

Clinical Variations of Adolescent Substance Abuse: An Empirically Based Typology

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ABSTRACT. This study was designed to establish and validate a multi-dimensional empirically based typology of clinically referred adolescent substance abusers. A total of 141 adolescent substance abusers, most of whom were male, African-American, and juvenile justice involved, comprised the study sample. Youth and their parents completed comprehensive assessments at intake to treatment, discharge, and at 6 months and 12 months post-discharge from treatment. Adolescents were classified based on individual and family risk factors, associated problems, and severity of substance use. Variables included in the 2-stage cluster analysis included adolescents' substance use, psychiatric disorders, and legal involvement; peer substance use; family substance abuse; parental psychopathology; and family conflict. Three groups emerged: Juvenile

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Justice Involved Substance Abusers, with the lowest level of overall risk but highest juvenile justice involvement; Comorbid Substance Abusers, with the greatest family risk and individual psychopathology; and Heavy Substance Abusers, marked by serious substance abuse and peer substance use. Discriminant and predictive validity of the typology were established. This multidimensional typology of teenage substance abusers suggests that risk factors, associated problems, and substance use severity are all critical in assessing and treating this heterogeneous population. Different intervention strategies may be appropriate for these subgroups of adolescent substance abusers. *[Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <http://www.HaworthPress.com> © 2004 by The Haworth Press, Inc. All rights reserved.]*

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Empirical evidence suggests that substance abuse is a heterogeneous syndrome with important variations in etiology, onset and course, presenting symptoms, and lifetime substance use patterns (Glantz & Leshner, 2000). Researchers attempting to understand these variations have developed typologies of both adult and adolescent substance abusers based on a range of factors (Cloninger, 1987; Zucker, 1987). However, few of these typologies have demonstrated strong predictive validity in differentiating treatment responses or long-term outcomes. Babor et al. (1992) suggest that classification schemes that are useful in predicting outcomes must be multidimensional in nature, taking into account the many individual and familial risk factors for substance abuse, the associated problems or consequences of use, as well as substance use severity. Further, an understanding of the variations in youth problem behavior must be rooted in an appreciation of the unique pathways of psychopathology and corresponding risk and protective factors that operate over the course of development (Loeber & Farrington, 1994). The purpose of the current study was to develop and validate a multidimensional typology of adolescent substance abusers based on these factors.

Research with both adults and adolescents suggests that there are distinct subtypes of substance abusers. Cloninger (1987) distinguished two genetically based subtypes of adult alcoholism: Type I alcoholics have later onset of problems and experience psychological rather than physical dependence, whereas Type II alcoholics have more serious, chronic

alcohol use, earlier onset, and greater genetic liability for alcoholism. Babor et al. (1992) established a similar two-group typology of adult alcoholics based on premorbid risk factors, pathological use of substances, and chronicity and consequences of drinking. Type A alcoholics have later onset of drinking, fewer risk factors, less severe problems, and better treatment outcomes than Type B alcoholics. This typology has also been replicated with adult cocaine abusers (Ball, Carroll, Babor, & Rounsaville, 1995) as well as marijuana and opiate abusers (Feingold, Ball, Kranzler, & Rounsaville 1996), consistently predicting worse treatment outcomes for Type B substance abusers. These studies suggest that at least one type of substance abuser first develops substance abuse and associated problems early in life and fares worse in treatment.

Researchers studying adolescent substance abusers maintain that this early onset group of substance abusers can be further differentiated (Zucker, Fitzgerald, & Moses, 1996). For instance, Zucker et al. (1996) suggest that there are at least two different types of early-onset alcohol problems. One type, "Antisocial alcoholism," includes individuals who have a history of conduct problems and familial dysfunction and whose alcohol problems persist through adulthood. The second type, "Developmentally-limited alcoholism," includes individuals who also have conduct problems in adolescence, but not early childhood problems, and their alcohol problems generally run their course in young adulthood. Mezzich et al. (1993) also suggest that adolescent alcohol abusers can be subdivided into two groups with a small percentage characterized by internalizing symptoms and the majority demonstrating mainly externalizing problems.

Research on juvenile delinquents also informs the development of clinically meaningful subtypes of problem youth. For instance, Moffitt (1993) identified a form of delinquency characterized by engagement in criminal acts mainly with peers during the adolescent years ("Adolescence-limited"), as compared to "Life-course persistent" delinquents, who evidence multiple problems in early childhood and continue to have serious mental health and substance abuse problems well into adulthood (Moffitt, Caspi, Harrington, & Milne, 2002). Interestingly, these two subtypes are not easily distinguished during the adolescent years. Loeber's (1982, 1989) series of studies with antisocial children and adolescents suggests a tripartite model of delinquency with "Aggressive/Versatile" youth distinguished by very early behavior problems, multiple risk factors in childhood, and serious deficits across domains in adolescence; "Nonaggressive" delinquents, who engage mainly in property offenses with peers, have fewer early risk factors,

and slower progression to serious antisocial behavior; and the “Exclusive substance abuse” path, in which deviant behavior generally surrounds substance use in the peer context and is not linked to childhood risk factors. Loeber, Stouthamer-Loeber, and White (1999) further demonstrated that the strength of the association between substance use and delinquency increases with age, stressing the importance of examining developmental trajectories and the persistence of problem behavior over time in developing multidimensional typologies.

Whereas severity of substance use (Tarter, Kirisci, & Mezzich 1997), level of comorbid psychopathology (Mezzich et al., 1993; Rowe, Liddle, & Dakof, 2001), and delinquency (Taylor, Malone, Iacono, & McGue, 2002) have been common dimensions of classification for adolescent substance abusers, other important risk factors have generally not been included in typology schemes. For instance, family conflict has been strongly linked to adolescent substance abuse (Hawkins, Catalano, & Miller, 1992), and has been important in distinguishing “Aggressive/Versatile” delinquents, the most severe and chronic subtype (Loeber, 1989). In adult studies, family history of substance use has been important in discriminating types of substance abusers (Cloninger, 1987). Further, negative peer affiliation is a robust predictor of adolescent substance abuse (Guo, Hill, Hawkins, Catalano, & Abbott, 2002), but has rarely been included in typologies of adolescent substance abusers. Finally, the majority of typologies of adolescents have been developed on alcohol abusers, yet less is known about types of adolescent drug abusers, particularly those involved in the juvenile justice system.

Taken together, these studies suggest that adolescent substance abuse and delinquency are developmental disorders constituting different subtypes, one with risk factors obvious early in childhood and more chronic patterns of substance use and delinquency, and another type with less severe antisocial behavior, less chronic problems, and fewer risk factors. Key factors in distinguishing problem youth appear to be the age of onset of problems (Taylor et al., 2002), the constellation of individual (Mezzich et al., 1993) and family risk factors (Loeber, 1989), and the severity of substance use (Tarter et al., 1997). For instance, the parent’s acceptance of and involvement with the adolescent interact with peer influences and individual risk factors such as emotional reactivity and feelings of low self-worth to predict both drug abuse and delinquency (Steinberg, 2001). The current study builds on this knowledge base by identifying and discriminating adolescent substance abuser subtypes based on three domains similar to those outlined by Babor et al. (1992): individual and family risk factors, severity of substance use, and associated problems. To establish the predictive

validity of the typology, the treatment outcomes of each identified subtype were examined. Three hypotheses were proposed:

1. Adolescent substance abusers would comprise distinct subtypes that could be differentiated based on risk factors, associated problems, and substance use.
2. Adolescent substance abuser subtypes would be distinguished on adolescents' perceptions of family cohesion, parental acceptance, and self-worth; age of substance use initiation; and comorbid psychopathology.
3. These subtypes would demonstrate differential treatment outcomes over time, establishing the predictive validity of the typology.

METHOD

Participants

The study sample consisted of 141 adolescents and their families who sought drug abuse treatment at Temple Teen Care (TTC), an inner-city treatment research clinic. Adolescents had an average age of 15 (range: 12 to 17; S.D. = 1.26) and 83% were male. The sample was 75% African-American, 16% Caucasian, and 9% Hispanic. The median yearly family income of the sample was \$11,000-\$13,000; 80% were juvenile justice involved; and 70% lived in single-parent homes. All adolescents met criteria for a substance use disorder according to the Diagnostic Interview Schedule for Children (DISC). Five percent had an alcohol abuse diagnosis, 20% had alcohol dependence, 18% had marijuana abuse, 89% had marijuana dependence, 2% had other substance abuse, and 16% had other substance dependence. Further, 86% had at least one comorbid psychiatric disorder. Only 28% of youth reported passing grades in school at intake.

Procedure

Data for this study were collected as part of a randomized clinical trial comparing the efficacy of two outpatient treatments for adolescent drug abuse, Multidimensional Family Therapy (MDFT, Liddle, 2002) and Individual Cognitive-Behavioral Treatment (CBT, Turner, 1992). Adolescents were included in the study if they were between the ages of 12 to 17, referred for outpatient drug treatment, had a parent or guardian

willing to participate in treatment, and had a substance use diagnosis according to either parent or youth report. Exclusion criteria included severe developmental delays, active suicidal or psychotic symptoms, and substance abuse problems severe enough to require inpatient detoxification. Referrals to the study were made from the juvenile justice system (48%), state department of child services (36%), school system (11%), and other sources such as self-referred or from other community agencies (5%). Of the eligible youth referred for the study, 78% agreed to participate and were successfully recruited into the study. Reasons for non-participation were as follows: did not show up for intake appointment (68% of study refusers), ran away (10%), and referred to residential treatment (22%).

Adolescents and their parents who provided written informed consent to participate in the study completed a set of self-report instruments measuring three broad dimensions of variables for the cluster analysis: risk factors, use of substances, and associated problems. Subjects were assessed at 4 time periods (intake to treatment, discharge from treatment, 6 months, and 12 months post-discharge) on multiple variables, described below. Adolescents and their primary parent (76% of whom were the biological mother, 10% of whom were the biological father, and 14% of whom were another family member such as an aunt, step-parent, or grandmother) were assessed independently. Trained assessors blind to study hypotheses and treatment condition conducted all assessments at Temple Teen Care. All of the instruments described below were given at all assessment points except for the DISC, given only at intake.

Measures

For purposes of constructing the typology, 33 variables drawn from 3 domains were used, based on data collected at the intake assessment.

Individual and Family Risk Factors

Peer Substance Use. The Adolescent Problem Severity Index (APSI) (Metzger, Kushner, & McLellan 1991), an adolescent self-report screening interview modeled after the Addiction Severity Index (McLellan et al., 1985), was used to assess adolescents' association with substance using peers.

Family Conflict. The Family Environment Scale (Moos & Moos, 1974), administered to both adolescents and their parents, consists of 10

subscales assessing family environment. Parents' reports on the Family Conflict subscale were used in the creation of the typology.

Parental Psychopathology. The Symptom Checklist-90-R (SCL-90-R) (Derogatis, 1983), a widely used self-report measure, was administered to parents to assess their own level of psychopathology using the Global Severity Index.

Family Alcohol and Drug Problems. At intake, parents were interviewed using a Client Intake Form assessing a range of family factors including family alcohol and drug problems. Parents were asked to respond either yes or no to a series of questions about the history of alcohol and drug problems among the teen's closest family members (parents, siblings, aunts, uncles, and grandparents). Separate measures of alcohol and drug problems in the family were obtained for the cluster analysis.

Adolescent Substance Use

Psychological Involvement with Substances. The well-validated Personal Experience Inventory (PEI) (Winters et al., 1993) 29-item scale, "Personal Involvement with Chemicals," measures adolescents' self-reported preoccupation with substance use.

Days of Substance Use in Past Month. The Timeline Follow-Back Method (TLFB), adapted for adolescent drug abusers (Bry & Krinsley, 1992), was administered to adolescents to measure the number of days they used substances in the month prior to each assessment. In order to create a consistent period of measurement for analyses over time, the 30-day period before each assessment was targeted regardless of the length of time between assessments. The TLFB has demonstrated adequate validity and reliability over the 30-day periods examined here (Sobell & Sobell, 1992).

Associated Problems

Number of Comorbid Psychiatric Disorders. The Diagnostic Interview Schedule for Children, 2nd Edition (DISC-2.3) (Costello, Edelbrock, Kalas, Kessler, & Klaric, 1982; Fisher et al., 1991) was administered to both adolescents and parents to obtain DSM-III-R recent (past year) psychiatric diagnoses for the adolescents. Each adolescent was evaluated for the presence/absence of the following disorders based on a positive endorsement by either the youth self-report or parent report: social and simple phobias, panic disorder, avoidant disorder, general-

ized anxiety disorder, overanxious disorder, OCD, MDD, bipolar disorder, dysthymia, ODD, ADHD, and CD.

Legal Involvement. A composite score of the youth's involvement in the juvenile justice system was computed from the youth's responses (yes/no) to interview questions about their probation status, trouble with the law, involvement in a gang, and whether they were court ordered to treatment and/or in detention.

For purposes of evaluating the discriminant and predictive validity of the typology, 14 additional variables were used to compare subtypes. Only intake data were used to establish discriminant validity of the typology. Outcome analyses to determine the predictive validity of the cluster solution were conducted using data on internalizing symptoms, externalizing symptoms, and substance use from all assessment points (intake, discharge, 6 months and 12 months). These outcome analyses utilized data on the number of times youth used alcohol and/or marijuana in the past month from the Timeline Follow-Back procedure, described above.

Internalizing and Externalizing Symptoms. The Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983), a parent-report measure, and the Youth Self-Report (YSR; Achenbach, 1991), its parallel adolescent self-report measure, were used to assess adolescents' internalizing and externalizing symptoms.

Age of Substance Use Initiation. Individual items from the Adolescent Problem Severity Index (Metzger et al., 1991) were used to assess age of first use of alcohol and marijuana. Adolescents were asked whether they had first used these substances before age 12, between ages 12 and 14, or at age 15 or older.

Perception of Substance Use Problems. Adolescents were asked whether they perceived themselves as having a drug or alcohol problem as part of the Adolescent Problem Severity Index (Metzger et al., 1991).

Adolescent Self-Worth. Adolescents completed Harter's (1982) Perceived Competence Scale for Children, which assesses four aspects of self-worth: adolescents' perceived social, scholastic, behavioral, and global self-competence.

Family Cohesion. Adolescents' responses on the Family Environment Scale (FES; Moos & Moos, 1974), described above, were used to measure family cohesion for the purposes of discriminating the clusters.

Parental Acceptance. The Parenting Style Questionnaire (PSQ; Steinberg, Mounts, Lamborn, & Dornbusch, 1991) is a 26-item scale completed by the adolescents to measure aspects of their parents' parenting behaviors. It was used to measure adolescents' reports of parental acceptance.

Specification of the Treatments

After their initial assessment, adolescents were referred to either Multidimensional Family Therapy or Individual Cognitive-Behavioral Treatment. The therapy provided to youth in both conditions was office-based and conducted once per week up to 24 sessions (10 sessions on average). Intensity, dose, and service delivery format were the same between the treatments. The CBT model (Turner, 1992) focuses on increasing coping and competence and reducing problematic behaviors using contingency contracting, self-monitoring, problem solving, and communication skills training. MDFT is a multicomponent treatment for adolescent drug abuse (Liddle, 2002) that identifies several pathways to change, including individual work with the teen and parent, family sessions, and extrafamilial work.

Data Analysis

A 2-stage cluster analysis was conducted including both hierarchical and non-hierarchical clustering methods in order to determine the simplest structure possible that would yield homogenous groupings of cases (Hair & Black, 1998). Hierarchical and K-means cluster analysis procedures were employed to construct the typology based on the 33 variables in the three risk categories described above. These 33 variables were reduced to 10 to simplify the clustering approach as described below. All variables were transformed into z-scores prior to performing the cluster analysis.

First, a series of principal components analyses using varimax rotation were conducted on the family alcohol history, family drug history, and adolescent legal involvement variables to derive composite scores based on the shared variance of the single variables. In each case, the analyses produced a single principal component with eigenvalues above 1. The components were well defined and internally consistent, with all component loadings exceeding .30. These 3 composite variables were then entered into the cluster analysis along with the other risk variables.

Second, the number of comorbid psychological disorders was summed along the internalizing and externalizing dimensions to create 2 separate variables: number of internalizing disorders and number of externalizing disorders. Internalizing disorders included social and simple phobias, panic disorder, avoidant disorder, generalized anxiety dis-

order, overanxious disorder, OCD, MDD, bipolar disorder, and dysthymia. Externalizing disorders included ODD, ADHD, and CD.

Third, the cluster analysis was conducted on the final 10 variables (see Table 1) using a 2-stage approach. We first used a hierarchical agglomerative method employing Ward's method with squared Euclidean distances to estimate the number of clusters that would best characterize the sample. Ward's method is commonly used as a starting point in cluster analysis because it provides quantifiable indices of the optimal numbers of clusters. However, because hierarchical techniques do not reassign cases once clusters have been created, a K-means clustering approach was used as a second step in the analysis. K-means cluster analysis calculates centroids for a prespecified number of clusters, places each subject in the cluster with the nearest centroid, and recalculates the centroids and reallocates the subjects through an iterative process until there are no changes in cluster membership (Borgen & Barnett, 1987). K-means clustering thus adjusts for poor initial clustering assignment. It is also the preferred clustering technique when there is a theoretical or empirical basis for estimating a priori a certain number of clusters (Hair & Black, 2000). Once the groups had been formed, they were compared using ANOVA's and Chi-Square tests to establish discriminant validity of the clusters.

Finally, Hierarchical Linear Modeling (HLM) analyses were conducted to establish the predictive validity of the typology, examining differences in the groups' trajectories of substance use, internalizing, and externalizing symptoms from intake to the 12-month follow-up. HLM is well-suited to test research questions related to change over time, because it models change over time in a way that allows change trajectories to vary across individuals as opposed to traditional methods of analyzing longitudinal data (such as Repeated Measures ANOVA), which assumes that all individuals have the same change trajectories. As such, HLM models make more realistic assumptions about the nature of longitudinal data, and therefore, the nature of change across time (Nich & Carroll, 1997). HLM simultaneously conducts analyses at two levels. The level 1 analysis plots an individual's change over time as a function of two parameters, an intercept (representing initial status at intake) and a slope (representing change over time across follow-up assessments). The level 2 analysis investigates systematic group (cluster) variation in change over time by modeling the intercept and slope parameters from the level 1 analysis as a function of cluster membership. In these analyses, we were interested in the extent to which HLM was

TABLE 1. Means and Standard Deviations of Cluster Subgroups on Clustering Variables

Clustering Variable	Juvenile Justice M (S.D.)	Comorbid M (S.D.)	Heavy M (S.D.)
Peer Substance Use	3.52 (1.27)	2.93 (1.31)	4.92 (0.94)
Family Conflict	3.33 (1.82)	4.53 (1.80)	3.86 (2.13)
Parental Psychopathology	0.31 (0.29)	0.71 (0.48)	0.31 (0.23)
Family Alcohol Problems	-0.40 (0.63)	0.53 (1.16)	-0.32 (0.76)
Family Drug Problems	-0.34 (0.71)	0.50 (1.21)	-0.20 (0.89)
Teen's Psychological Involvement w/Drugs	20.74 (10.22)	26.26 (11.83)	49.00 (15.63)
Days in Past 31 Used Substances	6.81 (4.93)	9.64 (6.86)	22.17 (8.71)
Number of Internalizing Disorders	0.43 (0.70)	2.15 (1.72)	0.97 (1.36)
Number of Externalizing Disorders	0.95 (0.78)	2.04 (0.88)	1.78 (0.93)
Legal Involvement	0.37 (0.94)	-0.36 (1.02)	-0.14 (0.94)

able to reliably distinguish clusters based on the outcome trajectories of the individual clients.

RESULTS

Given previous research with substance abusers and juvenile delinquents (e.g., Loeber, 1989; Moffitt, 1993), we had strong theoretical and empirical justification for testing both a two-group and a three-group clustering solution. The initial hierarchical clustering results using Ward's minimum variance clustering method provided support for the three-group solution. Specifically, a small pseudo- t^2 value combined with a peak in the pseudo- F statistic at three clusters indicated an optimal clustering solution. Further, a large increase in the pseudo- t^2 value occurred immediately prior to the three-cluster solution, further supporting this solution (Milligan & Cooper, 1985). However, because the cubic clustering criterion (CCC) was equivalent at both two and three clusters, we explored both solutions in subsequent K-means cluster analyses.

Next, both two-group and three-group solutions were attempted in the K-means cluster analysis, with the three-group solution providing the best statistical separation of the groups. A two-group solution could be obtained, but essentially created a low vs. high severity typology on

substance use, comorbidity, and peer substance use and failed to distinguish groups on any other clustering variables. However, the three-group solution differentiated youth on each of the 10 clustering variables. Inspection of the clusters in the three-group solution revealed qualitatively and theoretically meaningful differences between all three groups. When we divided the sample in half, the three-group solution was replicated in both of the randomly created half samples. Thus, the clustering solution yielded three groups that were statistically distinct and clinically meaningful.

Table 1 provides means and standard deviations of the 10 variables that differentiated the three groups (all significantly different at $p < .01$). The first group, labeled Juvenile Justice Involved Substance Abusers ($N = 58$: 55 males, 3 females), was the highest functioning group, with the least family conflict, the fewest comorbid disorders, and the least substance use, but the most legal involvement. The second group, labeled Comorbid Substance Abusers ($N = 47$: 36 males, 11 females) had a range of risk factors, and was marked by a relatively high level of family conflict, parental psychopathology, family alcohol and drug problems, and the greatest number of comorbid disorders. However, they had the lowest level of legal involvement and involvement with substance using peers. The third group, labeled Heavy Substance Abusers ($N = 36$: 26 males, 10 females), was characterized by the most psychological involvement with substances and the most frequent substance use, the most involvement with substance using peers, but less legal involvement relative to the Juvenile Justice Involved group.

Establishing Discriminant Validity of the Clusters

Demographic variables. Cross tabulations with Chi-Square tests of significance were conducted on race, gender, and family structure to determine differences among clusters. The alpha level was adjusted to .016 using the Dunn-Bonferroni correction. Neither race [$\chi^2(1,4) = 4.73, p = .03$] nor family structure [$\chi^2(1,3) = 0.02, p = .89$] differentiated clusters. However, gender significantly differentiated the clusters, with boys overrepresented in the Juvenile Justice Involved group and girls overrepresented in the Heavy Substance Abusing group ($\chi^2(1,2) = 8.96, p = .003$).

ANOVAs revealed that neither family income [$F(2,132) = 1.23, p = .29$] nor age [$F(2,138) = 1.85, p = .16$] differentiated the clusters.

Age of substance use initiation. Cross tabulations with Chi-Square tests of significance were conducted to determine differences in age at

first use of substances. The alpha level was corrected to .025. Age at first use of marijuana significantly discriminated clusters ($[\chi^2 (1,3) = 4.98, p = .02]$), with Heavy Substance Abusers underrepresented in the group reporting first use of marijuana after age 15. Adolescents in the Comorbid cluster were overrepresented in the group reporting first use of marijuana before age 12.

Perceived substance use problem. Youths' perceptions that they had a substance use problem discriminated adolescents in the clusters. A Chi-Square test was significant [$\chi^2 (1,2) = 5.02, p = .02$], with Comorbid Substance Abusers overrepresented in the "problem" category (perceiving themselves as having a drug or alcohol problem), and Juvenile Justice Involved Substance Abusers underrepresented in the "problem" category.

Adolescent self-worth. Four domains of adolescents' perceived self-worth, social, scholastic, behavioral, and global self-competence were also examined to determine differences among the subtypes (see Table 2). Four separate ANOVAs with Sheffe Least Significant Difference (LSD) post hoc tests were conducted, with an adjusted alpha level of .01 using the Dunn-Bonferonni correction. Perceived Behavioral Conduct was the only scale that significantly differentiated the groups [$F(2,134) = 4.42, p = .01$] with Heavy Substance Abusers feeling less confident about the appropriateness of their behavior in comparison to youth in the Juvenile Justice Involved group (LSD = 0.37, $p = .01$).

Family risk variables. Adolescents' reports of family cohesion and parental acceptance were also examined (see Table 2). The alpha level was corrected to .025. Adolescents' reports of family cohesion differentiated the groups [$F(2,137) = 4.61, p = .01$], with Juvenile Justice Involved adolescents reporting higher levels of cohesion than Heavy Substance Abusers (LSD = 1.30, $p = .01$).

Comorbid psychopathology. Finally, clusters were compared on both adolescent (YSR) and parent reports (CBCL) of internalizing and externalizing symptoms, with alpha adjusted to .01 for 4 separate ANOVA's. Adolescents in the Juvenile Justice Involved group had the lowest rates of internalizing and externalizing symptoms (see Table 2). For CBCL internalizing symptoms, the Comorbid group was significantly higher than both the Juvenile Justice Involved group (LSD = 9.26, $p < .000$) and the Heavy Substance Abusing group (LSD = 7.33, $p < .000$). CBCL Externalizing symptoms were higher among both Comorbid (LSD = 10.68, $p < .000$) and Heavy Substance Abusing groups (LSD = 7.87, $p = .007$) than the Juvenile Justice Involved group. Using adolescents' reports (YSR), teens in the Juvenile Justice Involved group had

TABLE 2. Discriminant Validity of Cluster Subgroups

Variable	Juvenile Justice M (S.D.)	Comorbid M (S.D.)	Heavy M (S.D.)	F
Scholastic Competence	2.07 (0.64)	2.06 (0.78)	2.33 (0.69)	1.90
Behavioral Conduct	2.49 (0.57) ^a	2.62 (0.63)	2.86 (0.56) ^b	4.42*
Social Acceptance	1.73 (0.50)	1.59 (0.53)	1.58 (0.59)	1.33
Global Self-Worth	1.92 (0.65)	1.98 (0.84)	2.04 (0.70)	0.30
Parental Acceptance	3.23 (0.58)	3.17 (0.58)	3.05 (0.55)	1.05
Family Cohesion	6.16 (1.85) ^a	5.85 (2.01)	4.86 (2.30) ^b	4.61*
CBCL Externalizing	18.65 (10.14) ^a	29.33 (9.73) ^b	26.51 (15.07) ^b	11.99*
CBCL Internalizing	8.07 (6.83) ^a	17.33 (8.06) ^b	10.00 (8.28) ^a	19.81*
YSR Externalizing	13.35 (7.07) ^a	19.23 (10.07) ^b	24.15 (10.67) ^b	15.57*
YSR Internalizing	7.35 (5.55) ^a	11.89 (9.76) ^b	13.29 (8.98) ^b	7.08*

* = $p < .01$; ** = $p < .01$

Note: Means having the same superscript letters are not significantly different at $p < .01$

significantly lower symptom scores than both Comorbid (internalizing: $LSD = 4.54, p = .02$; externalizing: $LSD = 5.88, p = .006$) and Heavy Substance Abusing groups (internalizing: $LSD = 5.94, p = .004$; externalizing: $LSD = 10.80, p < .000$).

Establishing Predictive Validity of the Clusters

As a test of the predictive validity of the cluster solution, HLM analyses were conducted comparing the trajectories of adolescents in each cluster subgroup from intake to discharge and up to 6 and 12 months post-discharge from treatment. The groups were first compared on overall number of sessions completed and their engagement in treatment (engagement defined as participating in one or more therapy sessions). Number of therapy sessions completed did not significantly differentiate clusters [$F(2,138) = 2.58, p = .08$]. However, a Chi-Square test of treatment engagement was significant [$\chi^2(1,2) = 5.29, p = .02$], with Juvenile Justice Involved Substance Abusers overrepresented in the “treatment refuser” category (participated in no therapy sessions) and Heavy Substance Abusers underrepresented in the “refuser” category.

The three cluster groups then were compared in terms of changes in substance use, internalizing and externalizing symptoms from admission to the 12-month follow-up using Hierarchical Linear Modeling techniques. Clusters were compared in level 2 in a pair-wise manner by

creating dummy coded variables representing cluster; the regression coefficients for the slope parameter (i.e., change over time) associated with cluster provided a statistical test for cluster differences in treatment outcome. Additionally, a quadratic term was created by squaring the slope time coefficients and entered into the models to test for curvilinear change. We then adjusted for baseline differences in the outcome variables by entering the baseline value as a covariate and assessing change trajectories from discharge through the 12-month follow-up assessment.

For substance use, both the linear ($B = -.812, t = -3.685, p < .0005$) and quadratic ($B = .035, t = 2.529, p = .012$) effects of time were statistically significant, with a decrease in substance use over time for all cluster groups and a lessening of that effect over time. When cluster membership was included as a level 2 predictor of individual slopes, only one statistically significant cluster difference was found. The Heavy Substance Abusing group reduced their substance use at a faster rate than the Juvenile Justice Involved group ($B = -2.382, t = -4.227, p < .0005$). This effect remained significant even after adjusting for baseline differences among the clusters in substance use.

For adolescents' reports of their internalizing symptoms, neither the linear ($B = -.003, t = -.025, p = .98$) or quadratic ($B = -.002, t = -.319, p = .75$) effects of time were statistically significant. For parents' reports of their adolescents' internalizing symptoms, however, both the linear ($B = -.475, t = -3.690, p < .0005$) and quadratic ($B = .021, t = 2.492, p = .013$) effects of time were statistically significant, with Comorbid youth decreasing more rapidly than Juvenile Justice Involved ($B = -3.12, t = -4.31, p < .0005$) and Heavy Substance Abusing youth ($B = 2.47, t = 2.60, p = .01$). The Comorbid group demonstrated the most rapid linear decline in symptoms from intake to 12-month follow-up, even after adjusting for baseline differences in internalizing symptoms. For adolescents' reports of their externalizing symptoms, the linear effect of time was statistically significant ($B = -.326, t = -2.234, p = .025$), indicating a steady decrease in symptoms across clusters following treatment. Both the linear ($B = -1.063, t = -5.484, p < .0005$) and quadratic ($B = .054, t = 4.068, p < .0005$) effects of time were also statistically significant using parents' reports of their adolescents' externalizing symptoms. For the Juvenile Justice Involved cluster, both the linear ($B = .621, t = -2.865, p = .006$) and quadratic effects ($B = .039, t = 2.420, p = .019$) were statistically significant, indicating reduction of symptoms but a slight return of symptoms after treatment. For the Comorbid group, only the linear effect ($B = -.986, t = -2.655, p = .011$) was statistically significant, suggesting steady reduction of symptoms. For the Heavy Substance Abusing group,

both the linear ($B = -1.885, t = -4.206, p < .0005$) and quadratic effects ($B = .112, t = 2.716, p = .001$) were statistically significant, indicating initial reduction of symptoms but return of symptoms between 6 and 12 months. Although a more pronounced quadratic effect was found for the Heavy Substance Abusing cluster than both the Comorbid cluster ($B = .083, t = 2.169, p = .030$) and the Juvenile Justice Involved cluster ($B = .073, t = 2.337, p = .020$), these effects did not remain significant after adjusting for differences in externalizing symptoms at intake.

Treatment condition was then entered as a level 2 predictor to determine if it moderated the effects described above. None of the statistically significant effects were moderated by treatment group membership, suggesting that the effects described above were consistent for both family and individual cognitive-behavioral therapy.

DISCUSSION

The results of this study are consistent with a growing body of literature indicating that adolescent substance abusers are a heterogeneous group comprising clinically meaningful subtypes that can be differentiated on the basis of a number of individual and family risk factors, associated problems, and substance use severity. The three subtypes identified in this study, Juvenile Justice Involved Substance Abusers, Comorbid Substance Abusers, and Heavy Substance Abusers, also could be distinguished in terms of their trajectories of substance use and emotional symptoms over time, suggesting that this typology has predictive validity.

The most common subtype, Juvenile Justice Involved Substance Abusers, was characterized by few risk factors but demonstrated relatively high legal involvement. The existence of this subtype is consistent with the observation that there may be a "developmentally-limited" form of adolescent problem behavior (Moffitt, 1993) in which delinquent activity is not related to other serious risk factors (Loeber, 1989). Adolescents in this group showed relative elevations only on a composite score of legal involvement, which was not reflected in either parents' or adolescents' self-reports of externalizing behaviors. They were also least likely to perceive that they had a drug or alcohol problem. This finding, combined with the fact that the cluster was overrepresented by males, suggests that these youth may have come to the attention of the juvenile justice system because of their substance-related offenses. Although they were referred for drug treatment, they tended to have less

severe substance use problems and later onset of substance use initiation, less comorbid psychopathology, and fewer family risk factors than the other subgroups.

Juvenile Justice Involved youth were less likely to follow through in treatment, perhaps due to less individual and family distress about their substance use, but showed promising long-term outcomes. They reduced their drug use steadily between intake and 12 months, and maintained relatively low levels of internalizing and externalizing symptoms over the long term. Previous studies show that lower risk in terms of limited family alcohol and drug history, better family functioning, and lower levels of comorbid psychopathology predicts better treatment outcomes (Babor et al., 1992; Ball et al., 1995; Crowley, Mikulich, MacDonald, Young, & Zerbe, 1998) and less chronic substance abuse and related problems in adulthood (Duncan, Alpert, Duncan, & Hops, 1997). Although these youth are at elevated risk due to their juvenile justice involvement, these results corroborate findings from recent studies suggesting that drug abuse and delinquency may be discrete factors, and that the relationship between substance use and criminal activity among youth may be more dynamic than some have proposed (Farabee, Shen, Hser, Grella, & Anglin, 2001; Paradise & Cauce, 2003).

Adolescents in the Comorbid group, while similar to the Juvenile Justice Involved group in terms of their relatively low substance use and psychological involvement with drugs, exhibited the greatest risk in terms of family history of drug and alcohol problems, current levels of family conflict, parental psychopathology, as well as their own comorbid psychopathology and early substance use. Based on previous research, it is likely that teens with this constellation of risk factors are at risk for a range of both substance abuse and mental health problems into young adulthood (Rohde, Lewinsohn, Kahler, Seeley, & Brown, 2001). For instance, Grella, Hser, Joshi, and Rounds-Bryant (2001) found that adolescents with comorbid psychiatric and substance use disorders have poor outcomes in response to drug treatment. The results of the current study are also consistent with research on adult substance abusers, demonstrating that family history of substance abuse distinguishes more severe types (Babor et al., 1992; Cloninger, 1987). Further, parental dysfunction and high family conflict are consistent predictors of serious substance abuse and delinquency among adolescents (Loeber, 1989; Steinberg, 2001).

In contrast to previous findings, however, youth in the Comorbid group demonstrated relatively positive treatment outcomes. They not only steadily reduced their internalizing and externalizing symptoms

between intake and 12 months, but also maintained relatively low levels of substance use over the long term. Although teens in the Comorbid Substance Abusing group responded positively to treatment, their high risk in terms of pervasive family dysfunction and their own elevated rates of comorbid psychiatric disorders may make them vulnerable for future substance abuse and psychopathology. The range of family problems seen in this group may indicate the need for intensive family-based treatment.

The third group, labeled Heavy Substance Abusers due to their very high level of substance use and their involvement with substance using peers, are perhaps at highest risk for future problems and chronic substance abuse. Heavy substance use during adolescence is linked to a range of problems, including greater risk of substance dependence (Duncan et al., 1997) and neuropsychological deficits (Tapert & Brown, 1999) in young adulthood. Several researchers have pointed to peer substance use as one of the most significant predictors of substance use escalation (e.g., Stice, Myers, & Brown, 1998). As the results here suggest, externalizing behaviors and peer deviancy training are intimately linked (Dishion, 2000). The adolescents in the Heavy Substance Abusing group showed high levels of externalizing symptoms, including both aggression and delinquency, which are known to be significantly related to chronic antisocial behavior and addiction into adulthood (Moffitt et al., 2002). There also is evidence that conduct disorder is predictive of poor treatment outcome (Crowley et al., 1998) and antisocial personality disorder into adulthood (Myers, Stewart, & Brown, 1998). Consistent with their reported behavioral problems, teens in this group felt least confident about their ability to behave appropriately. Thus, these youth may be the most challenging to treat of all the subtypes.

In fact, the Heavy Substance Abusing group showed mixed treatment response, with poor outcomes in terms of behavior problems, but rapid improvement in their substance use over time. Although they evidenced some reduction in externalizing symptoms from intake to discharge, there was a return to baseline symptom levels between 6 and 12 months post-discharge. Given their continued problems over the long term, these teens may need intensive, multimodal interventions with booster sessions in order to maintain treatment gains.

The finding that girls were overrepresented in the Heavy Substance Abusing group, whereas boys were overrepresented in the Juvenile Justice Involved group, supports previous research indicating that girls may not be referred for treatment until their substance abuse and related problems are fairly advanced (Dakof, 2000). Further, as was seen among the Heavy Substance Abusers generally, girls tend to be vulnera-

ble to the influence of deviant peers, possibly getting involved in substances through relationships with older males.

Limitations. Certain limitations in the current study need to be acknowledged. First, the study relied on the self-reports of the teens themselves, many of whom were court involved and perhaps reluctant to share incriminating data with the researchers. The parents' self-reports of their own psychopathology and family problems likewise must be interpreted with caution. However, the consistency of findings obtained from the parents and adolescents lends more confidence to the results. Further, the results cannot be generalized to a non-juvenile-justice involved sample. This particular typology may only apply to youth who are largely juvenile-justice involved, and even then mostly male and African-American.

Future research may shed more light on the issue of adolescent substance abusing types by following teens from preadolescence into adulthood. The current study is limited by the fact that reports of the adolescents' earlier childhood behavior were not available, and the follow-up period was only 12 months. However, it is unique in that it provides evidence as to the predictive validity of this kind of subtyping. More long-term follow-up studies of the treatment outcomes of various subtypes of adolescent substance abusers are clearly warranted.

Clinical Implications. The results of this study point to a need for greater attention to and more comprehensive assessment of individual and family risk factors, correlated emotional and behavioral problems, as well as substance use patterns in working with substance abusing teens and their families. Such assessments may lead to more appropriate treatment planning and intervention, and further support a movement within the field away from a unidimensional disease model in which "one size fits all." Contemporary research suggests that clinicians must attend to the important variations among these youth, assessing each teen's relative risk and the protective factors operating in his or her life that can be bolstered in therapy. Until these critical dimensions of functioning are adequately assessed and simultaneously targeted, progress in treating this very difficult population will remain limited. Research of this kind supports treatment development efforts that are increasingly moving in the direction of maximizing flexibility to account for the significant heterogeneity of adolescent substance abusers.

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