

Within-Intervention Change: Mediators of Intervention Effects During Multisystemic Therapy

Maja Deković
Utrecht University

Jessica J. Asscher
University of Amsterdam

Willeke A. Manders
Utrecht University

Pier J. M. Prins
University of Amsterdam

Peter van der Laan

Netherlands Institute for the Study of Crime and Law Enforcement, Amsterdam, the Netherlands

Objective: The present study tested the hypothesis that improvements in parental sense of competence during multisystemic therapy (MST) lead to positive changes in parenting, which in turn lead to a decrease of adolescent externalizing problems. Mediation models were tested separately for 3 dimensions of parenting (positive discipline, inept discipline, and relationship quality) that are targeted in MST. Each model included “3-path mediation,” in which 2 mediators (i.e., changes in parental sense of competence and parenting dimension) intervene sequentially between the independent (i.e., intervention status) and dependent variable (i.e., change in externalizing problems). **Method:** Participants in this randomized controlled trial were 256 adolescents and their families who received either MST ($n = 147$) or treatment as usual ($n = 109$). In addition to pre- and postintervention assessments, 5 monthly within-intervention assessments took place. **Results:** Both preintervention–postintervention comparison, through analysis of covariance, and comparison of trajectories during intervention, through latent growth modeling, showed that MST enhanced growth in parental sense of competence and positive discipline, led to no deterioration in relationship quality, and resulted in a decrease in adolescent externalizing problems. The results supported a sequential pattern of change for positive discipline: Changes in parental sense of competence predicted changes in positive discipline, which in turn predicted decrease in adolescent externalizing problems. No support was found for mediated effects of inept discipline and relationship quality. **Conclusions:** The results affirm the importance of directly targeting parental sense of competence and positive discipline in future interventions aimed at decreasing adolescent problem behavior.

Keywords: mediators of intervention effects, MST, parental sense of competence, parenting, externalizing problems

There is a growing body of research that aims to identify the mechanisms through which an intervention for children and adolescents exerts its effects. The vast majority of these studies has focused on parenting training programs for young children and has examined whether changes in parenting serve as a causal mechanism that produces changes in child behavior (e.g., Chamberlain et al., 2008; DeGarmo, Patterson, & Forgatch, 2004; Gardner, Bur-

ton, & Klimes, 2006; Lochman & Wells, 2002; Patterson, DeGarmo, & Forgatch, 2004). On the basis of basic developmental theory and numerous studies showing that parenting is both concurrently and longitudinally related to child problem behavior (Grusec, 2011), it is expected that changes in parental behavior (increases in responsiveness, consistency, and behavioral control) lead to improvements in child outcomes (a decrease in problem

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Maja Deković, Department of Child and Adolescent Studies, Utrecht University, Utrecht, the Netherlands; Jessica J. Asscher, Department of Forensic Child and Youth Care Sciences, University of Amsterdam, Amsterdam, the Netherlands; Willeke A. Manders, Department of Child and Adolescent Studies, Utrecht University; Pier J. M. Prins, Department of Clinical Psychology, University of Amsterdam; Peter van der Laan, Netherlands Institute for the Study of Crime and Law Enforcement, Amsterdam, the Netherlands.

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Correspondence concerning this article should be addressed to Maja Deković, Department of Child and Adolescent Studies, Utrecht University, P.O. Box 80.140, 3508 TC Utrecht, the Netherlands. E-mail: M.Dekovic@uu.nl

behavior). Although significant progress has been made, in a recent review of 46 randomized experimental trials of parenting interventions, the authors concluded that our knowledge of the processes by which these interventions have effects is “at a rudimentary stage” (Sandler, Schoenfelder, Wolchik, & MacKinnon, 2011, p. 323). In the present study we attempt to address the following gaps in the literature.

First, the majority of mediational studies involved parenting training programs that took place during middle childhood, and fewer studies focused on families with adolescents. As Lochman (2000) suggested, the next research issue is to determine whether the mediating processes that account for intervention effects are comparable across developmental periods. There are reasons to expect that this is not the case. The parental interventions employed at earlier ages are often preventive efforts, offered before the child problems have reached clinical levels. In adolescents, the problems have often persisted across many years, and this pattern might be more difficult to alter (Bernazzani, Côté, & Tremblay, 2001). Moreover, findings from both passive longitudinal and intervention studies suggest that (intervention-induced) changes in parenting might be more relevant in earlier stages of development. Younger children are more dependent on their parents for guidance and support, whereas adolescents spend more time outside the home and, from midadolescence forward, other socialization agents (i.e., peers) become increasingly more salient. In a meta-analysis comparing differential effectiveness of parental training and cognitive behavioral therapy for antisocial youth, it was found that parental training had a stronger effect for preschool and school-aged youth, whereas cognitive behavioral therapy had a stronger effect for adolescents (McCart, Priester, Davies, & Azen, 2006). In the present study we focus on adolescents and examine changes in parenting as putative mediators of effects of multisystemic therapy (MST) on adolescent externalizing problems. MST is an intensive home- and community-based treatment, grounded on social ecological and family systems theories and on research on the causes and correlates of serious antisocial behavior. Although MST aims to address multiple risk factors associated with delinquency (i.e., factors within the family, school, peer group, and neighborhood), its underlying assumption is that parents are central for adolescent behavior change (Henggeler, 2011). In line with this assumption, MST therapists use a strength-focused approach and aim to empower parents to change factors within or outside the family that promote and maintain adolescent antisocial behavior. Parents are trained in using more effective parenting skills, including reducing harsh discipline, employing more consistent discipline and monitoring, and enhancing supportive, positive interactions. For these reasons, it is expected that changes in parenting are working mechanisms behind the successful reduction of adolescent problems following MST. Previous studies on mechanisms of change in MST provide tentative support for this assumption: Effects of MST on adolescent antisocial behavior appear to be mediated by improvements in parental monitoring (Huey, Henggeler, Brondino, & Pickrel, 2000) and parental use of consistent discipline (Henggeler et al., 2009). However, the first study (Huey et al., 2000) had several important methodological limitations (i.e., small sample size, only two assessment points, lack of control group, and no formal mediational tests), whereas the second study (Henggeler et al., 2009) focused on a specific group (i.e., juvenile sexual offenders). There is a need to extend these findings to other

contexts by improved methodology. The present study is the first Dutch trial to determine the effectiveness of MST and offers the opportunity to examine the generalizability of these findings.

A second gap in the literature concerns the lack of information regarding the specificity of mediational effects. Although the need to include multiple putative mediators within the same study has been stressed (Kazdin & Nock, 2003), there are still very few studies that have tested mediational models for different parental dimensions. When this was the case, often different patterns of findings emerged for different dimensions. For example, Gardner, Hutchings, Bywater, and Whitaker (2010) examined whether changes in positive parenting (positive affect, use of praise) and negative parenting mediate the effects of the Incredible Years parenting program. The findings show that improvement in positive parenting, rather than reduction in harsh or negative parenting, is a key factor mediating change in child problem behavior. In the present study, in order to determine which aspects of parenting are especially promising targets of parenting interventions for parents of adolescents, we examined three dimensions of parenting that have been consistently linked to adolescent externalizing problems: positive discipline (defined as enforcement of predictable rules, consistency, limit setting, inductive discipline, and effective monitoring), inept discipline (harsh, punitive discipline, psychological control, and lack of control), and relationship quality (warmth, acceptance, low degree of conflict, and open communication). In this way, we capture both instrumental (i.e., supervision, discipline) and affective (i.e., warmth, conflict) aspects of parenting that are consistent with theoretical underpinnings of MST and that are targeted in MST by a strong emphasis on dealing with both discipline and relationship building.

The basic assumption underlying both parenting interventions and studies that have examined mediational models is that altering the ways in which parents manage their children would result in changes in child behavior. What these studies fail to address is, what are the mechanisms that explain change in parenting? The present study addresses this gap by investigating whether changes in parental cognitions (i.e., parents' confidence in their ability to effectively manage parenting tasks) are the mechanism through which the intervention induces changes in parenting behavior. The reason for focusing on parental sense of competence is that MST expressly aims to empower parents and to promote and maximize their self-efficacy (Bandura, 1997). Moreover, the results in the extant literature offer substantial evidence for a relationship between a high sense of competence and positive parenting (Dix & Meunier, 2009; Jones & Prinz, 2005). Conversely, if parental low sense of competence is a risk factor for inept parenting, then it is to be expected that the important prelude to changes in parenting might be the belief of the parents that they are capable of providing effective parenting and that their actions will positively affect their children's behavior.

Finally, it has been emphasized that when studying mediators of effectiveness, attention should be given to the criterion of temporal precedence; that is, in order to infer causality, it is necessary to demonstrate that the change in the proposed mediators preceded change in the outcome (Kazdin, 2007). In contrast to many studies that tested mediational models with data consisting of only two assessments (pre- and postintervention; Gardner et al., 2006), or more assessments but spread over a longer period (DeGarmo et al., 2004; Henggeler et al., 2009; Zhou, Sandler, Millsap, Wolchik, &

Dawson-McClure, 2008), in the present study multiple assessments of both putative mediators and the outcome were conducted *during* intervention. This allowed us to study changes as they unfolded at the time that participants were engaged in therapy, that is, when the change was supposed to occur, and to determine mechanisms by which the intervention led to a reduction in problems immediately after the intervention (Kazdin, 2007). This made the interpretation of the findings more straightforward, than in the case when change in mediators and outcomes came about during the follow-up intervals.

In sum, the present study addressed the gaps in literature on mechanisms through which an intervention exerts its effects by examining the nature of changes induced by MST, conducted in a real-world community setting with adolescents and their families. Several putative mediators, including both parental cognitions and parental behavior, and the outcome (adolescent externalizing problems) were assessed monthly during the period that the intervention took place. We first determined the effectiveness of MST compared with treatment as usual (TAU) using pre- and postintervention assessment of the main constructs in this study: parental sense of competence, three dimensions of parenting (positive discipline, inept discipline, and relationship quality), and adolescent externalizing problems. To reduce the single-informant bias, we used parent reports, adolescent reports, and observational measures of parenting. Given the previous evidence on effectiveness of MST in the United States, we expected that MST would lead to positive changes in both parents and adolescents. Then we examined the change that took place during the intervention, by conducting a series of latent growth models (Hess, 2000). Finally, we tested the mediational model proposing that the change would emerge in an orderly sequence, starting with the targeted mechanism of parental cognitions (increase in sense of competence), followed by changes in parental behavior, and eventually resulting in changes in adolescent behavior. In other words, we expected that MST had an effect on parental sense of competence ("first mediational link"), and that strengthening parenting sense of competence sets in motion changes in parental behavior ("second mediational link") and adolescent behavior ("third mediational link").

Method

Participants and Design

Participants in this randomized controlled trial were 256 adolescents (188 boys and 68 girls; mean age = 16.02 years, $SD = 1.31$; range = 12.00–18.10) and their families: 147 in the intervention group and 109 in the control group. Fifty-five percent of the adolescents had a Dutch background. Of the adolescents belonging to ethnic minorities, most had a Moroccan (34%) or a Surinamese (32%) background. Half the adolescents lived in a single-parent home. Fifty percent of the mothers and 36% of the fathers were currently unemployed. More than half the families (56%) lived below minimum income levels, and 45% of the families indicated experiencing financial strains. Independent-samples t tests for continuous variables and chi-square analyses for categorical variables were used to examine differences between treatment conditions at Time 1 (T1) on demographic variables, hypothesized mediators, and the outcome. No significant differ-

ences were found on any of these variables, suggesting that randomization was successful.

The design of the study was approved by the institutional review board and the medical ethical committee of Utrecht University. MST was provided by three community agencies. Adolescents with various types of serious antisocial behavior were referred from multiple community sources to either the Bureau of Youth Care or the Child Protection Council. They were then randomized to MST or TAU by research staff using computer-generated randomization sequence. Adolescents randomized to MST were treated through three agencies that provided MST, and adolescents randomized to TAU were referred, in collaboration with the staff involved in the referral, to a variety of alternative community programs. For a more elaborate description of the randomization process in this study, see Asscher, Deković, van der Laan, Prins, and van Arum (2007). Participants in both conditions were assessed on the same timeline. The assessments took place at the family's home at the baseline, before the start of the program (T1), and at postintervention (6 months later). The research assistants who visited the families at home were not informed of the family's randomly assigned condition. During the home visits, which lasted about 1.5 hr, the parent and the adolescent filled in the questionnaires and their interaction was observed by a research assistant. Each family member received €10 for completing each assessment. In addition, five monthly assessments took place during the intervention. Each month telephone interviews of 15–20 min were conducted, separately with adolescents and with parents, to assess the main constructs in this study.

Figure 1 charts the flow of participants from referral to data analyses. Inclusion criteria were severe and violent antisocial behavior, age between 12 and 18 years, and presence of at least one parent figure. The primary referral criterion was staff judgment that adolescent aggression and/or delinquent behavior at home, school, or in the community was serious enough to require treatment. Seventy-one percent of the participants had been arrested at least once before the baseline. According to the adolescent self-reports, 64% had contact with the police at some point during the year before the baseline. According to the clinical cutoff of the 90th percentile for the Child Behavior Checklist, 75% of the adolescents were reported by their parents to have clinically elevated scores on externalizing problems at baseline. Exclusion criteria were ongoing treatment by another agency, substance abuse without antisocial behavior, sexual offending, autism, acute psychosis, or imminent risk of suicide, and if the presence of the youth in the home posed a serious risk to the youth or to the family. As shown, the recruitment rate was 81%, which is comparable to those in other MST trials (Curtis, Ronan, & Borduin, 2004; Henggeler, 2011).

Despite extensive tracing efforts, 33 participants were lost to postintervention assessment. Participants lost to postintervention assessment did not differ significantly on any assessed variable from those retained. Little's test for missing completely at random indicated that data were missing completely at random, $\chi^2(3097) = 3200.556$, $p = .095$. Thus, all participants were included in the analyses, and with LISREL 8.8, the multiple imputation was carried out by the expected maximization algorithm (Graham, 2009).

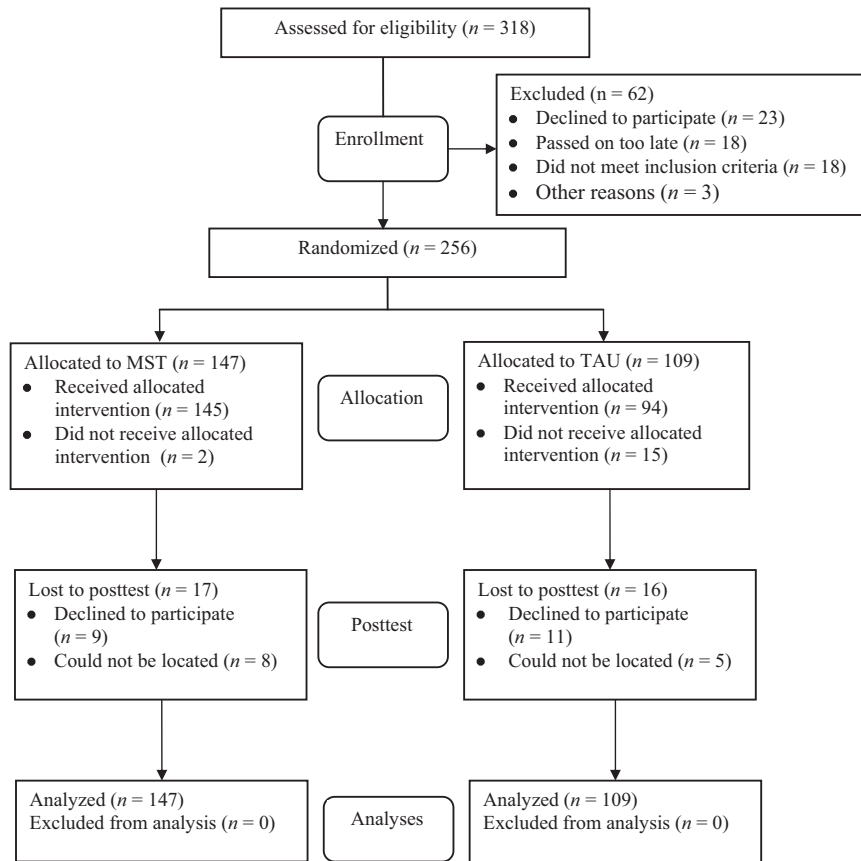


Figure 1. Flow diagram. MST = multisystemic therapy; TAU = treatment as usual.

Measures

Pre- and postintervention assessment. Because the sole use of parent-reported data inflates estimates of intervention effectiveness (Maughan, Christiansen, Jenson, Olimpia, & Clark 2005), and because composite scores, combining different measures and/or sources of information, are likely to provide a better measurement and have a better predictive validity than a single measure or a source of information (van Dulmen & Egeland, 2011; Webster-Stratton, Reid, & Hammond, 2001), in the present study, except for the measure of parental sense of competence, which was defined by a single indicator (parental self-report), all constructs were assessed by using a multi-informant, multimethod approach, including parent reports, adolescent reports, and observational measures. To create a composite score for each construct, we used the following strategy (Patterson et al., 2004; Webster-Stratton et al., 2001). First, we selected the indicators (scales from established measures) for each construct. The alphas for all indicators were acceptable, ranging from .61 to .94, with median .83. Next, we tested a single-factor model using confirmatory factor analysis (CFA) in LISREL 8.80, based on the covariance matrix and maximum likelihood estimation. An adequate fit of a single-factor model, with significant factor loadings of the indicators, was seen as support for the hypothesis that the indicators representing the construct addressed one underlying dimension and could thus

be combined into a composite score. The composite was computed by averaging the scores of the indicators. All items were standardized before computing the composite. Standardization was performed across the full sample and across both time points, so that the relative differences in variability across time were preserved.

Sense of competence. Parental sense of competence with regard to parenting was assessed with a 15-item scale from the Parenting Stress Index (Abidin, 1983), which is one of the most often used instruments to assess this concept (Jones & Prinz, 2005). The items were rated on a 6-point scale (1 = *I totally disagree* to 6 = *I totally agree*). The alphas were .87 at T1 and .90 at Time 2 (T2).

Positive discipline. The same four indicators of the construct positive discipline were used for both parental and adolescent reports. The first indicator, consistency, was assessed with a subscale of the Parenting Dimensions Inventory (Slater & Power, 1987), consisting of eight items to be rated on a 6-point scale. The second indicator, behavioral control, was assessed with six items of the Parenting Practices Questionnaire (Kerr & Stattin, 2000). Third, parents and adolescents were presented with three hypothetical situations from the Parenting Dimensions Inventory, describing adolescent misbehavior (e.g., "Your child comes home much later than the curfew"), each followed by several possible parental reactions. They were

asked to indicate how probable it was that parents would use each reaction. Two items describe parental use of inductive discipline (i.e., explaining the reasons for rules and pointing out consequences of misbehaviors for adolescent or for others). A mean score across three situations was calculated. Finally, parental monitoring (i.e., knowledge regarding adolescent whereabouts) behavior was assessed with six items. The observational assessment of parent positive discipline was based on the Coder Impressions Inventory (Webster-Stratton et al., 2001). The Coder Impressions Inventory has been used for home observations. This measure is based on the observer's overall impressions of the parent and adolescent and their interactions during an unstructured home observation (i.e., the parent and adolescent were told to do what they would normally do at that time). It is designed to collect information on the family, which may be missed by strictly defined microanalytic observational procedures or by global ratings. Immediately after a home visit, the research staff coded 14 items assessing positive parenting behavior on a 3-point scale (1 = *did not occur* to 3 = *four or more examples*). The coders had extensive training with videotapes before home visits and achieved agreement of greater than 80% during training. The single-factor CFA showed an adequate fit to the data, $\chi^2(33) = 54.77$, $p = .010$, root-mean-square error of approximation (RMSEA) = .051, comparative fit index (CFI) = .923, with all estimated factor loadings being significant. The composite score for positive discipline was computed including both parents' and adolescents' reports as well as an observational assessment. The composite alphas were .84 (T1) and .87 (T2).

Inept discipline. Two indicators of inept discipline were the same for both parents and adolescents, and both were based on the responses on three hypothetical situations from the Parenting Dimensions Inventory. First, harsh discipline, was the mean score across situations for the following reactions: yelling and physical punishment. The second indicator, other punishments, included ignoring, love withdrawal, and exercise of power. The third indicator was adolescent report on the level of psychological control used by parents. The Psychological Control Scale, Youth Report (Barber, 1996) consists of eight items, to be answered on a 6-point scale. The observers' ratings of 26 items from the Coder Impressions Inventory, tapping harsh or critical parenting and lack of control, were used as an observed measure of inept discipline. The CFA of a single-factor model with six indicators showed an adequate fit, $\chi^2(15) = 20.40$, $p = .157$, RMSEA = .038, CFI = .950. The composite alphas were .94 (T1) and .83 (T2).

Relationship quality. Four of the indicators were parent reports. The first indicator, responsiveness, was assessed on an eight-item scale of the Nijmegen Parenting Questionnaire (Gerris et al., 1993), rated on a 6-point scale. The second indicator, acceptance of the child, was measured with a 12-item scale from the Parenting Stress Index (Abidin, 1983), rated on a 6-point scale. Third, the degree of conflict and antagonism in the parent-adolescent relationship, was assessed with six items from the Network of the Relationship Inventory (Furman & Buhrmester, 1992), rated on a 5-point scale. Fourth, problems in communication were assessed with five items from the Parent-Adolescent Communication Scale (Barnes & Olson, 1985). Three indicators were adolescent reports. In addition to the

adolescent version of the Network of the Relationship Inventory and Parent-Adolescent Communication Scale, attachment of the adolescent to the parent was assessed with the Inventory of Parent and Peer Attachment (Nada Raja, McGee, & Stanton, 1992), consisting of 12 items. Finally, the observers' ratings of 20 items from the Coder Impressions Inventory, tapping parental responsiveness-nurturance and child bonding with parent, were used as an observed measure of relationship quality. The CFA on these eight indicators yielded an adequate fit, $\chi^2(23) = 35.63$, $p = .045$, RMSEA = .046, CFI = .982. The composite alphas were .77 (T1) and .81 (T2).

Externalizing problems. Both parent and adolescent reports were used. Parents were asked to fill in 33 items of the Externalizing Problems scale from the Child Behavior Checklist (Achenbach, 1991). The adolescent version of this scale, the Youth Self Report, had 30 items. Additionally, adolescents reported on their involvement in delinquent behavior during the past 6 months by using the Self-Report Delinquency Scale (Elliott & Huizinga, 1983). The Self-Report Delinquency Scale Violent Offending scale consists of five items (e.g., assault, sexual offense), and the Property Crimes scale consists of 10 items (e.g., theft, property damage). Finally, two scales, filled in by the parents, from the Disruptive Behavior Disorder rating scales (Pelham, Gnagy, Greenslade, & Milich, 1992) were used: Oppositional-Defiant Disorder (nine items) and Conduct Disorder (18 items). A single-factor CFA on these six indicators yielded an adequate fit, $\chi^2(12) = 15.54$, $p = .213$, RMSEA = .034, CFI = .993. The composite alphas were .84 (T1) and .87 (T2).

Within-intervention assessment. The same concepts were assessed monthly in a telephone interview with a shortened version of the above questionnaires. The items that most adequately tap each construct were selected, based on face validity and examination of items factor loadings in previous studies. Adolescents and parents were asked whether they or their child or parent showed behavior described in each item (1 = true, 2 = false) during the last month. Again, composite scores were created combining both parent and adolescent reports, with the exception of parental sense of competence that was rated only by parents.

To assess parental sense of competence, three items were used ("had a feeling that I cannot cope with parenting," "experienced problems with parenting," "had a feeling that I performed well as a parent"). Internal consistency ranged from .61 to .81. Positive discipline was assessed by four items, two items from adolescent reports (e.g., "Your parent had no trouble setting limits") and two from parent reports (e.g., "I knew what my child did in his/her free time"), with internal consistencies ranging from .65 to .67. The assessment of inept discipline included two items answered by parents (e.g., "I screamed and yielded at my child") and three items answered by adolescents (e.g., "Your parent punished you hard"). Alphas ranged from .57 to .67. Relationship quality was assessed by five items answered by parents (e.g., "I was satisfied about the way I and my child talked to each other") and five items answered by adolescents (e.g., "I had a fight with my parent"), with alphas ranging from .68 to .84. Finally, the monthly assessment of externalizing problems included four items to be answered by parents and five items to be answered by adolescents (e.g., "stole something"), with internal consistency ranging from .74 to .84.

Treatment Conditions

Multisystemic therapy. MST addresses several key systems in which the adolescent is embedded: family, school, peer group, neighborhood. Intervention strategies include strategic family therapy, structural family therapy, behavioral parent training, and cognitive therapy. Treatment is typically delivered for 4–6 months, and it is individualized to address specific needs of clients. Therapists are available 24 hr a day, 7 days a week. MST uses a home-based model of service delivery. In consultation with family members, the therapist identifies a well-defined set of treatment goals, assigns the tasks required to accomplish these goals, and monitors the progress in regular family sessions at least once a week. In the present study, MST was provided by six teams with a total of 30 therapists. The research team was independent of these agencies and was not involved in the treatment. Fifty-nine percent of the therapists were men, and 10% had an ethnic minority background. Eighty-six percent of therapist had a master's degree, and 41% followed additional training in cognitive behavioral therapy and/or in family system therapy.

To assess treatment integrity, we used the 15-item version of the Therapist Adherence Measure (TAM). Evidence for validity, as indicated by significant associations between a higher TAM score and more positive outcomes (i.e., lower rates of arrests, lower levels of externalizing problems, and more positive family and peer-related outcomes) has been reported in several studies (Henggeler, Schoenwald, Liao, Letourneau, & Edwards, 2002; Huey et al., 2000; Schoenwald, Henggeler, Brondino, & Rowland, 2000; Schoenwald, Letourneau, & Halliday-Boykins, 2005; Schoenwald, Sheidow, Letourneau, & Liao, 2003; see also Henggeler, 2011, for a recent overview). The TAM assesses therapist adherence to the nine principles of MST and was collected monthly by a telephone interview with the parents. The items were rated on a 5-point scale (1 = *not at all* to 5 = *very much*). The scores were averaged per family to indicate the mean level of therapist adherence experienced by a family during treatment. The mean adherence score is 4.36 ($SD = 0.51$), which is comparable to U.S. studies ($M = 4.41$, $SD = 0.49$).

Treatment as usual. The participants assigned to the control group were offered usual services for this target group, a broad array of social and mental health treatments, including juvenile justice services, child welfare services, and mental health center services. Mostly, these services included individual treatment (individual counseling or supervision by probation officer or case manager, 21%) and family-based interventions (family therapy, parent counseling, parent groups, or home-based social services, 53%). Seven percent received a combination of care (e.g., individual treatment and family counseling), and 4% were placed in a juvenile detention facility. Fourteen percent eventually received no treatment.

Analytic Strategy

An intention-to-treat analysis was employed; that is, all participants who were randomized were included in the analysis regardless of their level of attendance to the assigned condition. First, we examined the overall effectiveness of MST compared with TAU by conducting analyses of covariance comparing groups at T2, with the preintervention score as covariate. Effect sizes estimates

were computed as Cohen's d , based on adjusted means and standard errors, with a positive sign indicating improvement in the MST group relative to the control group.

The within-intervention change was assessed, following the strategy proposed by Muthén and Curran (1997) and Hess (2000), by modeling trajectories of each construct with a two-factor latent growth modeling: the intercept (with the factor loadings of five observed variables, corresponding to five within-intervention assessments, set at 1) and the slope factor (with the factor loadings of 0, 1, 2, 3, and 4, corresponding to the number of months that passed since first within-intervention assessment). A multigroup analysis was conducted to compare four growth parameters (intercept mean, slope mean, intercept variance, and slope variance) between the MST and the TAU group. Lack of parameter equality suggests a significant intervention effect.

Finally, mediation was tested by combining the parallel-process latent growth modeling method (Cheong, MacKinnon, & Khoo, 2003) and a "three-path mediation" framework (Taylor, MacKinnon, & Tein, 2008). The trajectories found in the previous step were combined into a single model (see Figure 2). A group assignment variable was included in the multivariate model, as a dummy variable that was coded 1 for the participants assigned to MST and 0 for the participants assigned to TAU. The mediational models were tested, separately for each dimension of parenting, each including three-path mediation, in which two mediators (i.e., changes in parental sense of competence and changes in a parenting dimension) intervene sequentially between the independent (i.e., group assignment) and dependent variable (i.e., change in externalizing problems). Although this model is the most plausible one, given the theoretical underpinning and the approach of MST, we also tested an alternative model in which the order of the respective mediators and the outcome was reversed. In this alternative model, it is assumed that improved parenting leads to a reduction in adolescent problems, which in turn leads to an enhanced sense of parental competence.

A joint significant test approach was used to evaluate the mediated effects, in which mediation is supported if each path representing the mediated effect is nonzero. This approach was developed originally for the single mediator (a two-path mediation; MacKinnon, 2008), but recent evidence suggests that this test has the most power and the most conservative Type I error rate in the case of two mediators and three-path mediated effects (Taylor et al., 2008). The confidence intervals (CIs) for the mediated effects were computed with the estimate of the mediated effects (the product of the three paths) and its estimated standard error based on multivariate delta method.

Results

Intervention Effects at T2

Results of the analyses of covariance (see Table 1) indicated significant intervention effects, with small to medium effect sizes, on four assessed variables: Increases in parental sense of competence, positive discipline, and relationship quality were significantly higher in MST than in the TAU group, and adolescents in the MST group showed a significant sharper decrease in external-

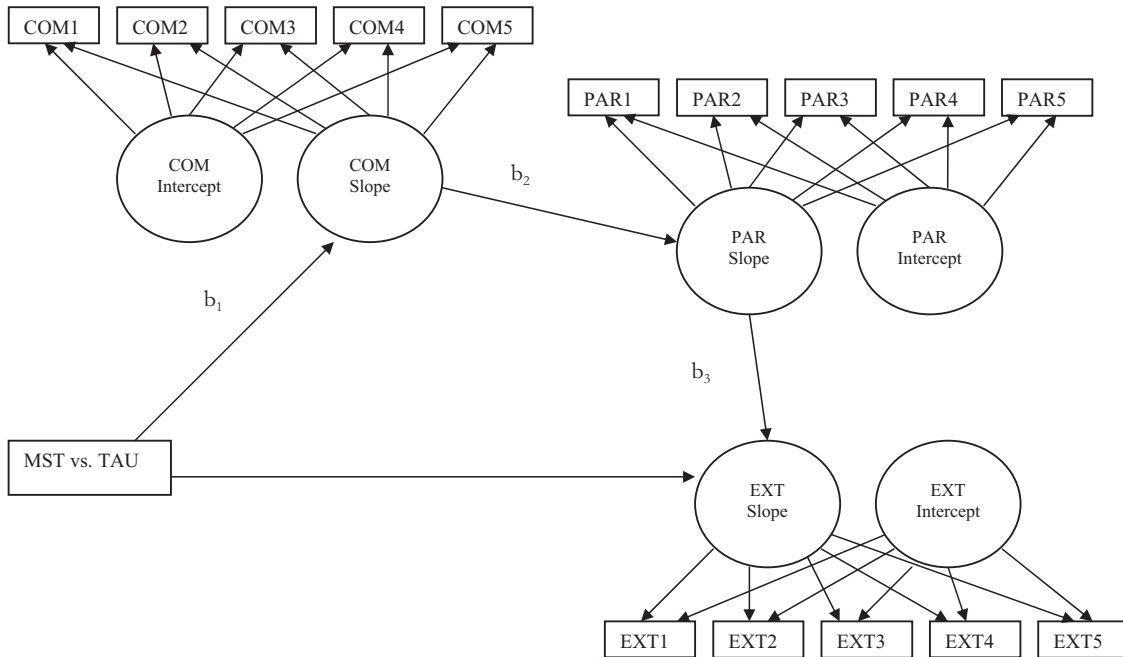


Figure 2. Hypothesized three-path mediational model. For the easy of presentation, other parameters included in the models were left out. COM = parental sense of competence; PAR = parenting behavior; EXT = adolescent externalizing problems; b_1 , b_2 , b_3 = the coefficients making up the mediated effect; MST = multisystemic therapy; TAU = treatment as usual.

izing problems than TAU. No significant difference was found for changes in inept discipline.¹

Within-Intervention Change

The analytic strategy to assess the within-intervention change consisted of comparing the initial levels and changes in the assessed constructs in the MST with those in the TAU group. A summary of the chi-square difference tests comparing a constrained to an unconstrained multigroup latent growth model is presented in Table 2. Figure 3 shows the within-intervention change for all assessed constructs.

Releasing the equality constraint on the intercept mean of sense of competence did not significantly improve the fit of the model. There were also no significant differences in intercept and slope variances between the two groups, indicating that the within-group variability in the initial levels and in changes in sense of competence was comparable between the groups. However, the slope means were significantly different, as indicated by a significant improvement in model fit when the equality constraint of this parameter was released. Parents in the MST group increased significantly more in sense of competence during the intervention period than parents from the comparison group. The same multigroup latent growth models were assessed for parental use of positive discipline. After releasing equality constraints, two significant improvements in model fit were found. There were significant differences between the groups in slope means and slope variance, with the MST group showing a larger improvement over time in positive discipline and more variability in change than the TAU group. The test of the multigroup models for inept discipline

showed that there was a difference in intercepts, with the TAU parents scoring higher at the first within-intervention assessment. Although both groups showed a significant decrease in use of inept discipline, this difference in change between the groups was not significant. Releasing constraints on intercept means, intercept variances, and slope variances did not result in a significant improvement in the fit of the models for relationship quality. There was, however, a significant difference in the rate of change: The TAU group showed a significant decrease in quality of relationship, whereas in the MST group there was a slight, nonsignificant

¹ Analyses conducted separately for each source of information (parent reports, adolescent reports, and observation) produced a similar pattern of findings. These findings can be obtained from the first author. To determine whether the effectiveness of MST varied as a function of demographic characteristics of participants, we tested the following potential moderators: gender, age (adolescents younger than 16 years of age vs. adolescents 16 and older), ethnicity (Dutch vs. ethnic minority), and family composition (two parents vs. single-parent family). Three significant Moderator \times Condition interactions emerged: MST was more effective in improving the quality of parent-adolescent relationship for boys ($d = 0.64$ vs. $d = 0.12$) and for older adolescents ($d = 0.84$ vs. $d = 0.13$), and MST was more effective in decreasing inept discipline in single-parent families ($d = 0.41$ vs. $d = -0.18$). Given the fact that only three (out of 20) moderator effects were significant (none of them involving the primary outcome: externalizing problems), confirming the findings of previous MST studies (Schaeffer & Borduin, 2005; Sundell et al., 2008) that also showed that MST is equally effective with adolescents and families of divergent backgrounds, these demographic characteristics were not included in subsequent analysis.

Table 1
Means, Standard Deviations, and Intervention Effects

Variable	Preintervention		Postintervention		<i>F</i>	<i>d</i> [95% CI]
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Parental sense of competence					8.17**	0.34 [0.13, 0.54]
MST	4.02	0.87	4.32	.94		
TAU	4.24	0.91	4.20	1.05		
Positive discipline ^a					17.40***	0.53 [0.28, 0.79]
MST	0.03	0.49	0.06	0.49		
TAU	0.02	0.51	-0.14	0.52		
Inept discipline ^a					0.35	-0.12 [-0.13, 0.37]
MST	-0.03	0.51	-0.04	0.57		
TAU	0.07	0.51	-0.01	0.55		
Relationship quality ^a					19.48***	0.55 [0.30, 0.81]
MST	0.00	0.68	0.06	0.47		
TAU	0.02	0.57	-0.11	0.47		
Externalizing problems ^a					7.80**	0.35 [0.10, 0.60]
MST	0.15	0.74	-0.19	0.65		
TAU	0.09	0.68	-0.04	0.58		

Note. CI = confidence interval; MST = multisystemic therapy; TAU = treatment as usual.

^a Composite score based on standardized indicators.

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

increase. Finally, the multigroup models were assessed for adolescent externalizing problems. Again, improvement in the model fit was found only when the equality constraints on the slope mean were released. Adolescents in both groups showed a decrease in externalizing problems, but the decrease was steeper in the MST group.

In sum, the results regarding the within-intervention change mirror those of preintervention–postintervention comparison. The comparison of the trajectories that the two groups follow during intervention period revealed that MST participants showed a significantly stronger increase in parental sense of competence and positive discipline, no deterioration in the relationship quality, and a steeper decline in adolescent externalizing problems. The difference in trajectories of inept discipline was not significant.

To further examine the within-intervention change, we calculated effect sizes for each construct at each measurement point. Figure 4 shows intervention effects in terms of effect sizes, with the zero ordinate line for the *y*-axis representing no intervention effects. After the 1st month of intervention, the impact of the intervention was relatively small. The largest—negative—effect size was found for inept discipline; adolescents and parents reported more use of strict, hard discipline in the MST group. After the 2nd month, the effect size for parental sense of competence starts to increase, stabilizing after the 3rd month and showing a slight increase in the last month of the intervention. The intervention effects on parental use of positive discipline emerged later on: The increase in effect sizes occurred after 4 months of intervention and further increased in the 5th month. The impact on relationship quality was less orderly. In the 2nd month, the quality of the parent–adolescent relationship deteriorated in the MST group, but after that there was a steady increase in effect sizes. Finally, the effect sizes for adolescent externalizing problems showed a slow increase during the first 4 months, and a significant effect size emerged only in the last month of intervention. These findings are compatible with the idea that changes in the family started with the

improvements in parental cognitions, followed by the improvements in parenting, followed by a decrease in externalizing problems.

Mediated Effects

Given the nonsignificant effects of intervention on parental use of inept discipline, in both preintervention–postintervention comparison and in the comparison of the within-intervention trajectories, the mediational model was tested for two dimensions that did show the intervention induced change: positive discipline and relationship quality. In each model, the trajectories of the mediators (sense of competence and parenting) and the outcome (externalizing problems) were combined into one parallel-process model (Cheong et al., 2003), and the relations between growth factors (initial levels and slopes) of the mediators and the outcome were assessed. To control for initial differences between the groups, we also regressed intercepts of the mediators and the outcome on the treatment status. The test of the mediational model involves examining whether MST significantly changes the trajectory of the sense of competence (first mediator), which in turn affects the trajectory of parenting behavior (second mediator), which in turn affects adolescent externalizing problems (outcome).

The fit of the mediational model involving positive discipline was adequate, $\chi^2(108) = 252.46$, RMSEA = .072, 90% CI [.061, .084], CFI = .980, and all three mediational paths were significant. Results are consistent with the hypothesized model: Participation in MST was related to a greater increase in maternal sense of competence (first mediational path: $b_1 = 0.024$, $SE = 0.007$, $p < .05$), which in turn predicted an increase in positive discipline (second mediational path: $b_2 = 0.553$, $SE = 0.126$, $p < .05$). These changes in parenting in turn predicted a decrease in adolescent externalizing problems (third mediational path: $b_3 = -0.990$, $SE = 0.237$, $p < .05$). The test of mediation with the joint significance test method showed that the mediating effect was

Table 2
*Parameter Estimates (and Standard Errors) for Latent Growth Models During Intervention:
 Differences Between Multisystemic Therapy (MST) and Treatment as Usual (TAU)*

Parameter	MST	TAU	$\Delta\chi^2(1)$	CFI
Sense of competence				.994
Intercept mean	1.294 (0.021)*	1.288 (0.025)*	1.82	
Intercept variance	0.044 (0.008)*	0.051 (0.009)*	0.20	
Slope mean	0.019 (0.005)*	0.004 (0.006)*	5.24*	
Slope variance	0.001 (0.001)*	0.001 (0.001)*	0.02	
Positive discipline				.967
Intercept mean	1.246 (0.021)*	1.256 (0.028)*	0.95	
Intercept variance	0.054 (0.008)*	0.066 (0.012)*	0.04	
Slope mean	0.032 (0.005)*	0.002 (0.007)	14.59*	
Slope variance	0.002 (0.001)*	0.004 (0.001)*	4.32*	
Inept discipline				.961
Intercept mean	1.801 (0.105)*	1.858 (0.018)*	7.17*	
Intercept variance	0.019 (0.005)*	0.020 (0.005)*	0.05	
Slope mean	-0.016 (0.005)*	-0.018 (0.006)*	0.35	
Slope variance	0.001 (0.001)*	0.002 (0.001)*	0.04	
Relationship quality				.961
Intercept mean	1.341 (0.017)*	1.359 (0.020)*	0.06	
Intercept variance	0.036 (0.005)*	0.030 (0.005)*	0.31	
Slope mean	0.010 (0.006)	-0.023 (0.008)*	9.93*	
Slope variance	0.003 (0.001)*	0.004 (0.000)*	0.75	
Externalizing problems				.983
Intercept mean	1.868 (0.013)*	1.846 (0.014)*	0.002	
Intercept variance	0.018 (0.003)*	0.026 (0.004)*	2.18	
Slope mean	-0.020 (0.003)*	-0.006 (0.003)*	9.57*	
Slope variance	0.001 (0.000)*	0.001 (0.000)*	0.42	

Note. CFI = comparative fit index.

* $p < .05$.

significant (0.013, 95% CI [0.002, 0.024]). The test of the alternative model, proposing that improvement of parenting leads to a decrease in externalizing problems, which in turn leads to enhanced sense of competence, also had an adequate fit, $\chi^2(108) = 277.17$, RMSEA = .078, 90% CI [.067, .090], CFI = .978. However, the mediated effect was not significant (0.002, 95% CI [-0.008, 0.011]).

In the mediational model for relationship quality, $\chi^2(115) = 316.68$, RMSEA = .082, 90% CI [.072, .093], CFI = .970, the effect of participation in MST on parental sense of competence was, as expected given the above results, significant ($b_1 = 0.018$, $SE = 0.006$, $p < .05$). The increases in sense of competence predicted an increase in the quality of parent-adolescent relationship ($b_2 = 1.397$, $SE = 0.632$, $p < .05$). However, in this model the third mediational path, from an increase in relationship quality to a decrease in adolescent externalizing problems, was not significant ($b_3 = -0.048$, $SE = 0.039$, ns). The mediating effect was not significant (0.001, 95% CI [-0.001, 0.004]). The mediating effect in the alternative model, $\chi^2(115) = 293.75$, RMSEA = .078, 90% CI [.067, .089], CFI = .974, was also not significant (0.001, 95% CI [-0.001, 0.003]).

Discussion

The present study expanded previous work on mechanisms that contribute to change due to an intervention by exploring the hypothesized mediated chain of change underlying MST. Given that the effectiveness of MST had not yet been established in the Netherlands, it was necessary to test first whether MST could be

transported to a Dutch setting and still be effective. Despite differences between our study and the U.S. studies in ethnic composition of the samples and organization of youth mental health and juvenile justice services, results show that MST succeeded in enhancing parental sense of competence, led to increases in positive parenting, and had no negative effects on the quality of parent-adolescent relationship during a period when parental discipline, supervision, and limit setting were being increased. Finally, MST also resulted in a decrease of adolescent externalizing problems. The treatment integrity, as assessed by TAM, and the effect sizes found in the present study, carried out in real-world youth mental health services with community therapists, are comparable to those from the U.S. effectiveness studies, although somewhat smaller than what has been found in more tightly controlled efficacy studies (Henggeler, 2011). In addition to differences in type of study (effectiveness vs. efficacy), another explanation for relatively smaller effects is the nature of services offered in the TAU condition. Nowadays in the Netherlands, the basis premises of MST that a treatment should be "ecologically valid" (offered in the setting in which the problems occur) and multifaceted (focused not only on the adolescent but also on a wider environment) are generally widely accepted. Long-term placements in a residential setting are rare, and there is general awareness of the importance of family. That the effects of MST are still superior to those offered by traditional services is possibly due to the fact that MST includes components that are still not widely accepted by service providers, such as ongoing training and tight monitoring of treatment integrity and outcomes.

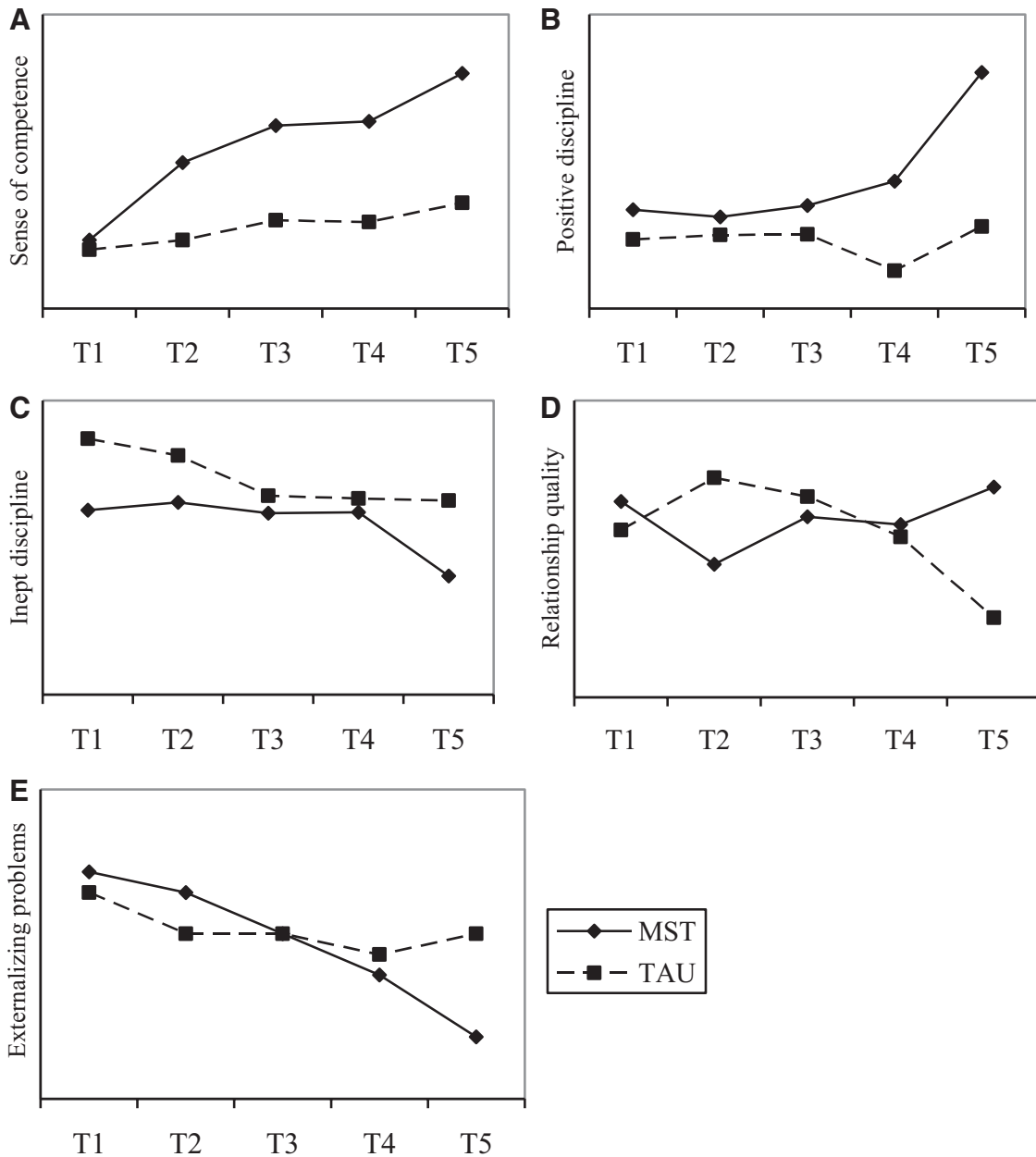


Figure 3. Changes in parental sense of competence (A), positive discipline (B), inept discipline (C), relationship quality (D), and adolescent externalizing (E) during the course of intervention. T = time (in months); MST = multisystemic therapy; TAU = treatment as usual.

The main aim was to examine putative intervention mechanisms, by determining whether change during the course of intervention in parental sense of competence and parenting mediate the impact of MST on adolescent externalizing problems. As expected, MST led to increases in parental sense of competence (first mediational link). Support for the second mediational link, that is, the hypothesis that increases in sense of competence would lead to positive changes in parenting, was found for two out of three assessed dimensions: positive discipline and relationship quality. There are several explanations as to why an increase in parental confidence regarding par-

enting ability promotes positive changes in parental behavior. In general, sense of competence is expected to influence the choice of activity, the amount of effort expended, and the persistence in the performance of a behavior (Bandura, 1997). The increases in sense of competence may motivate parents to be more persistent in attaining their goals, following through their discipline efforts, and thus becoming more consistent in their behavior toward the adolescent. It is also probable that parents who are feeling less helpless and inadequate when entering interactions with their adolescents start to derive more enjoyment from this interaction, which is reflected in more respon-

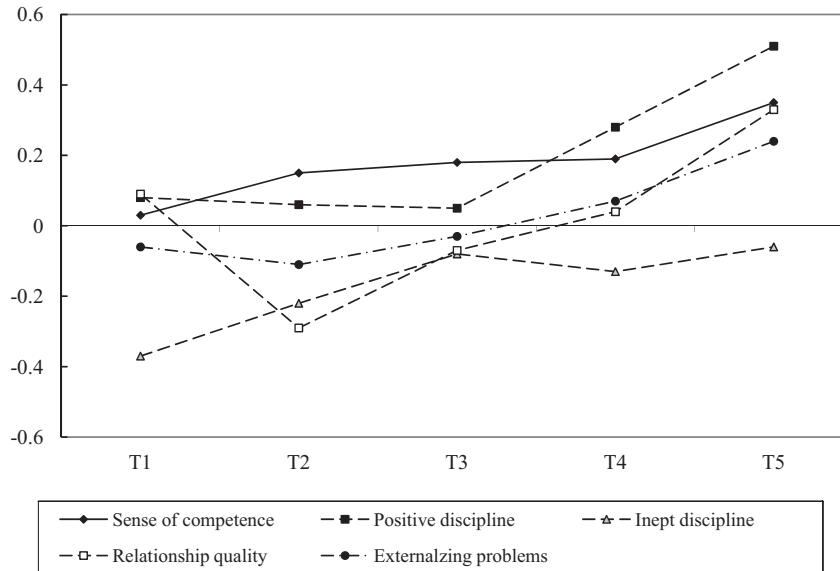


Figure 4. Effect sizes for each construct over five within-intervention assessments (Cohen's *d*). T = time (in months).

siveness toward the child and more acceptance of the child (Gondoli & Silverberg, 1997).

However, the tests of the mediational models showed that the mediated effect was significant only for positive discipline, whereas the improvements in relationship quality did not predict improvement in adolescent externalizing behavior (third mediational link). The intervention effect on parental use of inept discipline was not of sufficient magnitude to justify examination of the mediational model. The present findings suggest the specificity of mediation effects: The changes in adolescent externalizing problems are a result of improvement in parental sense of competence that led to improvement in positive discipline. Similar findings were reported by Gardner et al. (2010), who concluded that "improvement in positive parenting, rather than reduction in harsh or negative parenting, appears to be a key factor mediating change in child problem behavior" (p. 577). Interestingly, they examined the mediators of an intervention for parents with preschoolers, the Incredible Years parenting program. It appears thus that similar mechanisms are at work in interventions for younger children and adolescents. It is possible that change in positive parenting in families with a child or adolescent who shows serious problem behavior is more salient than change in harsh discipline, as such positive parenting does not occur often in such families. Moreover, in our study the concept of positive discipline included all ingredients (consistency, limit setting, reasoning, and monitoring of adolescent behavior) that have been identified as important predictors of adolescent problem behavior. It is unclear why the changes in relationship quality did not predict improvements in adolescent behavior. One possible explanation has to do with the less orderly change in relationship quality: During the 1st month of MST, the quality of the parent-adolescent relationship actually deteriorated, possibly due to parents' newly acquired skills in limit setting and supervision. Although eventually the relationship quality increased, it is possible that the degree of change was not strong

enough or that the length of time was not long enough to lead to steeper decreases in adolescent externalizing behavior.

In evaluating the significance of these findings, it is important to consider both strengths and limitations of the present study. The strength of the study is a naturalistic setting (community-based practitioners and an ethnically diverse sample representing the group that is targeted by MST in the Netherlands), which increases the external validity of the findings. Other methodological strengths include random assignment to conditions; a multi-informant, multimethod assessment of parenting and adolescent externalizing problems; availability of five assessment points during the intervention; and latent growth modeling analyses that specified and tested the theoretically based potential mediators of intervention effects. However, there are also some limitations worth considering. First, to assess treatment integrity, we relied on a sole measure (i.e., TAM). Although several studies have provided evidence for the validity of this measure, it must be recognized that due to the fact that MST is an individualized and highly flexible intervention, the TAM assesses therapist adherence to the nine principles of MST, rather than assesses whether a specific component or a specific intervention technique is implemented with a particular level of quality. In future studies more effort should be made to assess the implementation of different components of the intervention in order to determine how the procedures used in the intervention are related to changes in parenting and/or child outcomes. Such studies could help us to move intervention research to the next level by uncovering the "black box" of interventions and by answering why one intervention produces better outcomes than the other.

Second, the sample size in the present study is relatively large compared with many other intervention studies (Weisz, Jensen Doss, & Hawley, 2005), but still it is too small to allow for examination of more complex mediational models (such as a simultaneous test of all parenting dimensions) or even more com-

plex mediational chains. A possible extension of the present mediational chain process might include adolescent cognitions. For example, effective discipline, including clear limit setting, monitoring of adolescent behavior, and the consistent occurrence of expected consequences of misbehaviors, may potentially affect adolescents through enhancing their sense of control and belief in predictability of their environment. Similarly, attention to other aspects of parental cognitions, specifically parents' attributions about the causes of the child's negative behavior, deserve attention in further research (Scott & Dadds, 2009; Wiggins, Sofronoff, & Sanders, 2009).

Third, although, as recommended (Kazdin, 2007), the present study included multiple assessments of both mediators and outcome during the interventions, it must be recognized that the trajectories of the assessed constructs are a function of the same 6-month period. The results of the mediational analyses of both the hypothesized and alternative models are consistent with the idea of an earlier change in parental sense of competence contributing to future improvements in parenting, contributing to a reduction in adolescent externalizing problems. Still, the direction of causality cannot be proved from the correlated change in these constructs. Examination of effect sizes at each monthly assessment point suggests that effects on parental sense of competence appear earlier than the effect on parenting behavior and the effect on adolescent problems. As this conclusion is not based on a formal test, it is still tentative and needs further investigation.

Notwithstanding these limitations, the present results affirm the importance of targeting parental sense of competence, as the increases in parents' faith in their own ability to parent adequately were related to changes in both instrumental (i.e., supervision, discipline) and affective (i.e., warmth, conflict) aspects of parenting. By showing that increases in parental sense of competence and in use of positive discipline mediate the MST effects, the current study represents an important step toward elaborating the mechanisms through which interventions for children and adolescents operate. Our results are consistent with the results of a previous study on mediators of change in MST (Henggeler et al., 2009), regardless of the important differences between the studies in study population (Dutch antisocial adolescents vs. American juvenile sexual offenders) and in study design (multiple assessment during the course of intervention vs. three assessments over the course of 12 months). Both studies point out that the change in positive discipline, rather than the change in relationship quality, is the mechanism that explains change in adolescent behavior. The consistency in the results across these studies provides a strong support for the assumption stated by the MST theory of change that improvement in parenting, especially more consistent discipline, is one of the core working elements of this complex intervention.

A particular strength of the present study is that assessments of both mediators and outcome took place during intervention. Such data, at this moment virtually nonexistent (Kazdin, 2007), not only allow optimal testing of mediational models, but also could inform practitioners about the progress in various targets of the intervention during the course of the intervention. A recent review on patient feedback shows that measuring and providing feedback to therapists about the treatment progress enhances treatment effectiveness (Whipple & Lambert, 2011). Based on such information, a timely evaluation of intervention effects can be conducted, and if

necessary, alteration in focus and/or emphasis on certain aspects of the intervention can be made.

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