

Prospective Risk Factors and Treatment Outcomes Among Adolescents in DATOS-A

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The relationships between risk factors and outcomes in adolescents participating in the Drug Abuse Treatment Outcome Studies for Adolescents (DATOS-A) were examined. The study included 292 admissions to nine outpatient drug-free (ODF) and 418 admissions to eight residential (RES) programs. Assessments were administered at intake into treatment and 12 months following discharge. For ODF participants, (a) severity of drug use predicted less retention in treatment, and (b) family drug involvement predicted more alcohol use after treatment. For RES participants, (a) family drug involvement and criminal involvement predicted less treatment retention, and (b) conduct disorder predicted more marijuana use at follow-up. The findings underscore the need for intervention strategies that address the intrapsychic and interpersonal functioning of drug-abusing adolescents to improve their behavioral outcomes.

There are several risk factors associated with adolescent drug use (Beman, 1995; Scheier, Botvin, & Baker, 1997). Findings from clinical and treatment studies document deficits in intrapsychic functioning (e.g., psychological maladjustment, poor social skills, and lack of personal competence) as

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significant precursors to drug use (Needle, Lavee, Su, Brown, & Doherty, 1988; Scheier et al., 1997; Van Hasselt, Null, Kempton, & Bukstein, 1993). Evidently, social-learning factors (e.g., peer and adult models and normative expectations) and interpersonal functioning are key determinants for adolescent drug use (Bahr, Marcos, & Maughan, 1995; Milgram, 1993; Scheier et al., 1997). Although research has not unequivocally determined that using alcohol and other drugs causes crime or produces the motivation to commit crime in adolescents, a relationship between alcohol and other drug use and aggressive behavior is apparent (Durant, Knight, & Goodman, 1997). In sum, these studies provide substantial empirical evidence emphasizing the need to heed the risk factors (both intrapsychic and interpersonal) that influence alcohol and drug use among adolescents and, by extension, the effects of these risk factors on outcomes following drug treatment. Despite evidence documenting significant reductions in posttreatment drug use, criminal activity, and/or depression among adolescents in treatment programs (Brown, Myers, Mott, & Vik, 1994; Crowley, Mikulich, MacDonald, Young, & Zerbe, 1998; Jainchill, Hawke, De Leon, & Yagelka, 2000), there still remains uncertainty as to the nature of the relationship between risk factors and treatment outcomes among high-risk adolescents.

Few studies have been conducted to assess risk factors among adolescents in treatment. Consequently, little is known about how risk factors may affect treatment response and outcome among adolescents. Prior studies based on both adults and adolescents have shown that patients who stayed in treatment longer were more likely to have more favorable outcomes (Hser et al., 2001; Hubbard, Craddock, Flynn, Anderson, & Etheridge, 1997; Simpson, Joe, Fletcher, Hubbard, & Anglin, 1999). Thus, it is important to further investigate the relevance of these risk factors among drug-abusing adolescents.

Theoretical Position

Problem behavior theory (PBT) (Jessor & Jessor, 1977) describes the interaction of the adolescent with his or her social environment through the delineation of psychosocial variables that control or instigate risk behaviors. Problem behaviors are those behaviors that have been defined socially as problematic, age inappropriate, a source of concern, or undesirable, and their occurrence usually elicits a social-control response. Youth who engage in one behavior that deviates from the norm are more likely to engage in other related behaviors, including substance abuse and criminality (e.g., O'Donnell, Hawkins, & Abbott, 1995). Characteristic problem behaviors include delinquent behavior, problem drinking, illicit drug use, and/or anti-social behaviors, all of which can contribute to adolescent problems. Envi-

ronmental and individual factors that may contribute to problem behaviors among adolescents include poor social support from or poor relations with parents, poor psychological adjustment, and poor school performance. It may be that youth's antisocial behavior and substance use arise from a single problem behavior construct (Ary, Duncan, Duncan, & Hops, 1999). In addition, poor parental monitoring and associations with deviant peers are strong predictors of problem behaviors over time (Ary et al., 1999). If the process of developing a social bond to others has been interrupted by uncaring or inconsistent parents or by circumstances that make conventional involvement unrewarding, youth are more likely to engage in delinquent behavior and to come under the influence of peers who are in the same situation. Consequently, such youths are susceptible to those who reinforce deviant actions as well as to the direct reinforcement offered by involvement in delinquent activities.

Problem behavior theory provides the theoretical basis for the structural model used in this study. We propose that early delinquency (drug abuse, criminal behavior, and conduct disorder) and family involvement with drug use will predict less treatment retention and future delinquency, especially among high-risk adolescents.

Purpose of Study

To test this hypothesis, we examine the relationship of various risk factors (e.g., alcohol and marijuana abuse, criminal involvement, psychological maladjustment, conduct disorder, and family alcohol and drug involvement), retention in Drug Abuse Treatment Outcome Studies for Adolescents (DATOS-A) treatment, and posttreatment outcomes among adolescents receiving drug treatment within two modalities in DATOS-A, outpatient drug-free (ODF) and residential (RES) programs. We hypothesize that alcohol and marijuana abuse, criminal behavior, psychological maladjustment, conduct disorder, and family involvement in alcohol and drug abuse will be significant risk factors associated with shorter treatment retention, future drug use, criminality, and psychological maladjustment. In contrast, we expect that longer retention in DATOS-A treatment will be associated with reduced posttreatment alcohol and marijuana use, criminality, and psychological maladjustment. Because these relationships may differ by treatment modality, we have developed and tested distinct statistical models for each modality. Relative to patients in ODF, patients entering RES treatment typically exhibit much more severe drug use patterns, are more likely to be under criminal justice supervision, have more severe psychological problems, and

are more likely to have a history of drug treatment (Grella, Hser, Joshi, & Rounds-Bryant, in press; Hser et al., 2001).

METHOD

Study Design

DATOS-A is a multisite prospective treatment outcome study sponsored by the National Institute on Drug Abuse (NIDA). These studies include consecutive admissions to programs in four major U.S. cities (Pittsburgh, Minneapolis, Chicago, and Portland) from 1993 to 1995. Although the studies originally included patients and programs in Miami and New York, they were excluded from this study because of administrative and logistical problems in implementing follow-up interviews. In the present analysis, treatment modalities include RES and ODF programs. A third treatment modality used in this study, short-term inpatient care, is not analyzed in this article because retention, a key variable in our model, was typically very short, lacked variability, and was often determined by source of payment (e.g., insurance) rather than characteristics of the patient. All treatment programs were specifically designed to treat adolescents (Kristiansen & Hubbard, this issue). Adolescents were assessed at intake and were targeted for posttreatment interviews at 1 year following treatment.

Attrition Analysis

Of the 1,045 total admissions (665 for RES and 380 for ODF), 710 adolescents completed the follow-up interviews (67.9% interview completion rate) 1 year later (e.g., some were located but refused the interview). The somewhat high attrition rate at follow-up is not unusual for large-scale field studies of this type (Hser et al., 2001). Although the field research team attributed the attrition mainly to logistic and resource constraints, its effect was assessed to rule out any systematic bias. We compared patients without follow-up interviews (study dropouts) with those who completed follow-up interviews (participants) on all items assessed at Intakes 1 and 2. We did not find differences in severity of alcohol or marijuana use. For ODF, the study participants and dropouts differed on retention (mean number of days for the follow-up sample = 106.3 and for the dropout sample = 80.5). For RES, the study participants and dropouts differed on conduct disorder (higher for the follow-up sample) and retention (mean number of days for the follow-up sample = 124.4 and for the dropout sample = 104.3).

Participants

The focus of the present study was on patients (292 from ODF and 418 from RES) who had completed the intake assessments given during treatment admission and the 1-year follow-up interview. The majority of the total sample were male (74%), and 58% were White, 24% Black, 13% Hispanic, and 5% of other ethnic groups. About 61% were aged 16 or older, and 56% were in the 10th grade or higher at the time of treatment. More than 41% were not attending school at the time of treatment admission. The majority of the sample (72%) reported having no prior drug treatment. Forty-four percent of ODF and 59% of RES met *Diagnostic and Statistical Manual of Mental Disorders* (Rev. 3rd ed.) (*DSM-III-R*) (American Psychiatric Association, 1987) criteria for conduct disorder. Thirty-seven percent of ODF and 78% of RES were under legal supervision. Mean age of first alcohol use was 11.8 years, and mean age of first marijuana use was 12.8 years.

Patient Intake Assessment and Follow-Up Procedures

Informed consent for study participation for youth who were younger than 18 years of age was obtained from each participant's custodial parent or guardian, and the youth provided informed assent if they agreed to participate. Informed consent for study participation was directly obtained from youth who were 18 years or older. Face-to-face interviews were conducted by trained professional interviewers who were independent of the treatment programs. The interviews were conducted at intake and at a 1-year posttreatment follow-up. Intake interviews were conducted at the program sites in two separate sessions approximately 1 week apart. Interviewers recontacted patients for face-to-face follow-up interviews approximately 1 year after discharge. Each interview session lasted about 90 minutes, and participants were paid \$10 for each completed interview (Kristiansen & Hubbard, 2001).

Measures

Latent and Measured Variables at Treatment Admission (Intakes 1 and 2)

Severity of alcohol and severity of marijuana use. These two constructs were each represented by two indicators, number of symptoms and frequency of drug use. The alcohol symptom scale was made up of 10 items (reliability = .81), and the marijuana scale was made up of 11 items (reliability = .84). The 10 items used for the alcohol scale also were used for the marijuana scale.

The items were dichotomous variables coded 1 (yes) or 0 (no) for the following: if the adolescents (a) had used larger amounts of alcohol or marijuana for longer periods of time, (b) found the use irresistible, (c) could not cut down use, (d) increased their chance of injury, (e) gave up activities, (f) continued using/drinking after becoming aware of health problems and potential injury, (g) found that use caused emotional problems, (h) needed to use more for the same effect, and (i) used alcohol/marijuana to keep from having problems. The one extra item for the marijuana symptom scale was that the use of marijuana eased withdrawal symptoms. Frequency of alcohol and marijuana use were assessed by asking the patient's alcohol/marijuana use in the 12 months before treatment, which was measured on a 4-point scale ranging from 0 = *no use*, 1 = *monthly use*, 2 = *weekly use*, and 3 = *daily use*.

Family/friends' alcohol and drug involvement. This scale was composed of four variables measuring the extent to which the youth's friends and family had used drugs or alcohol or stopped using drugs (reverse coded) as well as whether the youth perceived that his or her drug use had hurt a lot of people.

Criminal involvement. This construct comprised the following three variables: criminal justice status, number of types of crimes committed, and number of arrests. For the RES sample, this construct was only measured by number of types of crimes committed and number of arrests; hence, criminal justice status was not a significant indicator of this construct for RES patients. Criminal justice status was coded as 1 if at the time of treatment entry youth were in jail, on parole, or on probation, and 0 if otherwise. Number of types of crimes committed during the 12 months before intake was assessed for the following illegal activities: aggravated assault, burglary, theft, robbery, forgery, stolen property, gambling, prostitution, and drug dealing. Participants were asked, "Were you ever involved in or did you ever do this?" where 1 = yes and 0 = no. The number of times adolescents were arrested during the 12 months before intake was assessed for the following types of offenses: possession of drugs, sale of narcotics, forgery, fraud, burglary, larceny, prostitution, robbery, attacks on people, and status offenses.

Psychological maladjustment. This construct comprised two scales, hostility and self-esteem. Hostility was measured by a subscale of the Symptom Checklist-90 (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974). It is a self-reported clinical rating scale composed of six items answered on a 5-point scale ranging from 0 = *not at all* to 4 = *extremely*. The questions asked about issues such as feeling easily annoyed, temper outbursts, urges to beat or break, and arguing and shouting in the past 30 days. This scale had an alpha

reliability of .88 and ranged between 0 to 24. Self-esteem was measured by 10 items (Rosenberg, 1965) using a 4-point scale ranging from 1 = *strongly disagree* to 4 = *strongly agree*, where a high score signifies high self-esteem. The alpha reliability for this scale was .89, and the scale ranged from 10 to 40.

Conduct disorder. A diagnosis of conduct disorder (coded 1, otherwise 0) was based on the *DSM-III-R* (American Psychiatric Association, 1987) criteria.

Treatment Retention

Treatment retention was defined as the number of days between DATOS-A program admission and discharge. The continuous measure was used in both of the models.

Latent and Measured Variables at the 1-Year Follow-Up

Frequency of alcohol and marijuana use. Youth's alcohol and marijuana use in the 12 months after treatment was measured on a 4-point scale ranging from 0 = *no use*, 1 = *monthly use*, 2 = *weekly use*, and 3 = *daily use*.

Criminal involvement. This construct comprised the same three items for ODF and two items for RES as described earlier for the intake assessments.

Psychological maladjustment. This construct comprised the same two scales as described earlier for the intake assessments.

Analyses

Data were analyzed with latent variable structural equation models (SEM) using the EQS structural equations program (Bentler, 1995). Goodness of fit was assessed with the maximum likelihood chi-square statistic, the Sattora-Bentler robust chi-square statistic, and the Robust Comparative Fit Index (RCFI). We use the robust solution because it adjusts for nonnormality in the data and provides stronger values. A chi-square value of no more than twice the degrees of freedom generally indicates a plausible, well-fitting model. In addition, we report the RCFI, an index of fit that ranges from 0 to 1, to indicate the improvement in fit of the hypothesized model compared with a model of complete independence among the measured variables. Cutoff values close to .95 and higher are desirable and indicate that 95% or more of the covariation in the data is reproduced by the hypothesized model.

Initial confirmatory factor analyses (CFA) were conducted separately by treatment modality to test the proposed factor structure among the indicator variables and the relations among the factors. A priori correlations between the error residuals of the same manifest variables across time were allowed. To improve model fit, a few supplementary correlated error residuals based on suggestions from the Lagrange multiplier (LM) test were added if they made sense theoretically and logically. Once the CFA models adequately fit the data, separate initial structural models (STR) by treatment modality were developed by replacing the across-time correlations in the final CFA models with directional paths. These were saturated models in which all of the across-time paths were included. The predictor variables were allowed to correlate among themselves as were the residuals of the dependent variables. Nonsignificant correlations and paths were dropped gradually until only significant paths remained in the final STR models by treatment modality.

RESULTS

Confirmatory Factor Analyses

Table 1 presents factor loadings, means, and standard deviations by modality for the CFA models. All manifest variables loaded significantly on their hypothesized latent factors, indicating that the hypothesized factor structure was plausible. Because the data for both ODF (mardia's coefficient for initial CFA = 114.9) and RES (mardia's coefficient for initial CFA = 116.8) were kurtose, the Satorra-Bentler robust statistic was considered appropriate and was used for the SEM analyses. Table 2 presents the intercorrelations among the latent and measured variables for the ODF and RES models, respectively.

ODF. The initial fit for the CFA model for ODF was not acceptable (chi-square = 196.05; $df = 97$; $\chi^2/df = 2.02$; RCFI = .90). However, after two correlated error residuals were added based on suggestions from the LM test, the final CFA model fit the data adequately (chi-square = 146.43; $df = 95$; $\chi^2/df = 1.54$; RCFI = .95). The supplementary relations added were between (a) number of symptoms for alcohol and marijuana use and (b) frequency of alcohol and marijuana use. Severity of alcohol and marijuana use, criminal involvement, psychological maladjustment, and conduct disorder were all negatively correlated with treatment retention.

TABLE 1: Descriptive Statistics and Factor Loadings in Confirmatory Factor Analysis

<i>Latent and Measured Variables</i>	<i>Outpatient Drug Free (N = 292)</i>			<i>Residential (N = 418)</i>		
	<i>Loading</i>	<i>M</i>	<i>SD</i>	<i>Loading</i>	<i>M</i>	<i>SD</i>
Factor 1: Severity of Alcohol Use (T1)						
1. Number of symptoms	.73	2.03	2.30	.76	1.19	2.48
2. Frequency of alcohol use	.59	1.34	0.71	.70	1.38	0.92
Factor 2: Severity of Marijuana Use (T1)						
1. Number of symptoms	.82	3.91	3.26	.87	4.00	3.11
2. Frequency of marijuana use	.62	1.91	1.04	.52	2.34	0.92
Family alcohol and drug involvement (T1)	NA	8.10	1.90	NA	8.42	1.82
Factor 3: Criminal Involvement (T1)						
1. Criminal justice status	.30	1.12	1.46	NA	1.55	0.99
2. Type of illegal acts	.76	2.55	2.15	.60	3.46	2.32
3. Number of arrests	.40	1.04	2.42	.33	4.48	7.64
Factor 4: Psychological Maladjustment (T1)						
1. Hostility	.81	7.89	5.91	.60	8.84	6.55
2. Low self-esteem	.40	29.67	5.37	.40	30.36	5.20
Conduct disorder (T1)	NA	43.95	49.73	NA	55.38	49.77
Frequency of alcohol use (T2)	NA	0.94	0.73	NA	0.98	0.91
Frequency of marijuana use (T2)	NA	1.28	1.09	NA	1.19	1.16
Factor 5: Criminal Involvement (T2)						
1. Criminal justice status	.41	0.71	1.20	NA	0.87	1.17
2. Type of illegal acts	.63	1.38	1.75	.76	1.32	1.83
3. Number of arrests	.46	0.50	1.59	.50	0.85	1.72
Factor 6: Psychological Maladjustment (T2)						
1. Hostility	.83	4.86	4.89	.62	4.56	4.92
2. Low self-esteem	.45	34.89	5.00	.42	33.95	6.41

NOTE: All factor loadings significant, $p < .001$. T1 = Time 1 (baseline; Intake 1 and 2), T2 = Time 2 (1-year follow-up); NA = not applicable.

RES. The initial fit for the CFA model for RES was not acceptable (chi-square = 157.42; $df = 65$; $\chi^2/df = 2.42$; RCFI = .92). After adding one reasonable correlated error residual (between number of symptoms of alcohol and marijuana use), the fit indexes improved. The final CFA model fit the data adequately (chi-square = 118.80; $df = 64$; $\chi^2/df = 1.86$; RCFI = .95). Family

TABLE 2: Factor and Measured Variable Intercorrelations for Confirmatory Factor Analyses Models by Treatment Modality

<i>Factor/Measured Indicator</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>
Time 1											
1. Severity of alcohol use	—	.25***	.34***	.69***	.55***	.23***	-.04	.22***	-.03	.04	.07
2. Severity of marijuana use	.07	—	.40***	.56***	.53***	.24***	-.10	.06	.04	.17**	.06
3. Family/friends' alcohol and drug involvement	.37***	.40***	—	.37***	.41***	.32***	-.14**	-.001	-.06	.06	-.09
4. Criminal involvement	.36***	.60***	.45***	—	.68***	.50***	-.18**	.09	.07	.32**	.02
5. Psychological maladjustment	.69***	.42***	.38***	.45***	—	.66***	-.07	.09	-.02	.20**	.53***
6. Conduct disorder	.23**	.42***	.17**	.48***	.33***	—	-.09*	.11*	.09	.20**	.21**
7. Treatment retention	-.23**	-.41***	-.30***	-.24**	-.17*	-.13*	—	-.02	-.08	-.11*	-.06
Time 2											
8. Frequency of alcohol use	.25**	-.01	.08	.21**	.16*	.17**	-.01	—	.45***	.36***	.50***
9. Frequency of marijuana use	-.05	.18**	.15*	.19**	.06	.12*	-.07	.48***	—	.33***	.45***
10. Criminal involvement	.12	.25**	.14	.58***	.28**	.42***	-.11	.53***	.50***	—	.66***
11. Psychological maladjustment	.29**	.14	.18**	.28**	.50***	.25***	-.01	.33***	.29***	.68***	—

NOTE: Factor correlation coefficients for residential are reported in the upper right triangle; factor correlation coefficients for outpatient drug free are reported in the lower left triangle.

* $p < .05$. ** $p < .01$. *** $p < .001$.

drug and alcohol involvement, criminal involvement, and conduct disorder were negatively correlated with treatment retention.

Path Models

The STR models with all possible paths included had the same fit statistics as the final CFA models for both ODF and RES models. Model modification proceeded as described previously with the gradual elimination of nonsignificant covariances and paths. Only significant regression paths and covariances were retained in the final STR models, which are depicted in Figures 1 and 2 for ODF and RES, respectively.

ODF. The final STR model for ODF had acceptable goodness-of-fit indicators (chi-square = 184.51; $df = 123$; $\chi^2/df = 1.50$; RCFI = .94). Severity of alcohol and marijuana use predicted less retention in DATOS-A treatment. Family drug and alcohol involvement predicted more alcohol use 1 year later. There was stability over time for alcohol use, criminal involvement, and psychological maladjustment.

RES. The final STR model for RES had acceptable goodness-of-fit indicators (chi-square = 159.69; $df = 90$; $\chi^2/df = 1.77$; RCFI = .94). Family alcohol and drug involvement and criminal involvement predicted less retention in DATOS-A treatment. Conduct disorder predicted more marijuana use during the year after treatment. There was stability over time for alcohol use, criminal involvement, and psychological maladjustment.

DISCUSSION

This study of a national sample of drug-using adolescents indicated that across both treatment modalities (ODF and RES), several risk factors were predictive of retention in DATOS-A treatment. Adolescents with high risk factors during the pretreatment periods tended to continue to be high in several risk areas (alcohol use, criminal involvement, and psychological maladjustment) during the posttreatment periods. Risk factors influencing treatment retention, however, appear to be different for patients in ODF and RES programs. These results confirm the importance of assessing risk factors among adolescents entering drug treatment.

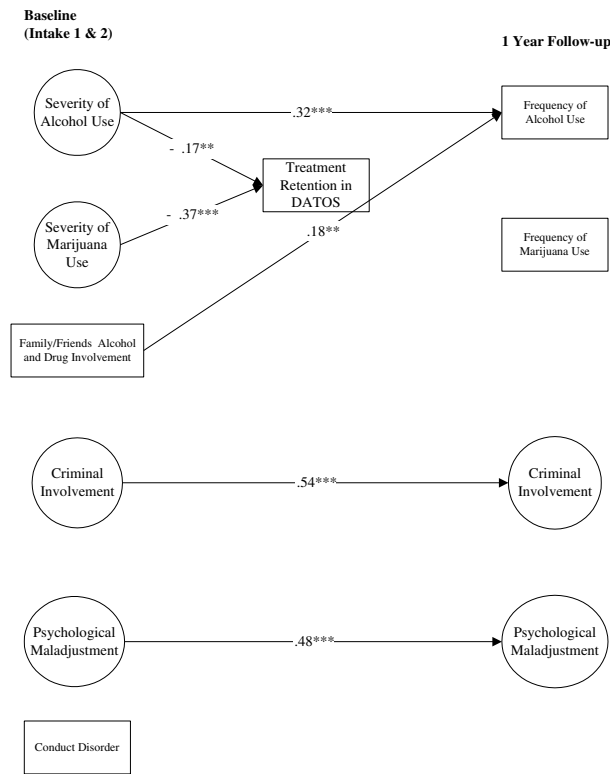


Figure 1. Outpatient drug-free structural model.

NOTE: T1 = treatment admission (Intakes 1 and 2); T2 = 12-month follow-up. Large circles represent latent constructs, and small circles represent construct residuals. Parameter estimates are standardized, and significance levels were determined by critical ratios on unstandardized coefficients.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Within-Time Correlates of Drug Use and Other Related Outcomes

It is noteworthy that for both ODF and RES participants, all of the constructs and measured variables were strongly and positively associated with each other at Time 1 (except for severity of alcohol and marijuana use for ODF patients). The implication is that because each of these risk factors was synergistically related to each other, they may be simultaneously contributing to deviancy in these high-risk youth. In addition, unique to ODF, all of the constructs and variables measured at Time 1 were negatively related to treat-

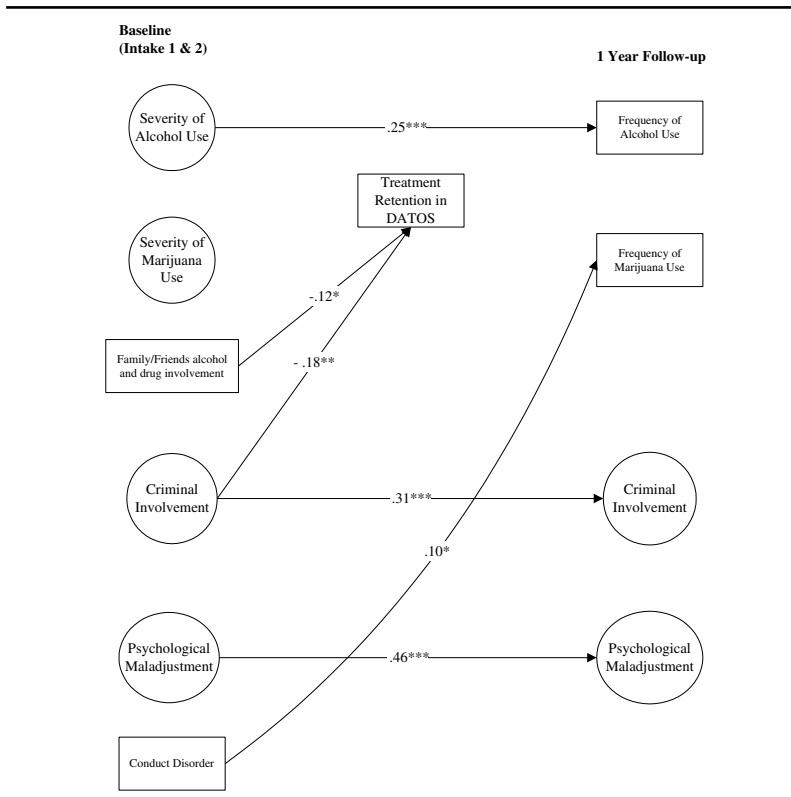


Figure 2. Long-term residential structural model.
 NOTE: T1 = treatment admission (Intakes 1 and 2); T2 = 12-month follow-up. Large circles represent latent constructs, and small circles represent construct residuals. Parameter estimates are standardized, and significance levels were determined by critical ratios on unstandardized coefficients.
 * $p < .05$. ** $p < .01$. *** $p < .001$.

ment retention. For RES, only family alcohol and drug involvement, criminal involvement, and conduct disorder were negatively associated with treatment retention. Thus, the number of factors affecting treatment retention differed depending on the treatment program.

Prospective Correlates of Drug Use and Other Related Outcomes

In general, delinquency (including drug abuse and criminal involvement) and family/friends’ alcohol and drug use involvement were positively related

to posttreatment delinquency. Moreover, psychological problems (including conduct disorder and psychological maladjustment) were positively related to posttreatment marijuana use, delinquency, and poor psychological functioning over time. The stability of alcohol use, criminal involvement, and psychological maladjustment over time has been consistently shown in previous research (Achenbach, Howell, McConaughy, & Stanger, 1998; Brook, Whiteman, Cohen, Shapiro, & Balka, 1995; Grella, Hser, Joshi, & Anglin, 1999). The implication is that those who engage in delinquent behavior or who experience psychological problems will continue to be delinquent and troubled over time. These results suggest that both delinquency and psychological problems need to be directly addressed in drug use treatment programs to combat their long-term detrimental effects on adolescents.

For patients in ODF programs, association with drug-using family/friends predicted more alcohol use 1 year later. For patients in RES programs, conduct disorder predicted greater marijuana use at follow-up (Grella et al., in press). Thus, certain risk factors may be more severe or influential in patient populations entering programs of different modalities and therefore need to be specifically addressed within each treatment program.

Retention in DATOS-A treatment was not significantly related to post-treatment outcomes for adolescents in either the ODF or RES programs. We are unsure how to interpret these results as they differ from our previous findings (Hser et al., 2001). One major difference between the studies is that the present analysis was based on retention measured as number of days in DATOS-A, whereas our previous findings were based on threshold criterion (e.g., dichotomized by thresholds). It is possible, however, that treatment effect requires meeting the threshold criterion in retention rather than following a continuous relation. A dependent variable, such as retention used in our models, is statistically desirable to be expressed as a continuous measure in the SEM setting. Thus, alternative methods to further investigate these complicated relationships are warranted in future studies. Furthermore, the decrease in marijuana use over time and the lack of increase in use may indicate that treatment interrupted the normal acceleration in alcohol or marijuana use typically experienced by adolescents given their developmental stage and stage in their addiction careers.

Predictive Relationships of Retention

Our results indicated that the more severe drug-abusing adolescents failed to remain in outpatient drug treatment. For patients in RES programs, criminal behavior and drug-using family/friends predicted less treatment retention, indicating that delinquent adolescents were less likely to remain in drug

treatment for sufficient time to receive the therapeutic benefit offered by the treatment. In contrast, Broome, Joe, and Simpson (this issue) found that exposure to deviant friends was linked to higher treatment readiness. Although greater involvement with deviant friends and family may be linked to higher treatment readiness, over time it is related to less treatment retention. This contradiction should be explored over longer periods of time.

Because there is evidence documenting the strong predictive relationship between drug use in adolescence and drug abuse in adulthood, treatment of drug-using adolescents is essential. However, the generally short lengths of stay among adolescents in DATOS-A treatment programs are troublesome; 77.5% in ODF and 62.7% in RES stayed in treatment less than 3 months (Hser et al., 2001). Strategies to engage adolescents in treatment, as discussed by Broome et al. (2001), are important steps to improve treatment retention and posttreatment outcomes for these high-risk adolescents.

Limitations

First, the high level of attrition may limit the generalizability of the study findings to those who successfully completed the 1-year follow-up interview, although we note that there were few differences between the intake and follow-up samples for both ODF and RES participants. Second, neither treatment modalities nor types of programs that patients entered were controlled. The DATOS-A sample of treatment programs was designed to represent specific types of stable programs operating in the communities participating in the studies rather than to be representative of all adolescent treatment programs in the United States (Hser et al., 2001). Thus, our results may not be generalizable to programs that are not similar to those participating in DATOS-A. Nevertheless, naturalistic studies such as DATOS-A, which routinely monitor and evaluate typical treatment for adolescent drug-abusing patients, are needed to provide the information necessary for developing strategies to improve treatment and policies (Hser et al., 2001). Finally, all data were based on participants' self-reports; independent corroboration of the outcomes may increase our confidence in these self-reports.

Conclusions

This study provides insight into drug-using adolescents' problems and the effects of two types of drug treatment. The results underscore the need for treatment programs that are tailored to the specific needs of adolescents. Evidence suggests that multiple risk factors lead to future drug use and related problems and that these risk factors involve deficits in age-appropriate devel-

opment (including social competence and psychological functioning) associated with adolescence. The relatively low retention rates of adolescents in these programs indicate that these programs need to incorporate age-appropriate strategies and services for improving retention and treatment outcomes. Moreover, treatment programs should be tailored to specifically address adolescents' drug use and related problems (delinquency and psychological problems) in addition to dealing with issues related to completing the stage-appropriate developmental tasks associated with adolescence. In sum, future research is warranted that examines the long-term effects of treatment on the psychological, behavioral, and interpersonal functioning of drug-using adolescents.

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