adequate reliabilities (Cronbach alpha values). Regarding predictive validity, the measures have been found to predict substance use or dependence and psychopathology (XXXX, 1990; XXXX, 1996). For each scale in the psychosocial domains, we summed the scores across each of the time periods listed in Table 1. The independent psychosocial variables in the logistic regression analyses were the standardized values of the sums. Assessing the psychosocial responses over time provides more reliable independent measures. In addition, we also examined the orthogonal linear and quadratic contrasts for each scale as supplementary independent variables.

As defined in the DSM-IV-TR (American Psychiatric Association, 2000), drug dependence, the dependent variable at T4, included marijuana dependence and other illegal drug dependence (Kessler & Ustun, 2004). A respondent was coded as dependent on marijuana or another illegal drug if he/she scored at least "1" on a scale from 0–3 on three or more of the following seven questions. In the past 5 years: 1. Did you ever find that you had to use more of this substance than usual to get the same effect or that the same amount had less effect on you than before? 2. Did you have withdrawal symptoms (e.g. shakes) or did you use alcohol or sedatives to avoid withdrawal symptoms? 3. Did you use much larger amounts of this substance than you intended to when you began, or did you use it for a longer period than you intended to? 4. Did you have unsuccessful attempts or a persistent desire to cut down or control drug use over a period of time? 5. Did you have a period of a month or more when you spent a great deal of time using this substance or getting over its effects? 6. Did you give up activities because of your use of this substance? 7. Did you have any emotional or psychological problems from using this substance-such as feeling uninterested in things, feeling depressed, or suspicious or did you have any legal problems because of your use of this substance? The percentage of drug dependence at T4 was 20% ($n=167$ of 838).

Analytic plan

Logistic regression analyses were conducted to examine whether T4 drug dependence can be predicted by assessing externalizing and internalizing behaviors, substance use, and contextual risk factors. We transformed each logistic regression coefficient $\hat{\beta}$ to an odds ratio, $e^{\hat{\beta}}$ (Agresti, 1996). We used the Statistical Analysis System (SAS; SAS Institute Inc., 2008) to perform all analyses. The SAS software has the capability of imputing missing data (called "PROC MI"). We used an option in this software called "Full Information Maximum Likelihood" (FIML). This approach specifies values of missing data that maximize the likelihood function of the independent variables (Schafer & Graham, 2002).

We report the means of externalizing and internalizing behaviors, substance use, and contextual risk factors separately for African American and Hispanic respondents, and separately for males and females. In Table 2, we calculated the t-values for racial/ethnic and gender differences in the measures.

Each entry in Table 3 is the odds ratio (OR) for externalizing and internalizing behaviors, substance use, and contextual risk factors in a logistic regression. The dependent variable was drug dependence at T4. The first three columns report the ORs from bivariate logistic regression analyses for females, males, and the combined sample. The last three columns report the ORs from multivariate logistic regression analyses for females, males, and the combined sample, controlling for the other variables in the domain. Race/ethnicity and age at T2 were controlled in each of the regressions. Male and female ORs were compared using the z-test given in Clogg, Petkova, & Haritou (1995). In addition, we tested the adequacy of the sum as a representation of the independent scale variable ($S_1+S_2+S_3$). We tested whether the linear contrast variable (S_3-S_1) and the quadratic contrast variable ($2S_2-S_1-S_3$) made a significant addition to the explanation of drug dependence using the likelihood ratio test.

Results

There were significant associations of T4 drug dependence with gender [OR=2.95, 95% CI=(2.08, 4.18), $p<.001$] and age at T2 [OR=0.83 (0.74, 0.94), $p<.01$]. Males were more likely to be drug dependent, with a prevalence of 12.3% for males vs. 7.6% for females. Younger respondents were also more likely to be drug dependent. There was no significant association between race/ethnicity and T4 drug dependence [OR=1.14 (0.81, 1.60), $p=0.46$].

Table 2 presents the mean differences on each of the risk variables for race/ethnicity and gender. There were significant mean differences between African Americans and Puerto Ricans on 3 of the 14 variables. According to the *t*-test, Puerto Ricans scored higher than African Americans on depression and peer illegal drug use, and African Americans scored higher on education. There were significant mean differences between males and females for each of the variables. Males scored higher than females on measures of risk taking, rebellion, theft and vandalism, aggression, smoking, alcohol use, marijuana use, violence towards subject, drug offering, and peer illegal drug use. Males reported lower educational status. Females reported more symptoms of depression and anxiety.

Table 3 presents the results of the bivariate logistic and multivariate logistic regression analyses. We discuss the results of logistic regression analyses for the combined sample here since the ORs in logistic regression analyses for the females were similar to logistic regression analyses for the males.

For the combined sample in the bivariate logistic analyses, each OR is significant at the 0.01 level. Specifically, risk taking, rebellion, theft and vandalism, aggression, depression, anxiety, smoking, alcohol use, marijuana use, violence towards subject, drug offering, peer

illegal drug use, and reduced education were associated with an increased risk for being drug dependent at T4.

For the combined sample in the multivariate logistic analyses, risk taking [OR=1.61 (1.24, 2.09), $p<.001$], theft and vandalism [OR=1.85 (1.36, 2.53), $p<.001$], depression [OR=1.25 (1.04, 1.51), $p<.05$], anxiety [OR=1.42 (1.19, 1.70), $p<.001$], smoking [OR=1.25 (1.01, 1.56), $p<.05$], alcohol use [OR=1.28 (1.03, 1.59), $p<.05$], marijuana use [OR=2.61 (2.11, 3.21), $p<.001$], violence towards subject [OR=1.35 (1.10, 1.65), $p<.01$], drug offering [OR=1.75 (1.41, 2.18), $p<.001$], and peer illegal drug use [OR=1.32 (1.03, 1.70), $p<.05$] were associated with an increased risk for being drug dependent at T4. From the coefficients of the linear contrasts, an increase in risk taking, theft and vandalism, and peer illegal drug use significantly increased the probability of drug dependence ($p<0.01$). The quadratic contrast did not improve the fit for any scale at the 0.01 level of significance.

The analyses represented in Table 3 were also run with drug use disorder, a combination of drug abuse and drug dependence, as the dependent variable (data not shown). The findings were not appreciably different from those shown in Table 3.

Discussion

Our findings contribute to the literature in three important ways. First, due to the longitudinal nature of the study, we were able to predict from risk factors measured across several developmental stages to drug dependence in adulthood. Second, we assess risk factors for drug dependence among a disadvantaged urban sample. Third, we explored ethnic/racial and gender differences in the prevalence of risk factors and in the relationships of the risk factors to drug dependence.

Our findings generally supported our hypotheses. First, our results indicate that adolescent and young adult risk factors in the externalizing, internalizing, substance use, and contextual domains are associated with adult drug dependence. Second, there were ethnic/racial and gender differences in prevalence of risk factors. Finally, there was no relationship between race/ethnicity and drug dependence at T4 and, with the exception of smoking and peer illegal drug use, the relationships of risk factors to later drug dependence were similar across genders.

The four components of externalizing problems included risk taking, rebellion, theft and vandalism, and aggression. Results indicated that individuals who report externalizing problems in adolescence and young adulthood, particularly risk taking and theft & vandalism, are more likely to develop drug dependence. These findings are consistent with Problem Behavior Theory (Jessor et al., 1991), and with prior research (Flory et al., 2003; Fergusson, et al., 2007). The results demonstrate that some individuals who engage in externalizing behavior in adolescence continue to engage in drug dependent externalizing behavior in adulthood. The path taken by these individuals has been termed Life-Course-Persistent Antisocial Behavior (Moffitt, 1993).

In terms of internalizing problems, the results indicated that both males and females who are depressed and anxious are more likely to develop drug dependence. As described in the Introduction, the Self-Medication Hypothesis (Khantzian & Albanese, 2008) may account for this relationship. Another internal mechanism for the relationship between depression and drug dependence is that the physical effects of depression such as exhaustion may make people susceptible to substance use. Additional external mechanisms may be at work whereby the negative social consequences of depressive and anxiety symptoms may predict substance use. These consequences may include difficulty in keeping a job and increasing family conflicts.

We found that the use of each tobacco, alcohol, and marijuana in young adulthood is related to drug dependence in adulthood. Of the substances, the use of marijuana was most strongly related to drug dependence in adulthood.

Results here suggest that smoking may be a slightly stronger predictor of drug dependence among males than among females. Research suggests that young adults reduce their use of substances as they assume more adult responsibilities, and that women, in particular, are likely to quit smoking as they take on responsibilities such as motherhood (Bachman et al., 2002). For example, a mother, on the advice of a pediatrician, may reduce her smoking. As such, according to Bachman et al., smoking among adolescent and young adult females may not be as stable going into adulthood as it is among males, so that the effects of early smoking behaviors on drug dependence may be weaker among females.

With regard to contextual influences, violence towards subject, drug offering and peer drug use significantly predicted drug dependence in adulthood. Early violent experiences were found to increase the likelihood of drug dependence in adulthood. Those who are victims of violence in adolescence and young adulthood may use drugs as a way of coping with the negative emotional response or “emotional dysregulation” induced by their experiences (Ouimette, Read, Wade, & Tirone, 2010).

Drug offering, an assessment of the availability and approval of drug use by those within the individual’s family, peer group, and environment, was also related to drug dependence. This variable may be strongly related to drug dependence because it is an active encouragement of use that goes beyond serving as a model for drug use. Furthermore, the variable is inclusive in that it incorporates the influence of a number of individuals from within the participant’s social sphere. Primary Socialization Theory (Oetting & Donnermeyer, 1998) suggests that peers, family, and teachers are “primary socialization sources” that can have an influence on normative and deviant behaviors such as drug use.

Gender differences were also present in the relationship of peer drug use to drug dependence; this relationship was somewhat stronger for females. This may be due to a difference in the susceptibility of adolescent and young adult females to peer influence (Maccoby, 1990; Dick et al., 2007). Maccoby suggested that this heightened susceptibility of females to the influence of same-sex peers may be due to the “enabling or facilitative” nature of female relationships. That is, in female relationships, women achieve their own goals, in part, by acquiescing to some of the other woman’s ideas.

Demographic variables also had significant associations with drug dependence in adulthood. Older adults are less likely to have a diagnosis of drug dependence than younger adults. These findings are not surprising as older adults as compared with younger adults are more likely to have a conventional life style, perhaps as a result of marriage, parenthood, and stable employment (Bachman et al., 2002). Male adults are more likely to have a diagnosis of drug dependence than female adults, which is consistent with the work of Stinson, Ruan, Pickering, & Grant (2006).

Though we found few gender differences in the relationships of the risk factors to drug dependence, the gender differences that we found in the prevalence of these risk factors were consistent with prior research (Card et al., 2008; Johnston et al., 2009; Taylor et al., 2007; Mendelson et al., 2008). There were racial/ethnic differences in the prevalence of three risk factors. The higher prevalence of depression among Puerto Rican participants is consistent with earlier research (Anderson & Mayes, 2010; McLaughlin et al., 2007). Puerto Ricans also reported more friends who used illegal drugs and lower educational attainment. The first finding may be reflective of the higher prevalence of illegal drug use among Hispanic adolescents (Johnston, O’Malley, Bachman, & Schulenberg, 2010), as individuals

often befriend those of a similar ethnic background (Graham, Taylor, & Ho, 2009), and substance using individuals frequently seek peers who engage in similar behaviors (Go, Green, Kennedy, Pollard, & Tucker, 2010). Lower educational attainment among Puerto Rican respondents is somewhat surprising given that all of the respondents were drawn from the same pool of schools. Nevertheless, this finding is consistent with national drop-out rates (Laird, Cataldi, KewalRamani, & Chapman, 2008).

Limitations

Our data are based on self-reports rather than medical records or police reports. However, wherever possible for each variable, we combined measures from multiple points in time. This enhanced the reliability and validity of our measures. Also, studies have shown that self-report data yields reliable results (Mennes, Abdallah, & Cottler, 2009). Another limitation is that we did not control for family relationships, cultural, or genetic factors that may serve as mediators in the relationships of externalizing and internalizing problems, substance use, and contextual factors with drug dependence. Additionally, variation in contextual risk factors may have occurred from T1 to T4 in the form of the respondents' relocation to another neighborhood, involvement in a new peer group, or decreased access to drugs due to increased law enforcement in their neighborhood. Although we did combine assessments of contextual risk factors over three waves whenever possible in recognition of the likelihood of variation over time, future research might benefit from examining trajectories of contextual risk factors as they relate to drug dependence.

The results have implications for preventive and treatment interventions. The current investigation provides significant information regarding the risk factors over time that predict drug dependence, a major challenge for the field of developmental psychopathology. From a clinical perspective, treating externalizing and internalizing problems, reducing substance use, and providing adaptive coping mechanisms for dealing with contextual risk factors in adolescence and young adulthood may serve to reduce the likelihood of becoming drug dependent in adulthood. There is some evidence that characteristics of externalizing, internalizing, substance use, and vulnerability to the modeling of peer drug use can be altered through family or school based interventions (Thomas & Perera, 2006; Thomas, Baker, & Lorenzetti, 2007; Griffin, Botvin, Nichols, & Doyle, 2003). As we noted in our earlier work (XXXX, 2006), the modality of interventions needs to be developmentally appropriate. While family interventions are effective in early adolescence, for example, in later adolescence, adolescent group therapy might be more appropriate.

Few significant gender differences were identified in the relationships of specific risk factors to drug dependence. However, gender differences in the prevalence of these risk factors which were found suggest different priorities for interventions with male and female adolescents and young adults; namely a focus on externalizing, substance use, and contextual risk factors for males and on internalizing problems for females. Likewise, interventions with Puerto Rican adolescents and young adults might focus more on internalizing problems and contextual risk factors which are more prevalent for this group. Furthermore, as Compton and colleagues (Compton, Grant, Colliver, Glantz, & Stinson, 2004) pointed out, intervention programs should always take care to tailor their approach to specific populations.

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Table 1**Independent Measures: Sources and Cronbach Alphas**

Domain/Scale (no. of items)	Time	Cronbach alphas	Source	Sample item
Demographic				
Gender	1	-	NA	1 for females; 2 for males
Age	2	-	NA	Age at time 2
Race/Ethnicity	1	-	NA	Are you Hispanic?, 1 for AA; 2 for PR
Externalizing behaviors				
Risk taking (19)	1,2,3	.78	Jackson, 1997	Do you like wild parties where anything goes?
Rebellion (9)	1,2,3	.70	Smith & Fogg, 1979	Do you enjoy doing things you should not, just for the fun of it?
Theft & vandalism (24)	1,2,3	.84	Huizinga <i>et al.</i> , 1989 (adapted)	During the last 5 years, how often have you broken into a house or building you were not supposed to be in?
Aggression (9)	1,2,3	.74	Huizinga <i>et al.</i> , 1989 (adapted)	During the last 5 years, how often have you gotten into a serious fight?
Internalizing behaviors				
Depression (12)	1,2,3	.80	Derogatis, 1994	Do you sometimes feel unhappy, sad, or depressed?
Anxiety (3)	4	.78	Derogatis, 1994	Over the last few years, how much were you bothered by feeling fearful?
Substance use				
Smoking (1)	3	-	NA	How many cigarettes do you smoke?
Alcohol (1)	3	-	NA	How many drinks/day have you had in the past 30 days?
Marijuana (1)	3	-	NA	How often have you used marijuana in the past year?
Contextual risk factors				
Violence towards subject (10)	2,3	.79	Chavez, Oetting, & Swaim, 1989	How often has someone held a weapon (gun, club, or knife) to you?
Drug offering (13)	1,2,3	.65	Original	How often have your best friends offered you marijuana or any other illegal drug?
Peer illegal drug use (6)	1,2,3	.60	Original	How many friends have ever used marijuana or other illegal drugs?
Education (1)	3	-	NA	What year of school are you in? If not in school, what was last grade completed?

Note. NA means not applicable.

Table 2

Mean Differences in Race/Ethnicity and Gender

Measures at T1-T3	Mean (Standard Deviation)				
	AA	PR	Female	Male	t value
Externalizing behaviors					
Risk taking	-0.04 (1.03)	0.06 (0.96)	-1.51	-0.24 (0.92)	0.35 (1.02) -8.49 ***
Rebellion	0.007 (0.98)	-0.008 (1.03)	0.22	-0.09 (0.99)	0.13 (1.00) -3.17 **
Theft & vandalism	-0.05 (0.94)	0.05 (1.06)	-1.18	-0.30 (0.68)	0.33 (1.18) -7.88 ***
Aggression	-0.04 (0.93)	0.04 (1.07)	-0.94	-0.32 (0.74)	0.35 (1.13) -8.50 ***
Internalizing behaviors					
Depression	-0.12 (0.97)	0.14 (1.02)	-3.80 ***	0.12 (1.00)	-0.17 (0.98) 4.08 ***
Anxiety T4	-0.05 (0.97)	0.06 (1.03)	-1.50	0.07 (0.99)	-0.10 (1.00) 2.38 *
Substance use					
Smoking T3	-0.05 (0.96)	0.06 (1.04)	-1.34	-0.09 (0.95)	0.10 (1.05) -2.26 *
Alcohol T3	0.08 (1.04)	-0.08 (0.96)	1.94	-0.14 (0.78)	0.15 (1.18) -3.52 ***
Marijuana T3	0.04 (1.02)	-0.04 (0.97)	1.06	-0.17 (0.89)	0.19 (1.08) -4.29 ***
Contextual risk factors					
Violence towards subject T2, T3	-0.04 (0.99)	0.05 (1.02)	-1.39	-0.33 (0.66)	0.48 (1.20) -11.42 ***
Drug offering	-0.04 (0.99)	0.05 (1.01)	-1.28	-0.15 (0.97)	0.22 (1.00) -5.28 ***
Peer illegal drug use	-0.13 (0.92)	0.013 (1.07)	-3.15 **	-0.14 (1.00)	0.16 (0.97) -3.69 ***
Education T3	0.15 (0.98)	-0.16 (1.00)	3.76 ***	0.12 (1.01)	-0.14 (0.97) 3.22 **

Note. t values came from t test.

* $P < .05$,

** $P < .01$,

*** $P < .001$.

Table 3

The Odds Ratios (ORs) and 95% Confidence Intervals (in parentheses): Externalizing and Internalizing Problems, Substance Use, and Contextual Risk Factors to Predict T4 Drug Dependence

Measures at T1-T3	Drug Dependence (T4)					
	Bivariate			Multivariate		
	Female	Male	Combined	Female	Male	Combined
Externalizing Behaviors						
Risk taking	2.10 *** (1.59, 2.78)	2.20 *** (1.69, 2.86)	2.34 *** (1.94, 2.81)	1.68 * (1.09, 2.57)	1.46 * (1.03, 2.06)	1.61 *** (1.24, 2.09)
Rebellion	1.61 *** (1.23, 2.10)	2.30 *** (1.75, 3.03)	1.98 *** (1.65, 2.38)	1.20 (0.78, 1.83)	1.46 * (1.04, 2.05)	1.22 (0.95, 1.57)
Theft & vandalism	2.27 *** (1.48, 3.47)	2.16 *** (1.65, 2.81)	2.35 *** (1.89, 2.93)	2.01 * (1.11, 3.62)	1.59 * (1.09, 2.32)	1.85 *** (1.36, 2.53)
Aggression	1.27 (0.87, 1.86)	1.78 *** (1.40, 2.26)	1.78 *** (1.48, 2.15)	0.60 (0.35, 1.04)	0.97 (0.68, 1.38)	0.87 (0.66, 1.16)
Internalizing Behaviors						
Depression	1.71 *** (1.33, 2.21)	1.59 *** (1.24, 2.02)	1.47 *** (1.24, 1.73)	1.42 * (1.07, 1.89)	1.38 * (1.06, 1.80)	1.25 * (1.04, 1.51)
Anxiety T4	1.81 *** (1.42, 2.30)	1.59 *** (1.26, 2.00)	1.56 *** (1.33, 1.83)	1.57 *** (1.20, 2.05)	1.40 ** (1.09, 1.81)	1.42 *** (1.19, 1.70)
Substance Use						
Smoking T3	1.65 *** (1.24, 2.20)	1.84 *** (1.43, 2.36)	1.79 *** (1.49, 2.15)	1.03 (0.71, 1.50)	1.40 * (1.05, 1.86)	1.25 * (1.01, 1.56)
Alcohol T3	1.45 * (1.02, 2.07)	1.45 ** (1.16, 1.81)	1.54 *** (1.27, 1.85)	1.33 (0.89, 2.00)	1.19 (0.92, 1.54)	1.28 * (1.03, 1.59)
Marijuana T3	3.00 *** (2.20, 4.11)	2.63 *** (2.03, 3.41)	2.89 *** (2.37, 3.53)	2.92 *** (2.06, 4.14)	2.35 *** (1.79, 3.07)	2.61 *** (2.11, 3.21)
Contextual Risk Factors						
Violence towards subject T2, T3	1.73 ** (1.23, 2.44)	1.45 *** (1.19, 1.76)	1.74 *** (1.48, 2.04)	1.04 (0.66, 1.64)	1.24 (0.97, 1.59)	1.35 (1.10, 1.65)
Drug offering	2.17 *** (1.71, 2.75)	2.45 *** (1.87, 3.22)	2.38 *** (1.99, 2.84)	1.69 *** (1.24, 2.29)	2.00 *** (1.44, 2.77)	1.75 *** (1.41, 2.18)
Peer illegal drug use	2.10 *** (1.54, 2.86)	1.88 *** (1.42, 2.49)	2.05 *** (1.67, 2.51)	1.50 * (1.03, 2.20)	1.18 (0.83, 1.67)	1.32 * (1.03, 1.70)

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Measures at T1-T3	Drug Dependence (T4)					
	Bivariate			Multivariate		
	Female	Male	Combined	Female	Male	Combined
Education T3	0.93 (0.68, 1.27)	0.72 * (0.54, 0.95)	0.76 ** (0.62, 0.93)	1.07 (0.76, 1.49)	0.75 (0.55, 1.02)	0.85 (0.68, 1.06)

Notes. 1. Each bivariate logistic regression analysis is controlled by race/ethnicity and age at T2. 2. Each multivariate logistic regression analysis is controlled by race/ethnicity, age at T2, and the other risk factors in the domain.

* $P<.05$,
** $P<.01$,
*** $P<.001$.