

Abstract

Objective: The aim was to explore mediators of change in parent training (PT) for 3-8 year-old children with ADHD difficulties. **Methods:** Parents of 64 children received PT with Incredible Years ® and assessed child ADHD symptoms and conduct problems and their parenting strategies, parental self-efficacy and therapeutic alliance before, during and after PT. Product-of-coefficients mediation analyses in multi-level models were applied, and causal relations between mediators and outcome were investigated in time-lagged analyses. **Results:** Increased parental self-efficacy and reduced negative parenting statistically mediated reductions in ADHD and conduct problems in the product-of-coefficient analyses. However, time-lagged analyses were unable to detect a causal relation between prior change in mediators and subsequent child symptom reduction. There was limited evidence of therapeutic alliance as mediator of child symptom reduction or change in parenting variables. **Conclusion:** Parental self-efficacy and reductions in negative parenting may mediate change in PT, but more fine-grained time-lagged analyses are needed to establish causality.

Keywords: *parent training; ADHD; conduct problems; mediation; incredible years; treatment*

Attention-deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder, characterized by age-inappropriate, persistent and impairing symptoms of inattention, hyperactivity and impulsivity (American Psychiatric Association, 2013). The prevalence of childhood ADHD is estimated to be about 5-7 %, and it is among the most commonly diagnosed childhood disorders (Willcutt, 2012). Children with ADHD are often suffering from emotional dysregulation (Shaw, Stringaris, Nigg & Leibenluft, 2014), social problems (Bagwell, Molina, Pelham & Hoza, 2001) and low self-esteem (Mazzone et al., 2013). Parenting a child with ADHD is challenging, as affected children are

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typically more non-compliant, more negative in interactional style and harder to manage, compared to children with normal development (Mash & Johnston, 1982). Consequently, families of children with ADHD are often distressed (Theule, Wiener, Tannock & Jenkins, 2013), have high levels of conflict, and negative parent-child interactions (Deault, 2010). A negative parenting style may increase the risk of maintaining or exacerbating ADHD symptoms and is a risk factor of development of oppositional defiance disorder (ODD) and conduct disorder (CD) (Johnston & Mash, 2001). Therefore, early interventions targeting both child and family difficulties have been developed and evaluated.

Parent training (PT) programs have been found to be effective interventions for ADHD and ADHD symptoms according to parental assessment (Daley, van der Oord, Ferrin, Danckaerts, Doepfner, Cortese & Sonuga-Barke, 2014; Rimestad, Lambek & Hougaard, 2016). Some PT programs, such as the Incredible Years (IY) program (Webster-Stratton et al., 2011), were developed from PT programs for ODD and CD; others, like the New Forest Parent Training Program (Abikoff, et al., 2015; Thompson et al., 2009), were specifically developed for ADHD. Rimestad and colleagues (2016) did not find differences in effectiveness between the two types of programs in their meta-analysis of PT for early (2½-6 years) ADHD.

However, little is known about change processes or mechanisms in IY or other PT programs. As stressed by Kazdin (2007), knowledge of *how* an intervention works should help in optimizing therapeutic change by providing optimal conditions and focusing on active ingredients. Studies on change processes are now increasingly conducted as mediation studies. A mediator or mediating variable may be defined as a variable that statistically accounts for, and thereby possibly explains the relationship between the dependent and independent variable (Kazdin, 2007; p. 3). Traditional approaches to statistical mediation have either used the Baron and Kenny (1986) ‘causal steps’ approach or the ‘product-of-coefficients’ approach suggested by Sobel (1982). However, none of

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these approaches to statistical mediation takes account of the timeline of change in variables that is necessary for conclusions as to the direction of causality. Kazdin (2007) recommends time-lagged analyses of repeated measurements of both process and outcome as an optimal approach to intervention research on mediation.

The assumption in PT programs is that a child's difficulties can be changed through a change in parenting practices. Potential mediating parental practices have been suggested to be both an increase in positive parenting and a decrease in negative/ineffective parenting as well as use of appropriate discipline. Positive parenting includes strategies such as praise, joint play and use of reasoning, humor and incentives (Gardner, Sonuga-Barke & Sayal, 1999), whereas negative parenting concerns critical comments, blame, hostility, disapproval and use of harsh discipline (Hinshaw et al., 2000). Another proposed mediator is parental self-efficacy, defined as parental beliefs about competence in one's parenting (Coleman & Karraker, 2003). A high degree of parental self-efficacy has been found to be associated with parental responsiveness, warmth and persistence in parental strategies (Sanders & Woolley, 2005). Conversely, a low degree of parental self-efficacy is associated with coercive parent-child interactions (Sanders et al., 2005).

The above-mentioned parental practices and self-efficacy have been found to change in PT interventions for children with ADHD (Daley et al., 2014), but there is currently limited empirical knowledge about their mediating role in treatment outcome (Forehand, Lafko, Parent and Burt, 2014). Three prior studies have investigated mediational processes in PT for early ADHD, all in the form of statistical mediation without taking account of the time-line of change in variables. One large study ($n=579$) compared medication, behavior therapy, their combination and a community control condition with school children in the age range of 7-10 years (Multimodal Treatment Study of Children with ADHD [MTA]; Hinshaw et al., 2000). Regression analyses (time x parenting x treatment condition) revealed a mediational effect of parent-rated negative/ineffective treatment

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(but not of positive parenting) on teacher-rated ADHD/oppositional symptoms and social skills for the combined group compared to community control (but not for the other condition comparisons). Hanisch, Hautmann, Plück, Eichelberger and Döpfner (2014) investigated the mediating effects of a preventive PT program (PEP) in a randomized controlled trial (RCT) in a product-of-coefficient analysis for both child conduct problems and ADHD difficulties, compared to a passive control group in a sample of 155 preschool children age 3-6 with or at risk of ADHD and behavioral problems. They investigated dysfunctional parenting, positive parenting, parental self-efficacy and parental warmth as mediators on child outcomes of ODD/CD and ADHD symptoms. The study found that changes in both ADHD and ODD/CD symptoms were mediated primarily by a reduction in dysfunctional parenting but also by an increase in positive parenting to a lesser extent. There were no mediating effects of parental warmth or parental self-efficacy. Seabra-Santos and colleagues (2016) investigated the mediating processes of IY PT in an RCT with 124 preschool children with or at risk of ADHD and behavioral problems. The study applied causal-steps mediation analysis and found that reductions in negative parenting as well as increased parental self-efficacy mediated the effect of IY PT on child externalizing behavior. Although the three studies were able to establish statistical mediation, it should be noted that the causal relations between mediator and outcome were not addressed in time-lagged analyses.

Besides parenting variables, other putative mediators in PT could be related to the therapeutic process itself. The therapeutic or working alliance is the most studied process variable in research on psychotherapy with adults (Horvath, Del Re, Flückiger & Symmonds, 2011). The alliance refers to the quality of the collaboration between therapist and patient; often specified as an emotional bond between the partners, and agreement on aims and tasks of the therapy (Bordin, 1979). The alliance has most often been considered a rather stable indicator of the quality of the therapeutic relationship, although it has also been suggested that an increase in alliance quality during therapy

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may be related to better outcome (e.g., Patterson & Chamberlaine, 1994). Most studies have simply investigated the correlation between alliance and outcome (Horvath et al., 2011), although some have corrected outcome variables for change prior to the time point of measurement of the alliance (11 studies in a recent meta-analysis by Crits-Christoph, Gibbons & Mukherjee, 2013).

The therapeutic alliance has also been found to predict outcome in psychotherapy with youths (McLeod, 2011; Shirk, Karver & Brown, 2011). In the largest meta-analysis by McLeod (2011; $k=38$), the mean weighted effect size (r) between alliance and outcome was small ($r=.14$) with no significant difference between results for therapist-child ($r=.12$) and therapist-parent alliance ($r=.15$); a somewhat smaller effect size (ES) than that found in the adult alliance literature ($r = .28$ in Horvath et al., 2011).

Since PT directly aims at changing parents' behavior, thereby indirectly influencing their children, it seems plausible that the parent-therapist alliance here might have a larger impact on parenting than on child behavior. Both of these associations have, however, been investigated.

There has, however, been little research on the therapeutic alliance in PT, and only one study specifically dealing with the therapeutic alliance in PT for children with ADHD could be localized. In the study by Lerner, Mikami and McLeod (2011), early (3rd session) observer-rated therapist-parent alliance and change in the alliance during an 8-session group-based PT (Parental Friendship Coaching) predicted improvement in several parenting and child behaviors observed during a 1-hour lab-based playgroup. In addition, some studies have investigated the alliance in PT for conduct problems. Kazdin and Whitley (2006) found that self-reported parent-therapist alliance in PT for children with oppositional and antisocial behavior was associated with self- and therapist-reported positive change in parenting variables. In contrast to these positive findings, however, Hukkelberg and Ogden (2013) in a large ($n = 331$) naturalistic study found that self-reported

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therapist-parent alliance *negatively* predicted change in children's problem behavior in individually delivered PT for children with externalizing behavioral problems.

Taken together, few studies have investigated mediators in PT for children with ADHD or ADHD difficulties, and results are somewhat mixed. The aim of this study was to explore mediating processes of the IY PT program for children aged 3-8 with ADHD or ADHD symptoms. We investigated parental discipline, positive and negative parenting, parental self-efficacy and therapeutic alliance as putative mediators.

Methods

Participants

The sample consisted of 64 families. These families took part in an RCT, in which they were randomized to PT with IY alone, or to IY PT combined with a brief Teachers Training (TT) (results concerning the effectiveness can be found in Rimestad, Trillingsgaard, O'Toole & Hougaard, 2017). Since the study found no significant differences in outcome between the PT only and the PT + TT group, we treated the whole sample as a unified group in the mediational analyses.

Participants were parents of 3-8 year old children, who had self-referred to the Centre for ADHD in Aarhus, Denmark. The Centre for ADHD is a non-profit private clinic funded by Edith and Godtfred Kirk Christiansen's Foundation. The Clinic offers treatment to families with young children with or at risk for ADHD. The intervention was announced at the Clinic's website as well as in flyers distributed in health clinics in the local area.

Families were accepted for treatment on the basis of an overall clinical assessment including a semi-structured interview with parents and validated questionnaires (see below). In accordance with the inclusion criteria at the Centre for ADHD, families in the study had to have a child between 3

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and 8 years with ADHD symptoms, but a formal ADHD diagnosis was not necessary. Families who had received PT prior to the intervention were excluded.

Measures

Outcome measures

The intervention study applied several outcome measures (Rimestad et al., 2016), but in this study only the two parent rating scales on ADHD symptoms and conduct problems were used, as these were the primary outcomes.

Conners' 3 ADHD Index Parent Rating Scale (CPRS; Conners, 2009). The CPRS is a questionnaire to be filled out by parents assessing child ADHD symptoms. The scale consists of 10 items, each rated on a 4-point Likert-scale from 0 = *never or almost never* to 3 = *Very often or always*. The CPRS is a short index version of the full form of the Conners' ADHD Rating scales, including the items that most effectively differentiated youth with ADHD from nonclinical controls (Westerlund, Ek, Holmberg, Näswall & Fernel, 2009). The scale has been found to have good psychometric properties, with a Cronbach's α of .90 (Westerlund et al., 2009). In the present study, Cronbach's α was .76 at pre-treatment.

Eyberg Child Behavior Checklist (ECBI; Eyberg & Pincus, 1999). The ECBI is a questionnaire assessing child ODD/CD symptoms (henceforth labeled conduct problems). The questionnaire consists of two subscales, an Intensity Scale and a Problem Scale, but in this study only the intensity scale was used. The Scale has 36-items concerning frequency of opposition and conduct problems, with each item rated from 1 = *Never* to 7 = *Always*. The scale has been found to have good psychometric properties with a Cronbach's alpha of .93 (Reedtz, Bertelsen, Lurie, Handegård, Clifford & Mørch, 2008). In this study, Cronbach's alpha was .86 at pre-treatment.

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Mediator measures

Parenting Sense of Competence (PSOC) (Johnston & Mash, 1989). The PSOC is a questionnaire assessing parental competence or self-efficacy in their role as parents. The scale has 16 items, each rated on a 6-point Likert scale from 1 = *Strongly Disagree* to 6 = *Totally Agree*, with higher scores indicating greater parental self-efficacy. The scale has been found to have acceptable psychometric properties, with a Cronbach's alpha of .80 (Ohan, Leung & Johnston, 2000). The pre-treatment Cronbach's alpha was 0.83.

Parenting Practices Index (PPI); Conduct Problems Prevention Research Group, 1996). The PPI is a questionnaire that assesses the frequency of specific parental practices. Items are rated on 7-point Likert scales, ranging from 1 = *never/not likely* to 7 = *always/almost 100% likely*. The scale has several subscales, of which three were used here; Appropriate Discipline Subscale (APP DISC) (16 items, Cronbach's alpha = .80 in this study), Harsh and Negative Parenting (NEG PAR) (14 items, Cronbach's alpha = .70) and Positive Parenting (POS PAR) (consisting of 15 items, Cronbach's alpha = .81).

Working Alliance Inventory - Short Form - Patient version (WAI-SF-Pt); Tracey & Kokotovic, 1989). The WAI-SF-Pt is a widely used 12-item version of the original 36-item WAI (Horvath & Greenberg, 1989) measuring the therapeutic alliance between therapist (here group leader) and patient (participant parent) from the patient/parent perspective. Each of the 12 items of the scale are scored on a 7-point Likert scale from 1 = *never* to 7 = *all the time*. The full scale WAI is a measure of the overall quality of the alliance, and the scale has sub-scales for the three dimensions of Bordin's (1979) working alliance concept, therapeutic bond, agreement on therapeutic goals, and agreement on therapeutic tasks. In the present study, only the full scale was used. The scale has been found to have good psychometric properties, with a Cronbach's alpha of .93 for the full scale (Tracey & Kokotovic, 1989). Cronbach's' alpha pretreatment in this study was .91.

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Procedures

After the families had contacted the Centre, a clinical psychologist screened them for eligibility via the telephone. If eligible, two clinical psychologists arranged a home-based intake interview with the parents concerning the child's problem behavior and aspects of their family life. The parents also completed the CPRS and the ECBI. Based on the intake interview and the parental scores on the questionnaires, it was decided if the families should be offered treatment at a following clinical conference. Both mothers and fathers were encouraged to participate in the PT course, regardless of their marital status; 64 mothers and 45 fathers participated in the courses. Childcare facilities were arranged for the children (including siblings) during the PT intervention, and the families were provided with free meals during the treatment. The intervention was free of charge, but parents paid for the IY PT book and handouts.

Data were collected pre-, mid- and post-treatment. Six-month follow-up data from the effectiveness study (Rimestad et al., 2017) were not used in the analyses, since therapeutic processes are most meaningfully investigated in the intervention period. Except for WAI, all measures were collected at all three data points. Pre-test scores on outcome and process measures were obtained no later than 2 weeks before PT start; except for WAI that was collected after 3 sessions of PT. Mid treatment scores were obtained after the 10th session, approximately two months after treatment start. Post measures were obtained no later than four weeks after termination of the interventions.

Parent-rated pre-measures were collected in paper form; all other data were collected via email using an online data collection platform. In case parents did not complete the questionnaires, they were reminded up to four times in total; two times by email, one time by text message and one time by telephone call.

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All participants signed a consent form after receiving verbal and written information on the study. The study was conducted in compliance with standards from the regional ethical committee and approved by the Danish Data Protection Agency.

Intervention

The PT intervention was an 18-session group based PT program, consisting of the Incredible Years Parent Training Program ® BASIC version as well as some content from the ADVANCE program (Webster-Stratton, 2011) and additional ADHD specific content added by the Clinic (cf. Cassøe, Bæk Bomme, Møller & Straarup, 2011) The program is designed for 2-8 year old children, aiming to enhance attachment and positive parent-child interactions as well as reducing negative parenting. Parents are trained in integrating play and positive appraisal in their parental practices, along with structuring difficult everyday situations. Furthermore, parents are taught how to use behavioral contingency principles in the form of rewards and negative consequences, such as loss of privileges and time-out. A supplementary ADHD specific guide developed by the Clinic (Cassøe et al., 2011) was implemented, covering psychoeducation on ADHD and supplementary exercises focusing on dealing with ADHD problems. All sessions consisted of video vignettes showing effective and ineffective parental strategies, group discussions and exercises where parents train new ways of managing their child's difficulties. Groups consisted of parents of 6-7 children and two group leaders. All eight group leaders were clinical psychologists accredited or under education in IY. Treatment fidelity checklists were filled out by the group leaders at the end of each session and screened for treatment adherence by IY certified Peer Coaches. All group sessions were videotaped and reviewed during weekly collegial supervision with participation of a certified IY mentor. Teachers of the 34 children who were randomized to PT + TT received a 4*3 hours of training course and an individual supervision session dealing with the teacher's experiences with their

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focus-child (Bertelsen & Straarup, 2017). The course was held in groups of 10-15 teachers and two group leaders, and it was based on the core principles of the IY PT. The manual included psychoeducation on ADHD and disruptive behavior, strategies to promote inclusion of children with special needs, use of behavioral contingency principles to motivate the children to cooperate, and, generally, to focus on positive aspects of the child's behavior.

Analytical procedure

Missing data at the item level were low (3.5 %) and handled by mean imputation; a procedure that performs well if few items are missing per individual on a scale, and if scales have acceptable internal consistency (Shafer & Graham, 2002). For changes in variables over time, ESs were calculated as standardized mean differences between variables based on *SD* difference scores (a variant of Cohen's *d*; Borenstein, Hedges, Higgins and Rothstein, 2009).

We conducted two sets of mediational analyses. First, we analyzed all proposed mediators separately by use of the product-of-coefficients method; for all variables that here met the criterion for mediation. Secondly, we conducted time-lagged analyses of change to address the causal relationship between the variables.

We used the product-of-coefficients approach in the analyses of statistical mediation, as it has been recommended over the causal-steps approach due to more statistical power and lower risk of type 1 error (MacKinnon, Lockwood, Hoffman, West & Sheets, 2002). The product-of-coefficients approach investigates the indirect mediational path as indicated by the interaction ($a \times b$) of path *a* (from the independent variable to the mediator, i.e., from time to one of the proposed five mediators) and path *b* (from the mediator to the dependent variable controlling for the independent variable, i.e., from one of the proposed five mediators to one of the two outcomes controlling for time) in Baron and Kenny's (1986, p. 1176) mediational figure (see Figure 1). Path *c* in figure 1

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indicates the direct association between the independent and dependent variable (i.e., from time to one of the two outcomes).

Insert Figure 1

With no passive control group in the study, time served as a continuous independent variable (entered as 1, 2, and 3) in the product-of-coefficients analyses. The product-of-coefficients was determined in multilevel models (MLMs) (cf. Krull & MacKinnon, 2001). These MLMs were two-level models, where time as a continuous variable at level 1 was nested within individuals level 2. Since all mediators were time-varying variables, that is at level 1, the model specified is considered a lower-level mediation model (Krull & MacKinnon, 2001). All MLMs were based on the intent-to-treat sample, as MLMs tolerate missing values and thus do not unnecessarily compromise statistical power. Using MLMs, without any ad hoc imputation of missing values, is recommended over other options of handling missing data in longitudinal designs with missing values (Chakraborty & Gu, 2009). After obtaining the coefficients, results were bootstrapped, since this method provides an empirical approximation of the sampling distribution of ab as normal, thereby making it possible to construct confidence intervals for the indirect effect (Preacher & Hayes, 2008). The bootstrapping was conducted with 5000 iterations in order to obtain both standard errors and confidence intervals. A significant mediating effect was established when the 95% bootstrapped confidence interval did not include the value zero. ESs in the analyses were expressed as the proportion of the total effect over time accounted for by the proposed mediator, that is the mediated effect / total effect based on absolute values of the variables (Kenny, Korchmaros & Bolger, 2003; MacKinnon et al., 2007). Since separate models were specified for each of the proposed mediators, the effect sizes do not sum to 100%.

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As mentioned, time-lagged analyses were conducted on all variables that fulfilled the criteria for statistical mediation in the product-of-coefficients analyses. First, it was analyzed if the proposed mediator at mid-treatment (controlling for pre-intervention value) predicted the outcome at post intervention (controlling for mid-treatment value). Secondly, the reverse path was investigated, that is, if the outcome at mid-treatment (controlling for pre-treatment value) predicted the mediator post-treatment (controlling for mid-treatment value). Controlling for the preceding time points partials out stable aspects and prior changes of variables (Pek & Hoyle, 2016).

Because the therapeutic alliance is most often considered a rather stable indicator of the quality of the therapeutic relationship, we here also conducted analyses of the relationship between alliance (at the two data points) and residualized pre-post change in outcome and process variables. In case mid-treatment alliance predicted residualized pre-post change in a criterion variable, we also analyzed its association with mid-post change.

We did not correct for familywise error rates in the analyses, since the parenting variables may be conceived as separate putative mediators. We did, however, discuss the problem with multiple analyses in relation to the therapeutic alliance.

All statistical analyses were conducted in STATA v. 14.

Results

Study inclusion

In total, families of 84 children were screened for eligibility of inclusion, and 64 were included (for further information of the inclusion process, see Rimestad et al., 2016). No families dropped out of treatment, but there was some non-completion of questionnaires. Mothers of 55 and 52 children completed questionnaires at the mid-intervention and post-intervention assessment, respectively.

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Post hoc analysis revealed no difference in parent-reported child symptom severity of ADHD as measured on the CRS at baseline between the mothers that did complete post assessment ($M=23.05$, $SD = 4.67$) and the mothers that did not ($M = 24.16$, $SD = 3.27$) ($p = .442$) (Rimestad et al., 2016).

Sample characteristics

For the whole group of participants, the mean age of the child was 6.4 years ($SD = 1.7$), with 15 girls (24.4 %). Twenty-six of the children (40.6 %) had received a formal ADHD diagnosis prior to the intervention. Of these children, 15 only had a diagnosis of ADHD and 11 had ADHD and a comorbid disorder. Comorbid diagnoses were CD in nine children, autism spectrum disorder in one child and tic disorder in one child. Fifty-four (84.4 %) of the families had had prior contacts with the public services concerning their child's difficulties (e.g. school psychologist, child psychiatrist or general practitioner), and 14 of the children (21.9 %) received medical treatment for their ADHD. Mean number of attended PT sessions was 14.

Within changes over time

Mean scores and ESs on measures across the three time points are presented in Table 1. There was a significant reduction in both ADHD and conduct problems from pre- to post-treatment, corresponding to moderate and large ESs, respectively. The largest changes, however, were from pre-to mid-treatment. There were also positive and significant changes from pre- to post-treatment in all variables except for appropriate discipline. The largest ESs were found for positive parenting and reduction in negative parenting ($ESs > 1.0$). Changes in mediation variables were also generally largest in the first half of intervention period.

*** *Insert Table 1 about here****

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Product-of-coefficients analyses

Corresponding to the within change analyses reported above, MLMs of the effect of time (i.e., path c) on the two outcomes, that is CRS ($B=-1.5, p<.001$) and ECBI ($-12.4, p<.001$) were significant, thus revealing a significant change over time. Results of the mediational analyses are seen in Table 2. Two of the parent variables, parental self-efficacy (PSOC) and negative and harsh parenting (PPI NEG PAR) showed a significant indirect ($a \times b$) effect on both outcomes; parental self-efficacy explained 81% and 28% of the total effect on ADHD symptoms and conduct problems, respectively; negative and harsh parenting explained 29% in both cases. WAI also showed an indirect effect on ADHD symptoms explaining 7% of the effect.

Time-lagged analyses

Neither of the three variables with significant indirect effect in the product-of-coefficients analyses, that is parental self-efficacy (PSOC), negative and harsh parenting (PPI NEG PAR) or therapeutic alliance (WAI), predicted later outcomes in the time-lagged analyses ($ps>.05$). However, in the reverse analyses, exploring the opposite direction of causality, ADHD symptoms at mid-treatment significantly predicted self-efficacy at post-treatment (after controlling for the variables' prior values) ($B=-0.4, p=.037$). This was not the case for conduct problems ($B<0.1, p=.132$) or therapeutic alliance ($B<0.1, p=.133$). None of the two outcome measures predicted negative parenting ($ps>.05$).

Further analyses on therapeutic alliance

Therapeutic alliance (WAI) measured in session 3 only significantly predicted pre-post residualized change in one of the six criterion variables, appropriate discipline ($z=2.54; p=.011; r=.32$); and measured mid-treatment it only predicted positive parenting ($z=2.31; p=.021; r=.29$). Mid-

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treatment alliance did not predict mid-post change on positive parenting ($z=1.28$; $p=.201$; $r=.16$). Range of ESs (Pearson's r) for the non-significant analyses was $-.04$ to $.22$.

Discussion

The product-of-coefficient analyses revealed indirect mediational effects of two of the four parenting variables, namely increases in parental self-efficacy (PSOC) and reductions in harsh and negative parenting (PPI NEG PAR), on both symptoms of ADHD (CRS) and conduct problems (ECBI). Parental self-efficacy appeared to be the strongest mediating variable, explaining 81% of the change in ADHD symptoms. There was no significant indirect effect of appropriate discipline or positive parenting on child outcomes.

These findings largely correspond to previous findings in studies of statistical mediation, although there is some variation in previous results. Reductions in negative parenting and increased parental self-efficacy were also found to be statistical mediators of the treatment effect in the Seabra-Santos et al. (2016) study of IY PT for early ADHD as in the present study. Hinshaw et al. (2000) in the MTA study, found that reduced negative parenting, and not increased positive parenting, mediated the efficacy of PT, albeit only in the PT+ medication group. Hanisch et al. (2014) found statistical mediation on both reduced negative parenting and increased positive parenting.

Considering that IY PT (and most other PT programs) specifically targets harsh and negative parenting and aims to increase self-efficacy in parents, it is coherent with the underlying assumptions in PT that these parenting variables will be associated with the outcome on child symptoms (Tarver, Daley & Sayal, 2015). Parental self-efficacy is generally associated with secure attachment feelings towards the child (Lovejoy, Verda & Hays, 1997), persistence in strategies (Bandura, 1977), greater satisfaction with the parental role (Sanders et al., 2006) and increased likelihood of engaging in difficult parenting tasks (Tarver et al., 2015), all contributing to positive

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parent-child interactions. Likewise, reductions in negative parenting may improve parent-child interactions over time and prevent aggression and coercion cycles (Patterson, 2002).

Appropriate discipline did not improve over the PT course, contrary to what could be expected. However, appropriate discipline did not improve in the Danish study by Trillingsgaard and colleagues (2014) either, whereas it increased in Webster-Stratton et al. (2011), possibly suggesting that disciplinary styles diverge due to cultural differences.

In the time-lagged analyses, taking the time-line of change into consideration, none of the statistical mediators in the product-of-coefficients analyses predicted subsequent reductions in child ADHD or conduct problems. On the contrary, one of the two reversed time-lagged analyses showed that reductions in ADHD symptoms from pre to mid-intervention significantly predicted increased parental self-efficacy from mid- to post-intervention. None of the other reversed analyses revealed significant results.

The negative findings in the time-lagged analyses of the proposed mediators may, likely, be due to the fact that almost all of the change in both outcome variables took place from pre- to mid-intervention. With small and insignificant change in outcomes from mid- to post-intervention, there is limited possibility of mediational influence. Moreover, seeing that midpoint assessment was conducted approximately two months from start of intervention, many complex patterns of change could have occurred prior to midpoint assessment that would not be detected by the time-lagged analyses used in the current study.

The reverse finding that decline in ADHD symptoms predicted improvement in parental self-efficacy indicates that when child symptoms were reduced, mothers perceived their parenting as more efficacious and competent. A child with less ADHD symptoms may be easier to parent (Theule et al., 2013) and since parental self-efficacy increases with a sense of successful mastery of

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the parental role (Coleman & Karraker, 1998) it is plausible that more successful parenting and thus more parental self-efficacy increased following child symptom reductions.

Since the children did not receive any other active treatment than PT (and ineffective TT), it seems unlikely that change in parental variables were not involved in the children's improvement. A possible speculation could be that changes in parental practices early in treatment led to symptomatic decline, which again led to improved self-efficacy. Such a reciprocal causal relation between mediators and outcome has been found in other studies with reversed time-lagged analyses (e.g., in a study on self-efficacy as a mediator in cognitive behavior therapy for panic disorder; Fentz et al., 2013). The design of the present study precludes, however, a test of this possibility.

Results from the present study suggested that improvement in parental self-efficacy explained up to 81% of the variance in child ADHD symptoms following PT, compared to 28% of the variance in conduct problems. Although speculative, a possible explanation could be that parents in this study had self-referred to the clinic with a primary concern of their child's ADHD symptoms and as such, ADHD may have been the primary focus in the group. Experiencing other parents facing similar struggles with child ADHD difficulties and receiving extensive psychoeducation on the disorder may have prompted the parental understanding of their child's difficulties and their parental coping of this to a greater extent than conduct problems.

In the product-of-coefficients analyses, change in therapeutic alliance over the intervention period came out as a statistical significant mediator of child ADHD symptoms, although only explaining 7 % of the variance. This was not the case for conduct problems. In the correlational analyses, 3rd session alliance only significantly predicted residualized pre-post change on one of eight outcomes and parental criteria variables, appropriate discipline; and mid-treatment alliance only predicted change in positive parenting.

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Although the mediational parenting variables may be considered to relate to different mechanisms of change (with no need for correction), the matter is different for the therapeutic alliance. The association between alliance and the two child outcome and the four parenting variables might, respectively, make up two ‘families’ of variables. With Bonferroni correction (e.g., dividing α -value .05 by 2 and 4, respectively), only the correlation between mid-treatment alliance and positive parenting would be significant ($p = .012$; i.e. $<$ the corrected α -level .0125). Thus there was little evidence of a major impact of the alliance. As mentioned in the introduction, ESs for the association between therapist-parent alliance and outcome in psychotherapy with children have generally been smaller than those reported for therapist-patient in the adult literature (McLeod, 2011), and one study even found a negative association between alliance and outcome in PT for children with externalizing problems (Hukkelberg & Ogden, 2013). It could be that the therapeutic alliance is less important in PT, being a rather educational intervention, than in more traditional forms of psychotherapy. However, it should be kept in mind that parents generally rated the alliance high (a mean of 5.86 of max 7 per item across data points), corresponding to the high degree of satisfaction with the PT intervention (Rimestad et al., 2016). The high ratings and consequently low variability of the alliance could limit the possibility of detecting mediational effects. It should be noted, however, that client ratings of the alliance are generally high in the psychotherapy literature (e.g., a mean of 5.73 on the WAI-SF in a review of studies with adult clients; Tryon, Blackwell & Hammel, 2008).

There are several limitations to this study. The lack of a passive control group hinders a firm conclusion as to the effectiveness of the PT intervention and we are thus only able to look at an uncontrolled effect over time. Concerning missing data, there was a considerable non-completion of questionnaires at mid and post, corresponding to 14% and 19%, respectively. With less individuals included in estimation of a specific path, the uncertainty in this estimation will increase with more

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missing data. Furthermore, the study had only three data points thereby not capturing the change dynamics during the early sessions, which precluded conclusive time-lagged analyses. In addition, all measures were parent-reported with potential biases due to shared method variance of process and outcome variables, and to parents themselves being actively involved in treatment. Valid objective assessment of variables would have heightened the methodological quality of the study; however, objective assessment of ADHD symptoms within the field may be difficult to provide (e.g. Sonuga-Barke et al., 2013; Rimestad et al., 2016).

Conclusion

Statistical mediation was found for two of the four proposed parental mediators, self-efficacy and negative and harsh parenting. Improved self-efficacy explained 81% of the change in ADHD symptoms and 28 % in conduct problems; reduced negative and harsh parenting explained 29% of the change in both outcome variables. However, time-lagged analyses with pre-, mid- and post-intervention data points did not find that prior change in mediators predicted subsequent change in children's symptoms. For one of the proposed mediators, a reversed pattern of mediation was found, indicating that parental self-efficacy increased as a consequence of prior reduction in ADHD symptoms. Therapeutic alliance between parents and group-leaders was only weakly related to parental variables or to outcome. The study is the first to apply time-lagged analyses of mediators in PT for ADHD. However, the few data points in the study preclude any firm conclusions as to causal mediation, especially concerning change early in the intervention. Future mediation studies would profit from more fine-grained time-lagged analyses with more (optimally session-wise) data points.

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Table 1

Within-group changes over time

	Pre-intervention (n= 64)		ESs pre- mid	Mid-intervention (n= 55)		ESs mid- post	Post-intervention (n= 52)		ESs pre- post
<i>Outcome</i>	<i>M</i>	<i>(SD)</i>		<i>M</i>	<i>(SD)</i>		<i>M</i>	<i>(SD)</i>	
<i>measures</i>									
CRS	23.27	(4.44)	0.63*	20.51	(6.26)	0.03	20.38	(7.14)	0.48*
ECBI	158.66	(24.52)	0.77**	141.02	(22.04)	0.30	134.50	(24.99)	0.94**
<i>Proposed mediators</i>									
WAI	68.41 ^a	(11.57)	0.14	70.66	(11.20)	0.27	71.85	(0.04)	0.33*
PSOC	61.90	(9.57)	0.45*	66.69	(10.54)	0.42*	69.47	(10.91)	0.76**
PPI APP DISC	3.65	(0.77)	0.36*	3.52	(0.69)	-0.28	3.63	(0.71)	-0.31
PPI POS PAR	4.51	(0.75)	1.06**	5.31	(0.68)	0.18	5.41	(0.62)	1.16**
PPI NEG PAR	2.51	(0.49)	0.44*	2.22	(0.55)	0.40*	2.05	(0.43)	1.0**

Note: All ESs are adjusted so that a positive change is indicated by a positive ES and a negative change is indicated by a negative sign. *= significant at alpha = .05; **= significant at alpha = .001.

^a: measured after 3rd session

CRS: Conners Parent Rating Scale- Index; ECBI: Eyberg Child Behavior Inventory; PPI: Parental Practices Index; PPI APP DISC: Appropriate Discipline Subscale, PPI NEG PAR: Negative /harsh parenting subscale; PPI POS PAR: Positive Parenting Subscale; PSOC: Parental Sense of Competence; WAI: Working Alliance Inventory.

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Table 2
Product-of-coefficients analysis

	Path a	Path b	B	BSSE	95% BSCI	Total effect explained mediator
CRS						
WAI	1.45	-.07	-.10	.08	-.35 - <-.01	7 %
PSOC	-3.92	.16	-.63	.17	-1.04 - -.33	81 %
PPI APP DISC	<-.01	.63	<-.01	.05	-.13 - .11	<1 %
PPI POS PAR	.45	-.56	-.25	.28	-1.16 - .24	17 %
PPI NEG PAR	-.23	1.76	-.41	.20	-.81 - -.03	29 %
ECBI						
WAI	1.45	-.05	-.07	.43	-.99 - .75	1 %
PSOC	-3.92	.84	-3.30	1.35	-6.43 - -1.12	28%
PPI APP DISC	<-.01	1.93	<-.01	.20	-.50 - .36	<1 %
PPI POS PAR	.45	-1.21	-.55	1.23	-3.23 - 1.72	5%
PPI NEG PAR	-.23	14.36	-3.34	1.03	-5.65 - -1.57	29 %

Note: Significant mediators are in bold. BSSE: Bootstrapped standard error; BSCI: Bootstrapped confidence interval; CRS: Conners Parent Rating Scale- Index; ECBI: Eyberg Child Behavior Inventory; PSOC: Parental Sense of Competence; WAI: Working Alliance Inventory; PPI APP DISC: Parental Practices Index - Appropriate Discipline Subscale; PPI POS PAR: Parental Practices Index- Positive Parenting Subscale; PPI NEG PAR: Parental Practices Index- Negative and Harsh Parenting Subscale.

Figure 1 The mediational model

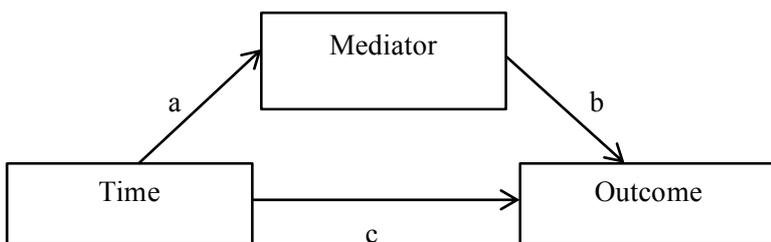


Figure 1. The Mediational model