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Parent inclusion in Early Intensive Behavioral Intervention: The influence of parental stress, parent treatment fidelity and parent-mediated generalization of behavior targets on child outcomes

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ABSTRACT

Although early intensive behavior interventions have been efficient in producing positive behavior outcome in young children with Autism Spectrum Disorder, there is a considerable variety in the children's progress. Research has suggested that parental and treatment factors are likely to affect children's response to treatment. The purpose of the current study was to examine the interrelating factors that impact children's progress, highlighting the influence of parent inclusion in treatment provision captured by parental stress, how faithfully the parents followed the treatment protocols and the intensity of treatment provided at home. Twenty-four children received cross-setting staff- and parent-mediated EIBI, including continuous parent training and supervision. A comparison group of 20 children received eclectic intervention. Standardized tests were carried out by independent examiners at intake and after six months. The intervention group outperformed the eclectic group in measures of autism severity, developmental and language skills. Parent training and constant parent-mediated treatment provision led to reduced challenging behaviors from the children, increased treatment fidelity and child direct behavior change as measured by performance in correct responding on behavior targets. Variables of treatment progress and potential predictors of child outcome were analyzed in detail and mapped with regard to their relationships drawn from multiple regression analysis. Particularly, the study highlights an association between parental stress and staff treatment fidelity that interferes with decision making in treatment planning and consequently with positive behavior outcome. Such results provide important scientific and clinical information on parental and treatment factors likely to affect a child's response to treatment.

1. Introduction

Although research has convincingly demonstrated that EIBI is effective in improving cognitive, communication, adaptive and social abilities in children with Autism Spectrum Disorders (ASD) in clinical and community-settings (Cohen, Amerine-Dickens, & Smith, 2006; Eldevik, Eikeseth, Jahr, & Smith, 2006; Eldevik et al., 2009; Eikeseth, Smith, Jahr, & Eldevik, 2002, 2007;

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Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Perry et al., 2008; Reed, Osborne, & Corness, 2007; Remington et al., 2007; Smith, Groen, & Wynn, 2000), there is considerable variability in the extent to which the children progress. In fact, concerns have been voiced concerning such variability in child outcomes and a recognition of the need for individualization of treatment schedules and approaches in autism has been growing (Sherer & Schreibman, 2005). There have been promises that relating variables regarding the pre-treatment profile of the child and treatment variables to later child outcome will enable professionals to match individual children to specific treatment programs. The inherent heterogeneity of the Autism Spectrum Disorder with a variety of different symptom clusters ranging from severe to minor impairments, naturally complicates the scientific and clinical goal of identifying such predictors likely to affect a child's response to treatment. Well-established factors include the child's age at the initiation of treatment, with younger children yielding better outcomes (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009; Harris & Handleman, 2000; Perry, Cummings, DunnGeier, Freeman, Hughes, & Managhan, 2011). Cognitive ability at intake has a moderate relation to outcome (Eikeseth et al., 2002, 2007; Hayward, Gale, & Eikeseth, 2009; Sallows & Graupner, 2005), and children with better adaptive behaviors at intake tend to achieve better outcomes, and more language skills at intake accurately predict "rapid responders" to treatment (Remington et al., 2007; Sallows & Graupner, 2005).

The predictive value of autism symptom severity in determining developmental trajectories rarely has been investigated. Nevertheless, autism severity has been proven to account for additional explanation of different child outcomes (Darrou, Pry, Pernon, Michelon, Aussilloux, & Baghdadli, 2010; Sutera, Pandey, Esser, Rosenthal, Wilson, & Barton, 2007). Studies that address treatment factors such as intensity of intervention have revealed inconsistent results, with one group claiming that comprehensive and high-intensity treatments produce better outcomes (Reed et al., 2007), and others suggesting that intensity does not necessarily correlate with outcome (Darrou et al., 2010; Luiselli, O'Malley Cannon, Ellis, & Sisson, 2000).

These inconsistent results lead to questions about factors that may promote or impede children's progress and, as such, modify the actual effectiveness of specific treatment models. It is suggested that there may be other factors, such as the amount of parental involvement in teaching throughout the child's day, complementary to hours of professional service delivery that may impact outcomes (Luiselli et al., 2000). Although it was shown that staff-provided EIBI results in decreased parental stress and improved outcome with the children, the comparison parent training comprised both less child and less parent work load (Smith et al., 2000). In contrast, Sallows and Graupner (2005) did not find marked differences between clinic- and parent-directed treatments with children improving regardless of treatment condition. It was shown that high parent treatment fidelity via parent training leads to the maintenance of the child's mastery of skills and lasting behavior changes in children with ASD (Vismara, Colombi, & Rogers, 2009). It was also demonstrated that parental stress decreases in parents who are providing low-intensity treatment, but increases in high-intensive treatment provision (Brookman-Frazee, 2004; Keen, Couzens, Muspratt, & Rodger, 2010). This may lead to reduced positive child outcomes solely in high time-input treatments (Osborne, McHugh, Sounders, & Reed, 2008a). Further, parent stress does not solely influence outcomes in parent-mediated interventions: higher initial parent stress is also associated with less adaptive behavior outcome in staff-provided intervention (Shine & Perry, 2010). The professor for the current study was to evaluate to what extent the parent inclusion in treatment provision accounts for an appropriate implementation of teaching strategies as such predicts or counteracts the facilitation of child's behavior improvement across clinical and community setting. Specifically, we aimed:

(1) To evaluate the impact of the EIBI model compared to an Eclectic intervention on child outcomes after six months of treatment and to monitor the level of parental stress in the two cases.
(2) To examine the progress of parent treatment fidelity and treatment provision after six months of inclusion in EIBI treatment, and to reproduce the child's six months direct behavior progress in child challenging behaviors and as performance in (a) producing correct responses to newly introduced behavior targets and (b) producing correct responses in generalization and maintenance probes.
(3) To investigate the interrelating factors that affect children's performance and outcome measures after six months of parent-mediated EIBI treatment, highlighting the impact of parent inclusion in treatment provision as indexed by parental stress, parent treatment fidelity and the intensity of treatment provided at home.

2. Methods

2.1. Procedures

In order to achieve the study aims, a set of hierarchical steps were followed. Drawing conclusions regarding interrelating factors that influence child and parent outcome, requests the efficiency of a specific treatment to produce positive outcomes. Therefore, the applied treatment model was compared with an eclectic treatment approach via intra- and between group analysis across a six-month time-span. The relative influence of parental stress on child outcomes after six months was measured in both treatment groups in order to check the generalizability of such effects. Detailed analysis of interrelating variables influencing child and parent outcomes have been possible solely for the interventions group, as treatment and parent variables other than parental stress were not available for the comparison group. Thus, in order to provide congruent analysis of all variables included, efficiency of the treatment model in producing improvements on all additional variables available only for the treatment group, were reported prior to the final analysis. The predictive value of introduced child,

parental and treatment factors on child outcome factors after six months and interrelationships were examined applying multiple hierarchical regressions.

The participants were 44 children diagnosed with autistic disorder or pervasive developmental disorder – not otherwise specified (PDD-NOS) according to the DSM-IV-TR criteria. Potential participants in the cross-setting staff- and parent-mediated EIBI program were referred by the child neuropsychiatry unit of the Children's Hospital Bambino Gesù. Diagnosis for all 44 children was made independently of the study by external child psychiatrists who conducted additional cognitive, language and adaptive assessments at intake and follow-up after six months. The allocation of a child to a treatment group was dependent on parental preference. Children from parents who requested parental participation in treatment provision comprised the intervention group and received EIBI. Children whose parents were not actively seeking parental involvement went into the comparison group where the available intervention mainly consisted of in-home treatment without active parental inclusion in therapy sessions. We will refer to this as the Eclectic group.

2.2. Participants

Our study enrolled children according to the following criteria: (a) a diagnosis of autism or PDD-NOS, (b) the absence of major medical issues other than autism or mental retardation, (c) completed the first six months of treatment progress, (d) were re-evaluated by the external child psychiatrist after six months. The intervention group, which received the cross-setting staff- and parent-mediated EIBI program, consisted of 24 children (22 male:2 female). Twenty children were recruited by the Children's Hospital Bambino Gesù as a comparison group. They were diagnosed and re-assessed during the same time span of intake and six months as the 24 EIBI participants. The groups were not significantly different with respect to intake measures on autism severity (EIBI $M = 15.96$, SD = 4.33) vs. (Eclectic $M = 14.56$, SD = 5.05), mental developmental state (EIBI $M = 58.00$, SD = 20.61) vs. (Eclectic $M = 66.91$, SD = 26.21), language comprehension (EIBI $M = 52.60$, SD = 29.71) vs. (Eclectic $M = 47.87$, SD = 29.71) and production skills (EIBI $M = 32.95$, SD = 35.20) vs. (Eclectic $M = 16.88$, SD = 24.72), adaptive behavior functioning composite score (EIBI $M = 78.33$, SD = 22.82) vs. (Eclectic $M = 66.92$, SD = 19.25, parental stress (EIBI $M = 89.21$, SD = 26.03) vs. (Eclectic $M = 91.71$, SD = 19.61) and treatment duration at baseline assessment (EIBI $M = 6.38$, SD = .71) vs. (Eclectic $M = 6.87$, SD = 1.08); except of age at intake ($t(42) = 2.661$, $p = .011$), with children of the control group being younger – the EIBI intervention group of 24 children with ASD (22 males:2 females) had an age range of 26–81 months (mean age = 55.67 months, SD = 17.63) compared to the Eclectic group of 20 children with ASD (19 males:1 female) with an age range of 27–69 months (mean age = 41.94 months, SD = 13.07). Since age at intake has been reported as a factor influencing later child outcome, we did control further data analysis for this variable.

2.3. Early intervention

Two intervention approaches, comprehensive cross-setting staff- and parent-mediated EIBI and eclectic, were compared. Parents of both groups received the same amount of financial support from national services.

2.3.1. Cross-setting staff- and parent-mediated EIBI

All children received a complementary staff- and parent-mediated EIBI treatment of 25 h/week in centre-based one-to-one and play room setting and at least 10 h/week in home-based setting (Fava & Strauss, 2011). Cross-setting treatment took place in a *one week centre – three weeks home* rhythm for 12 months. This pattern was chosen to allow the maintenance and generalization of skills acquired at the clinical setting to a natural and everyday life environment of the children. Differential settings in the centre were accomplished using two curriculums: (1) one-to-one sessions targeting individual skills and problem behaviors and (2) small group sessions with 4–5 children using play rooms and a play garden targeting the child's individual skills favoring incidental teaching in order to promote inclusion in facilitated play and social interaction. Each child followed a daily rota of three learning environments in the sequential order of facilitated play, social interaction session, and intensive one-to-one training three times a day (approximately 25 h a week). The Intervention was based on ABA-VB principles and comprises the systematic use of discrete trail teaching (DTT) and more natural approaches such as incidental teaching (IT), and natural environment teaching (NET). A continuous record of treatment was kept on a trial-by-trial basis within each treatment session based on the target behavior to be learned. Mastery of skills was determined by the supervisors, based on the achievement of 80% performance in at least three consecutive sessions. New behavior programs were introduced after mastery in expanded trials (Weiss, 1999).

Parent training started out with a one week (15 h) of group-based work-shops which were held by the program director and comprised a wide range of general core topics such as theoretical principles of ABA, teaching strategies, functional communication, problem behaviors, play and social interaction, maintenance and generalization issues, data record, etc. The parents' individual priorities, perceptions and needs were identified and recognized during a second week of direct observation of staff-provided treatment sessions once a day (total 6 h) that were discussed and reframed during an additional daily life video observation with the program director (total 6 h). The initial parent training concluded with a third week of parent participation and assistance in staff-provided one-to-one sessions (5 h) together with direct treatment application under supervision (10 h). During the alternating three-week home-based phase, treatment was basically done by the parent for approximately 19 h a week. Home-based treatments followed an individual treatment plan. Parents were provided with detailed schedules of behavior targets to be taught including pre-defined material and procedures to be

applied. In addition, there were video-reminders of treatment sessions presented during the child and parent training phase at the centre. Parents received one hour of weekly supervision with the child's therapist and/or supervisor. Such supervision provided (1) individualized advice and guidelines aimed to facilitate parental observation of child behavior change and the appropriate application of teaching strategies, (2) checks that essential criteria for target progress has been measured and achieved. When criteria were met, subsequent progression was facilitated by the introduction of new behavior targets to be mastered and by the introduction of maintenance and generalization schedules regarding the previously mastered target. At monthly re-entry, prior to continuation of individual treatment schedules, three maintenance and generalization probe sessions (two in the structured one-to-one setting, one in the quasi-natural play room setting) were conducted, with the aim of confirming target mastery, maintenance and generalization at home and as such the appropriateness of progression in target introduction. While difficulty stages (base, intermediate, advanced targets) in single programs and skill domains were designed to be carried out sequentially, there was some flexibility in moving through the difficulty stages. In any case, when target mastery at home could not be confirmed, each specific behavior target was re-scheduled until they had been achieved. For instances where generalization of mastered targets was absent or performance on revisited earlier targets was not maintained, targets were re-scheduled especially when these skills needed to be consolidated in order to accomplish the later difficulty stage or to ensure synchrony with other skill domains. Prior to the parents' monthly transition from the centre to the home-based and community-based treatment phase, three sessions with newly introduced targets to be mastered (two in the structured one-to-one setting, one in the quasi-natural play room setting) were recorded in order to gain data of the child's starting point in each newly introduced behavior target. These sessions had the further objective to control and verify the appropriate application of treatment strategies either by parent and staff over all available environments. Each problem of treatment fidelity was tackled in continuous parent supervision of weekly 5 h of parent-directed treatment application in the centre and weekly 2 h of staff supervision with the program director.

2.3.2. Eclectic intervention

Participants in the eclectic group received in-home developmental intervention and cognitive behavioral treatment for approximately 12 h a week (comparable to an average of 14 h a week for the intervention group). Eclectic programs were different in several aspects: the teaching principles and procedures used, treatment intensity, the type of professional involved and their responsibilities, data recording, and extent of parent involvement. Related services for these children varied from psychomotricity, speech therapy and music therapy. Each child's program comprised individual goals and treatment objectives but was mainly based on staff expertise and preferences rather than on treatment protocols and continuous measures of progress. Treatment procedures used in the eclectic group included: behavioral procedures that used selected programs from treatment manuals but implementation would be restricted solely to DTT (discrete trail teaching) and a more stringent use of continuous reinforcement procedures rather than differential reinforcement and pivotal response procedures. Alternative communication included working on picture exchange communication (PECS) or sign based systems. Unfortunately, it was not possible to determine how much time was spent on individual treatment strategies in the eclectic group. Teaching sessions often integrated a mixed model of different treatment approaches and strategies. However, the organization of treatment programs for the eclectic group did not incorporate any teaching protocol specific to the developmental goals of the child nor particularly followed the specific application of continuous steps in the PECS training and joint attention training. In addition, the particular adaptation of the environment at home suggested by the TEACCH protocol was not carried out. In contrast with the weekly supervisions carried out in the intervention group, staff of the eclectic group only received monthly supervision or had no access to a qualified supervisor at all. Thus, intensive and continuous staff training as well as parent training coordinated by specialized program directors offering sound theoretical and practical suggestions were both absent.

2.4. Measures and data collection

2.4.1. Child variables

Diagnosis of ASD was confirmed accounting on DSM diagnostic criteria and the *Autism Diagnostic Interview-Revised* (ADI-R; Lord, Rutter, & LeCouteur, 1994). During treatment intake (T1) and after first six months of treatment (T2), severity of autism core symptoms was assessed with the *Autism Diagnostic Observation Schedule* (ADOS, Lord, Rutter, DiLavore, & Risi, 1999). The child's mental developmental state was ascertained at T1 and T2 with the *Griffith Mental Developmental Scales for ages 2 to* 8 (GMDS-ER 2–8, Luiz et al., 2006), and we reported standard scores on the general developmental quotient (GQ). Adaptive behavior functioning was determined for T1 and T2 using *the Vineland Adaptive Behavior Scales – Interview Edition* (VABS, Sparrow, Balla, & Cicchetti, 1984). The instrument yields four broad domains indicative of communication, daily living skills, socialization, and motor skills. Standard scores have a mean of 100 and SD of 15. The Adaptive Behavior Composite (ABC) score is based on the mean of the three principal domains without motor skills for all children older than six years. Child early language skills were assessed via the *McArthur Communication Developmental Inventories* (CDI, Fenson, Pethick, Renda, & Cox, 2000), and we report child's vocabulary comprehension and vocabulary production in Table 1. All these measures were conducted and evaluated by an independent child psychologist.

Child outcome measures drawn directly from the treatment centre were child behavior problems and child performance rates in correct responding. *Frequencies of child's challenging behaviors* were measured for T1 and T2 via video rating procedures, comprising aggressive behaviors, stereotypes and dysfunctional behaviors. The procedure regarding the

Table 1
Group comparisons of child outcomes: score change over time in EIBI vs. Eclectic interventions.

	Intervention group ($n = 24$) (M, SD)		Measure change over time		Eclectic group ($n = 20$) (M, SD)		Measure change over time	
	T1	T2	*t*	*p*	T1	T2	*t*	*p*
Autism severity								
Social interaction	10.54 (2.34)	8.83 (2.70)	−3.995	.001	9.63 (3.24)	9.00 (2.97)	−1.775	.096
Communication	6.04 (1.88)	4.38 (1.34)	−3.745	.001	4.94 (2.23)	4.56 (1.97)	−1.031	.319
ADOS total	15.96 (4.33)	13.21 (3.83)	−3.100	.005	14.56 (5.05)	13.56 (4.72)	−1.826	.088
Mental developmental state standard score *								
GMDS-ER GQ	55.65 (20.06)	68.75 (19.58)	4.639	<.0001	74.29 (29.37)	76.00 (26.08)	.332	.751
Early language skills *								
CDI Comprehension	53.83 (28.81)	70.33 (27.04)	6.460	<.0001	47.17 (27.80)	61.33 (32.37)	3.885	.012
CDI production	35.29 (35.97)	51.81 (35.23)	3.410	.003	19.17 (28.12)	33.17 (42.47)	1.69	.151
VABS standard scores								
Communication	71.00 (39.24)	91.43 (40.44)	5.900	<.0001	60.78 (30.42)	83.56 (41.32)	3.549	.004
Daily living	78.43 (33.39)	100.26 (35.60)	4.936	<.0001	56.44 (23.81)	88.33 (37.29)	4.441	.001
Socialization	61.96 (21.31)	67.78 (19.93)	1.295	.209	56.88 (19.21)	70.50 (24.04)	3.434	.004
Motor	105.78 (22.38)	112.87 (13.30)	1.840	.079	92.00 (19.97)	106.59 (21.63)	4.190	.001
ABC	79.29 (22.84)	93.09 (23.61)	6.171	<.0001	66.92 (19.25)	84.88 (29.03)	4.503	.001

Note: * missing cases at T2 in the Eclictic intervention group.
GMDS-ER GQ for both measure point missing in 5 children, thus $n = 15$ in the eclectic group. CDI scores for both measure points are missing in 2 children, thus $n = 18$ in the eclectic group.

challenging behavior rates was adapted from Fava and Strauss (2010) and extended using operational items from the Autism Spectrum Disorder-Behaviors Problems for Children Scales (ASD-BPC; Matson, Gonzalez, & Rivet, 2008). For both, staff and parents, video sessions were analyzed at T1 and T2 after six months. For each measurement point two sessions were selected at random, each split into three parts and rated by two independent raters (Fava, Strauss, Valeri, D'Elia, Arima, & Vicari, 2011). In total, ratings were made for each child of 72 min of sessions done with their parent and 72 min of sessions done with staff. Intra-class correlation between the paired ratings at both measurement points were used to assess the consistency between raters' category codes, which ranged from .83 to .89 and from .91 to .95 for treatment fidelity. Direct measures of behavior targets guide moment-to-moment treatment decisions and capture the child's change in abilities in the very short-term (Granpeesheh et al., 2009). Therefore, additional treatment progress measures were tracked. Change in the child's skill repertoire was directly measured via *performance in correct responding* on (a) behavior targets newly introduced and (b) on maintenance and generalization probes of previously mastered targets. We considered as response variable, a dichotomy variable: 1 if the child answers correctly and 0 otherwise (approximate, prompt, and not correct). Rates of correct responding have been adjusted by the amount and the difficulty of behavior targets worked on.

2.4.2. Parent variables

Parental stress was measured at T1 and T2 using the *Parental Stress Index – Short Form* (PSI-SF; Abadin, 1999) comprising three scales: parenting distress, parent–child dysfunctional interaction and difficult child, as well as a total parental stress score. *Parent treatment fidelity* was measured via video observation rating of therapy sessions carried out by the parent, comprising data record, facilitated play, discrimination training and introduction of new targets and DTT with mastered targets (Hayward et al., 2009). Rating procedures for treatment fidelity were the same as those used for problem behaviors described above. Thus, there were ratings available for each child of 72 min of sessions done with parent and 72 min of sessions done with staff. Intra-class correlation between the paired ratings at both measurement points ranged from .91 to .95. Parent work load during treatment inclusion at T1 and T2 was measured via the *amount of sessions done at home*.

2.4.3. Treatment variables

Simple treatment intensity tracked as hours of centre-based treatment provision was stable for all children and therefore not included in analysis due to lack of variability. Alternatively, we tracked treatment intensity in terms of the *amount and the difficulty of behavior targets* (base = 1, intermediate = 2, advanced = 3) for both (a) newly introduced targets and (b) maintenance and generalization probe targets. *Staff treatment fidelity* was measured in the same way as parent treatment fidelity via video observation rating of therapy sessions done by staff. Intra-class correlation between the paired ratings at both measurement points ranged from .89 to .96.

2.5. Data analysis

Statistical analysis was performed using SPSS software. Mean scores at intake and after six months of therapy were compared using paired *t*-test. Group effects and age at intake effecting group effect were established using Generalized Linear Models (GLM). The significance level was set at .05. Normality was checked using the Shapiro–Wilk test. Post-hoc comparisons have been applied using Bonferroni adjustment. Multiple hierarchical linear regression models with stepwise method were fitted at intake (T1) and after six months (T2). At T1 variables were fitted in Step 1 child age and diagnosis, in Step 2 child intake variables (ADOS, GMDS-ER, CDI, VABS scores and problem behavior frequencies, child performance in correct responding), in Step 3 parent variables (PSI, treatment fidelity, amount of sessions), in Step 4 treatment variables (staff treatment fidelity, target amount and difficulty) as dependent variables to test whether initial values of the scores, influence the outcome. At T2 variables were fitted in the same way as at T1, including scores from each measure at intake and after six months The models were estimated using the maximum likelihood principle and the significance was estimated using standard *t*-test.

3. Results

Study aim [1]: To evaluate the impact of the EIBI model compared to an Eclectic intervention on child outcomes after six months of treatment and to monitor the level of parental stress in the two cases.

3.1. Group comparisons on score change over time EIBI vs. Eclectic interventions

3.1.1. Child outcomes

As shown in Table 1, significant improvement in child outcome measures for the intervention group compared to the eclectic group was found in a number of tests. Paired *t*-tests showed that after six months, there was an advantage for the intervention group over the eclectic group in three main measures derived from evaluation by an external neuro-psychiatrist: autism symptom severity, mental developmental state, and early language abilities. In detail, the staff- and parent-mediated EIBI treatment group showed a significant decrease in autism total symptom severity ($t(23) = -3.100$, $p \leq .01$), and an increase in social interaction ($t(23) = -3.995$, $p \leq .01$) and communication scores ($t(23) = -3.745$, $p \leq .01$). Significant child outcome improvements were further demonstrated by increases in early language abilities and an increase

in mental developmental state to a level more appropriate to chronological age. Specifically, they had significant gains in the mental developmental state GQ ($t(23) = 4.639$, $p \leq .001$), and early language production ($t(23) = 3.410$, $p \leq .01$). The eclectic treatment group did not exhibit any significant change in autism symptom severity, early language word processing and mental developmental state measures within the six-month period. Significant gains were found in both the EIBI and eclectic groups in early language word comprehension and in adaptive behavior functioning. However, the EIBI children outperformed children in the eclectic group at T2 on early language comprehension ($t(23) = 6.460$, $p \leq .001$) vs. ($t(19) = 3.885$, $p \leq .05$), functional communication ($t(23) = 5.900$, $p \leq .001$) vs. ($t(19) = 3.549$, $p \leq .01$), daily living skills ($t(23) = 4.936$, $p \leq .001$) vs. ($t(19) = 4.441$, $p \leq .01$) and overall adaptive functioning (ABC) ($t(23) = 6.171$, $p \leq .001$) vs. ($t(19) = 4.503$, $p \leq .01$). On the other hand, children in the eclectic intervention group achieved greater gains in adaptive behavior socialization ($t(19) = 3.434$, $p \leq .01$) and motor skills ($t(19) = 4.190$, $p \leq .01$), whereas children of the EIBI group did not show statistically significant increases in those skill areas within the six-month period. In additional calculations on between group differences on score change over time via GLM a significant group main effect was detected for all outcome measures. We did control for age at intake as confounding variable and did not found in any outcome measure a significant group × age at intake interaction influencing between group differences (age effect on score change differences on ADOS total ($F(44) = 1.009$, $p = .230$); GMDS-ER GQ ($F(44) = .729$, $p = .493$); on CDI language comprehension ($F(44) = 1.492$, $p = .249$); on CDI language comprehension ($F(44) = 1.553$, $p = .233$) and on VABS ABC composite ($F(44) = .158$, $p = .855$)).

3.1.2. Parent outcomes

Parent reports on their parental stress did not differ between the groups at intake in their total level of parental stress on either mean standard scores ($t(42) = -.345$, $p = .732$) or percentiles ($t(42) = -.865$, $p = .393$), as presented in Table 2. However, examination of parental stress subscales indicated a differing distribution of parenting stress in the two groups. *t*-test group comparisons revealed that parents in the EIBI intervention with parental inclusion show higher parental distress standard scores ($t(42) = 3.148$, $p = .003$) and exhibit more clinical significant parental distress ($t(42) = 3.240$, $p = .003$), whereas parents in the Eclectic group report higher difficult child standard scores ($t(42) = -3.721$, $p = .001$) and show a more clinical significant perception of a difficult child ($t(42) = -3.148$, $p = .004$). Paired *t*-tests revealed that during the first six months of the EIBI intervention, none of the parenting stress scales of parents significantly changed either on standard scores (($t(21) = -.105$, $p = .917$) to ($t(21) = 1.071$, $p = .296$) or in percentile distribution (($t(21) = .207$, $p = .838$) to ($t(21) = -1.115$, $p = .277$)). On the other hand, parents in the eclectic group show a significant decrease in parental stress on total standard scores ($t(19) = -3.546$, $p = .004$) and percentile distribution ($t(19) = 3.398$, $p = .005$). Examination of the percentile distributions revealed that the decrease of parental total stress in the eclectic group is mainly derived from a decrease in the clinical significant perception of a difficult child ($t(19) = 3.039$, $p = .009$). As such, *t*-tests between groups show at T2 that, after six months, parents in the EIBI intervention group, who are involved in the treatment provision, remain with more parenting distress ($t(21) = 2.198$, $p = .034$) and a higher total parental stress ($t(21) = 2.402$, $p = .021$) as well as with a higher clinical significant parenting distress ($t(21) = 2.696$, $p = .011$) and total stress level ($t(21) = 3.678$, $p = .002$), than parents of the eclectic comparison group. We did control for age at intake as confounding variable and did not found in any outcome measure a significant group × age at intake interaction influencing between group differences (age effect on score change differences on parenting distress ($F(44) = 1.138$, $p = .066$); on parent child dysfunctional interaction ($F(44) = 1.568$, $p = .224$); on difficult child perceptions ($F(44) = .983$, $p = .385$); and on parental stress total stress ($F(44) = .237$, $p = .790$)).

Table 2
Group comparisons of parental stress standard scores and percentiles distribution.

	Intervention group ($n = 24$) *N* (%)		Measure change over time		Eclectic ($n = 20$) *M* (SD)		Measure change over time	
	T1	T2	*t*	*p*	T1	T2	*t*	*p*
Parental stress PSI standard scores								
Parenting distress	31.04 (9.21)	32.18 (8.71)	1.071	.296	23.36 (5.83)	25.13 (10.52)	.564	.583
Dysfunctional interaction	28.92 (7.83)	27.36 (6.20)	−.871	.394	26.36 (7.84)	28.31 (13.35)	.488	.633
Difficult child	33.46 (26.03)	33.36 (9.69)	−.105	.917	41.79 (5.98)	33.56 (18.93)	−1.388	.189
PSI total	89.21 (26.03)	91.55 (20.99)	.588	.563	91.71 (9.64)	78.56 (17.42)	−3.546	.004
Parental stress PSI percentiles								
Parenting distress								
Normal stress <80	12 (50)	15 (62.5)	−.207	.838	18 (92.9)	17 (87.5)	.131	.898
Clinical significant > 85	12 (50)	9 (37.5)			2 (7.1)	3 (12.5)		
Parent child difficult interaction								
Normal stress <80	12 (50)	11 (45.5)	.382	.707	14 (71.4)	11 (56.3)	.147	.885
Clinical significant > 85	12 (50)	13 (54.5)			6 (28.6)	9 (43.8)		
Difficult child								
Normal stress <80	9 (37.5)	8 (36.4)	.699	.492	0 (0)	9 (43.8)	−3.039	.009
Clinical significant > 85	15 (62.5)	16 (63.6)			20 (100)	11(56.3)		
PSI total								
Normal stress <80	5 (20.8)	6 (22.7)	−1.115	.277	7 (35.7)	12 (62.5)	−3.398	.005
Clinical significant > 85	19 (79.2)	18 (77.3)			13 (64.3)	8 (37.5)		

3.1.3. Parenting stress influencing child outcome

Simple hierarchical regressions with age at intake in Step 1, child intake measures (ADOS, VABS ABC, GMDS-ER GQ, CDI) in Step 2, and intake parenting stress (PSI scales) in Step 3, revealed predictors of child outcome measures after six months. These were different for the EIBI intervention with parent inclusion and the eclectic comparison group. As shown in Table 3, child characteristics at intake do predict child outcome after six months, besides the outcome measures pre-treatment scores which were stable predictors in both groups. As expected, autism severity after six months was best predicted by pre-treatment autism severity in the EIBI group ($\beta = .696$) as well as in the Eclectic group ($\beta = 1.332$), the Vineland ABC Composite predicted by pre-treatment adaptive behaviors ($\beta = .517$) vs. ($\beta = .342$), the child's GMDS-ER GQ outcome by pre-treatment mental developmental state ($\beta = .704$) vs. ($\beta = .990$), and as such the CDI early language outcome by pre-treatment early language skills ($\beta = .265$) vs. ($\beta = 1.213$). However, initial pre-treatment scores were not the unique predictor for the measures outcome score drawn from Step 2 child characteristics (as for ADOS autism severity and GMDS-ER developmental quotient), since additional child variables did account for variance in the prediction models. Age at intake was a predictor within the EIBI treatment group, with older children achieving better adaptive behaviors outcome VABS ABC ($\beta = .624$), and younger children making more gains in CDI early language comprehension ($\beta = -.118$) as well as production ($\beta = -.257$). Furthermore, within the EIBI group, CDI early language skills were not solely predicted by their pre-treatment scores. Children who gained more CDI language comprehension skills also showed higher adaptive behavior pre-treatment scores ($\beta = .584$), whereas pre-treatment language comprehension predicted outcome language production ($\beta = .839$). In the Eclectic group, apart from the pre-treatment score predicting the outcomes measures, additional child variables accounted for variance only on VABS ABC outcomes, with a child's higher pre-treatment mental developmental state ($\beta = .269$) and early language skills ($\beta = .557$) predicting better outcome on adaptive behaviors, whereas initial higher adaptive behaviors predicted better early language comprehension after six months ($\beta = .955$).

Besides age at intake and various child characteristics at the start of treatment, parental stress was a stable predictor of child outcome on ADOS autism severity, with a high perception of a difficult child impeding decrease in autism severity after six months in both the EIBI group ($\beta = .437$, $p = .001$) and the Eclectic group ($\beta = .587$, $p = .047$). Further common pattern for both study groups was found for CDI early language production, where initial high parenting distress positively influences a six-month outcome language production ($\beta = .426$, $p = .001$ vs. $\beta = .086$, $p = .001$). A differential pattern regarding the potential influence of pre-treatment parental stress was found on adaptive behavior outcomes. Adaptive functioning after

Table 3
Group comparisons of parent outcomes – parenting stress influencing child outcome.

Predictors T0 Intake measures	T1 ADOS severity		T1 VABS ABC		T1 GMDS-ER GQ		T1 CDI comprehension		T1 CDI production	
	β	t	β	t	β	t	β	t	β	t
Intervention group (n = 24)										
Step 1										
Age at intake	−.044	ns	**.624**	**3.822****	−.163	ns	**−.118**	**1.555***	**−.257**	**−2.526***
Step 2										
ADOS severity	**.696**	**8.580*****	−.180	ns	−.048	ns	−.317	ns	−.061	ns
VABS ABC Composite	−.305	ns	**.517**	**3.990****	.120	ns	**.584**	**2.529***	.012	ns
GMDS-ER GQ	−.444	ns	.164	ns	**.704**	**3.714****	.345	ns	.003	ns
CDI Comprehension	−.449	ns	.180	ns	.094	ns	**1.114**	**11.168****	**.839**	**7.388****
CDI Production	−.213	ns	.149	ns	.003	ns	.267	ns	**.265**	**2.570***
Step 3										
Parenting distress	.224	ns	.233	ns	−.146	ns	.565	ns	**.426**	**4.735****
Dysfunctional interaction	.142	ns	**−.385**	**−3.142****	−.323	ns	−.140	ns	−.082	ns
Difficult child	**.437**	**4.394****	−.041	ns	−.233	ns	−.421	ns	−.106	ns
PSI total	.188	ns	.175	ns	−.284	ns	.475	ns	.148	ns
ΔR^2	.890**		.906**		.460**		.945*		.952**	
Eclectic group (n = 20)										
Step 1										
Age at intake	−.089	ns	.014	ns	−.052	ns	−.288	ns	−.002	ns
Step 2										
ADOS severity	**1.332**	**7.377****	−.068	ns	−.130	ns	−.065	ns	−.008	ns
VABS ABC Composite	−.382	ns	**.342**	**6.382***	.293	ns	**.955**	**5.607***	.002	ns
GMDS-ER GQ	−.274	ns	**.269**	**6.059***	**.990**	**12.244****	.115	ns	.007	ns
CDI Comprehension	−.052	ns	.061	ns	.096	ns	.481	ns	.004	ns
CDI Production	−.117	ns	**.557**	**15.745****	.003	ns	.323	ns	**1.213**	**41.961*****
Step 3										
Parenting distress	.026	ns	**.056**	**3.963***	−.153	ns	.081	ns	**.086**	**20.216****
Dysfunctional interaction	.383	ns	−.032	ns	−.175	ns	−.223	ns	−.001	ns
Difficult child	**.587**	**3.254***	−.133	ns	−.055	ns	−.203	ns	−.014	ns
PSI total	.051	ns	.051	ns	−.040	ns	.250	ns	.007	ns
ΔR^2	.927*		.996*		.974**		.884*		.990**	

Note: Hierarchical regressions for child age at intake, child intake measures and intake parenting stress. Predictors that account for significant F change in the final model are highlighted in bold. Significance levels of related coefficients t scores are defined as $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, $^{***}p \leq 0.001$.

six months is negatively predicted by a parent child dysfunctional interaction at the start of treatment in EIBI children ($\beta = -.385$, $p = .008$), whereas high parenting distress at intake positively predicts more adaptive functioning after six months ($\beta = .056$, $p = .019$) in the Eclectic control group. However, pre-treatment parental stress predicted neither the child's mental developmental state nor early language comprehension after six months.

3.2. Score change over time on additional variables from the EIBI group

Study aim [2]: To examine the progress of parent treatment fidelity and treatment provision after six months of inclusion in EIBI treatment, and to reproduce the child's six-month direct behavior progress in child challenging behaviors and as performance in (a) producing correct responses to newly introduced behavior targets and (b) producing correct responses in generalization and maintenance probes.

3.2.1. Child outcome

Observation data on child's direct behavior change available from recorded therapy sessions for the intervention group revealed a decrease in problem behaviors in staff ($t(23) = -9.953$, $p < .0001$) and in parent provided sessions ($t(23) = -11.644$, $p < .0001$). As displayed in Table 4, detailed analysis of challenging behavior categories show a significant decrease of child aggressive behaviors, child stereotypes and dysfunctional behaviors in both staff and parent provided sessions (all $p < .0001$). Further analysis of the scores of challenging behaviors in staff and parent provided sessions from T1 to T2 indeed demonstrate that problem behaviors in parent provided sessions decrease significantly more than in staff provided sessions ($t(46) = 2.747$, $p = .009$). Given that at treatment intake challenging behaviors appeared more frequently in parent provided sessions (all $p < .01$), these data indicate an accelerated reduction of initially higher amount of problem behaviors in parent provided session. Such difference in score change were particularly demonstrated for aggressive behaviors ($t(46) = 2.560$, $p = .014$) and dysfunctional behaviors ($t(46) = 2.047$, $p = .042$), but not on child stereotypes ($t(46) = 1.425$, $p = .161$), which reduced at comparable rates during time in both staff and parent provided sessions.

The children' direct behavior change was measured from direct performance on each behavior target request (adjusted for target difficulty), where correct responding was counted with 1 and other response categories (approximate, prompt,

Table 4
Score change over time on additional variables from the EIBI group.

	Intervention group ($n = 24$) M (SD)		Measure change over time	
	T1	T2	t	p
Categories of challenging behaviors				
Parent sessions				
Aggression	9.95 (6.23)	4.83 (3.88)	−6.283	<.0001
Stereotypes	16.52 (6.35)	9.21 (4.21)	−7.618	<.0001
Dysfunctional	13.79 (4.34)	7.07 (2.48)	−8.178	<.0001
Total challenging behaviors	40.26 (9.64)	21.11 (6.59)	−9.952	<.0001
Staff sessions				
Aggression	5.69 (3.81)	2.94 (1.95)	−6.227	<.0001
Stereotypes	12.26 (5.13)	6.60 (2.93)	−8.679	<.0001
Dysfunctional	9.44 (3.41)	4.81 (2.01)	−7.652	<.0001
Total challenging behaviors	27.29 (8.17)	14.35 (4.92)	−11.644	<.0001
Child performance rate in correctly responding on				
Newly introduced targets	56.76 (28.02)	95.38 (31.32)	5.971	<.0001
Maintenance probes of mastered targets	89.47 (28.48)	102.03 (32.65)	2.401	.025
Target difficulty rate (1 min – 3 max)				
Newly introduced targets	1.22 (.31)	1.45 (.28)	4.545	<.0001
Maintenance probes of mastered targets	1.36 (.27)	1.47 (.31)	2.493	.020
Target amount				
Newly introduced targets	13.96 (8.31)	19.67 (4.21)	3.139	.005
Maintenance probes of mastered targets	23.58 (7.06)	25.83 (8.84)	1.015	.321
Treatment fidelity				
Parent				
Data collection	1.55 (1.05)	3.33 (1.14)	15.891	<.0001
Facilitated play	6.67 (1.89)	10.56 (2.50)	10.017	<.0001
DTT with mastered skills	8 .44 (3.08)	14.53 (4.01)	10.414	<.0001
Discrimination training and introduction of new programs	3.58 (1.72)	6.29 (1.75)	12.303	<.0001
Total treatment fidelity	5.06 (1.83)	8.68 (2.25)	12.581	<.0001
Staff				
Data collection	3.38 (.94)	5.00 (.96)	9.659	<.0001
Facilitated play	10.21 (2.67)	13.25 (2.14)	6.484	<.0001
DTT with mastered skills	13.94 (3.63)	18.04 (3.07)	7.071	<.0001
Discrimination training and introduction of new programs	6.35 (1.75)	7.87 (1.44)	4.816	<.0001
Total treatment fidelity	8.47 (2.15)	11.04 (1.71)	8.202	<.0001
Sessions provided by parents at home	18.83 (9.91)	16.25 (7.86)	−1.356	.188

non correct) with 0. This revealed a significant increase in child performance in correct responding on both newly introduced targets ($t(23) = 5.971$, $p < .0001$) and during maintenance and generalization probes of previously mastered targets ($t(23) = 2.401$, $p = .025$).

3.2.2. Parents outcome and treatment variables

The goal of intensive staff supervision and parent training was to ensure appropriate treatment provision and application of teaching strategies. Therefore, observation data from treatment sessions provided information of the treatment fidelity achieved by parent and staff prior to and following intensive training. Intensive parent training and parent inclusion lead to a significant increase in parent ($t(23) = 12.581, p < .0001$) and staff treatment fidelity ($t(23) = 8.202, p < .0001$). As shown in Table 4, paired *t*-tests demonstrated a significant increase in fidelity within six months for both treatment providers, staff and parents on data collection, facilitated play, discrimination training and introduction of new targets and DTT with mastered skills (all $p < .0001$). As demonstrated on changes in child challenging behaviors, differences in change scores of treatment fidelity from T1 to T2 reveal that parents treatment fidelity increase significantly more within six months ($t(46) = -2.462, p = .018$) than staff fidelity, particularly in DTT with mastered skills ($t(46) = -2.408$; $p = .020$) and in the introduction of new targets ($t(46) = -3.120$; $p = .003$). Comparable rates on increase of treatment fidelity between parents and staff were found on data record ($t(46) = -.763, p = .449$) and facilitated play ($t(46) = -1.402, p = .168$) indicating difficulties of parents to make up initial differences between staff and parents (all $p < .001$) in treatment fidelity within those fidelity categories.

High staff and parent treatment fidelity should not only ensure the appropriate implementation of teaching strategies, but guarantee the appropriateness of behavior target choice. Paired *t*-tests between T1 and T2 rates detected in fact an increasing difficulty of newly introduced behavior targets ($t(23) = 4.545$, $p < .0001$) and targets in maintenance and generalization probes ($t(23) = 2.493$, $p = .025$) as well as an increasing amount of newly introduced targets ($t(23) = 3.139$, $p = .005$). However, the amount of targets in maintenance and generalization probes ($t(23) = 1.015$, $p = 341$) remained level. Since the introduction of new behavior targets is controlled at monthly re-entry at the centre and as such is strongly linked to the confirmation of target mastery, maintenance and generalization from parent-provided treatment at home, the basis of each advance in target mastery would be the lasting treatment provision at home. Indeed, paired *t*-Test confirmed a stable parent-mediated treatment provision at home over time ($t(23) = -1.356$, $p = .118$).

3.3. Predictors of progress: child, parent and treatment variables

Study aim [3]: To investigate the interrelating factors that affect children's performance and outcome measures after six months of parent-mediated EIBI treatment, highlighting the impact of parent inclusion in treatment provision as indexed by parental stress, parent treatment fidelity and the intensity of treatment provided at home.

In order to capture the initial significance of each included factor, we calculated each planned regression model with only pre-treatment variables at each step: Step 1 age at the start of treatment, Step 2 intake child variables, Step 3 intake parent variables, Step 4 intake treatment variables. Results of the multiple regressions reveal that at treatment intake (T1) both pre-treatment child and parent characteristics influence the initial decision-making concerning the behavior target choice by professional staff; and predict subsequent child performance and parent inclusion, as presented in Fig. 1. In detail, a

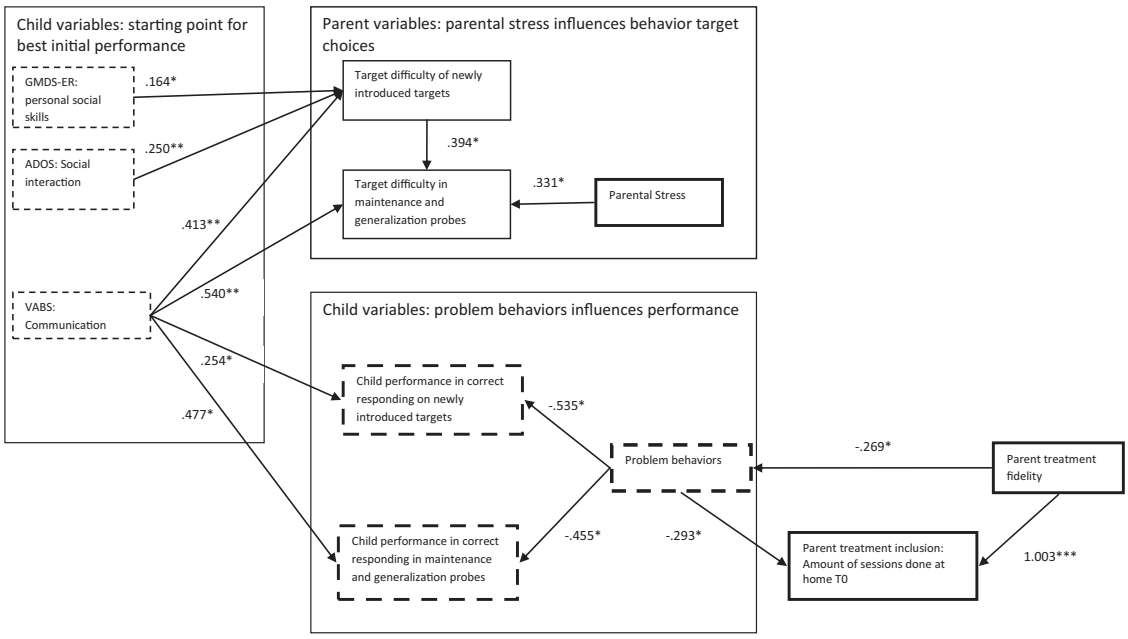

Fig. 1. Interrelations of child, parent and treatment variables at treatment intake.

combination of communicative (as measured by VABS social communication scores) and social interaction skills (as measured by ADOS social Interaction scores and GMDS-ER personal-social skills) are the best predictors for appropriate staff decision-making in the choice of behavior targets, raising the target difficulty on the child's skill level (range from $\beta = .540$, $t = 3.099$, $p = .008$ to $\beta = .164$, $t = 2.768$, $p = .016$), providing more difficult behavior targets with children who show capable pre-treatment communication and social interaction skills. Simultaneously, the initial professional staff decision-making in behavior target choice and the appropriate adaption of target difficulty to the child's skill level is influenced by parental stress ($\beta = .331$, $t = 2.627$, $p = .021$), with staff tending to raise the target difficulty facing parents with more parental distress ($\beta = .756$, $t = 6.468$, $p = .0001$) and with a higher parent child dysfunctional interaction ($\beta = .312$, $t = 2.670$, $p = .018$). However, at the start of treatment, neither parental stress nor target difficulty influences the child's performance in correct responding on behavior targets or the likelihood of parents providing treatment at home. Regression analysis revealed that pre-treatment child communication skills (as measured by VABS social communication scores) are best predictors for child's initial performance in correctly responding on newly introduced targets ($\beta = .254$, $t = 2.483$, $p = .033$) and in maintaining and generalizing the first mastered behavior targets ($\beta = .477$, $t = 2.618$, $p = .019$). Contrarily, the amount of child problem behaviors at treatment intake is the best predictor for reduced initial child performance on newly introduced targets ($\beta = -.535$, $t = -2.531$, $p = .022$) and the maintenance/generalization of the first mastered targets ($\beta = -.455$, $t = -2.497$, $p = .025$). Problem behaviors that impede a child's performance in target sessions are mainly derived from child stereotypes, as demonstrated in staff provided session ($\beta = 1.033$, $t = 8.821$, $p = .0001$) as well as parent provided sessions ($\beta = .766$, $t = 5.440$, $p = .0001$), a type of problem behaviors strongly linked to the autism symptom presentation rather to educational issues and differential developmental disabilities. Finally, the initial parent work load and number of sessions carried out at home are best predicted by the parents' initial treatment fidelity ($\beta = 1.003$, $t = 7.598$, $p = .0001$) and less child behavior problem ($\beta = -.293$, $t = -2.218$, $p = .042$).

In order to examine the interrelating parent and treatment factors that impact child's outcome measures after six months, we recalculated the exact regression models as implemented for treatment intake T1 under inclusion of T2 scores (after six months) of each factor. As such, each regression model comprised in Step 1 age at intake, Step 2 child variables at intake (T1) and after six months (T2), Step 3 parent variables at intake (T1) and after six months (T2), and Step 4 treatment variables at intake (T1) and after six months (T2).

Consistent with the prediction of child outcome after six months (see Section 3.1.3 parenting stress influencing child outcome), applied regression models show that CDI early language skills after six months are predicted by CDI intake scores ($\beta = 1.089$, $t = 13.511$, $p = .0001$), increased adaptive behaviors ($\beta = .232$, $t = 3.576$, $p = .006$) and decreased parental stress ($\beta = -.206$, $t = 4.362$, $p = .002$). The extension of the regression model by additional treatment variables revealed the significant contribution of two factors to the prediction of early language outcome, namely the steady increase of child performance in correct responding in maintenance and generalization probes ($\beta = .469$. $t = 5.961$, $p = .0001$) and the corresponding number of targets requested ($\beta = .354$, $t = 6.035$, $p = .0001$). The importance of child characteristics as predictors of Vineland ABC Composite Score outcome after six months was replicated with higher intake ABC scores ($\beta = .945$, $t = 4.914$, $p = .0001$), higher developmental mental state GQ ($\beta = .790$, $t = 4.883$, $p = .0001$), more early language skills ($\beta = .445$, $t = 2.794$, $p = .016$), and reduced parental stress ($\beta = -.328$, $t = -2.674$, $p = .020$) leading to better adaptive functioning after six months. Treatment factors that additionally predict adaptive behaviors after six months were increased child performance in maintenance and generalization probes ($\beta = .803$, $t = 5.041$, $p = .0001$) as well as the corresponding target difficulty ($\beta = .353$, $t = 2.335$, $p = .038$). Child outcome on the GMDS-ER mental developmental state GQ was predicted by a higher intake mental developmental GQ ($\beta = .521$, $t = 2.631$, $p = .022$), but additional variance was significantly explained by T2 variables, namely, decreased parental stress ($\beta = -.579$, $t = -2.558$, $p = .024$), reduced child behavior problems with staff ($\beta = -.561$, $t = -4.234$, $p = .002$) and with parents ($\beta = -.722$, $t = -4.533$, $p = .001$), and increased child performance in correctly responding on newly introduced behavior targets ($\beta = .374$, $p = 2.195$, $p = .024$). As such, child outcome on early language skill, mental developmental state and adaptive behaviors are significantly predicted by child characteristics, but we could highlight additional parental and treatment factors that influence child outcome significantly: (1) parental stress, (2) child performance in correctly responding, (3) the number and difficulty of targets requested in maintenance and generalization probes, and (4) child problem behaviors in target sessions.

In order to examine how these potential predictors of child outcome interfere and as such could be tackled during treatment progress, all variables of treatment progress and potential predictors of child outcome were analyzed in detail and mapped with regard to their relationships drawn from regression analysis.

After the initial six months of treatment provision, child performance in correct responding on new behavior targets was associated with higher generalization and maintenance of behavior targets ($\beta = .121$, $t = 8.478$, $p = .0001$), as presented in Fig. 2. Consequently, appropriateness of responding on new behavior targets predicted scores on the maintenance and generalization probes once the specific target was mastered ($\beta = .819$, $t = 6.188$, $p = .0001$). In detail, increase in skill maintenance and generalization was facilitated by increased target difficulty in maintenance probes ($\beta = .702$, $t = 6.110$, $p = .0001$) and reciprocally associated with the number of sessions provided by parents in the child's natural environment. Higher treatment provision at home predicted higher target maintenance and generalization ($\beta = .447$, $t = 5.315$, $p = .0001$) and the child's successful performance led to an increase in the parents' treatment provision at home ($\beta = .489$, $t = 3.129$, $p = .010$). Further, parent treatment provision was positively predicted by higher parent treatment fidelity ($\beta = .613$, $t = 4.184$, $p = .002$) and this led to reduced child problem behaviors ($\beta = -.580$, $t = 11.344$, $p = .0001$). In contrast, child performance on new targets was mainly predicted by high staff treatment fidelity ($\beta = .077$, $t = 3.740$, $p = .013$) and less child

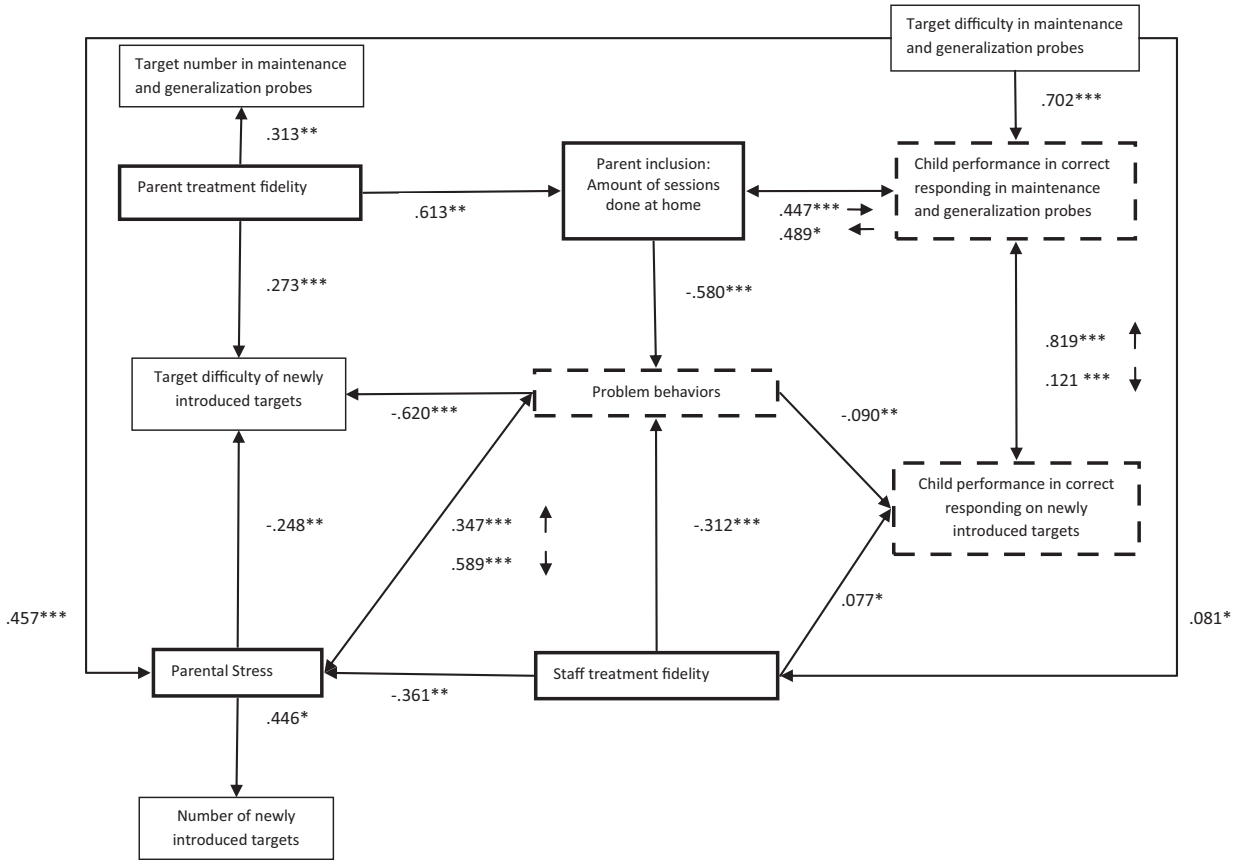

Fig. 2. Interrelations of child, parent and treatment variables at six months of treatment progress.

problem behaviors ($\beta = -.090$, $t = -6.154$, $p = .002$), whose reduction was predicted by high staff treatment fidelity ($\beta = -.312$, $t = -12.066$, $p = .0001$). Staff fidelity itself, was positively predicted by increase in target difficulty ($\beta = .081$, $t = 3.451$, $p = .014$) and leading to reduced parental stress ($\beta = -.361$, $t = -4.203$, $p = .002$). This mechanism was found to be impeded by increased parental stress that was found to be associated with low staff treatment fidelity ($\beta = -.361$, $t = -4.203$, $p = .002$) and high behavior target difficulty ($\beta = .457$, $t = 5.334$, $p = .0001$). Further, high parental stress predicted increase in child problem behaviors ($\beta = .347$, $t = 7.014$, $p = .0001$) with both, stress ($\beta = -.248$, $t = -6.376$, $p = .001$) and challenging behaviors ($\beta = -.620$, $t = -3.221$, $p = .0001$) resulting in a reduction in child performance in correct responding on behavior targets.

4. Discussion

With regard to the first study question, our results prove an advantage for children following the staff and parent-mediated EIBI. These children showed a significant decrease in autism symptom severity, gains in mental developmental state and early language production, improvements that were not achieved by children following Eclectic interventions. Indeed, group comparisons in score change over time on early language skills demonstrated that children following both the EIBI and the Eclectic treatment developed recognizable early language comprehension skills, whereas improvements in language production could be demonstrated only for the parent-mediated EIBI intervention group. We do not have information available concerning detailed teaching strategies in the Eclectic group, but speech therapy has been confirmed for the main part of the children comprised in this group. As there are fundamental differences between the Verbal Behavior and the classical speech therapy approach, we infer that initially favoring functional verbal requesting over semantic labeling, promotes language production due to its functionality for the child in the daily life. This assumption is supported by the lack of improvement in ADOS Communication scores in the Eclectic group, a measure that captures functional reciprocal communication rather than word processing. Changes in adaptive behavior functioning were found to be comparable for the parent-mediated EIBI and the Eclectic intervention on all scales except the socialization and motor skills, where only the eclectic group made significant gains within six months. This result was divergent considering that significant changes in social interaction skills on the ADOS observation were only significant for children following the EIBI intervention. It is suggested that differing data sources – professional observation vs. parent report – might interfere. Anyhow, children in the Eclectic group attended regular psychomotricity sessions that might promote motor skills more effectively. In addition, the pronounced delivery of group intervention in the school environment for the Eclectic group might account for gains in peer related interaction and autonomy during leisure time.

Parental stress outcomes of children were examined in both groups. Parents that follow Eclectic intervention benefit in decrease of parental stress that, in contrast, remained relative stable in the intervention group. This result joins previous research findings indicating a relation of parental stress and parent treatment provision: with decreases in parental stress in low-intensity treatments and increase in parental stress in intensive treatments, where parents are involved in treatment provision (Brookman-Frazee, 2004; Keen et al., 2010). However, one novel finding in our data, was that less parent inclusion in treatment provision, as in the Eclectic intervention, resulted in decreased perception of a difficult child and consequently in less parental stress. It is an intriguing question as to how pure professional treatment delivery applied in a child's natural environment may support a reshaping of parent–child relationships, without training the parent to tackle directly difficulties with its own child. Furthermore, it has been demonstrated that parental stress affects child outcome in both the parent-mediated EIBI and the Eclectic intervention. Regression analysis revealed particularly that child outcomes that imply a reciprocal interaction between parent and child, such as expressive language, adaptive behaviors and autism core symptoms are influenced by pre-treatment parental stress, whereas more cognitive abilities as mental developmental state and language comprehension outcome measures are likely to be unaffected by parental stress. We found a consistent negative influence of high perception of having a difficult child which impeded improvements in autism symptom severity and a positive influence of parental stress on child language production, with parents who worked more intensively on the child's daily development facilitating language improvements. An equally positive relation between high parenting distress and the child's improvement has been demonstrated for adaptive behavior functioning, though solely for the Eclectic intervention group. In the parent mediated EIBI group, this positive impact of high parental distress on adaptive behavior functioning has been suppressed by the negative impact of a parent–child dysfunctional interaction that impedes significantly adaptive improvements. Since children in the EIBI group made less gain in adaptive behavior functioning, partly due to higher intake parent–child dysfunctional interactions, the trend to an increase in dysfunctional interactions in the Eclectic group might negate in the long term the initial positive gains made in the comparison group. This result particularly underlines the importance of teaching the parent to tackle directly difficulties experienced with its own child.

The present study extends earlier research by the introduction of a detailed analysis of direct behavior measures that might influence child outcome. In summary, our results indicated that parent inclusion in treatment provision can be effective already in the very short term, when parents undergo sound training and supervision to the same extent as professionals do. This gives the parents confidence in the application of teaching strategies. In detail, analysis of score change on observational data revealed that both staff and parents significantly achieved more treatment fidelity through consistent training and supervision. In particular, it has been shown that parents can recover initial fidelity deficits, demonstrating accelerated change for discrimination training skills with new targets and DTT skills with mastered targets that leads within six months to comparable levels of treatment fidelity as a professional treatment provider. Nevertheless, no accelerated score change has been detected for either data report or facilitated play skills. This underlines the difficulties firstly of persuading parents of the importance and utility of keeping records of their child's progress, as well as encouraging them to address play in their natural environment, a skill domain that requires different implementation strategies as structured teaching of cognitive and language skills. In any case, analysis of score change on observational data revealed that child challenging behaviors decreased significantly during intervention in both conditions: parent- and staff-provided treatment. Furthermore, it was demonstrated that within six months, there is an improvement in the child's performance in correctly responding to newly introduced behavior targets as well as during maintenance and generalization probes. This is accompanied by increases in the difficulty and number of targets that are proposed to the child.

How and in which way these additional variables, drawn from observation and daily data record, might promote or impede positive progress of both, child and parent during treatment provision has been addressed by mapping interrelations obtained from multiple regression analysis for treatment intake and outcome after six months.

In the final model for treatments there emerge two important factors to consider while starting up an effective treatment plan: Parental stress and child's challenging behaviors. It has been demonstrated that professional staff successfully adapt behavior target choice to the child's pre-treatment characteristics, allocating more difficult targets to treatment plans for children that manifest higher communication, personal and social interaction skills. This procedure is supported by the finding that children with higher communication skills exhibit higher initial performance in correct responding on such behavior targets. This performance was found to be influenced by high pre-treatment parental stress and child problem behaviors. In detail, parental stress was found to potentially compromise the staff decision making toward appropriate behavior targets, when the target difficulty is raised due to parental stress regardless of the child's actual skill level. Child challenging behaviors, indeed impact negatively the child's performance in correct responding to behavior targets. These results highlight two substantial components of planning and implementing a treatment plan: functional analysis of problem behaviors and the role of stress in parent inclusion. As parental stress interferes with staff treatment planning, there is a need to consider this component constantly in parent and staff training. Since the child's challenging behaviors impede child outcomes there is a striking lack of standard assessment and evaluation regarding problem behaviors prior to and during treatment progress. Further, the amount of parent-provided treatment in the child's natural environment was proven to decrease with high child's challenging behaviors. Such negative influences on child and parent performance at treatment begin, were found to be influenced solely by parent treatment fidelity. Indeed, higher initial parent treatment fidelity predicted increased implementation of treatment sessions at home and less child challenging behaviors. This important result underlines not only the role of parents in approaching dysfunctional child behaviors, but stretches the necessity of a sound parent training, comprising constant practical guidance, in order to increase and facilitate parent treatment fidelity.

In the final model of the situation after six months, interrelations between factors have been processed, and both an outcome promoting and an outcome impeding mechanism could be distinguished. First of all, we note that at treatment onset, child performance in correct responding on newly introduced behavior targets and during maintenance and generalization probes were unrelated and mainly predicted by child characteristics and child problem behaviors. After six months, however, a learning mechanism has been established, with high performance on maintenance and generalization probes predicting appropriate performance in subsequent newly introduced behavior targets, and vice versa. Nevertheless, the direction of influence between child problem behaviors and the amount of parent-provided treatment changed after six months. While at treatment intake high child challenging behaviors negatively impacted the probability of parent-provided treatment at home, higher amount of parent-mediated treatment provision predicts decrease of child problem behaviors after six month. This outcome is facilitated by the positive impact of high parent treatment fidelity and increased child performance in maintenance and generalizations skills, confirming the importance of constant parent training and supervision as identified in the model for treatment onset (Fig. 1). Further, the impact of parental stress on target decision making by professional staff was inverted after six month. While high parental stress at treatment intake predicted more difficult behavior targets at intake, after six months high parental stress predicted the introduction of less difficult behavior targets favoring a higher amount. This result indicates that the staff strategy to manage high parental stress has changed, probably due to target difficulty that exceeded parent's capacity to maintain and implement teaching in the child's natural environment. Thus, the choice of targets after six months favored less difficult targets, to be introduced. This meant that, at the same time, more targets were achieved. However, to the influence of parental stress rather than child pathology on target choice was shown to be dysfunctional, predicting increase in child problem behaviors and decreased child performance on behavior targets. As such, in both models treatment fidelity emerged as one of the core factors influencing treatment progress. In summary, high parent treatment fidelity influences increase in difficulty of newly introduced targets, amount of targets achieved in maintenance and generalization probes and the amount of parent-provided treatment at home. In turn, the amount of parent-provided treatment at home leads to a decrease in the child's challenging behaviors and increase in child performance in correctly responding to behavior targets. Contrary to our expectations, results revealed that lack of parent treatment fidelity does not impede this progress. Rather, it is negatively influenced by lack of staff treatment fidelity. Low staff treatment fidelity predicts increase in parental stress and child problem behaviors, both facilitating an inappropriate mechanism of professional decision making, with staff responding on high child problem behaviors with the reduction of target difficulty and responding on high parental stress with increase in newly introduced behavior targets. This inappropriate mechanism, with less staff treatment fidelity and higher child problem behaviors impede consequently child performance in correct responding.

There are limitations to this study which constrain the interpretation of our results. First, the sample size remained relatively small and assignment to treatment groups was parent-determined rather than random. However, except for age at intake the two study groups were not significantly different on dependent measures at pre-treatment. Age at intake has been constantly controlled by inclusion as covariate that revealed no group $\times$ age at intake interaction effects, thus demonstrated outcome differences were likely to be due to differing treatments rather than to a selection bias or pre-treatment differences among included participants. Second, additional measures on treatment and parental factors were not available for both study groups. Thus, interrelations between child, parent and treatment factors have been examined solely for the parent-mediated EIBI treatment. Further, due to small sample size, reported interrelations between factors have been examined, based on multiple regressions of total scores rather than subscales. Therefore, no clear conclusion can be drawn on the importance of parental and treatment factors on families following Eclectic interventions and results cannot be easily generalized on different staff and parent training programs.

We identified the future need to include such factors in large scale studies, in order to account for differences in child's response to treatment. Scientific and clinical questions emerged regarding differential components that are comprised in the psychological concepts of parental stress and treatment fidelity likely to promote or impede treatment progress. Granpeesheh et al. (2009) demonstrated that behavior task mastery was predicted by a relation of increase in treatment hours and decrease in child age, whereas increase in child age was related to point of diminishing-returns. We suggest that there are such points of diminishing-return related to parental stress and treatment fidelity, where with increase in amount and difficulty of behavior targets, children and parent begin to burn out. Furthermore, Osborne, McHugh, Sounders, and Reed (2008b) demonstrated that earlier diagnosis is associated with greater stress that did not systematically decline once diagnosis has been received, while later diagnosis was related to decreased stress. It is mandatory that early diagnosis and access to EIBI services needs to be accompanied by parents support. We propose to include in further analysis the factor of the time between the parents noticing a problem and autism diagnosis and treatment intake. This will enable us to gain information relevant to adjusting the parent training with regard to parental stress and differential needs related to time elapsed since diagnosis and consequently to prepare staff in stress management. Lastly, the need emerged to deepen the examination of parent treatment priorities and unmet needs in treatment provision. Pituch et al. (2011) demonstrated that parent treatment priorities are not sufficiently addressed. This might be due to lack of concordance between staff and parent's selection progress, where parents follow both a strength based and deficit based logic, with some priorities being selected independently of child deficits. There is a need to understand how professional staff selects treatment priorities and how parental stress and lack of concordance in selecting treatment priorities counteract professional decision-making in choosing appropriate treatment objectives.

Nevertheless, our data provide evidence that the inclusion of parents in the treatment provision leads to lasting child behavior changes, and the implementation of intensive and continuous parent training and supervision reliably achieves

parent treatment fidelity which, in turn, facilitates the children's progress. Particularly, the study highlights an important association between parental stress and staff treatment fidelity that interferes with decision making in treatment planning and consequently with positive behavior outcome. Such results provide important scientific and clinical information on parental and treatment factors likely to affect a child's response to treatment.

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