

How Do Outcomes in a Specified Parent Training Intervention Maintain or Wane Over Time?

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In a randomized prevention trial, 238 recently separated mothers and their young sons were assigned to either Parent Management Training (PMT) or a comparison group. Families were intensively assessed at baseline and at each 6-month interval through 30 months. To understand the effects of PMT, we first evaluated effect sizes among family variables over time. Second, because observed parenting was the target of PMT, we hypothesized a sequential pattern of structured changes within and between individuals. Using constructs with mismatched sources of data, we conducted a set of latent growth mediational analyses to test hypothesized mechanisms explaining change. Effect sizes indicated that parenting changed first within 12 months, followed by changes in boy behaviors and finally changes in maternal depression within 30 months. Unique follow-up findings indicated that intervention effects on reductions in maternal depression were mediated by reductions in boy externalizing; intervention effects on externalizing were mediated by reductions in boy depression. As expected, increases in effective parenting predicted reductions in child behavior problems. PMT effects on internalizing were direct and indirect, partially mediated by parenting practices. Results are discussed from a system's perspective on PMT amplifiers.

KEY WORDS: parent training; child adjustment; maternal adjustment; divorce; growth curve.

INTRODUCTION

In the last decade the field of prevention science rapidly grew in scope and specificity. As an increasing number of intervention programs are demonstrated to be efficacious and disseminated in multiple contexts, the question emerges as to why intervention processes work and how they mature over time. Prevention scientists, for example, have taken the position that prevention trials should be used to answer questions refining moderating and mediating mechanisms explaining effectiveness (Brown, 1993; Brown & Lia, 1999; West *et al.*, 1993). With the current data we conducted a series of latent growth models to examine mediators that define a prevention process, including a focus on both normative and

pathogenic development. We addressed questions of change that accrued during the follow-up stages of the Parent Management Training (PMT)-based intervention that was tailored for single mothers in the Oregon Divorce Study II (ODS-II, Forgatch & DeGarmo, 1999).

In general, applications of PMT to clinical samples of families referred for treatment of out-of-control children have generally produced positive outcomes in both efficacy (Bien & Bry, 1980; Eisenstadt *et al.*, 1993; Serketich & Dumas, 1996) and effectiveness trials (Tynan *et al.*, 1999). For some clinical samples, some of these improvements are lost during follow-up as shown in the studies by Bank *et al.* (1991), Baum and Forehand (1981), and Patterson and Fleischman (1979). On the other hand, less disturbed samples have maintained improvements for at least a 12-month follow-up (Webster-Stratton & Hammond, 1997). Such results call for the understanding of why PMT results persist or decline.

In addition to clinical samples, recent efforts have been made to understand PMT effectiveness

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in universal, indicated, and selective populations. Several independent randomized trials have demonstrated that changes in parent management strategies served as causal mechanisms producing changes in child outcome (Eddy & Chamberlain, 2000; Forgatch & DeGarmo, 1999, 2002; Martinez & Forgatch, 2001; Reid *et al.*, 1999; Vitaro *et al.*, 2001). For example, in one study, improvements in effective parenting were followed by improvements in teacher's ratings of school adjustment and delinquency, and by significant improvements reflected in child ratings of depression and mother's ratings of disruptiveness (DeGarmo & Forgatch, 2000; Forgatch & DeGarmo, 1999). Each of these tests for parenting practices as causal mechanisms has employed a mediational analysis outlined by Baron and Kenny (1986). That is, when adequate measures of parenting practices are introduced as mediators, the contribution of treatment involvement to change in child outcomes becomes nonsignificant.

These randomized PMT trials importantly demonstrate that targeted mechanisms of parenting practices can be changed to alter child outcomes. However, they fail to address questions concerning processes that maintain changes over time. Why do the altered parenting practices not eventually return to their baseline levels? It is likely that there must be some, as yet undefined, structural changes in the interactions among family members that accompany changes in parenting and child outcome variables. Presently, we employ long-term data from the Forgatch and DeGarmo (1999) prevention trial to examine changes in effect size over time for a set of family variables that includes child outcomes, observed parenting practices, and maternal depression. PMT prevention hypotheses are based on findings from prior longitudinal studies incorporating divorce and parenting models.

The Role of Parenting and Maternal Depression in a Family Divorce Model

With the assumption that parenting practices are the primary shaping agent of children's behavior, social interactional models of stress and parenting examine how acute stressors impact parental functioning. For example, independent samples of two-parent families from Oregon and Iowa using multiple-method strategies have replicated a process showing that acute stressors predict parental depression; depression, in turn, predicts ineffective discipline; and finally, ineffective discipline in turn predicts child prob-

lem behaviors (Conger *et al.*, 1995). Applying this, the divorce model examines the impact of marital separation as an acute stressor on parental functioning. Several multiple-method studies have documented that these disruptions in parenting interactions place a significant portion of children at risk for increased problem behaviors (Forgatch *et al.*, 1996; Hetherington *et al.*, 1998; Simons, 1996).

One major source of disrupted parenting is the many personal and structural changes occurring in the life of divorcing parents. Divorce places the parent at the epicenter of many minor, chronic, and potentially cataclysmic stressful events. From a social interactional perspective, depression and its accompanying irritable behavior thoroughly disrupt efforts to effectively manage a child. The irritable and depressed behaviors also disrupt interactions with support confidants and, in turn, contribute to a further loss of support and decline in effective parenting (Patterson & Forgatch, 1990). If stress is maintained and obtains chronic levels, there is further vulnerability for depressive symptoms for divorced mothers (Simons *et al.*, 1993) and we presume further risk for parenting disruptions.

In addition to antecedents of child problem behaviors, divorce models have also shown a contribution of children's behaviors on future maternal functioning. Testing stress maintenance hypotheses from the passive Oregon Divorce Study (ODS-I), Patterson and colleagues have shown prior children's problem behaviors predicted future levels of mother's distress (e.g., confidant and interviewer reports of stress and depression) controlling for prior levels of maternal stressors (e.g., self-reported daily hassles and major life events) (Forgatch *et al.*, 1996; Patterson & Forgatch, 1990).

Together, findings from divorce studies suggest the possibility of a potential feedback loop from maternal adjustment to parenting, from parenting to child adjustment, and child adjustment feeding back to maternal adjustment. Expanding this notion further also suggests that introducing PMT to reduce antisocial child behavior could reduce maternal depression and in turn facilitate further improvements in parenting. These hypotheses are consistent with findings from Patterson's (1980) treatment of a clinical sample. Following PMT, children became less coercive and the mothers became less depressed. In reviewing these data, Maccoby (1980) stated,

... the case is strengthened for the interpretation that the mothers of problem children have become

depressed because the children are abusive and out of control, not vice versa, although of course the reverse possibility cannot be entirely ruled out. . . . It is here that the value of combining an assessment program with a treatment program is seen. (pp. 60-61)

Another potential link between child behavior predicting future maternal reports of psychological well-being include changes in the mother's sense of parental efficacy. Studies now underway employ variables that assess a limited set of parental cognitions as well as the set of variables included in the present report. An expanded process model will include changes in maternal perception of efficacy as a potential feedback loop. Presumably, modest reductions in child deviancy and experiencing occasional success in the employment of parenting practices would be followed by increasing sense of efficacy (Bugental *et al.*, 1998). This in turn, could bring about a reduction in maternal depression. In testing a related proposition, recent analyses by Patterson and Stoolmiller (1999) showed that both behavioral measures of discipline and parental self-ratings of efficacy (Bugental *et al.*, 1998) served as significant main effects in predicting future growth in antisocial behavior. It was also the case that the product term for discipline and parent efficacy made yet an additional contribution in predicting future outcomes. Within the context of divorced families, we evaluate long-term prevention effects of

PMT in the conceptual model outlined in Fig. 1. The scope of the model is based on the literature reviewed and measures in this study.

We propose that understanding how prevention mechanisms unfold requires an examination of effect sizes within a theoretical evaluation. Intuitively it would seem that changes in the family system as a result of PMT would emerge in an as yet unknown but orderly sequence, starting with the targeted mechanism of parenting practices. Effect sizes should be largest for the manipulated variable in the system followed by proximal variables. To determine what the sequence might be would require repeated, intensive assessment of several components in the family system using multiple methods (e.g., parenting practices, maternal adjustment, and child adjustment).

HYPOTHESES

Together, the above studies lead us to a model specifying relations among targeted changes in parent management and subsequent changes in child behaviors and maternal affect. The model starts with a given acute stressor setting forth changes in the family system increasing maternal stress and depression that lead to changes in effective parenting. Changes in effective parenting will be inversely related to changes

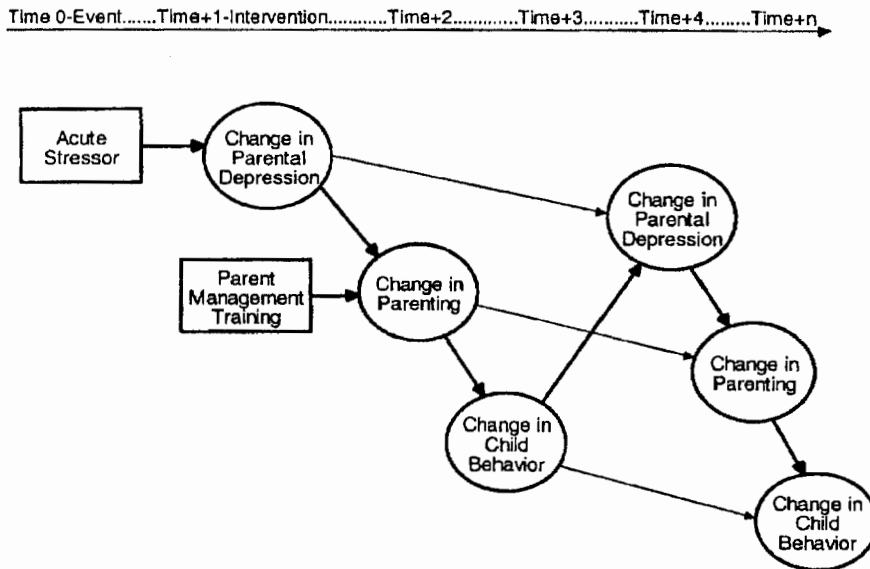


Fig. 1. Theoretical Model of Preventive Parenting Intervention linking changes in Maternal Parenting to Child Adjustment and Subsequent Maternal Adjustment.

in children's problem behavior. As demonstrated previously, PMT is expected to benefit parenting behaviors and thereby serve as a protective factor for child adjustment. With successful changes in child behaviors, benefits of PMT through child behaviors should feed back to future benefits for the mother in the form of reduced depression. Over time, unique effects of the PMT intervention introduced in the system of variables should produce changes in parenting as a result of prior changes in child behavior and maternal depression.

Within the scope of current available data, we evaluated change in maternal depression out to 30 months represented by Time 4 in the conceptual figure. For change in child behavior, we evaluated construct measures of internalizing and externalizing. For child adjustment, problem behaviors that are co-occurring should show similar patterns of change over time as change covariates. Prior studies have shown a co-occurring and predictive relation between child antisocial behaviors and depressive symptoms over time (Capaldi, 1991; Kellam *et al.*, 1991; Patterson & Stoolmiller, 1991).

METHOD

Participants

Participants were 238 recently separated single mothers and their sons residing in a medium-sized city in the Pacific Northwest. Families were recruited through media advertisements, flyers distributed throughout the community, and divorce court records. Mothers in eligible families (a) had been separated from their partner within the prior 3–24 months, (b) resided with a biological son in Grades 1 through 3, and (c) did not cohabit with a new partner. The sample was restricted to boys because they are more likely than girls to exhibit adverse effects of divorce as preadolescents (Hetherington & Clingempeel, 1992; Shaw *et al.*, 1993).

At baseline, mothers had been separated for an average of 9.2 months. Families tended to be small, with 2.1 children on the average. Mothers' mean age was 34.8 years ($SD = 5.4$; range = 21.4–49.6); boys' mean age was 7.8 years ($SD = 0.93$; range = 6.1–10.4). The racial/ethnic composition of the boys in the sample was 86% White, 1% African American, 2% Latino, 2% Native American, and 9% from "other" racial/ethnic groups including those who were identified as belonging to more than one group. This distri-

bution reflected the racial/ethnic makeup of the community in which the study was conducted. The mean annual family income was \$14,900, which was similar to that reported for other female-headed households with children in the county at that time (i.e., \$15,300; U.S. Bureau of the Census, 1993). Seventy-six percent of the families were receiving public assistance.

The majority of mothers (76%) had some academic or vocational training beyond high school, although only 17% had completed a 4-year college degree or higher. Approximately 20% of the women completed their education with high school graduation; 4% had not completed high school. Most mothers were classified within the lower and working-class ranges in terms of occupation (Hollingshead, 1975): 32% unskilled, 21% semiskilled, 23% clerical/skilled, 22% minor professional to medium business, and 3% major business/major professional.

At baseline, the groups differed in terms of months since separation, $t(236) = -3.21$, $p = .001$, and boy's age, $t(236) = 2.27$, $p = .02$. On average, mothers in the experimental group ($M = 9.84$, $SD = 5.79$) had been separated for about 2.4 months longer than those in the control group ($M = 7.48$, $SD = 4.56$). Boys in the experimental group ($M = 7.65$, $SD = 0.93$) were about 0.28 years younger than those in the control group ($M = 7.93$, $SD = 0.92$) on average. Models were tested controlling for these variables. None of these control variables altered the substantive findings of the present analysis, thus they were excluded from the presentation of results.

Regarding the sample's psychosocial functioning at baseline, roughly half of the mothers were clinically depressed and roughly 10% of the boys had internalizing or externalizing problems above clinical ranges. Cutoff scores indicated 49% of the mothers were depressed on the Center for Epidemiological Studies–Depression Scale (CESD; Radloff, 1977; cutoff > 16); 12% of the boys were depressed on the Child Depression Inventory (CDI; Kovacs, 1985; cutoff > 12); 10% of the boys had internalizing problems rated by teachers on the Teacher Report Form (TRF; Achenbach, 1991; $t > 69$); 15% of the boys had internalizing rated by mothers on the Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983; $t > 69$); and 8% of the boys had externalizing problems on both the teacher TRF and mother CBCL.

Study Design

The study employed an experimental longitudinal design. Families were assigned randomly with

approximately two thirds to the experimental group ($n = 153$) and one third to the control group ($n = 85$). The unequal assignment to group condition was done to provide sufficient sample size within the experimental group to examine potential full-implementation effects of the intervention (Vinokur *et al.*, 1991). Mothers in the experimental group were invited to participate in the intervention; families in the control condition received no intervention. The intervention involved no work with the children; only mothers participated.

Both group conditions were assessed on the same timeline. Families received extensive multiple-method, -setting, and -agent assessment five times: baseline, 6 months, 12 months, 18 months, and 30 months. A minor assessment, including telephone interviews with mothers and ratings from teachers, occurred at 24 months, but did not include assessment of the key outcomes analyzed for this paper. All experimental families had completed the intervention by the 6-month assessment, although 4–6 weeks may have transpired between termination of the intervention and the 6-month assessment.

Intervention

The intervention consisted of a series of parent group meetings held weekly in the early evening hours at the Oregon Social Learning Center (OSLC). Experimental-group mothers were offered 14 sessions. Thirteen parent groups ranged in size from 6 to 16 ($M = 9.5$). Average participation rate was 8.5 sessions (60.7% of sessions), $SD = 5.7$. Nineteen percent never participated in intervention and 42% attended at least 10 sessions. Interventionists made midweek telephone calls to encourage use of the procedures and troubleshoot home practice assignments. When mothers missed regularly scheduled meetings, they were encouraged to catch up by attending another group's meeting, having an individual session, or discussing materials by telephone. Sixteen mothers (10%) had at least one individual session at the center, four mothers had two or more catch-up sessions.

The content of intervention sessions, description of interventionist training, and details regarding program fidelity are provided elsewhere (Forgatch & DeGarmo, 1999). The manualized intervention program is described in *Parenting Through Change* (Forgatch, 1994). The program also includes a 30-min videotape, *The Divorce Workout* (Forgatch & Marquez, 1993), which shows three families using

effective parenting practices to help their children adjust to the divorce transition.

The intervention was built around five theoretically based effective parenting practices (i.e., appropriate discipline, skill encouragement, monitoring, problem solving, positive involvement) and other issues relevant to divorcing women (e.g., regulating negative emotions, managing interpersonal conflict). The parenting topics taught mothers strategies for decreasing coercive exchanges with their children by responding early and appropriately to child misbehavior with noncorporal discipline (e.g., time-out, work chores, privilege removal). Simultaneously, the intervention focused on the use of contingent positive reinforcement (e.g., praise, incentive charts) to promote prosocial behavior. The topics were presented in an integrated step-by-step approach. Each new topic was introduced to build upon a previously learned skill. Topics were usually introduced in one or more sessions and then reviewed and revisited throughout the remainder of the program. The program was flexible in that it allowed participants to discuss current relevant issues as part of the regular agenda for each session. These issues were often linked directly to a specific curriculum topic.

Measures and Construct Scores

Multiple-informant, multiple-method assessments were conducted at each assessment. Relevant portions of the assessment battery for this study included structured interviews with mothers and laboratory observations of mother-child interactions during structured interaction tasks. Participants were paid approximately \$10 per hour for their time. Laboratory observation included a set of structured interaction tasks totaling 45 min. The activities included four 5-min mother-son problem-solving discussions about current hot conflicts (e.g., chores, school problems, behavior), a 10-min teaching task (involving the mother assisting her son with a series of academic problems set one grade level above his current grade), a 10-minute unstructured activity (involving directions for the child not to play with certain toys and to put toys away), and a 5-min period for participants to share refreshments. These interactions were videotaped and scored using the Interpersonal Process Code (IPC; Rusby *et al.*, 1991) and a global rating system (Forgatch *et al.*, 1992). Approximately 15% of the interactions were scored by randomly selected pairs of coders to assess

intercoder agreement. Average Cohen's kappa for IPC content codes was .78 (range = .77-.80) and for affect was .70 (range = .67-.76) across all five waves.

To model change over time, mean construct scores were created for outcomes comprising multiple indicators using methods outlined by Stoolmiller (1995) for modeling growth of construct scores. Each indicator was rescaled on a scale from 0 to 1 and then averaged. For microsocioal observational scores (e.g., frequency counts) that were not rated on a fixed Likert-type scale with known boundaries, across wave upper-bounds determined scaling for computing growth scores. In addition, each construct was required to obtain an eigenvalue of greater than 1 for each wave across time and obtain a one-factor solution using principle components analyses.

To model mechanisms linking how the PMT intervention influenced outcomes in divorced families, we first identified six measures of child outcome that were theoretically identified as associates of maternal depression (Forehand *et al.*, 1987) and showed significant improvements over the course of the study for members of the experimental group. These were factor analyzed into externalizing behaviors (i.e., delinquency, noncompliance, and aggression) and internalizing behaviors (depression and loneliness at school). Mother outcomes included observed parenting and self-reported maternal depression. Psychometrics are provided in the next section with further details on these outcomes and validity are provided elsewhere (see Forgatch & DeGarmo, 1999, 2002; Martinez & Forgatch, 2001).

Maternal Depression

For this analysis, the criterion measure of maternal adjustment was the mother report of depressed mood using the CESD Scale (Radloff 1977), a 20-item symptom-oriented summative index. Items are on a 4-point scale (0-3) indicating the frequency of events during the previous week, ranging from *Rarely or none (0-1 day)* to *Most or all of the time (5-7 days)*. Sample items include felt depressed, fearful, lonely, hopeful about the future, and so forth. Cronbach's alpha reliabilities ranged from .92 to .94 from baseline to 30 months.

Boy Externalizing Behaviors

Externalizing behaviors was a construct score of three main indicators, teacher ratings of antisocial

and delinquent behaviors, observational measures of noncompliance, and observational measures of aggression. The three-indicator growth construct produced Cronbach's alphas of .59, .68, .63, .64, and .65, respectively.

Delinquency was measured with the delinquency *t* score from the TRF of the CBCL (Achenbach, 1991). The *t* score is nationally normed and consists of nine items describing child behaviors over the previous 2 months. Items were rated on a 3-point scale from 0 (*Not true*) to 2 (*Very True or Often True*). Sample items include steals, uses drugs or alcohol, hangs around with trouble makers. Cronbach's alphas were .76, .71, .75, and .72 across the four annual teacher assessments.

Noncompliance was a construct score itself developed and validated in Martinez and Forgatch (2001). The noncompliance score included three indicators: a microsocioal score, a coder rating scale score, and an interviewer impression score. The indicators were subjected to principal components factor analyses yielding a single-factor solution at each wave. The factor loading ranged from .65 to .89 across the five waves of data. The *microsocioal score* was computed from IPC codes. The score was the frequency proportion of child noncompliance (relative to all other behaviors) following a mother's directive, that is, the total number of child noncompliance divided by the total number of directives issued by the mother during the observation. This proportion score accounts for differential base rates of maternal directives, which could arbitrarily inflate or deflate child noncompliance rates. The intraclass correlation coefficient (ICC) of intercoder reliability for the microsocioal noncompliance score was .71, .80, .84, .64, and .86, respectively. *Coder ratings* was a scale score based on global observations made directly following scoring of the microsocioal behaviors. Ten Likert-scale items assessed noncompliance on a scale from 1 to 5. Sample items include the following: withdrew from interaction in a negative way, was noncompliant, complied with commands from mom, was resistant to doing task. Cronbach's alphas were .90, .89, .87, .90, and .89; ICCs were .77, .87, .87, .66, and .90, respectively. Finally, the *child interviewer impressions* was a scale score based on global ratings of noncompliance. This scale consisted of three items rated from 1 to 5 including items such as the following: was cooperative during the interview, was noncompliant with you, was noncompliant with mother. Cronbach's alphas were .85, .84, .85, .81, and .83, respectively.

Aggression was a microsocial indicator scored as the rate per minute of physical aversive behaviors observed during the structured interaction tasks. Examples of physically aversive behaviors from the IPC included any contact of the child with the mother involving hitting, kicking, pinching, and so on. The aggression indicator was log-transformed before factor analyses because the indicator was skewed and leptokurtic in its distribution.

Boy Internalizing Behaviors

The construct score for internalizing was based on two boy-reported indicators: depressed mood and loneliness/peer rejection. The two-indicator growth construct produced Cronbach's alphas of .68, .73, .71, .68, and .76, respectively.

Depressed mood was reported by the child on the CDI (Kovacs, 1985), a 27-item symptom-oriented summative index. The items are listed below. All items are on a 3-point scale. Some items were reverse scored so that all indicated increasing depression. Sample items were as follows: feel sad, feel like crying, things bother you, feel alone, others love you. Cronbach's alphas were .81, .83, .79, .82, and .86, respectively.

Loneliness and peer rejection was measured with the Loneliness in Children Scale (Asher *et al.*, 1984), a 16-item scale of loneliness and dissatisfaction with peer relations. Items were rated by the child on a 3-point scale from 1 (*True most of the time*) to 3 (*Not at all true*). Ten items were reverse-scaled to indicate increasing loneliness. Sample items were as follows: have nobody to talk to in class, lonely in school, don't have any friends in school, feel left out. Cronbach's alphas were .87, .85, .86, .86, and .89, respectively.

Effective Parenting Construct

Domains of effective and ineffective parenting were derived from theoretically based research on Patterson's coercion model (Patterson, 1982; Patterson *et al.*, 1992). These observationally based measures of effective skills and ineffective coercive strategies have demonstrated sensitivity to change in PMT and shown convergent and predictive validity in at-risk and divorce samples (Forgatch *et al.*, 1996; Forgatch & DeGarmo, 1999; Patterson, 1982; Patterson *et al.*, 1992). For this analysis, the final construct score was the mean of the seven indicators of parenting skill, four positive measures, and three

coercive measures. Positive domains included positive involvement, skill encouragement, problem solving, and monitoring. Negative domains included inept discipline, negative reinforcement, and negative reciprocity. Negative domains were reverse scored and each indicator was rescaled to range from 0 to 1 so that a higher score reflected effective parenting. The seven-indicator growth construct produced Cronbach's alphas of .73, .70, .73, .72, and .63, respectively.

Positive involvement was a mean scale score of coder ratings following each of the structured interaction tasks. Five indicators of mother's observed prosocial involvement following the interaction tasks and two overall ratings were averaged for the final scale. The seven indicators included 38 Likert-scale items concerning the mother's interaction with her son (e.g., showed empathy, support, genuine concern; provided encouragement; showed warmth; showed respect; was accepting; was affectionate). Alphas for the overall scale ranged from .90 to .94 across the assessment waves. ICCs were .83, .90, .82, .79, and .93 from baseline to 30 months.

Skill encouragement was a mean scale score based on global coder ratings following the 10-min teaching task. Eleven scale items assessed the mothers' ability to promote child skill development through contingent encouragement and scaffolding strategies (e.g., breaks task into manageable steps, reinforces success, prompts appropriate behavior, corrects in a nonaversive way). Cronbach's alphas were .69, .73, .81, .70, and .67; ICCs were .73, .67, .66, .48, and .76, respectively.

Problem solving was a scale score of global coder ratings made following each of the three problem-solving interactions involving a mother-identified issue. Nine Likert-scale items were averaged to compute the scale score (e.g., solution quality, extent of resolution, likelihood of follow-through, apparent satisfaction). Cronbach's alphas ranged from .87 to .92 across the three topics and five waves; ICCs were .77, .81, .76, .84, and .79, respectively.

Monitoring was a scale score from two agents' reports of how effective the mother was in supervising her son. Parent interviewers provided global Likert-scale ratings on three items: skillful in supervising during the assessment, keeps close track of youngster outside of laboratory, and skillful at obtaining information from the child. Cronbach's alphas were .82, .76, .73, .74, and .60 from baseline to 30 months. Coders also provided global ratings of monitoring after coding the entire 45 min of laboratory interactions. The two Likert-scale items assessed the

mothers' apparent knowledge of their sons' day-to-day activities and tolerance of negative behavior. The two items were correlated .22, .13, .38, .59, and .47 from baseline to 30 months and were significant at the $p < .05$ at each wave. The final score was an average of the ratings by the two agents.

Inept discipline was a scale score based on coder global impressions of discipline following their coding the entire 45 min of laboratory observation. The scale consisted of 13 items rated from 1 (*Untrue/Doesn't Fit*) to 5 (*True/Perfect Fit*). Sample items include overly strict, authoritarian, oppressive; erratic, inconsistent, haphazard; threatens unlikely disciplines; uses nagging or nattering to get compliance. Cronbach's alpha ranged from .91 to .92; ICCs were .70, .85, .78, .77, and .88, respectively.

Negative reinforcement was a microsocial score based on IPC coding of the mother-child interactions observed from the full 45 min of interaction. Our operationalization of negative reinforcement was based on conflict bouts, which involved an exchange of aversive behavior between mother and son. Negative reinforcement was defined as the frequency of conflict bouts initiated by the mother and terminated by the son. In the first step of the bout, the mother introduced an aversive behavior following a period of at least 12 s of interaction without aversive behavior. In the second step, the son responded with an aversive behavior within 12 s. In the last step, the bout ended following a period of at least 12 s without either person's use of aversive behavior. In this sense, the son escaped an aversive situation by employing an aversive behavior and was negatively reinforced. The ICCs were .78, .58, .49, .68, and .60, respectively.

Negative reciprocity was a microsocial score based on the entire 45 min of laboratory observation. The derived score was the Haberman binomial z score (Gottman & Roy, 1990) reflecting the conditional probability that the mother reciprocated the son's aversive behavior with an aversive behavior of her own. ICCs were .65, .74, .54, .63, and .67 from baseline to 30 months.

Analytic Strategy

We employed Latent Variable Growth models (LGM) providing several advantages to modeling developmental changes (Stoolmiller, 1995) and evaluating prevention designs (Muthen & Curran, 1997). Growth models take into account individual differences in change as well as group differences. For ex-

ample, linear slopes were estimated for the repeated measures of each individual, thus specifying variation in individual trajectories. Group means and variation in growth for the intervention and control conditions are then estimated from individual trajectories. Outcome slopes can then be regressed on predictors of change such as group assignment representing intervention effects.

For evaluation, LGM partials out time-specific measurement error and can accommodate missing data, thereby providing more reliable estimates of change for prevention evaluation (Kraemer & Thiemann, 1989; Muthen *et al.*, 1987). In the current analyses, we employed the AMOS program (Arbuckle, 1997) incorporating Full Information Maximum Likelihood (FIML; Arbuckle, 1996). FIML is an iterative model-based process that handles missing data under an assumption of multivariate normality to maximize the likelihood of the model, given the observed data. In contrast to analyses that incorporate list-wise deletion covariance matrices, FIML uses all available information from the observed data, including derived information about means and variances for missing portions of the covariance matrix based on observed portions of data. The FIML approach has greater statistical efficiency for longitudinal data when computing standard errors compared to mean-imputation, list-wise, or pair-wise deletion methods (Wothke, 2000).

In contrast with hierarchical linear growth models (Bryk & Raudenbush, 1987), initial status and growth in one outcome can simultaneously be tested as predictors of growth in another outcome in LGM. This can be important for intervention designs because intervention effects can be modeled controlling for baseline levels of mother depression, child behaviors, and how effective parents were at entry in the study. By controlling for initial status, any baseline variable can be represented as the true effect of initial status controlling for change and vice versa.

Finally, for specifying mechanisms of change, hypotheses can be tested in a series of LGM mediational models (Cheong *et al.*, 2001). These models are particularly relevant for prevention designs. If, for example, the intervention produces changes in children's outcomes over time, we would want to test more proximal mechanisms associated with the intervention as potential causes associated with the more distal outcome. Changes in children's outcomes are considered distal to the intervention because we did not intervene directly with children. Therefore a mediational variable must be considered as a conduit of change

in children's behavior. Following this, we conducted a series of mediational models testing hypotheses in Fig. 1, using mismatched sources of data, meaning no method overlap from a proximal construct to the next. For example, the model specified observed parenting predicting child-reported internalizing; internalizing, in turn, predicting observed and teacher-rated externalizing; and externalizing, in turn, predicting mother-reported depression.

RESULTS

PMT Effect Sizes for Maternal and Child Outcomes

To identify how the PMT intervention influenced outcomes in divorced families, we first summarized intervention effects on maternal and child outcomes and their chronology over 30 months. Figure 2 summarizes the changes in maternal and child outcomes for members of both the experimental and the comparison groups in terms of relative effect sizes over time for each respective outcome. We plotted effect

sizes, using Cohen's *d* measured as differences in standard deviation between the intervention and control groups (Cohen, 1988). The univariate *d* for each of construct score is plotted as opposed to a multivariate D^2 for multiple indicators because the univariate *d* specifically represents outcomes employed in the latent growth models and it has directional interpretation of intervention influence whereas D^2 does not (Stevens, 1992). The more negative the value on the *Y*-axis, the greater the reductions associated with PMT. Conversely, the more positive the effect size, the greater the increases associated with PMT.

The box at the left labeled PMT represents the 14-week parent training intervention terminated before the 6-month follow-up. The zero ordinate line for the *Y*-axis represents no effect of the intervention. Note the slight variation around zero at baseline. Ideally with random assignment all constructs would start at zero. There were no significant differences at baseline between the groups on any construct, thus the plots represent random variation. It can be seen that during the 6- to 12-month interval that mothers' effective parenting showed the strongest effect size

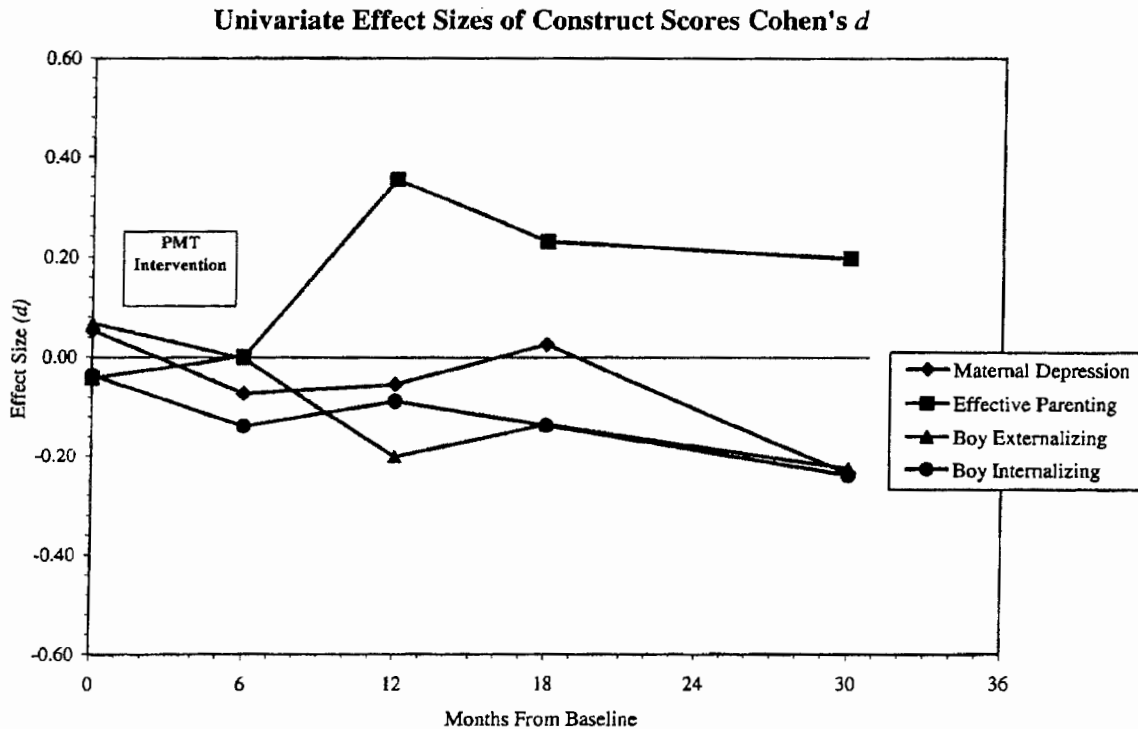


Fig. 2. Plot of Intervention Effect Sizes for Maternal and Child Adjustment Over Time using Cohen's *d*.

among the data ($d = .35$ representing a moderate effect). This benefit to parenting tended to dissipate slightly but then maintain a small intervention effect out to 30 months ($d = .23$ and $.20$, respectively). Boys' negative outcomes showed a relatively steady linear reduction over time with the strongest and moderate long-term effect for internalizing ($d = -.24$) followed by a small long-term effect for externalizing ($d = -.23$). Finally, maternal depression displayed random variation around zero for the first 18 months and then an intervention effect emerged at 30 months ($d = -.24$).

Chronologically, the plots indicated that the strongest effect was on parenting and that this effect occurred by the 12-month follow-up. Subsequent changes in the family system were followed by gradual decreases in boys' behavior problems followed finally by changes in maternal depression. These changes are consistent with the parenting model outlined in Fig. 1. Although the intervention was associated with each of these outcomes as dependent variables, that is not sufficient evidence that the outcomes covary or are related in any time-ordered pattern. We now turn to a more formal test of the model.

Formal Mediation Analyses

The first step in the mediational analysis is to model the PMT effect associated with the most distal

outcome. Maternal depression was chosen because it was the last to change and it was the departure point in the feedback loop. The first step in testing the mediational hypotheses is to demonstrate a significant direct effect of the intervention on the outcome. The LGM is displayed in Fig. 3 in the form of standardized path coefficients. The LGM specified linear growth and initial status as latent variables by fixing the growth factor loadings at 0, 1, 2, 3, and 5 to correspond to respective assessment periods and by fixing initial status loadings at 1, respectively. Because the groups were randomly assigned, the correlation between the PMT group and initial status was fixed at 0. The best fitting model for maternal depression freed the last factor loading on the growth slope (loading for the 30-month score), representing the accelerated intervention effect shown in the effect size plot. No substantive differences in subsequent path models were found with or without strict linear growth for maternal depression. The maternal depression model showed adequate fit to the data, $\chi^2_{(13)} = 18.63$, $p = .14$. Comparative Fit Index (CFI) = 1.00. Initial depression was associated with decreases over time ($\beta = -.44$, $p < .05$); that is, mothers who were more depressed initially were more likely to improve. Finally, the PMT mothers benefited from greater decreases in maternal depression over 30 months relative to the control group ($\beta = -.16$, $p < .05$).

The second step of mediation requires that a specified intervening, or mediating, mechanism be

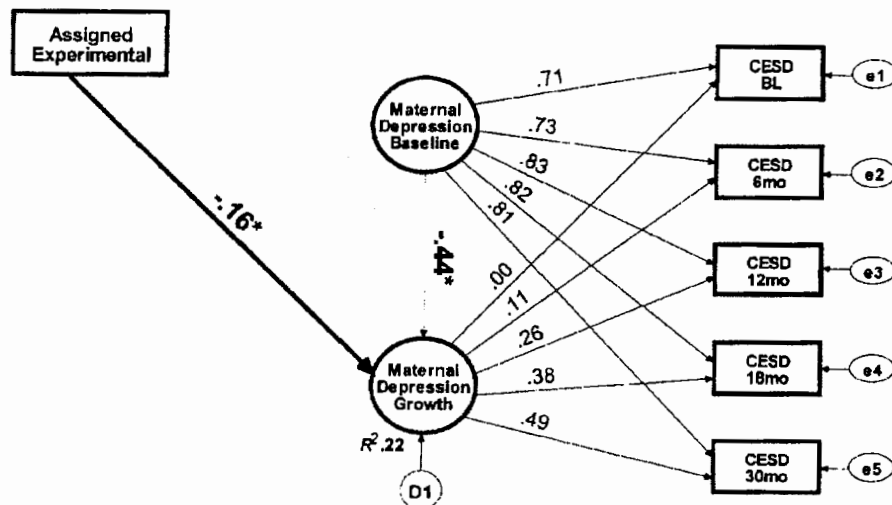


Fig. 3. Intervention Effect on Maternal Depression, Latent Variable Growth Model with Standardized Path Coefficients. $\chi^2_{(13)} = 18.63$, $p = .14$. χ^2 ratio = 1.43, Comparative Fit Index = 1.00. * $p < .05$. ** $p < .01$. *** $p < .001$.

entered in the model. The mediator must significantly predict the outcome and the direct effect of the intervention must become nonsignificant. Finally, the intervention effect must be significantly associated with the mediator (Baron & Kenny, 1986; Holmbeck, 1997). Independent of the intervention, we examined growth in both boys' externalizing and internalizing as predictors of maternal depression. Growth in boys' externalizing was significantly associated with maternal depression, whereas growth in internalizing was not. This is consistent with the temporal ordering of effect sizes and mean trends shown above. To test for mediation of the intervention effect on maternal depression, we then entered growth in externalizing behaviors. Results are shown in Fig. 4. The model showed good fit to the data, $\chi^2_{(50)} = 48.94$, $p = .52$, CFI = 1.00. Growth

in boys' externalizing significantly predicted growth in maternal depression ($\beta = .48$, $p < .05$), and the intervention was significantly associated with trajectories of linear decreases in externalizing ($\beta = -.29$, $p < .05$). At the same time, the intervention effect on changes in maternal depression became nonsignificant, indicating that growth in externalizing behaviors accounted for the relationship of PMT with reduced maternal depression. In fact, the explained variance in maternal depression doubled upon entering child behaviors. This is consistent with prior findings testing the coercion model indicating that negative escalation and reinforcement traps increase the likelihood of maternal depression and children's aggression (Hops *et al.*, 1987). The intervention effect that was mediated in Fig. 4 was removed and constrained to zero in the

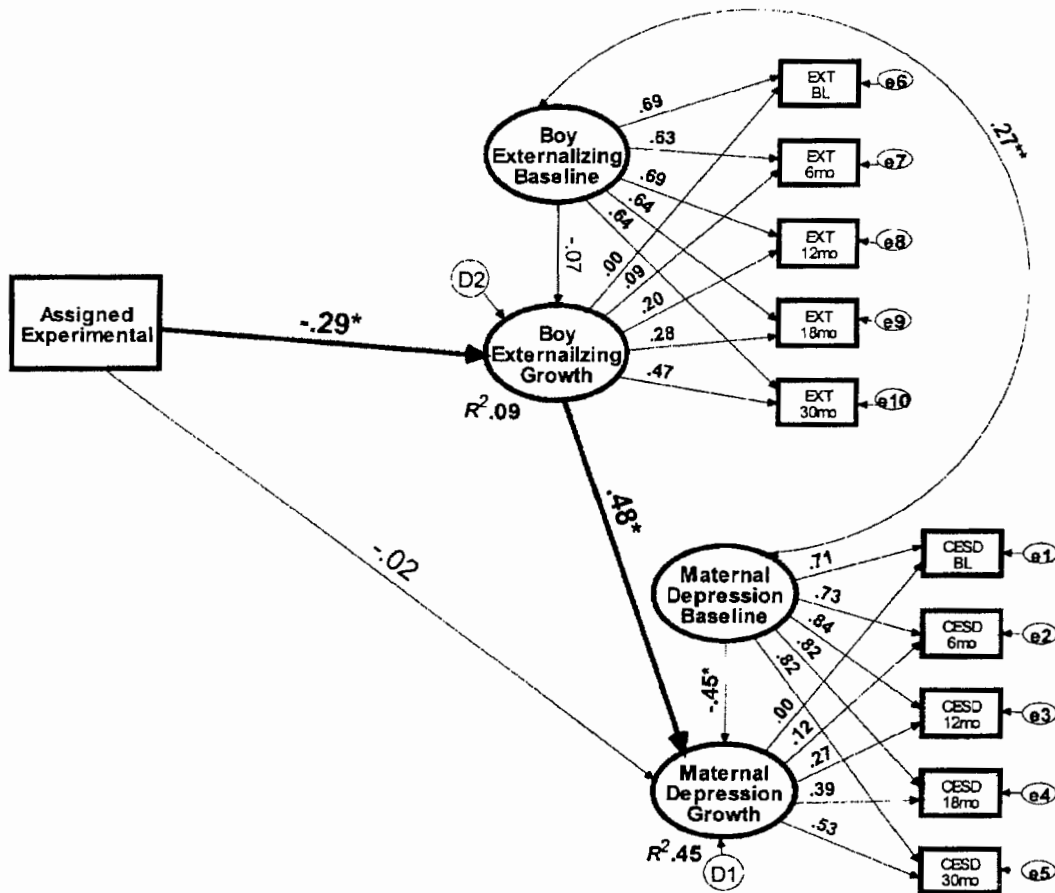


Fig. 4. Growth in Boys' Externalizing Mediating Intervention Effect on Maternal Depression, Latent Variable Growth Model with Standardized Path Coefficients, $\chi^2(50) = 48.94$, $p = .52$, χ^2 ratio = 0.98, Comparative Fit Index = 1.00. * $p < .05$. ** $p < .01$. *** $p < .001$.

subsequent model (likewise for each mediated path to follow).

In the same manner as above, we entered growth in boys' internalizing in the subsequent model. Interestingly, a series of alternative models indicated that changes in internalizing were driving the changes in externalizing. That is, we modeled the correlated and co-occurring outcome of internalizing and externalizing for children following divorce to determine whether these paths were covariates or followed a sequence. In fact, the results indicated that the internalizing was driving externalizing because an alternative model specifying growth in externalizing predicting internalizing produced both a nonsignificant path and a worse fit to the data, $\chi^2_{(112)} = 134.29$, $p = .07$. Furthermore, and more interestingly, the intervention effect on growth in boys' externalizing was mediated by growth in boys' internalizing behaviors. That is, growth in internalizing predicted growth in externalizing ($\beta = .54$, $p < .01$), the PMT intervention was associated with reductions in internalizing

($\beta = -.19$, $p < .05$), and finally, the intervention effect on externalizing became nonsignificant. The resulting LGM identifying these relationships is shown in Fig. 5, [$\chi^2_{(112)} = 125.23$, $p = .19$, CFI = .99.

The final model shows the last step in mediational analysis by entering the most proximal variable associated with the intervention. Early change in parenting was entered as the specified mediator of the intervention effect on internalizing. Parenting was entered as a change score from baseline to 12 months because growth modeling is more appropriate for 4 or more time points. Although we controlled for baseline parenting as a predictor of change in each of the outcomes, the paths were not shown in the final model for clarity of presentation. Results indicated that the intervention effect significantly reducing boy internalizing was not fully mediated by changes in parenting. Instead, the intervention had both direct ($\beta = -.17$, $p < .05$) and indirect effects on growth in internalizing through the effects on change in parenting. In an alternative model (not shown), we determined that

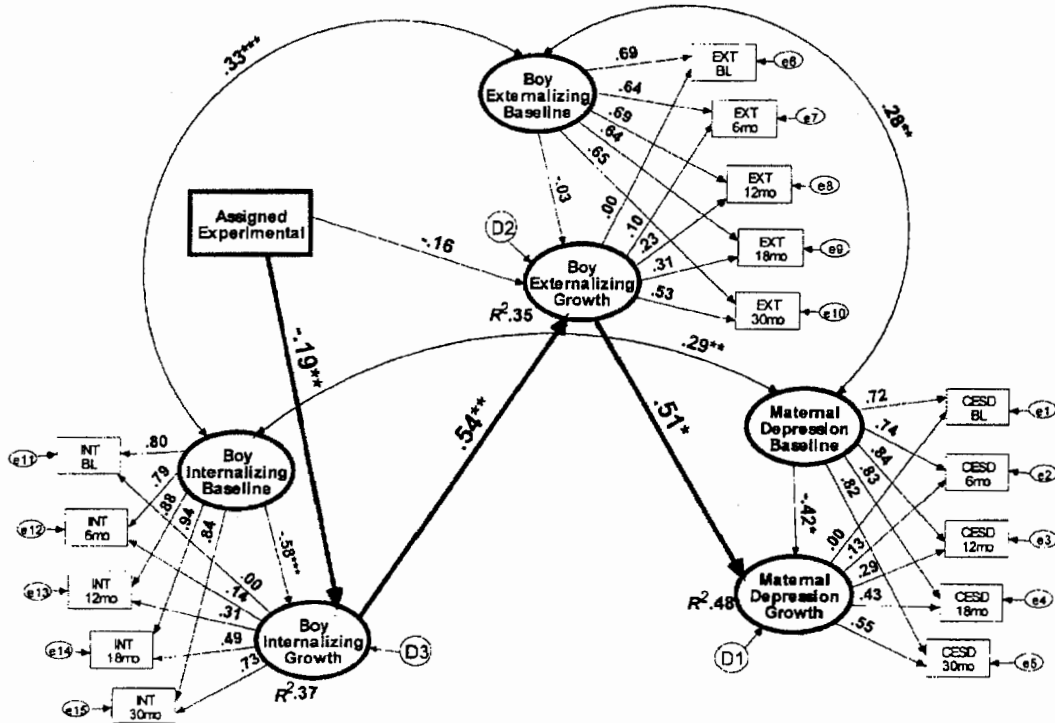


Fig. 5. Growth in Boys' Internalizing Mediating Intervention Effect on Externalizing. Latent Variable Growth Model with Standardized Path Coefficients, $\chi^2(112) = 125.23$, $p = .19$, χ^2 ratio = .99, Comparative Fit Index = 1.00. * $p < .05$. ** $p < .01$. *** $p < .001$.

parenting also mediated the effect of the intervention on growth in externalizing; however, it was reduced to a significance level of $p = .068$, meaning the mediation was more associated with intervention changes in internalizing behaviors. The final resulting model is shown in Fig. 6, $\chi^2_{(137)} = 183.27$, $p = .01$, CFI = .99.

DISCUSSION

Over the past several decades, longitudinal studies have identified predictable pathways to children's negative outcomes following transitions in family structure from intact to single and to stepparent status (e.g., Capaldi & Patterson, 1991). We have come to expect correlations between transitions-induced changes in maternal depression and disrupted parenting practices. The prevention trials designed for recently separated families show that training in parenting practices brings about changes in maternal

depression; parenting practices; and various child outcomes associated with aggression, achievement, and child depression. However, we do not fully understand processes by which these changes occur over time. Nor do we understand how these effects are maintained or even erode over time. Other prevention trials with long-term follow-up actually have shown increases in effect sizes during the months following termination of the intervention (e.g., Vitaro *et al.*, 2001). The current study is a beginning effort to study processes associated with change in families, particularly prevention-induced changes that come about during follow-up intervals.

The general hypothesis examined in the present report was the simple idea that during and following intervention, the changes in family process would be orderly. This would occur in the sense that changes at one point in time would correlate significantly with either current or future changes in the child or the mother. To reduce the likelihood of type I errors,

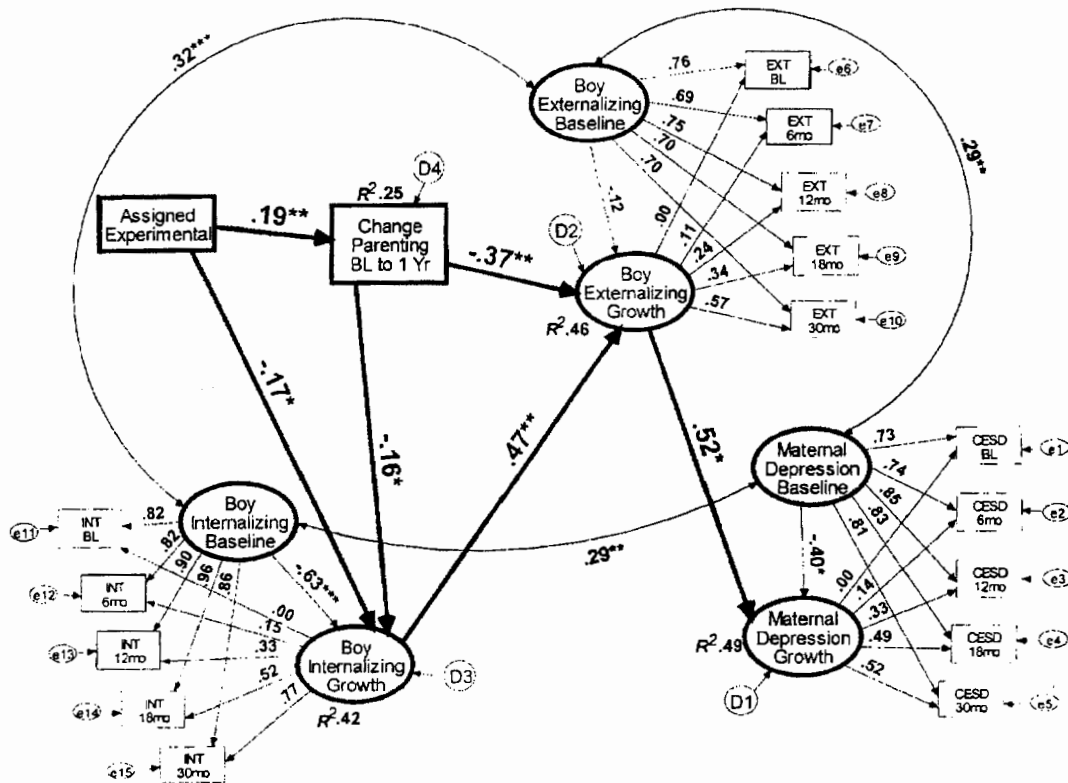


Fig. 6. Early changes in Parenting Linking Growth in Boys' Adjustment to Growth in Maternal Depression, Latent Variable Growth Model with Standardized Coefficients, $\chi^2_{(137)} = 183.27$, $p = .01$, χ^2 ratio = 1.33, Comparative Fit Index = .99. * $p < .05$. ** $p < .01$. *** $p < .001$. Note: Model controls for baseline levels of effective parenting.

the variables sampling family process were limited to changes in two types of parenting practices (combined positive and coercive practices), two types of child outcomes (externalizing and internalizing), and changes in maternal depression.

Because we evaluated a PMT intervention, it was assumed that the initiator for the process might well be a significant shift in effect size for parenting practices. The effect size data showed marked differences between the experimental and comparison groups during the interval from 6 to 12 months. Further inspection of the data suggested that during this interval, the experimental group showed significant improvement for coercive discipline and maintenance of positive parenting practices. During this interval, the comparison group showed a worsening for both positive and coercive parenting practices. Presumably studies involving clinical samples with relatively homogeneous problems could produce significant effect sizes during the first weeks of intervention as demonstrated by others (Walter & Gilmore, 1973; Wiltz & Patterson, 1974).

We also expected that parenting would improve child behavior and subsequently maternal depression. Examining the effect sizes indicated that indeed after the marked improvement in parenting, child behavior improved, followed by an emerging difference in maternal depression at 30 months. To formally test the sequence, growth models were specified starting with an intervention effect on the distal outcome of maternal depression. Mediating mechanisms were then entered in each model tracing back through the hypothesized paths.

Findings showed that (a) intervention effects associated with reductions in maternal depression were mediated by changes in boy externalizing, (b) intervention effects on boys externalizing was mediated by changes in boy internalizing, and (c) improved parenting practices predicted both reductions in internalizing and externalizing. The intervention effect on internalizing was only partially mediated by parenting practices. However, as expected, changes in parenting were associated with changes in boys' externalizing behavior and with equally modest changes in child internalizing.

Both of these child outcomes had a significant impact in determining future changes in the process. For the moment, we consider these outcomes as amplifiers in the sense that they increase the likelihood of future changes. The first amplifier consists of the relation between reductions in child internalizing and reductions in child externalizing. Indeed, changes in

externalizing and internalizing were strongly correlated in terms of growth over time although assessed by different methods. Unique to this analysis, however, the relatively stronger path coefficient suggests that most of the child's improvements in externalizing related more to his reductions in internalizing than directly to the changes in parenting practices. In fact, the intervention effect on internalizing was the mediating mechanism for the PMT effect. This finding is important for several reasons.

First, it suggests a more complex relation between child depression–loneliness and child externalizing than we had previously suspected. Prior modeling studies had suggested a direction of effects from externalizing to internalizing (Capaldi & Patterson, 1991; Patterson & Stoolmiller, 1991). Those models identified a kind of dual-failure model where failure in peer relations and achievement led to child depression. But the current findings strongly suggest that the nature of the relation must be bidirectional. That is consistent with findings from Kellam *et al.*'s (1991) Baltimore prevention trial showing co-occurrence of depression and aggression and reductions in co-occurrence following school-based interventions associated with achievement. In examining the direction of co-occurrence in the ODS-II growth models, our efforts to force the path to move from externalizing to internalizing were not successful. Would an intervention that focused solely upon child depression produce a lasting reduction in child externalizing? Probably not, but the present findings suggest that a dual focus might accelerate positive outcomes. Clinical samples, for example, have shown that treatment for child behavior problems is improved when depression is also treated (Griest *et al.*, 1982).

Also unique to this study is that child internalizing is measured in the context of divorce. For children of recently separated parents, sadness and dysphoria may result at higher levels than normative samples and precede acting-out behaviors related to changes in parent–child relations. Additionally, the current measure of internalizing included an indicator of peer relations that may be directly affected by both moves and changes in schools that can follow a divorce.

The second potential amplifier identified in this study is based on the finding that changes in child externalizing were associated with changes in maternal depression. Earlier studies had detected associations of parental depression with disrupted parenting practices, and indirectly child aggression. The passive longitudinal divorce study also identified child deviant behavior as a major stressor for mothers (Forgatch

et al., 1996). One study had shown borderline reductions in maternal depression following PMT with a sample of clinical referred cases (Patterson, 1980). The current findings emphasize the currency of these prior findings showing a direct relation between child aggression and maternal depression.

What might be the mechanisms relating aggression to depression? We believe it is the reinforcement schedules for family members' aggressive and depressive behavior. The programmatic studies of depression reviewed by Sheeber *et al.* (2001) suggest that family members may reinforce each other's depressed behaviors. For example, at a microsocial level, studies of depressed mothers showed that displays of depressive affect function to thwart off aggressive behaviors by other family members. The present findings imply that a change in family member reinforcement for externalizing might be accompanied by a commensurate reduction in family member reinforcement for maternal depressive behaviors. Without direct measurement of reinforcement schedules we can only make inferences about the process as it relates to the coercion model in the current data.

Related, we would presume a lagged sequence of reinforcement schedules would explain the delayed sequence of effects presented in the current models. That is, changes in reinforcement schedules for an entire family system must take longer than changes to reinforcement schedules for one individual. A mother first must learn new parenting skills and be provided initial reinforcement for changes in her own parenting behaviors before she can promote changes in the child's behavior. Subsequently, structural changes in the social environment related to incentives (e.g., point charts) and consequences (e.g., removal of privileges) must be consistent and maintained for reinforcement schedules to work. Using a systems analogy, change in one component necessitates subsequent change in other interdependent units but not simultaneously.

We also note that the early improvements in parenting did not continue after 12 months. Rather, they began to vitiate which has been observed in other treatment studies using PMT for conduct disorder children (Patterson, 1982). In terms of the group-level design, it is likely more important in follow-up data, post 36 months, to examine which subsets of families showed continued improvement in parenting maintenance and improvements in children's problem behaviors. Related, during adolescence, prior correlational studies have shown that maternal depression had a stronger predictive association to ado-

lescent functioning over time than did adolescent behavior predicting maternal depression (Forehand *et al.*, 1987). Forehand and colleagues note that their analysis was limited in the absence of behavioral data and experimental manipulation. It will be interesting to see if the above findings continue during entry into adolescence for these boys.

Data from 48- and 60-month follow-up are currently being collected. We will examine the status of child internalizing and maternal internalizing as amplifier mechanisms; testing the hypothesis that the changes in maternal depression at 30 months will predict future levels of parenting practices controlling for prior change in parenting. For the present there is no way of knowing whether this same sequence of effects will be found in other studies. We are currently completing a prevention trial on the basis of data from stepparent families. This will enable us to test for the same sequence of PMT effects, that is, changes in parenting followed by child improvements feeding forward to changes in mother's depression. It would be astonishing to find that the sequence is invariant across samples or even within samples of single mothers.

The current prevention trial was not with a treatment sample; therefore, each participating mother presumably selected from the prevention menu in such a way as to maximize her self-interest. Shown elsewhere, the majority of the mothers did not perceive their sons as having any particular problem. We suspect that each mother selects different ideas and procedures to try out at home. In doing so, the effort may or may not meet with success. Changing behaviors may vary a great deal from one family to the next. In a sense the prevention trial is much like a smorgasbord, it is only when a sufficient number tries the same procedures directed to a commonly shared problem that we get a change in effect size. Once the change process begins, there is a very good chance that it will continue and that the sequence of changes may be an orderly one.

At present, the core issue in this process seems to revolve around shifts in child and mother internal states. From a behavioral perspective, it is a curious fact that to understand changes in child behavior one must take into account changes in child and maternal feelings. Some changes might occur prior to any real reductions in problem behaviors. For example, findings from several studies reviewed in Patterson and Fisher (2002) showed that as the environment becomes more contingent, physiological data show commensurate drops in cortisol levels in studies for

both animals and preschool children. One can well imagine that one of the important preludes to major changes in deviancy would be the perception on the part of the child, and the mother that things are now more predictable around the house (i.e., uncertainty is reduced) following an acute stressor such as divorce.

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