Treatment Outcomes for Adolescent Substance Abuse at 4- and 7-Month Assessments

Holly Barrett Waldron, Natasha Slesnick, and Janet L. Brody
University of New Mexico

Charles W. Turner
University of Utah

Thomas R. Peterson
University of New Mexico

This randomized clinical trial evaluated individual cognitive–behavioral therapy (CBT), family therapy, combined individual and family therapy, and a group intervention for 114 substance-abusing adolescents. Outcomes were percentage of days marijuana was used and percentage of youths achieving minimal use. Each intervention demonstrated some efficacy, although differences occurred for outcome measured, speed of change, and maintenance of change. From pretreatment to 4 months, significantly fewer days of use were found for the family therapy alone and the combined interventions. Significantly more youths had achieved minimal use levels in the family and combined conditions and in CBT. From pretreatment to 7 months, reductions in percentage of days of use were significant for the combined and group interventions, and changes in minimal use levels were significant for the family, combined, and group interventions.

The pervasiveness of the substance abuse problem among adolescents in the United States is evident from many sources, including prevalence data, substance use mortality data, and costs to society (Johnston, O'Malley, & Bachman, 1998; U.S. Department of Health and Human Services, 1995). The increasing social concern for these problems has prompted greater attention to treatment outcome research. Evaluating outpatient treatment is particularly important, given that two thirds of adolescents presenting for treatment receive outpatient services (Office of Applied Studies, 1998). The purpose of the present study was to evaluate the efficacy of outpatient treatment for adolescent substance-use disorders, with a focus on comparing cognitive–behavioral skills-based interventions and family-based interventions.

Reviews of formal clinical trials of family-based treatments have consistently found that more drug-abusing adolescents enter, engage in, and remain in family therapy than in other treatments and that family therapy produces significant reductions in substance use from pre- to posttreatment (cf. Liddle & Dakof, 1995; Stanton & Shadish, 1997; Waldron, 1997). In seven of eight studies comparing family therapy with a nonfamily-based intervention, adolescents receiving family therapy showed greater reductions in substance use than did those receiving adolescent group therapy (Azrin et al., 1994; Joanning, Thomas, Quinn, & Mullen, 1992; Liddle et al., 2001), family education (Joanning et al., 1992; Liddle et al., 2001), and individual therapy, individual tracking through schools, or juvenile justice system interventions (Henggeler et al., 1991; Krinsley & Bly, 1995). In a study focusing specifically on adolescent alcohol abusers, Trepper, Piercy, Lewis, Volk, and Sprenkle (1993) found that both family and individual therapy approaches resulted in reductions in alcohol use, though no changes in use were observed from a drug education condition.

One limitation of family-based treatments not often acknowledged is the lack of attention to intrapersonal risk factors for adolescents' substance use disorders, such as substance use expectancies, self-efficacy, and specific substance-related coping strategies such as peer refusal and coping with urges and cravings to use. Historically, primary and secondary prevention programs targeting the individual have combined traditional educational/information approaches with a range of self-regulation and other skills, such as decision making, goal setting, stress management training, resistance training, and life-skills training. Reviews of this literature (cf. Botvin & Botvin, 1992) have found that prevention programs focusing on social influence specifically or integrating a broad spectrum of strategies were able to demonstrate both

Holly Barrett Waldron, Center for Family and Adolescent Research and Department of Psychology, University of New Mexico; Natasha Slesnick, Center on Alcoholism, Substance Abuse, and Addictions, University of New Mexico; Janet L. Brody and Thomas R. Peterson, Center for Family and Adolescent Research, University of New Mexico; Charles W. Turner, Department of Psychology, University of Utah.

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Correspondence concerning this article should be addressed to Holly Barrett Waldron, Department of Psychology, Logan Hall, University of New Mexico, Albuquerque, New Mexico 87131. Electronic mail may be sent to hwaldron@unm.edu.
significant delay in the onset of substance use and reductions in current use.

The skills-training components included in many of the school-based group prevention programs overlap considerably with alcohol-abuse treatment programs formulated for individual, cognitive–behavioral interventions. Although the effectiveness of these individual interventions has been established for adult alcohol abusers (cf. Hester & Miller, 1995; Marlatt & Gordon, 1985), similar empirical evidence for adolescents is only beginning to emerge. For example, Myers and Brown (1990a, 1990b) found that after cognitive–behavioral treatment, adolescent alcohol abstainers and minor relapers were more likely to use problem-solving coping strategies than were major relapers. Further, coping factors have been identified as significant predictors of treatment outcome (Myers, Brown, & Mott, 1993).

Cognitive–behavioral approaches typically involve multiple components derived from theories of learning and are designed to address individual, intrapersonal factors associated with substance use. Specifically, these models aim to enable adolescents to identify appropriate behavioral goals and develop self-regulation and coping behaviors. Interventions may include techniques to increase self-efficacy for change, contingency management to increase activities not associated with substance use, identification of stimulus cues preceding use behavior, implementation of strategies for avoiding situations in which use is likely to occur, and development of coping skills such as drug and alcohol refusal, communication, and problem solving. Though similar in content domain to the traditional group prevention interventions, individual therapies can be expected to demonstrate more powerful treatment effects than group therapy, in part because of the more focused attention of the therapist and the therapist’s ability to tailor the treatment to the specific needs of the individual client. However, because of the potentially greater cost effectiveness of group interventions, it is important to study conditions under which these interventions might be effective.

A shortcoming of both the individual and the group-based treatments is that they place considerably less emphasis on addressing the various risk and protective factors associated with the family. Theoretically, family systems theorists argue that alcohol-and drug-abuse develops and is maintained in the context of maladaptive family relationships and that correcting faulty family interaction patterns will, in turn, reduce adolescents’ involvement with alcohol and other drugs. Family therapy may also offer the advantage of simultaneously providing treatment and prevention that influences patterns of substance use or the initiation of alcohol use in parents and siblings. Specifically, family treatments are designed to effect change in risk factors such as parent and sibling drug use, ineffective supervision and discipline (monitoring), negative parent–child relationships, and family conflict.

Findings from two studies have highlighted the potential benefit of exploring a combination of family and individual cognitive–behavioral skills-training strategies. Brown, Myers, Mott, and Vik (1994) found that decreased use was not necessarily associated with better functioning in areas such as family relationships and suggested that individual skills-based treatment with adolescents had a “fluctuating” impact on other life domains. In another study, evaluating behavior therapy for adult and adolescent drug abuse, Azrin et al. (1993) noted that the adolescent participants (17% of the total sample) demonstrated significantly greater substance-use reductions than did adults. However, in discussing this finding, the authors attributed these results to active parental participation in the adolescents’ treatment sessions. Thus, for both theoretical and empirical reasons, combining family and cognitive–behavioral skills treatment approaches may provide significant advantages over either approach alone, as different risk factors are addressed in each treatment modality, and combining treatments increases the number of factors addressed.

The present study was designed to address some of the limitations in previous treatment outcome research by including more in-depth assessment of adolescent substance use, including post-treatment and follow-up assessments, and by evaluating contrasting treatment models for reducing substance use and associated problems. Interventions evaluated in this study included functional family therapy (FFT; Alexander & Parsons, 1982), a systems oriented, behaviorally based model of relatively structured family therapy in which the overall goal is to alter maladaptive family patterns that contribute to adolescent substance use, and individual cognitive–behavioral therapy (CBT), patterned after coping-skills training programs developed by Moni, Abrams, Kadden, and Cooney (1989) and by Project MATCH (Kadden et al., 1995). An intervention in which the cognitive–behavioral and family approaches were combined was also offered to evaluate the additive or interactive treatment effects for adolescents and their families. The efficacies of these three interventions were compared with a fourth group intervention involving elements of drug and alcohol education and skills training similar to the broad-based secondary prevention programs described earlier. Together, an evaluation of outcomes across the four conditions was intended to provide a clearer understanding of which approaches to treatment have greatest benefit at the level of the adolescent and for the family. Because empirical studies have demonstrated a strong relationship between family influences and adolescent substance use and have provided considerable support for the efficacy of family-based treatments, we expected that youths who completed either family therapy alone or family therapy in combination with CBT (joint intervention) would show significantly greater reductions in substance use compared with youths who did not receive family therapy. We also expected that the joint intervention would be superior to the other three interventions because more unique risk factors would be addressed by the combination of family therapy and the individual skills training presented in CBT. Substance use and family relationship outcomes were examined at 4 months and at 7 months after the initiation of treatment.

Method

Participants

Participants were 120 adolescents (96 boys, 24 girls) and their families living in the Albuquerque, NM, area. Six of these adolescents completed neither the 4-month nor the 7-month posttreatment assessment and were dropped from the analyses, yielding a final sample of 114. The participants were referred to the University of New Mexico Center for Family and Adolescent Research for drug-abuse treatment (see Table 1 for adolescent characteristics and Table 2 for caregiver characteristics). Referral sources included the juvenile justice system (43%), public school system (31%), self- or parent referral (21%), and other treatment agencies (15%). Most adolescents were mandated to treatment by court order, by probation officers in lieu of a court order, or by the schools in lieu of suspension or other consequence.
Table 1
Adolescent Characteristics by Intervention Condition for the Pretreatment Sample (N = 120)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>FFT (n = 30)</th>
<th>CBT (n = 31)</th>
<th>Joint (n = 29)</th>
<th>Group (n = 30)</th>
<th>Univariate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>p</td>
<td></td>
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<td>dfs</td>
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<td>Adolescent gender</td>
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<td>24</td>
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<tr>
<td>Female</td>
<td>6</td>
<td>6</td>
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<tr>
<td>Adolescent age (years)</td>
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<td>9.69</td>
<td>9.10</td>
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<tr>
<td>Adolescent substance use</td>
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</tr>
<tr>
<td>(% days of use)</td>
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<tr>
<td>Age of first use*</td>
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<td>11.10</td>
<td>11.53</td>
<td>1.49</td>
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<td>SD</td>
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<td>2.11</td>
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<tr>
<td>No. of adjudicated offenses</td>
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<td>0.93</td>
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<td>SD</td>
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<td>No. of comorbid diagnoses</td>
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<td>1.76</td>
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<td>SD</td>
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<td>2.01</td>
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<td>12</td>
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<tr>
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<td>1</td>
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</tr>
<tr>
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Note. FFT = functional family therapy; CBT = cognitive-behavioral therapy; Joint = family therapy in combination with CBT; Group = group intervention with drug and alcohol education and skills training.

* Excluding tobacco.

Comorbid diagnoses were examined for the treatment sample on the basis of data from the Child Behavior Checklist (CBCL: Achenbach & Edelbrock, 1982). For delinquent behavior, 89.8% of our sample had scores at or above the mean for a comparison group of referred adolescents. In similar comparisons, the percentages of our sample at or above the mean for various clinical problems were 29.7%, anxious/depressed; 27.3%, attention difficulties; 47.7%, externalizing behavior; and 45.3%, internalizing behavior.

Youths between the ages of 13 and 17 years were eligible for the study if they were living at home with a primary caretaker who was also willing to participate and if they met Diagnostic and Statistical Manual of Mental Disorders (4th ed.; DSM-IV; American Psychiatric Association, 1994) diagnostic criteria for a primary substance abuse disorder. The focus of the study was illicit drug use, with youths primarily abusing only alcohol and/or tobacco excluded from participation. As a result, in the final sample, marijuana typified the vast majority of substance abuse. Youths and families were also excluded if the adolescent needed services other than outpatient treatment (e.g., was dangerous to self or others, needed monitored detoxification), if there was evidence of a psychotic or organic state, or if a sibling was participating in the study. During the 2-year recruitment period for the study, a total of 235 youths were screened for participation, 120 of whom completed at least one therapy session. The majority of the remaining 115 adolescents screened did not meet one or more eligibility criteria (e.g., diagnostic criteria, 30%; other services needed, 14%; unwilling to be treated, 55%; moved, 1%).

Procedure

All families referred to the center completed an intake interview to identify clinical concerns and to determine study eligibility. Eligible families were then scheduled for a pretreatment assessment. Consent/assent for participation was obtained at the beginning of the assessment session. The assessment battery was about 4–5 hr, with approximately half of the families completing the battery in a single session and half, in two shorter sessions spaced 1–2 days apart, according to family preference.

After the initial assessment, adolescents were randomly assigned to one of four treatment conditions: FFT, individual CBT, a combination of FFT and CBT (joint), or a psychoeducational group. An urn randomization procedure, used successfully in other clinical trials (e.g., Project MATCH Research Group, 1993), was used to retain random allocation while balancing treatment condition groups on a priori continuous and categorical variables. With this procedure, relative probabilities of assignment to treatment groups (urns) are computer adjusted on the basis of previous randomizations to ensure pretreatment group equivalence. The variables included in this project’s urn were gender, age, level of substance use, ethnicity, psychiatric severity, and family constitution. The sample included 30 families randomly assigned to FFT, 31 assigned to CBT, 29 assigned to the joint intervention, and 30 assigned to the group intervention. Treatment was provided at no cost to the families.

Follow-up assessments were conducted at 4 and at 7 months following the initiation of treatment. The timing of these follow-ups was designed to correspond generally with the completion of treatment and then with the time point 3 months after treatment completion. All measures except the
Table 2  
Caregiver Characteristics by Intervention Condition for the Pretreatment Sample (N = 120)  

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>FFT (n = 30)</th>
<th>CBT (n = 31)</th>
<th>Joint (n = 29)</th>
<th>Group (n = 30)</th>
<th>Univariate</th>
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<tr>
<td>Primary caregiver education</td>
<td></td>
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<tr>
<td>(years)</td>
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<td>13.67</td>
<td>14.69</td>
<td>13.47</td>
<td>1.01</td>
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<tr>
<td>SD</td>
<td>2.84</td>
<td>3.01</td>
<td>3.41</td>
<td>2.30</td>
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<tr>
<td>Other caregiver education</td>
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<tr>
<td>(M)</td>
<td>13.61</td>
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<td>SD</td>
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<td>1.83</td>
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<td>(M)</td>
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<tr>
<td>SD</td>
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<td>36.46</td>
<td>12.40</td>
<td>18.97</td>
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<tr>
<td>(% days of use)</td>
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<td>16.62</td>
<td>12.30</td>
<td>18.19</td>
<td>0.31</td>
</tr>
<tr>
<td>SD</td>
<td>30.91</td>
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<td>23.03</td>
<td>26.66</td>
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<td>(% days of use)</td>
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<td>34.95</td>
<td>29.41</td>
<td>26.45</td>
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<tr>
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<td>35.36</td>
<td>31.07</td>
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<td>Two parent</td>
<td>20</td>
<td>15</td>
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<td>16</td>
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</tr>
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</table>

Note. Parent criminal activity only available from Form 90 "days incarcerated" category. No parent reported spending any days incarcerated during the pretreatment Form 90 assessment period. FFT = functional family therapy; CBT = cognitive–behavioral therapy; Joint = family therapy in combination with CBT; Group = group intervention with drug and alcohol education and skills training.

Problem Oriented Screening Instrument (POST; Radert, 1991; see Measures below) were collected at each assessment point. Families were compensated for completing the assessment portions of the study: $75 for the pretreatment, $75 for the 4-month follow-up (both given to the family at the 4-month follow-up appointment), and $90 for the 7-month follow-up.

Therapists

Six therapists provided therapy at any one time, two in each of the three treatment modalities (FFT, CBT, and group). The CBT and FFT therapists each provided treatment for the joint intervention. An effort was made to balance treatment conditions with respect to therapist gender and ethnicity. Each condition included a male and a female therapist, of whom one was Anglo and one was Hispanic. Therapist experience ranged from 4 to 10 years. Two therapists held doctorates in clinical psychology, and seven therapists were master’s-level graduate students in clinical or counseling psychology. All therapists were employed to provide treatment services for the project and received extensive training and supervision in their respective treatment approaches. To examine therapist effects, a repeated measures analysis was conducted with the percentage of days substance was used as the dependent measure and therapist as the independent variable, with no significant interaction, F(2, 28) = 0.96.

Treatment Conditions

Adolescents were offered 12 hr of therapy in three of the treatment conditions, FFT, CBT, and the group intervention, and 24 hr of therapy in the joint intervention (i.e., 1 hr of FFT and 1 hr of CBT per week). The group intervention was designed to include eight 90-min sessions. At therapist discretion, an additional 2 hr in each condition were available to resolve crisis situations. However, the crisis sessions were rarely used (i.e., in four cases across three conditions).

The individually oriented, CBT skills-training program was patterned after coping-skills-training programs developed by Monti et al. (1989) and by Project MATCH (Kadden et al., 1995). The underlying model was designed to teach the individual adolescent self-control and coping skills useful in avoiding substance use (Hester & Miller, 1989; Wilkinson & LeBreton, 1986). The CBT intervention consisted of a two-session motivational-enhancement intervention (MET) and 10 skills modules, including communication training, problem solving, peer refusal, negative mood management, social support, work- and school-related skills, and relapse prevention. The initial MET sessions were based on principles described by Miller and Rollnick (1991). During the MET sessions, therapists used nonconfrontational strategies to maximize motivation for change, prioritize treatment goals, create a treatment plan, and enhance the adolescent’s sense of self-efficacy.

FFT is a systems-oriented, behaviorally based model of relatively structured family therapy in which the overall goal is to alter dysfunctional family patterns that contribute to adolescent substance use (Alexander & Parsons, 1982). The model has substantial empirical support as an effective treatment for a variety of adolescent problem behaviors (Alexander, Pugh, & Parsons, 2000). The FFT intervention is applied in two phases. The first phase focuses on engaging families in the treatment process and enhancing motivation for change. Therapists strive to maximize families’ expectations for positive change and to effect changes in attitudes and feelings by reducing blaming behavior and emphasizing the relationship aspects of identified problems. A family assessment, involving the identification of the interactional and functional aspects of specific behaviors, attributions, and feelings of family members, is also conducted during this phase. Once the initial phase is completed, the second phase is introduced, and the focus of treatment shifts to effecting behavioral changes in the family. Contingency management, communication and problem solving, behavioral contracting, and other behavioral interventions are implemented, using the family assessment of relationship functions as a guide, to reduce problem
behaviors and to facilitate more adaptive patterns of interaction in a manner that preserves the original functions of the problem behavior within the family system.

Combined FFT and CBT intervention (joint). In the combined treatment, participants received both the CBT and the FFT treatment. The youth was assigned a CBT therapist and the family was assigned as FFT therapist. The youth assigned to this treatment condition attended 2 sessions weekly for a total of 24 sessions.

Psychosocial/educational group intervention. The group intervention was modeled after tertiary prevention education strategies widely used in adolescent substance abuse programs (Bovin & Bovin, 1992). This intervention provided information about drugs and alcohol, explored expectancies and consequences of substance use, provided opportunities for adolescents to identify self-esteem-enhancing alternatives to substance abuse, and included some skills-based training, such as assertiveness training and refusal skills. Though there was some content overlap between the CBT and the group conditions, the focus in CBT was on the individual adolescent issues, with a flexible treatment plan based on individual needs. The group was more highly structured, focusing on group participation and cohesion and sharing of experiences, and had less emphasis on individual skill building.

Adherence to treatment protocol. To ensure treatment adherence, manuals and session checklists were developed for each treatment condition, and all treatment sessions were videotaped. Supervision for each treatment condition was provided by a supervisor with expertise in the particular treatment approach. Videotapes of the sessions and the adherence checklists were used to provide feedback to therapists and maximize model adherence. In addition, for the joint therapy condition, therapists and supervisors met monthly to ensure coordinated treatment.

To evaluate treatment adherence, we rated one therapy session for half the total sample (n = 60), selected at random, on a 10-point scale for adherence (1 = least adherence, 10 = greatest adherence) to the clinical manuals for the FFT condition (n = 11, M = 9.09, SD = 1.04), the CBT condition (n = 11, M = 8.91, SD = 1.04), the family therapy sessions in the joint condition (n = 9, M = 9.33, SD = 0.71), the CBT sessions in the joint condition (n = 11, M = 9.09, SD = 0.83), and the group condition (n = 18, M = 9.50, SD = 0.52). Ratings were based on standardized session checklists. The range of ratings was on a 7–10-point scale. A one-way analysis of variance (ANOVA) was calculated with the five tape sources operating as the independent variable and the adherence rating treated as the dependent variable. The results indicated that the five sources of tapes were not significantly different in adherence ratings. F(4, 55) = 1.09, p < .37.

Measures

Because marijuana was the predominant drug of choice for youths in this sample, the primary substance-use outcome measures were (a) percentage of days marijuana was used and (b) percentage of youths achieving minimal use. To evaluate the clinical significance of the reductions in marijuana use, we created a dichotomous dependent variable that classified each adolescent as having "minimal" or "heavy" marijuana use. Minimal use indicated that the youths reported abstinence or near abstinence (i.e., they reported use on fewer than 10% of the days) in the assessment period; whereas heavy use involved use of the drug on greater than 10% of the days.

Substance use outcome. The primary measures of the quantity and frequency of substance use were percentage of days marijuana was used and percentage of days any drug was used, obtained for all adolescents and parents with the Form 90D version (Miller & Del Bocca, 1994) of the Timeline follow-back interview (TLFB; M. S. Sobell et al., 1980). The TLFB, a standard method for obtaining substance-use information, is a semistructured interview that samples a specific time period, using a monthly calendar and memory anchor points to prompt recall of drinking and/or drug use episodes and to retrospectively reconstruct daily consumption of alcohol or use of drugs during the period of interest (L. C. Sobell & Sobell, 1992). The calendar is used to account for each day in the assessment window (e.g., 90 days), providing a record of drinking or drug use that will yield a variety of consumption measures, including number of drinking days, number of standard drinks consumed, number of drinks per drinking day, and blood alcohol level. In principle, the TLFB may offer a particularly sensitive approach for adolescents, having the advantage of assessing the widely variable drinking patterns that often characterize teen drinking and that might not be modeled adequately by the averaging approaches (Lecese & Waldron, 1994).

For all participants, substance use at pretreatment was examined for the previous 90-day period. At the 4-month and 7-month follow-up points, the calendar period for the TLFB interview extended back to the date of the last assessment. The family of Form 90 instruments has shown excellent test–retest reliability for indices of drug use in major categories (Tonigan, Miller, & Brown, 1997), with kappas for different drug classes ranging from 0.74 to 1.00. The TLFB also has adequate reliability and validity with adolescents (Waldron, 1996) and has been used to detect pre–post changes in substance use in another adolescent treatment outcome study (Krensley & Bry, 1995). In the present study, coefficient alphas for the TLFB were calculated on the past 90 days use in each assessment period. The alphas were .99 for pretreatment, 4-month, and 7-month assessments, indicating strong internal consistency of the measure.

Other measures. Collateral reports, urine drug screenings, and other measures were obtained to examine convergent validity of the TLFB. Collateral TLFB reports on substance use, a method well established in the addictions field (Miller, 1996; Needle, McCubbin, Lorenz, & Hochhauser, 1983; L. C. Sobell & Sobell, 1992), were obtained from parents and siblings of the target adolescents. In addition, adolescents provided urine specimens at the project site. Urinalyses, conducted by a local laboratory, included a nine-panel screen for amphetamines, barbiturates, benzodiazepines, cannabinoids, cocaine, methadone, methaqualone, opiates, and phencyclidine, plus a screen for alcohol. The screens were carried out by immunoassay, and all positive screens were confirmed by gas chromatography/mass spectrometry (GC/MS).

The POSIT and the CBCL were also administered. The POSIT is a 139-item self-report instrument developed to assess 10 functional areas associated with adolescent substance abuse. McLaney, Del Bocca, and Babor (1994) have reported adequate psychometric properties of this instrument. The CBCL provides a standardized format for assessing child behavior across a range of problem areas. This 113-item scale is a widely used research instrument with well-documented psychometric properties (Achenbach & Edelbrock, 1982). In the present study, evaluation of internal consistency at baseline assessment revealed coefficient alphas of .88 for the Internalizing Scale and of .91 for the Externalizing Scale.

Attrition From Treatment and Research Protocols

Treatment completion. Youth and families were considered enrolled in treatment if they attended at least one session, and they were considered engaged in treatment if they attended at least three therapy sessions. Seven families agreed to participate in treatment but did not attend a single therapy session. These families were dropped from the research sample. Eleven adolescents and their families terminated treatment prematurely (i.e., attended only one or two sessions). However, 10 of these completed follow-up assessments, and their data were included in all analyses as part of the full intent-to-treat sample.

The 18 families who attended two or fewer therapy sessions (noncompleters) were compared with the 109 families who attended three or more sessions (completers) by chi-square analyses. No statistically significant differences were found for treatment condition, \( \chi^2(3, N = 127) = 3.49, p > .05 \); ethnicity, \( \chi^2(4, N = 127) = 6.73, p > .05 \); gender, \( \chi^2(1, N = 127) = 30, p < .05 \); or single- versus two-parent family constellation, \( \chi^2(1, N = 127) = 6.01, p < .05 \). Moreover, there were no significant differences
between youths who engaged in therapy and completed follow-up assessments and those who did not complete treatment on the basis of age, family income, or percentage of days of substance use at baseline.

Research completion. Six families dropped out of the research protocol (i.e., did not complete either follow-up assessment). Youths from 4 of these families completed at least 3 hr of therapy. All 4 of these adolescents were male, 1 was Hispanic, and 3 were Anglo youth. One of the 4 participated in CBT, 1 in the group condition, and the other 2 in the joint intervention.

Results

Overview of Analyses

Three sets of analyses were conducted. Preliminary analyses examined pretreatment demographic and dosage effects as potential confounds in the interpretation of the findings. The next analyses evaluated the convergent validity of the primary outcome measure, percentage of days of substance use that was reported on the TLFB for marijuana, alcohol, and tobacco. The final set of analyses examined adolescent marijuana use, other adolescent substance use, primary caregiver substance use, family conflict, and internalizing and externalizing behavior across treatment conditions.

Preliminary Analyses

To ensure that differences in pretreatment substance use were not significantly affected by age, gender, or ethnicity, we conducted separate one-way ANOVAs for adolescents on each independent variable. Pretreatment substance use did not differ by age, $F(4, 115) = 1.81, p > .05$; gender ($M = 64.40\%$ days of use for girls, and $M = 58.90\%$ days of use for boys), $F(1, 118) = 0.61, p > .05$; or ethnicity, $F(3, 116) = 2.49, p > .05$.

Other analyses examined the equivalence of the treatment conditions. The analyses assessed possible systematic differences between conditions that might occur because of recruitment, engagement, or attrition biases following the random assignment of individuals to treatments. Separate one-way ANOVAs showed no statistically significant differences between treatment conditions on adolescent substance use, $F(3, 116) = 1.03, p > .05$; age, $F(3, 116) = 0.82, p > .05$; annual family income, $F(3, 110) = 1.34, p > .05$; or primary caretaker education, $F(3, 114) = 1.01, p > .05$. Sample size differences among analyses resulted from unreported data on some measures. A categorical analysis conducted with Pearson's chi square showed no systematic differences between treatment conditions for ethnicity, $\chi^2(9, N = 120) = 7.45, p > .05$; gender, $\chi^2(3, N = 120) = 0.53, p > .05$; or family constitution, $\chi^2(3, N = 120) = 2.36, p > .05$. (See Tables 1 and 2 for means and standard deviations of pretreatment measures in treatment conditions.)

An analysis was conducted to assess possible differences among conditions in the percentage of the planned therapy sessions that were completed for each intervention. The percentage of therapy sessions completed was $81.0\%$ for FFT, $79.3\%$ for CBT, $70.0\%$ for group, and $80.0\%$ for joint treatment. A one-way ANOVA was conducted with treatment condition as the independent variable and the percentage of completed therapy sessions as the dependent variable. The results revealed no statistically significant differences among treatment conditions in the percentage of planned sessions that were completed, $F(3, 116) = 0.59, p > .05$. As expected, however, the average number of therapy hours was greater in the joint intervention ($M = 19.28, SD = 7.02$) relative to the other conditions ($M = 9.73, SD = 4.30$, for FFT; $M = 9.52, SD = 3.71$, for CBT; and $M = 8.40, SD = 4.57$, for group). Also, as expected, the average number of weeks required to complete the treatments was less for the group intervention ($M = 7.71, SD = 5.35$) relative to the other conditions ($M = 15.42, SD = 7.80$, for FFT; $M = 16.29, SD = 7.48$, for CBT; and $M = 18.05, SD = 7.81$, for joint).

Convergent Validity of TLFB With Other Measures of Marijuana Use

Analyses examining the convergence of the primary dependent measures with other measures of substance use were conducted first for marijuana, the drug of choice for youths in this sample, and then for alcohol and tobacco use. In this pretreatment sample, $99\%$ of youths reported some marijuana use during the 90 days prior to assessment, and $83\%$ of youth also had positive urine findings, indicating convergence of self-reported use and biological measures. This evidence of convergence is likely conservative because marijuana is only detected in the urine for about 3 weeks, and a number of youths could have been using marijuana in the earlier part of the 90-day assessment window and still have had a valid negative urine screen. Parent collateral reports of the percentage of days the adolescent used a substance were provided for all 120 youths in the study, and sibling collateral reports were obtained for 46 youths.

Bivariate correlations showed convergence between an adolescent's self-reported marijuana use at pretreatment on the TLFB and parent collateral report ($n = 120$) of the youth's marijuana use, $r(118) = .37, p < .001$, as well as between an adolescent's self-report and a sibling's collateral report, $r(44) = .55, p < .001$, on the adolescent's marijuana use. Percentage of days marijuana was used as reported by the adolescent was also significantly correlated with self-reported number of other drugs used, $r(118) = .31, p < .001$; problems associated with substance use on the POSIT, $r(118) = .31, p < .001$; and parent report of externalizing problems on the CBCL, $r(118) = .26, p < .005$.

Bivariate correlations also showed convergence between the TLFB frequency of substance-use measure (percentage of days any drugs or alcohol were used) and reported number of drugs used, $r(118) = .39, p < .001$; problems associated with substance use as reported on the POSIT, $r(118) = .41, p < .001$; and the parent report of externalizing problems on the CBCL, $r(118) = .27, p < .003$.

Missing Values

Some of the 120 adolescents failed to complete measures either at the 4-month ($n = 8$) or at the 7-month ($n = 7$) assessment period. Six others missed both follow-up assessments; these 6 were removed from subsequent analyses, leaving 114 families. We assessed whether the values from remaining families appeared to be missing, randomly using the missing completely at random (MCAR) statistic (SPSS Missing Value Analysis [MVA] 7.5, Hill, 1997). This statistic, $\chi^2(1, N = 114) = 48.78, p < .001$, provided evidence that the values were not missing at random. To avoid possible bias from deleting these individuals from subsequent
analyses (i.e., listwise deletion), we created estimates for the missing scores. The regression plus random residuals MVA module in SPSS provided the estimates.

This SPSS procedure can provide inappropriate estimates if the observed data are not normally distributed. We assessed non-normality by calculating skewness and kurtosis within the four treatment conditions across the three measurement periods. Skewness ranged from -0.52 to 1.16, and kurtosis ranged from -1.86 to 1.26. Only one skewness index (i.e., 8.3% of tests) and one kurtosis index (8.3%) were statistically significant at the .05 level. These findings are consistent with the premise that the dependent measures were approximately normally distributed.

We used the data from pretreatment and one follow-up period to estimate the scores missing from the other follow-up periods. Missing values were estimated only for participants who had data available for both the pretreatment and one of the two follow-up periods. Ordinary regression-based estimates of missing values can provide an underestimate for the variance of predicted (i.e., estimated) scores. To correct for this underestimation, the MVA options in SPSS add a random residual to each estimate so that the variance of predicted scores is equivalent to the variance of observed scores. This random residual imputation process was repeated five times for each missing value. Next, the mean for those five values was calculated and substituted for the missing scores.

The differences between the means with and without imputed scores ranged from 0.00 to 1.61. The differences between the standard deviations with and without imputed scores ranged from 0.00 to 1.58. The effects of adding random residuals to regression-based estimates can be determined by calculating the variances among the five repeated imputations for each measurement in each condition. These variances reflect the uncertainty in the estimates of means (similar to an empirical standard error) based on imputed values. The variances ranged from 0.03 to 6.54 with a mean variance of 1.38.

**Marijuana Use Outcomes**

The central aim of the study was to compare the efficacy of four interventions for adolescent substance abuse: FFT, CBT, joint, and group treatments. The comparison was conducted using a 4 (treatment condition) × 3 (time) repeated measures ANOVA. Treatment condition (FFT, CBT, joint, and group) was a between-subjects variable, whereas time (pretreatment, 4-, and 7-month follow up) was a within-subjects variable. Percentage of days marijuana was used, from the TLFB procedure, served as the dependent variable. Missing values at 4 months and 7 months were replaced by the mean of imputed scores. The statistical analyses revealed a nonsignificant main effect for treatment condition, $F(3, 110) = 1.70, p > .05$, a significant main effect for time, $F(2, 220) = 12.38, p < .001$, $\eta^2 = .101$; and a significant interaction between time and treatment condition, $F(6, 220) = 2.84, p < .011$, $\eta^2 = .072$ (see Table 3).

**Simple main effects within treatment conditions.** To help explain the time and Time × Group interaction, we performed simple main effects analyses examining the time effects within each of the four treatment conditions (see Figure 1). These four simple effects explain the same sum of squares as the combined time and Time × Group interaction effects (Parducz & Schmelkin, 1991, pp. 523–527). These analyses indicated that the time simple effect was statistically significant for the FFT, $F(2, 56) = 8.05, p < .001$, $\eta^2 = .233$; joint, $F(2, 52) = 5.81, p < .005$, $\eta^2 = .183$; and group, $F(2, 56) = 5.98, p < .004$, $\eta^2 = .176$. The time simple effect was not statistically significant within the CBT condition, $F(2, 56) = 0.02, p < .98$, $\eta^2 = .001$.

Additional analyses were used to examine the significant simple effects and assess change from pretreatment to the 4- and 7-month follow-up points within each treatment condition. A priori comparisons using repeated measures $F$ tests with a Bonferroni adjustment of $\alpha = .0125$ were conducted for each of the four treatment conditions from pretreatment to the 4-month follow-up (see Table 3). Youths in the FFT condition, $F(1, 28) = 20.42, p < .001$, $\eta^2 = .20$. Youths in the CBT condition, $F(1, 28) = 5.24, p < .05$, $\eta^2 = .15$. Youths in the joint condition, $F(1, 28) = 6.24, p < .05$, $\eta^2 = .18$. Youths in the group condition, $F(1, 28) = 4.34, p < .05$, $\eta^2 = .13$.
.229, and in the joint condition, \( F(1, 26) = 7.71, p < .01, \eta^2 = .292 \), showed significant reductions in marijuana use. As expected from the simple effects analysis, youths in the CBT condition, \( F(1, 28) = 0.00, p > .125, \eta^2 = .000 \), and in the group condition, \( F(1, 28) = 2.82, p > .08 \), did not have a significant reduction in marijuana use.

To examine the stability of change from pretreatment to the 7-month follow-up, we conducted a second set of four planned comparisons using Bonferroni adjustment for \( \alpha = .125 \). Youths in the joint treatment condition maintained a significant reduction from pretreatment to 7-month follow up, \( F(1, 26) = 8.37, p < .008, \eta^2 = .243 \). Youths in the FFT condition were not significantly different from pretreatment to 7-month follow up, \( F(1, 28) = 3.18, p < .085, \eta^2 = .102 \), suggesting that the changes occurred before they were maintained at 7 months. The youths in the group condition significantly reduced their substance use from pretreatment to 7 months, \( F(1, 28) = 7.72, p < .01, \eta^2 = .216 \). Finally, youths in the CBT condition did not change significantly from pretreatment, \( F(1, 28) = 0.02, p < .87, \eta^2 = .001 \).

**Simple effects within time periods.** Another strategy for examining the Treatment \( X \) Time interaction is to examine the treatment effects within each of the two postintervention time periods. The pretreatment marijuana use measure was used as a covariate. These two simple effects analyses indicated that the treatment effect was statistically significantly different in the 4-month measurement period, \( F(3, 109) = 4.94, p < .003, \eta^2 = .120 \). The treatment simple effect was not statistically significant within the 7-month follow-up period, \( F(3, 109) = 1.14, p < .338, \eta^2 = .030 \). Bonferroni adjusted comparisons among the 4-month means indicated that the FFT condition had a significantly lower rate of marijuana use than did the CBT and group treatment conditions but that FFT was not significantly different from the joint condition. None of the other mean comparisons was statistically significant. None of the between-treatment effects was statistically significant for the 7-month measurement period.

**Clinical Reductions in Marijuana Use**

To evaluate the clinical significance of the reductions in marijuana use, we created a dichotomous dependent variable that classified each adolescent as having minimal or heavy marijuana use. Minimal use indicated that the youth reported abstinence or near abstinence (i.e., reported use on fewer than 10% of the days) in the assessment period. Although no adolescents were completely abstinent at pretreatment, 7.5% of the total sample reported using marijuana only minimally. The proportion of youths with minimal use at pretreatment was not significantly different across the four treatment conditions, \( \chi^2(3, N = 120) = 3.38, p > .05 \), during each of three assessment periods.

Pretreatment to 4-month and 7-month change in clinically significant marijuana use was assessed with a Wilcoxon’s signed-ranks test procedure within each condition (see Figure 2). The Wilcoxon’s sign test indicated a significant change in heavy to minimal use from pretreatment to 4 months in FFT (86.6% vs. 55.2%, \( z = 2.89, p < .004 \)), CBT (96.8% vs. 72.4%, \( z = 2.65, p < .008 \)), and joint (89.7% vs. 55.6%, \( z = 3.00, p < .003 \)) conditions, but not in the group condition (96.7% vs. 87.8%, \( z = 1.63, p < .102 \)). The Wilcoxon’s sign test analysis also indicated a significant change from heavy use to minimal use from pretreatment to 7 months in the FFT condition (86.6% vs. 62.1%, \( z = 2.53, p < .011 \)), the joint condition (89.7% vs. 55.6%, \( z = 2.71, p < .007 \)), and the group condition (96.7% vs. 69.0%, \( z = 2.53, p < .011 \)), but not in the CBT condition (96.8% vs. 82.8%, \( z = 1.63, p < .102 \)).

The two family conditions were combined and contrasted with the CBT and group conditions at the 4- and 7-month measurement periods by use of Mann-Whitney tests. The findings revealed a significant difference between the combined family conditions and group at 4 months (\( z = 2.49, p < .013 \)) but a nonsignificant difference at 7 months (\( z = .90, p < .37 \)). The combined family condition was not significantly different from CBT at 4 months (\( z = 1.51, p < .128 \)), but it was significant at 7 months (\( z = 2.20, p < .028 \)).

Both of the family therapy conditions had significant changes in heavy marijuana use from pretreatment to the 4-month assessment, and this reduction persisted until the 7-month assessment. The initial changes in CBT from pretreatment to 4 months did not persist through the 7-month assessment. Finally, the changes in the group condition did not emerge until the 7-month assessment.

**Outcomes for Other Variables**

Urinalysis data, internalizing and externalizing behaviors, and family conflict were examined to evaluate within- and between-treatment condition effects for these variables. Positive urine screens were found for 84% at pretreatment, 81% at 4 months, and 76% at 7 months. Analyses of the differences in urine screen rates...
over time or between condition differences did not approach statistical significance.\textsuperscript{2} No statistically significant effects of treatment on either the Internalizing or the Externalizing Scale of the CBCL or in the adolescent or primary caregiver family conflict scores were found.\textsuperscript{3}

\section*{Discussion}

This study evaluated the efficacy of family-based and cognitive–behavioral treatments for reducing adolescent substance use in the context of a randomized clinical trial. Pretreatment assessment of substance-use patterns, however, revealed relatively high rates of marijuana use, with much lower rates of alcohol and other substance use, making it difficult to detect pre- to post-treatment change for substances other than marijuana. Thus, data analyses primarily focused on evaluations of marijuana use. Independent analyses were conducted at two follow-up points on two important outcome measures: overall percentage of days of use and percentage of youths who were abstinent or nearly abstinent (minimal use).

Within-treatment condition comparisons examined substance use at 4 months (i.e., posttreatment) and at 7 months (i.e., 3-months posttreatment) following the initiation of treatment relative to pretreatment use. From pretreatment to 4 months, significant reductions in percentage of days of substance use were found for the FFT and joint interventions, and significant numbers of youths had achieved minimal-use levels in the FFT, joint, and CBT interventions. By 7 months, reductions in percentage of days of substance use were significant for the joint and group interventions, and changes in minimal-use levels were significant for the FFT, joint, and group interventions.

The findings for the family-based and group interventions are generally consistent with the adolescent substance-abuse treatment literature (Friedman, 1989; Henggeler et al., 1991; Joanning et al., 1992; Kaminer, Burleson, Bliz, Sussman, & Rounsavl, 1998; Lewis, Piercy, Spreenkle, & Trepper, 1990; Liddle et al., 1993). The CBT findings, however, differ from other research. Investigators participating in the Cannabis Youth Treatment (CYT) study, a recently completed multisite treatment outcome study, did find significant reductions in percentage of days of substance use from pretreatment to 3-month follow-up for CBT interventions (Dennis et al., 2000). However, they also found differential treatment effects over time, depending on the form and dosage of CBT and the severity of substance use. Still, the CYT findings are encouraging, especially since the CBT interventions implemented in the CYT study included a motivational-enhancement component, as in the current study.

The pattern of findings for the group intervention is striking, given that Dishion and his colleagues have reported iatrogenic effects for group interventions (Dishion, McCord, & Poulin, 1999; Dishion, Spracklen, Andrews, & Patterson, 1996). However, their research focused on preventive interventions for youths at risk for substance use but not yet diagnosed with a substance-use disorder. Outcomes may vary as a function of study population, particular substances used, and the nature of the group intervention (Tobler, 2000; Tobler et al., 2000).

Interpreting the efficacy of the joint intervention was complicated by having youths attend twice as many therapy sessions in this condition compared with the other three conditions. Possibly, more therapy sessions are needed to produce enduring change for adolescent substance-use disorders. However, our finding that youths in the group intervention significantly reduced their use on both outcome measures at the 7-month follow-up does not support an argument for simple dose effects. Alternatively, because our cognitive–behavioral intervention in the joint intervention included a motivational-enhancement component, perhaps there were interactive or additive effects between the individual motivational enhancement and family therapy that produced better long-term outcomes.

The between-treatment comparisons of the family-based conditions (FFT and joint) with CBT and with the group condition revealed that the percentage of minimal use in the two family conditions was significantly greater than in the group condition at 4 months and significantly greater than in the CBT condition at 7 months. These findings provide support for the differential efficacy of the family treatments in producing short-term clinically significant changes (compared with group) and in producing relatively longer term changes (compared with CBT). It is important to note, however, that all of the interventions in this study demonstrated some degree of treatment efficacy. Differences were found only in terms of how quickly the changes emerged and the maintenance of change over time. Dennis et al. (2000) reported findings similar to those in the current study, with overall increases in the percentage of youths reporting no past-month use from 4%--

\begin{itemize}
\item The mean reported percentage of days of use at pretreatment was 63.0% for tobacco, 8.7% for alcohol, 2.6% for cocaine/crack, 1.6% for hallucinogens, 1.6% for uppers, and less than 1% for tranquilizers, sedatives, opiates, inhalants, LSD, stimulants, or downers. Thus, other than alcohol, tobacco, and marijuana, the adolescents enrolled in the present study had very low use rates for other drugs. There were no statistically significant changes over time in percentage of days of alcohol use or tobacco use. Analyses of self-reported substance use for the primary caregiver also revealed no statistically significant effects.
\item A time effect was obtained both for the Internalizing scale, $F(2, 176) = 42.39, p < .001$, and the Externalizing scale, $F(2, 176) = 51.13, p < .001$. A Bonferroni-adjusted comparison of the time main effect on the Internalizing scale indicates that the pretreatment mean (for all conditions, $M = 12.93$) was significantly higher in internality than the 4-month ($M = 7.62$) and the 7-month ($M = 6.68$) measures. The latter two means were not significantly different. Similarly, the pretreatment mean ($M = 21.21$) on externality was significantly higher than the 4-month ($M = 14.18, p < .001$) and the 7-month mean ($M = 12.67, p < .001$). The latter two means were not significantly different from each other. Both internalizing and externalizing symptoms decreased from pretreatment to posttreatment, and this decline persisted until the 7-month measurement period.
\item The statistical analyses revealed a significant main effect of time for both the adolescent, $F(2, 220) = 9.66, p < .001$, $\eta^2 = .081$, and the primary caregiver, $F(2, 218) = 19.20, p < .001$, $\eta^2 = .150$, indicating a reduction in perceived family conflict, regardless of treatment condition, over time. A Bonferroni-adjusted comparison of the pretreatment (youth $M = 4.46$, primary caregiver $M = 3.91$) with the 4-month (youth $M = 3.72$, primary caregiver $M = 3.10$) measures revealed a statistically significant reduction in conflict ($p < .001$) for both youth and primary caregivers. The comparison between baseline and 7-month assessment (youth $M = 3.60$, primary caregiver $M = 2.89$) also revealed a statistically significant reduction in conflict for adolescent and primary caregiver ($p < .001$). The 4-month and 7-month means were not statistically significant either for the youth or for the parent.
\end{itemize}
at pretreatment to 13% at 3-month and 34% at 6-month assessments. They also found support for the efficacy of both family-based and cognitive-behavioral interventions, with generally greater immediate gains and evidence of relapse for some youths over time.

Taken together, potential interpretations of the findings can be offered in relation to the theoretical mechanisms of change for each intervention. In the family interventions, substance-use risk factors relating to the family, such as family conflict, are addressed directly. Moreover, family members have the opportunity to learn and practice new behaviors, such as communication skills and problem solving, immediately within the context of the therapy session, and they obtain direct feedback from the therapist. Enhancing parenting skills may further provide direct support for reductions in other substance-use risk factors such as adolescent exposure to high-risk use situations.

By contrast, the CBT intervention focuses on risk factors related to the individual and provides less opportunity for direct observation and feedback on the use of new skills in a social context. Although rehearsal with the therapist is an integral component of the CBT intervention, there is less opportunity for observation of skill use with the intended target population.

In the group intervention, individual client issues receive less attention, but behavior change strategies are practiced directly in a social context that closely mirrors the clients' actual peer group, and immediate feedback can be provided by the therapist during skill rehearsal. Thus, the differences in outcomes among the treatment conditions may relate to both the number of risk factors addressed by the interventions and the social context in which behavior change skills are learned (Brown et al., 1994). Although treatments addressing a single domain may have some initial benefit, the beneficial effects of interventions may be more likely to persist in those interventions that address multiple risk factors and are supplemented by either improved peer or enhanced family support.

Another goal of the study was to establish convergent validity of the TLFB interview method for assessing adolescent substance use with other measures of related behavior. Historically, there have been concerns that youth would underreport their substance use, calling into question the validity of the self-report method. Evidence for convergent validity was found for the primary TLFB measures (i.e., percentage of days with any drug or alcohol use, percentage of days with marijuana use, and number of drugs used) with urine toxicology screens, parent and sibling TLFB collateral reports, the POSIT, negative consequences associated with substance use, and externalizing behaviors as measured by the CBCL. Moreover, we also found that the urine screens actually resulted in more negative findings when compared with adolescent self-report. Taken together, these findings lend support for the validity of the adolescent TLFB as a measure of adolescent substance-use problems.

As with any treatment outcome study, the pattern of findings needs to be replicated with other treatment populations. Youths in our study primarily abused marijuana, and the efficacy of the treatments for abuse of other drugs such as alcohol, crack or cocaine, amphetamines, or hallucinogens needs to be established. Also, the treatments were offered in an outpatient setting, and treatment outcomes may differ for youths in inpatient or residential settings or for homeless youths. Moreover, our sample included predominantly Anglo Americans and English-speaking (i.e., highly acculturated) Hispanic Americans; our findings may not generalize to less acculturated Hispanics, African Americans, Native Americans, or other ethnic cultural groups.

Another important limitation stems from the unequal number of sessions across treatments in the current study. Because of our interest in examining the potential additive effect of the family and cognitive-behavioral treatment, we confounded the number of sessions with type of treatment, making it difficult to determine the contribution of treatment dose to outcome. We are currently conducting another clinical trial to reevaluate the joint intervention, providing equal numbers of treatment sessions across the different intervention conditions.

The findings provide preliminary evidence for the benefit of several different modalities for treating adolescent marijuana use disorders, but they also highlight that findings may differ for different outcome measures. Moreover, changes in the pattern of findings over two follow-up periods demonstrate that conclusions concerning the treatment outcomes will differ depending on when the follow-up data are collected. The benefits of some treatments may emerge only over time, and the immediate benefit of others may dissipate. Thus, treatment outcome must be examined at more distal points in time.

The minimal-use outcome measure, constructed to reflect clinically significant levels of marijuana use, should also be explored further. The finding that youths achieved abstinence or near abstinence after completion of treatment is particularly interesting because all of the interventions adhered to a harm reduction model rather than to an abstinence model. Minimal use or abstinence, then, may occur in response to treatment even when abstinence is not an explicit treatment goal. Moreover, achieving some threshold of minimal use may be important in the maintenance of treatment gains over time.

Other avenues for research include coding of therapy tapes to more clearly identify connections between therapy process and positive outcomes. In addition, examining client and family characteristics and other variables associated with positive change may be important for identifying variables attributable to successful client-treatment matching. Greater attention is also warranted for group treatments. One focus of our group intervention was to help youths identify abstinent peers who might support their behavior change. Some research has suggested that treatments that specifically target enhancing relationships with nondeviant peers may be related to reductions in substance use over time (Ozechowski & Liddle, 2000). Future research should focus on examining the relationship between substance use outcome and changes in peer relationships.

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