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Parenting Practices as Mediators of Treatment Effects in an Early-Intervention Trial of Multidimensional Family Therapy

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Background: Contemporary intervention models use research about the determinants of adolescent problems and their course of symptom development to design targeted interventions. Because developmental detours begin frequently during early-mid adolescence, specialized interventions that target known risk and protective factors in this period are needed. **Methods:** This study ($n = 83$) examined parenting practices as mediators of treatment effects in an early-intervention trial comparing Multidimensional Family Therapy (MDFT), and a peer group intervention. Participants were clinically referred, low-income, predominantly ethnic minority adolescents (average age 14). Assessments were conducted at intake, and six weeks after intake, discharge, and at 6 and 12 months following intake. **Results:** Previous studies demonstrated that MDFT was more effective than active treatments as well as services as usual in decreasing substance use and improving abstinence rates. The current study demonstrated that MDFT improves parental monitoring—a fundamental treatment target—to a greater extent than group therapy, and these improvements occur during the period of active intervention, satisfying state-of-the-science criteria for assessing mediation in randomized clinical trials. **Conclusions and Scientific Significance:** Findings indicate that change in MDFT occurs through improvements in parenting practices. These results set the foundation for examining family factors as mediators in other samples.

Keywords Adolescent substance abuse, mediation, multidimensional family therapy, young adolescents

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INTRODUCTION

Parenting, family management, and parent–adolescent relationship factors are instrumental to healthy adolescent adjustment and are implicated in a range of negative developmental outcomes. Research consistently demonstrates that family and parenting factors are among the strongest predictors of substance abuse and delinquency in adolescence (1).

Developmental psychopathology research also shows that the more individual and environmental risk factors accumulate early in life, the more vulnerable a child is to developing problems. The presence of early emotional and/or behavioral disorders predicts problem formation in other areas, including school, peer relationships, and delinquency and substance abuse (2). Longitudinal research convincingly demonstrates that the earlier delinquency and drug abuse develop, the more likely it is that without effective intervention, these problems can become chronic and contribute to deepening dysfunction into adulthood (3). Thus a public health perspective supports early intervention programming that targets those evidencing highest risk at certain windows of development, such as early adolescence (4).

Contemporary prevention and intervention science uses the available research about the known determinants of problems and the timing and course of symptom development, as well as critical contextual factors such as family factors, to design targeted prevention and intervention models (5). A number of effective prevention and treatment models have been developed based on the core assumption that changes in family environment can prevent or prompt reductions in child and adolescent problem behaviors. In fact, parenting and

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family factors respond to intervention (6), and parenting can change even after problem behaviors have begun and have become entrenched (7). Further, certain family-based treatments have not only shown effectiveness in reducing adolescent problems in randomized clinical trials, recent studies of treatment mechanisms have also explored how the interventions achieve their effects. Accumulating evidence supports the theoretical basis of family-based interventions; studies show that fundamental changes in family dynamics are instrumental in retracking adolescent development. Mediation analyses indicate that changes in certain family factors and processes, including parental monitoring and parent-adolescent communication, reliably predict change in adolescents' substance use and delinquency (8, 9).

Multidimensional Family Therapy (MDFT) (10) has demonstrated efficacy in reducing adolescent drug abuse and delinquency and improving family functioning in a series of randomized clinical trials (11). Additionally, process research on MDFT has defined core processes that are instrumental to launching, maintaining, and progressing treatment, and also those that are presumably linked to the perpetuation of adolescents' problems, such as family conflict and negativity (12). These studies have illuminated core therapeutic processes (e.g., alliance building techniques, parenting practices, use of salient cultural themes, resolution of in-session impasses) that impact specific therapeutic targets. A next step in this research program is to demonstrate that changes in family factors mediate effects on adolescent outcomes using state-of-the-science criteria for assessing mediation in randomized clinical trials (13).

Using the same multiethnic, young adolescent sample used in this study, (14) found that MDFT was more effective than peer group treatment in reducing frequency of substance use and dependency symptoms associated with it, delinquency, and internalized distress, as well as reducing risk in family, peer, and school domains. One reason for the superior MDFT treatment effects could be that youth in the group intervention did worse due to peer deviancy training (15); however, results from this study indicated that youth in both interventions showed improvement in substance use as well as other outcomes. In the current study, we sought to extend these findings by examining how MDFT achieved its effects. Based on hypothesized mechanisms of action and existing research demonstrating mediation of adolescents' outcomes through changes in family functioning, we hypothesized that changes in family relationships and parenting, specifically, parental monitoring and more positive parent-adolescent relationships, would mediate changes in teens' drug use over time.

METHODS

Participants and Procedure

To be eligible for study participation, adolescents had to be: (a) between the ages of 11 and 15, (b) referred for outpatient treatment for indications of substance use, (c) living with at

least one parent or parent-figure who could participate in the assessments and therapy, (d) not in need of inpatient detoxification or other intensive services, and (e) not actively suicidal, demonstrating psychotic symptoms, or diagnosed mentally retarded. Referrals to the study came from juvenile justice (45%), schools (41%), substance abuse/mental health facilities (2%), or other sources such as parents (12%). Contact persons at these agencies provided referrals to the study research coordinator, who conducted a brief screening interview to determine whether the referred adolescent had met study eligibility criteria. A total of 61 males (74%) and 22 females (26%) living in Miami, FL with an average age 13.73 ($SD = 1.1$) participated in this study. Youth were ethnically diverse: 42% Hispanic, 38% African American, 11% Haitian or Jamaican, 3% white, non-Hispanic, and 4% other. At intake, 47% of the participants met criteria for substance abuse, and 16% met criteria for substance dependence.

A telephone screening process established initial study eligibility. Project staff then met with eligible youth and parents in their homes to describe the study and obtain written informed consent prior to the first assessment session. Adolescents were randomly assigned to either peer-group therapy ($n = 43$) or MDFT ($n = 40$) after the baseline assessment. The Research Coordinator used an urn randomization program to ensure equivalence. Please see (14) for more information on the participants and procedure.

Treatment Conditions

Both treatments were conducted twice per week (90-minute sessions) for 12–16 weeks. MDFT sessions were conducted mostly in the home, while the peer group therapy was conducted in clinic offices. Case management services were provided in both treatments as needed and separate case managers were assigned to each treatment condition. Both treatments were free of charge and transportation assistance (i.e., bus tokens) was provided to reduce treatment participation barriers.

Adolescent Group Therapy

The adolescent group therapy was a manual-guided intervention based on social learning principles and cognitive behavioral therapy. The approach used empirically established CBT guidelines for adolescent substance abuse (16). One therapist led each session, and between four and six male and female adolescents participated. Groups were "open"—new members were admitted as previous members completed treatment and the approach was designed so that each adolescent could begin treatment as a new content module was beginning and could complete all 6 modules (each approximately 2 weeks long) in the 12–16 weeks of treatment without significant repetition of content over the course of treatment. Using a risk and protective factor framework, the treatment aimed to reduce substance use both by targeting it directly and by focusing on accompanying risk factors such as low self-esteem, school problems, and poor social

functioning. Drug education was combined with interpersonal and relationship skills training and social support (peer sharing and feedback). Worksheets and role-plays individualized the generic content. Therapists explored beliefs about drugs, and used classical relapse prevention methods, including how to understand drug use triggers, re-evaluate and eventually avoid drug using friends, improve refusal techniques, recognize automatic thoughts about drug use, and increase prosocial, non-drug related ways to have fun and feel good.

Multidimensional Family Therapy

MDFT is an integrative, family-based, multiple systems oriented treatment system for adolescent drug abuse and related behavior problems. As a treatment system, several versions of the approach, office-based, in-home, brief, intensive outpatient, day treatment, and residential treatment, have been developed and tested. MDFT can be delivered from one to several times per week over the course of three to six months depending on the treatment setting, and the impairment severity of adolescent problems, family functioning, juvenile justice involvement, and other contextual factors. Therapists individualize sessions based on ongoing assessment in four interdependent treatment domains according to the particular risk and protection profile of the adolescent and family.

The *adolescent domain* helps teens engage in treatment, communicate and relate effectively with parents and other adults, disaffiliate with drug using, antisocial peers and develop new friends, and develop social competence and alternative behaviors to drug use and delinquency. The *parent domain* engages parents in therapy, increases their behavioral and emotional involvement with the adolescents, and improves parental monitoring and limit setting. The *family interaction domain* focuses on decreasing conflict, improving emotional attachments and patterns of communication, and problem solving using multi-participant family sessions. The *extrafamilial domain* fosters family competency and collaborative involvement within all social systems in which the teen participates (e.g., school, juvenile justice, recreational). Throughout treatment therapists meet alone with the adolescent, alone with the parent(s), or conjointly with the adolescent and parent(s), depending on the treatment domain and the individual needs of the adolescents/family. Sessions are held in the family's home, court, in schools, and on the telephone.

Treatment Fidelity

We conducted rigorous treatment fidelity monitoring and evaluation on both interventions. Therapeutic contact logs showed that adolescents in the two conditions received similar amounts of treatment per week, but that youth receiving MDFT received a significantly greater number of total treatment hours. Further, equivalence testing procedures of observational ratings of MDFT sessions showed that MDFT adherence in the current study was statistically equivalent to adherence scores obtained

in a previous MDFT efficacy study (17). Please see (14) for more details on treatment fidelity.

Measures

Assessments were conducted at intake, at six weeks post-intake, at discharge, and at 6 and 12 months following treatment intake. Measures described below were administered at all assessment points. Ninety-seven percent of scheduled assessments were completed at follow-up time points. Measures were administered separately to youth and parents by extensively trained assessors, who were blind to treatment assignment and to study hypotheses.

Background and Demographic Information

The Parent and Adolescent Interviews gathered information on relevant demographic variables (age, gender, ethnicity).

Treatment condition was coded as 0 for MDFT and 1 for group treatment.

Substance Use

Adolescents' substance use was measured with the Timeline Follow-Back Method (TLFB) as adapted and validated with adolescents (18). The TLFB obtains retrospective reports of daily substance use by employing a calendar and other memory prompts to stimulate recall. In the current study, we used a summary measure consisting of the number of days in which the adolescent reported using any substance, including alcohol.

Parenting Practices

The Adolescent Daily Interview (ADI) is a self-report checklist of family interactions that occurred during the previous 24 hours adapted from the Oregon Social Learning Center's Adolescent Daily Report (19) (sample item: "Did your parent(s) talk to you before leaving the house in the morning?"). It was administered to teens over the phone on three days within a 1-week period at each assessment point. Each participant received an average score for each item at each assessment point. Henderson et al. (20) performed exploratory factor analysis on the ADI items and identified 3 unidimensional factors: (1) relationship quality, consisting of behaviors associated with closer parent-adolescent relationships; (2) monitoring, consisting of behaviors indicating parents' monitoring of their adolescents' friends and daily activities; and (3) negative valence, consisting of coercive behaviors associated with negative parent-adolescent relationships. Henderson et al. (20) then used IRT methods (2 parameter logistic model) to analyze the relationship quality and monitoring items, determining that the items formed two well-defined scales.¹ As produced in Multilog, IRT person scores are scaled in logits, with the average value receiving a score of 0.

¹The negative valence items were not further analyzed due to extreme parameter estimates, indicating that the items did not provide a good match to the samples' severity of these negative interactions (i.e., item threshold values exceeded values of 6).

Data Analytic Approach

The study examined the extent to which changes in parenting practices mediate the relationship between treatment condition and change in substance use. To this end, we examine whether: (1) treatment condition predicts change in parental monitoring and relationship quality, (2) changes in parental monitoring and relationship quality are associated with decreases in substance use, and (3) the relationship between treatment condition and decreases in substance use is mediated by improvement in parenting practices. Whereas substance use was measured at intake, 6 weeks, treatment discharge, and 6- and 12-month follow-ups, parenting practices were measured at intake, 6 weeks, and treatment discharge. This design feature allows us to assess whether a putative mechanism of change precedes change in a treatment outcome (21).

We analyzed individual client change in substance use and parenting practices using latent growth curve (LGC) modeling, analyzing an unstructured error covariance structure, which is the default estimation method in Mplus. Missing data was handled with full information maximum likelihood (FIML) estimation, under the assumption that the data were missing at random (22). LGC modeling was conducted using Mplus software (Version 5.1) and proceeded in four stages. First, we tested a series of growth curve models, representing possible forms of growth (e.g., no change, linear change, discontinuous change), to determine the overall shape of the parenting practice change trajectories. Second, we added treatment condition to the models to test the impact of treatment type on initial status and change over time (i.e., the intercept and slope growth parameters). To test for mediated effects, we followed the approach of (23), which provides guidelines for testing mediation using LGC methodology. Following their approach, we conducted a parallel process model, in which we simultaneously estimated two LGC models, one representing change in parenting practices, and one change in substance use, and regressed the growth parameters from these two models on treatment condition. We allowed the slope of the parenting practices to correlate with the slope of substance use. Following (23)'s recommendations, we used Sobel's (24) test to examine the indirect effect between treatment condition and decreases in substance use through parental monitoring and relationship quality². Because frequency of substance use deviated substantially from normality, we used two-part growth curve modeling. Thus in the same analysis, we estimated separate but correlated continuous and categorical LGC models (25).

RESULTS

Table 1 provides the means and standard deviations for frequency of substance use, parental monitoring, and relation-

ship quality at intake, 6 week, discharge, and 6- and 12-month follow-up assessments. We organize the following findings according to the four main questions introduced above: (1) Is treatment condition differentially related to decreased substance use? (2) Is treatment condition differentially related to improvements in parenting practices? (3) Are improvements in parenting practices related to decreases in substance use? and (4) Do improvements in parenting practices mediate the relationship between treatment condition and decreases in substance use?

Model Selection

Two-part growth models were used to examine change in substance use frequency. As a first step, we examined the functional form of growth for each part of the unconditional (i.e., excluding intervention status and background variables) two-part LGC following procedures outlined in Muthén (27). First, we determined the functional form for trajectories in the categorical part of the model (e.g., abstinence vs. any substance use) using likelihood ratio difference tests for nested models. Having established the functional form for the categorical part of the model, we determined the functional form of the model's continuous part (e.g., substance use frequency) by selecting the two-part model that produced the smallest Bayesian Information Criterion (BIC). The functional form of the continuous model would typically be selected from a series of nested models. However, there were too few participants in this study reporting substance use to produce a proper solution. The continuous part of the model was best represented by linear growth (Linear Model BIC = 798.147; Piecewise Model BIC = 815.173) with a fixed variance for the slope (fixing the slope variance was necessary to achieve model convergence). Model fit statistics for all models reported below are included in Table 2.

Is Treatment Condition Differentially Related to Decreased Substance Use?

Liddle et al. (14) found a significant intervention effect for the continuous part of the 2-part growth model ($b = -.13$, pseudo $z = -3.51$, $p < .001$), as well as the categorical part of the model ($b = -.73$, pseudo $z = -2.98$, $p = .003$). Youth in MDFT reported fewer days of substance use as well as increased abstinence from drugs and alcohol over the 12-month follow-up period.

Is Treatment Condition Differentially Related to Improvements in Parenting Practices During Treatment?

To examine this research question, we first used LGC modeling to determine whether parenting practices improved over time. Results indicated that across treatments, parental monitoring improved between intake and treatment discharge ($b = .10$, pseudo $z = 2.39$, $p = .02$), and relationship quality also showed a marginal trend in improvement ($b = .12$, pseudo $z = 1.52$,

²We were unable to estimate bootstrapped mediation test statistics using the asymmetric confidence interval method (26) because the procedures are not available when using the numerical integration techniques that are necessary to estimate two-part models.

TABLE 1
Descriptive statistics for frequency of substance use, parental monitoring, and relationship quality by treatment condition

	Intake <i>M (SD)</i>	6 Week <i>M (SD)</i>	Discharge <i>M (SD)</i>	6 Month <i>M (SD)</i>	12 Month <i>M (SD)</i>
Substance Use					
MDFT	3.05 (5.65)	.62 (1.80)	.68 (3.64)	.87 (3.72)	.23 (.74)
Group	4.21 (4.84)	2.95 (5.62)	4.31 (7.11)	2.66 (3.64)	2.55 (3.22)
Abstinent n (%)					
MDFT	22 (55)	31 (78)	36 (90)	33 (83)	34 (85)
Group	12 (28)	21 (51)	21 (51)	16 (39)	19 (45)
Monitoring					
MDFT	.06 (.69)	-.11 (.68)	.12 (.66)	N/A	N/A
Group	.29 (.83)	-.27 (.68)	-.12 (.41)	N/A	N/A
Relationship Quality					
MDFT	< .01 (.63)	-.22 (0.97)	.12 (.66)	N/A	N/A
Group	< .01 (.81)	-.71 (.96)	-.12 (.42)	N/A	N/A

Note: Means for substance use represent the average number of days used in the previous 30.

$p = .09$). We then regressed the slope parameters for parental monitoring and relationship quality on treatment condition and found that MDFT participants reported greater improvement in parental monitoring than group participants ($b = .22$, pseudo $z = 2.39$, $p = .02$). However, treatment condition was not significantly related to improvement in relationship quality ($b = .03$, pseudo $z = .27$, n.s.). Therefore, we did not examine relationship quality in further analyses.

Are Improvements in Parenting Practices Related to Decreases in Substance Use?

A parallel process model in which we regressed the slope parameter representing change in substance use on the slope parameter representing change in parental monitoring revealed that improvements in parental monitoring were related to increasing proportions of youth abstaining from substance use over the 12-month follow-up ($b = -19.90$, pseudo $z = -1.93$, $p = .05$). However, parental monitoring was not related to decreases in frequency of substance use in the continuous part of the 2-part model ($b = -2.11$, pseudo $z = -1.36$, $p = .18$).

Do Improvements in Parenting Practices Mediate the Relationship between Treatment Condition and Decreases in Substance Use?

Finally, we included treatment condition in the parallel process model in which change in substance use was predicted by change in parental monitoring. The slope parameters from both growth processes were regressed on treatment condition. This model yielded the following results: (1) change in parental monitoring regressed on treatment condition ($b = .98$, $SE = .02$), and (2) change in proportion abstinent regressed on change in parental monitoring ($b = -4.03$, $SE = 2.92$). Results of the Sobel test were marginally significant (Sobel test = 1.38, $p = .08$), suggesting that in this small sample, parental monitoring mediated the relationship between treatment condition and increased abstinence from substance use.

DISCUSSION

Results from the current study indicate that in this sample of young adolescents, MDFT achieved its effects on substance use by improving parental monitoring to a greater extent than peer group treatment. Previous intervention studies, both

TABLE 2

Model chi-square, BIC^a, CFI, and SRMR statistics for models reported in text^a

Model	BIC	χ^2	CFI	SRMR
1	793.368	N/A	N/A	N/A
2	533.11	12.29*	.70	.11
3	576.73	2.12	.97	.05
4	1243.04	N/A	N/A	N/A
5	1227.19	N/A	N/A	N/A

Note. Model 1 = Two part model examining treatment effects on frequency of substance use.

Model 2 = Linear model regressing change in monitoring on treatment condition.

Model 3 = Linear model regressing change in relationship quality on treatment condition.

Model 4 = Parallel process model regressing change in frequency of substance use on change in monitoring.

Model 5 = Parallel process model regressing slope parameters of frequency of substance use and monitoring on treatment condition.

^a χ^2 , CFI and RMSEA tests not available for two-part model at the time the analyses were conducted.

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

prevention and treatment, have demonstrated that family functioning is either associated with treatment effects or mediates treatment outcomes (cf. 28, 29). However, many of these studies have been limited by examining mediation effects in the experimental condition alone or assessing change in the mediator and change in outcome simultaneously. Our formal examination of mediation also extends previous MDFT research; although MDFT process studies have shown that improvements in parenting are associated with reduction in drug use (30), we have not used contemporary methods for testing mediation hypotheses in randomized clinical trials. The results we report here are consistent with Kraemer et al.'s (13) criteria for assessing mediation in that: (1) MDFT improves parental monitoring, (2) increases the proportion of youth abstaining from drug use to a greater extent than group therapy, and (3) parental monitoring improves during treatment and to a greater extent for youth receiving MDFT. Importantly, improvements in parental monitoring also precede increases in the proportion of youth abstaining from drug use, empirically demonstrating that parental monitoring may not only statistically mediate treatment effects, but that it may also be an MDFT mechanism of change (21).

We find it interesting that improved parental monitoring was directly responsible for MDFT treatment effects. At the same time, relationship quality was related to greater increases in abstinence from substance use, but across both treatments (and is consistent with previous MDFT process research; 30). Therefore, relationship quality was associated with improvement in MDFT participants, but it did not mediate treatment effects. Because younger adolescents are more dependent on their parents for issues such as transportation, peer choice, and selection of leisure activities, it is possible that parental monitoring is particularly important in influencing younger adolescent behavior, including drug use. An interesting area for future research is whether monitoring may mediate treatment effects for younger adolescents and other family variables such as communication and affective expression may work similarly for older adolescents. Such research designs would involve examining moderated mediation; that is, mediated effects that are stronger for one group (e.g., age) than another (31). Finally, the mediation findings are specific to the proportion of adolescents abstaining from drug use, and were not significant for frequency of use for those who continued to use drugs. Therefore, parental monitoring seems to be particularly effective in preventing future post-treatment drug use, at least among young African American and Hispanic adolescents.

The study findings must be considered in light of its limitations. First, we limited our focus to relationship quality and parental monitoring as mediators of treatment effects. It is possible that other factors (e.g., peer contagion) may mediate treatment effects in other samples and/or interventions. Second, they may apply only to the study's predominant demographic: urban, African American and Hispanic males. Third, although substance use was assessed through a reliable and valid

instrument, it is based on youths' self-report. Finally, our results may overestimate the magnitude of the mediated effect because we were unable to report bootstrapped statistics and confidence intervals (26), which are currently unavailable in the routines for two-part growth modeling implemented in Mplus. Foremost among the study's strengths include our use of a state-of-the-science research design for testing meditation effects and the lack of research demonstrating mediation of treatment effects in empirically-supported substance abuse interventions. Second, balanced against the limitation of the potential lack of generalizability of the findings is the fact that very few treatments have been tested with ethnic minority samples, not to mention examining the means by which they achieve their effects. This study (along with the parent trial [14]) is one of the very first that does both.

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Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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