CRITICALLY APPRAISED TOPIC

TITLE

Parent mediated interventions for young children with autism spectrum disorder: parent training, therapist fidelity, parent fidelity and child outcomes

AUTHOR

Prepared by	Julie D. Smith, OTR/L	**Date**	7/29/17
Email address	julie-smith@ouhsc.edu		
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CLINIAL SCENARIO

Autism spectrum disorder (ASD) is a complex condition usually apparent before the age of three years. The most recent estimated prevalence among children aged 8 years is 14.6 per 1,000 (one in 68) (Christensen, 2016). Children with ASD demonstrate varying degrees of difficulty in social interaction and communication and frequently restricted repetitive behaviors (American Psychiatric Association, 2013). An early focus on social engagement and reciprocity during parent–child interactions may influence the developmental trajectory of children with ASD (Dawson, 2008; Dawson et al., 2012). Parent-child interactions offer natural contexts for child development, and parents of children with ASD are taking part in parent-mediated interventions (PMI) to reduce ASD core symptoms (e.g., social-communication, language, imitation and play) and maladaptive behaviors (e.g., disruptive, feeding, sleep, toileting) (Bearss, Burrell, Steward, & Scahill, 2015). We need to understand which ingredients of PMI contribute to effectiveness including parent training strategies, therapist fidelity in training parents, parent fidelity in use of intervention techniques, and intervention targets.

FOCUSSED CLINICAL QUESTION

In studies of parent-mediated interventions to improve social-communication, play and / or learning skills for young children with autism spectrum disorder (ASD):

- What are the approaches to assessing therapist fidelity in the use of intervention techniques?
- What are the strategies used to train parents in the use of intervention techniques?
- What are the approaches to assessing therapist fidelity in training parents?
- What are the approaches to assessing parent fidelity in the use of intervention techniques?
- What are the child outcomes where parents have demonstrated fidelity in the use of intervention techniques?

SUMMARY OF SEARCH
[Best evidence appraised and key findings]

A review of 141 parent-mediated intervention studies resulted in 6 studies that examined parent training strategies, therapist fidelity in training parents, parent fidelity in use of intervention techniques, and interventions targeted at improving child social-communication, learning and / or play. Children ranged in age from 7 months to 9 years. This review includes a randomized controlled trial investigating the effectiveness of parents' implementation of the Early Start Denver Model (P-ESDM) compared to a treatment as usual group. During the 12 week PMI, parents in the P-ESDM received coaching (i.e., parent training strategies) one hour per week by therapists trained to fidelity in both treatment delivery and coaching. They found that parents in both groups demonstrated gains in use of intervention techniques and children in both groups improved. They also found younger children at entry and children who received more hours of intervention made greater gains.

CLINICAL BOTTOM LINE

Both groups of parents demonstrated gains in their use of the P-ESDM techniques, and both groups of children made improvements. However, the authors argue the gains do not compare to the randomized control trial of ESDM intervention conducted in 2010 where children received more than 15 hours per week of therapist delivered intervention over 24 months. In combination with the findings from the current study under review, the authors conclude because children made greater gains when they entered the program at younger ages and when they received more hours of intervention, systems identify children at risk of ASD and begin intervention as young as one year. Additionally, professionals can coach families to provide high frequency learning opportunities during daily routines and activities.

Important note on the limitation of this CAT

This critically appraised paper (or topic) has /has not been peer-reviewed by one other independent person/lecturer

SEARCH STRATEGY

Terms used to guide the search strategy
• **P**atient/Client Group: Parents of children with ASD aged 9 years and younger • **I**ntervention (or Assessment): Parent training, education or coaching to implement ASD-related social-communication intervention strategies • **C**omparison: • **O**utcome(s): Parent adherence or fidelity of implementation

Databases and Sites Searched	Search Terms	Limits Used
MEDLINE(Ovid) EBM Reviews - Cochrane Central Register of Controlled Trials May 2017 Cochrane Database of Systematic Reviews 2005 to June 20, 2017	(autis* OR "pervasive developmental disorder" OR "PDD" OR "ASD") AND ("parent training" OR "parent coaching" OR "parent mediated" OR "parent implemented" OR "caregiver mediated") AND ("parent fidelity" OR "parent adherence") AND ("infant" OR "toddler" OR "children")	English language Period of 2002 to May 2017

INCLUSION and EXCLUSION CRITERIA

Inclusion Criteria
Procedures used to provide training, education or coaching were described
Parent fidelity of intervention strategies were measured before and after training, education or coaching
Intervention strategies targeted child's social-communication, learning and/or play
Studies published in English
Studies published within the last 10 years (inclusive of 2007–2017)
Studies with children aged birth through 8 years old
Studies with children who were at-risk or diagnosed with ASD
Exclusion Criteria
Therapist provided additional hours of intervention
Intervention provided by therapist / tutor as directed by parent
Parent reported fidelity or adherence
Study that included children with other developmental disabilities and the results were not described for children with ASD separately
Interventions to reduce or manage challenging behaviour or sleep patterns
Interventions combined with medications

RESULTS OF SEARCH

A total of 14 *(insert number)* relevant studies were located and categorised as shown in Table 1a (based on Levels of Evidence, Centre for Evidence Based Medicine, 2011)

A total of 10 *(insert number)* relevant studies were located and categorised as shown in Table 1b (based on Levels of evidence for single-subject research designs, Logan, Hickman, Harris, & Heriza, 2008).

Table 1a: Summary of Study Designs of Articles Retrieved

Study Design/Methodology of Articles Retrieved	Level	Number Located	Author (Year)
Systematic review of randomized control trial	I	2	McConachie, H., & Fletcher-Watson, S. (2015). Oono, I. H., Honey, E. J., & McConachie, H. (2013).
Systematic Review	I	2	Beaudoin, A., J., Sébire, G., & Couture, M. (2014). Lang, R., Machalicek, W., Rispoli, M., & Regester, A. (2009).
Randomized Control Trial	II	6	Casenhiser, D. M., Shanker, S.G., & Stieben, J. (2013). Ingersoll, Wainer, Berger, Pickard, & Bonter (2016). Nefdt, N., Koegel, R., Singer, G., & Gerber M. (2010). Rogers S. J., Estes. A., Lord, C., Vismara, L., Winter, J., Fitzpatrick, A., Guo, M., & Dawson, G. (2012). Shire, S. Y., Gulsrud, A. & Kasari, C. (2016) Shire, S. Y., Goods, K., Shih, W., Distefano, C., Kaiser, A., Wright, C, Mathy, P., Landa, R., & Kasari, C. (2015).
Non-randomized control trial, community comparison	III	1	Stadnick, N. A., Stahmer, A., & Brookman-Frazee, L. (2015).
Non-randomized control trial, cohort comparison	IV	1	Rogers, S. J., Vismara, L., Wagner, A. L., McCormick, C., Young, G., & Ozonoff, S. (2014).
Expert opinion / bench research	V	2	Ingersoll, B. R., & Wainer, A. L. (2011). Matson, M. L., Mahan, S., & Matson, J. L. (2009).

Table 1b: Summary of Study Designs of Articles Retrieved

Study Design/Methodology of Articles Retrieved	Level	Number Located	Author (Year)
Systematic review and meta-analysis of single subject research designs	I	2	Debodinance, E., Maljaarsa, J., Noensa, I., & Van den Noortgatec, W. (2017). Patterson, S. Y., Smith, V., & Mirenda, P. (2012).
Randomized controlled multiple baseline	I	1	Welterlin, A., Turner-Brown, L. M., Harris, S., Mesobov, G. & Delmolino, L. (2012)
Non-randomized controlled, concurrent multiple baseline	II	5	Ingersoll, B., & Wainer, A. (2013).

Study Design/Methodology of Articles Retrieved	Level	Number Located	Author (Year)
			Rollins, P. R., Campbell, M., Hoffman, R. T., & Self, K. (2015). Rocha, M. L., Schreibman, L., & Stahmer, A. C. (2007). Steiner A. M., Gengoux, G. W., Klin, A., & Chawarska, K. (2013). Vismara, L. A., McCormick, C., Young, G. S., Nadhan, A., & Monlux, K. (2013).
Non-randomized controlled, non-concurrent multiple-baseline	III	2	Brown, J. A., & Woods, J. J. (2015). Vismara, L. A., Colombi, C. & Rogers, S. J. (2009).

BEST EVIDENCE

The following study/paper was identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting this study were:

- The authors conducted a randomized controlled trial.
- The authors described parent training strategies, therapist fidelity in training parents, parent fidelity in use of intervention techniques, and intervention targets for child social communication, learning and/or play skills.

SUMMARY OF BEST EVIDENCE

Table 2: Description and appraisal of Rogers S. J., Estes. A., Lord, C., Vismara, L., Winter, J., Fitzpatrick, A., Guo, M., & Dawson, G. (2012). Effects of a brief Early Start Denver model (ESDM)-based parent intervention on toddlers at risk for autism spectrum disorders: a randomized controlled trial. *Journal of the American Academy of Child & Adolescent Psychiatry, 51*, 1052-65. doi:10.1016/j.jaac.2012.08.003

Aim/Objective of the Study:
To investigate the effectiveness of a 12 week parent-implemented intervention for toddlers aged 12-24 months at risk for autism spectrum disorder with one-hour-per-week therapist coaching. Hypotheses included: (1) "Children receiving 12 weeks of the P-ESDM will demonstrate greater gains in social communication and developmental quotients than will those in the community intervention group. (2) Parents receiving 12 weeks of P-ESDM parent training will show more skilled use of interactive techniques measured by the P-ESDM Fidelity measure than will parents in the community intervention group. (3) Two child pre-intervention variables that will moderate the effects of P-ESDM on child social and developmental outcomes are social orienting and imitation, key behaviors that support social learning in typically developing pre-verbal toddlers and two of the earliest distinguishing features of ASD in toddlers (4) Parents receiving P-ESDM will demonstrate more positive working relations with their primary therapist than will parents in the community intervention group." (Rogers et al., 2012, p. 3)
Study Design
The authors used a multisite randomized controlled trial design. Children were randomized to the parent delivery Early Start Denver Model (P-ESDM) or community treatment as usual groups. The authors used a computer algorithm blocks based on age, gender and developmental quotient. Blocks were monitored and controlled for equal groups. Parent and child measures were administered before and after the 12 week intervention.
Setting
Three university clinics (Sacramento, Seattle, and Ann Arbor).

Participants

Study n = 98 (Control group n = 49, Intervention group n = 49)

Inclusion criteria:

(a) Child met risk criteria for ASD on two screeners, as well as criteria for ASD in a clinical assessment
(b) Child crawled or walked
(c) Child had developmental quotients of 35 or higher
(d) The family spoke English in the home daily

Exclusion criteria included:

(a) Parent reported significant mental illness or substance abuse
(b) Child had other medical conditions including cerebral palsy
(c) Child's gestational age was less than 35 weeks,
(d) Child had genetic disorders related to developmental disabilities,
(e) Child had developmental quotient below 35
(f) Child was receiving or previous received greater than 10 hours weekly of an intensive 1:1 autism intervention

Of 228 referrals, 57 did not meet screening criteria or chose not to participate, and one child had a developmental quotient less than 35. Of the 166 children who met the at-risk screening criteria, 118 met criteria for ASD symptoms and had developmental quotients 35 or greater. Of the 118, 20 families declined and 98 enrolled of which 49 were assigned to the P-ESDM group and 49 to the community treatment as usual. Child and family baseline characteristics described in Table 3.

Table 3

Child and family baseline characteristics of 98 toddlers by assignment group. (Table taken from Rogers et al., 2013, p. 16)

	P-ESDM (n=49)		Community (n=49)	
Variable	Mean	%	Mean	%
Male gender	37	75.5	39	62.5
White ethnicity	34	69.4	37	75.5
Income				
<50K	10	22.2	15	32.6
50K–75K	5	11.1	9	19.6
75K–100K	15	33.3	12	26.1
>100K	15	33.3	10	21.7
Maternal education				
Less than high school	6	12.8	13	27.1
Some college	10	21.3	8	16.7
College	17	36.2	21	43.8
Some graduate school or graduate school	14	29.8	6	12.5
SCL-90 Primary caretaker *p<.05	47.05	11.02	53.47	11.46
Child age pre-treatment (month)	21.02	3.51	20.94	3.42
Child age post-treatment (month)	24.77	3.15	24.49	3.43
Time 1 cumulative treatment hours over child's life	16.16	4.97	11.06	3.13
Time 2 mean weekly treatment hours *p<.05	1.48	1.94	3.68	3.91
Modified ADOS Social Affect*	34.14	8.69	29.45	9.16
Imitation score *	2.53	2.6	3.78	3.12
Nonsocial orient *				
0	7	14.3	8	17.0
0.25	6	12.2	10	21.3
0.5	8	16.3	2	4.3
0.67	0	0	2	4.3
0.75	13	26.5	12	25.5
1	15	30.6	13	27.7

Note: ADOS = Autism Diagnostic Observation Schedule; P-ESDM = Parent delivery–Early Start Denver Model; SCL-90 = Symptom Checklist-90.

* Two sample Wilcoxon test (continuous variable) or Fisher's exact test (categorical variable) p value < 0.05

Intervention Investigated

Control

The children in the control group received intervention as usual provided by community providers.

Experimental

Parents received one hour per week of training at one of the three clinics for 12 consecutive weeks in the use of the10 ESDM intervention techniques: (a) increase child's attention and motivation; (b) use sensory social routines; (c) promoting dyadic engagement and joint activity routines; (d) enhancing nonverbal communication; (e) building imitation skills; (f) facilitating joint attention; (g) promoting speech development; (h) using antecedent-behavior-consequence relationships; (i) employing prompting, shaping, and fading techniques; and (j) conducting functional assessment of behavior to develop new interventions.

Therapist fidelity: Therapists demonstrated treatment and coaching fidelity before training parents in the use of the techniques. The authors assessed therapist fidelity quarterly during the intervention using a 14-item fidelity measure with scores ranging from 1-5. The therapist average score while implementing with a child was 4.47 (SD=.24). Therapists demonstrated fidelity in the use of coaching practices (Hanft, Rush, & Shelden, 2004) measured using a 13-item fidelity scale with scores ranging from 1-4. The therapist average score was 3.62 (SD=.25). Each parent training session was videotaped for clinical supervision and coding therapist fidelity.

Parent training procedures: Each parent training session was videotaped for coding parent fidelity. Session schedule:

(a) 5-minute parent-child interaction during play activities chosen by the parent or child;
(b) Therapist discussed new topic using materials from the ESDM manual;
(c) Parent observed therapist briefly modelling with the child during play activities;
(d) Therapist and parent briefly discussed what the parent observed during therapist modelling;
(e) Parent practiced the technique with the child during play activities with therapist coaching, encouragement, and feedback on technique use;
(f) Parent practiced the technique with the child during different types of activities (e.g., books, feeding, dressing or changing, toy play, and social play) until demonstrating fidelity of implementation of 80% or greater;
(g) Therapist and parent discussed using the new technique in various activities and settings at home and in the community; and
(h) Therapist provided parent with self-instructional manual materials on the target technique to review.

Outcome Measures (Primary and Secondary)

Child measures

The following were used a dependent measures and administered pre- and post-intervention (time 1 and time 2 or T1 and T2).

Mullen Scales of Early Learning (MSEL): The MSEL is a standardized, normed referenced developmental assessment for children aged birth through 68 months. The MSEL provides an overall index of ability, an Early Learning Composite and subscale scores of Receptive Language, Expressive Language, Visual Reception, and Fine Motor skill. To measure intervention efficacy, the authors created three developmental quotient scores because many of the children had standard t scores at the floor of 20 on individual subscales. The three quotient scores were derived from the developmental age equivalents subscale including: verbal developmental quotient using the Receptive Language and Expressive Language scales, nonverbal developmental quotient using the Visual Reception and Fine Motor scales, and an overall developmental quotient using the Receptive Language, Expressive Language, Visual Reception and Fine Motor scales. Across the three sites, administration practices were monitored for standard protocol adherence.

MacArthur-Bates Communicative Developmental Inventory: Words and gestures (MCDI): Parents completed the 396-word vocabulary checklist to identify the expressive words, gestures, and receptive vocabulary their child used during the past week. The authors used raw scores to measure treatment efficacy and reported strong psychometric properties for the instrument.

Vineland Adaptive Behavior Scales, Second Edition (VABS II): The VABS-II measures adaptive behavior in four domains: communication, self-care, social and motor skills. Psychometric properties were reportedly excellent. Parents completed the VABS-II by telephone at T1 and T2. Age equivalent scores and developmental quotients for the four domains were used to measure treatment efficacy.

Child moderating variables

The following variables were examined as moderators of child change.

Imitation: During a 10 minute or less playful probe, the researchers administered 12 imitation tasks comprised of familiar and novel objects, manual and oral-facial gestures imitations. Used in previous autism research, the imitations were live coded and scored as full pass (2), partial pass (1), and failure (0) resulting in a total imitation score.

Orienting to social, non-social and joint attention stimuli: To assess child social engagement, the authors administered a brief

task to observe a child's orientating behaviors to "three types of probes: four "social" noises (e.g., human-produced; voice, finger snap, clap, and hum) and (b) four non-social noises (timer ticking, phone beep, sandpaper scratch, light switch click), and (c) four joint attention bids" (Rogers et al., 2012, p. 5). Assessment of the social and non-social probes involved a lab assistant who delivered all sounds at the same decibel level while an experimenter recorded each time the child turned their head or gazed toward the sound within 10 seconds. Sitting in front of the child, the experimenter administered four joint attention bids: two for name, head turn, and point, and two for name and head turn without pointing. Each task was scored on a scale of 0–4.

Parent measures

ESDM Parent Fidelity Tool (Rogers, Dawson, Vismara, unpublished material, 2012): The P-ESDM Fidelity tool comprised of 13 parent behaviors that the ESDM curriculum defines as child-centered and responsive.

(a) management of child attention
(b) quality of behavioral teaching (use of clear antecedent-behavior-consequence events and efficient teaching strategies embedded in the play)
(c) adult ability to modulate child affect and arousal
(d) management of unwanted behaviors using positive approaches
(e) use of turn taking/quality of dyadic engagement
(f) giving child choices
(g) optimizing child motivation for participation in activity
(h) parent display of positive affect
(i) parent sensitivity and responsivity to child communications
(j) parent use of multiple and varied communicative functions
(k) appropriateness of parent language for child's language level
(l) parent use of flexible joint activity routines with theme and variation in activities
(m) smooth transitions between activities that maximize child interest and engagement

10 minute parent-child interactions with specific toys were video recorded at T1 and T2. Parents were instructed to "play as you typically do at home." Using the videos, parent behaviors were coded by expert ESDM therapist blinded to group assignment. Behaviors were scored on a 5 point Likert-based rating scale resulting in a total score ranging from 14 to 60. Higher scores indicated parent interaction styles closer to ESDM principles.

Working Alliance Scale for Interventions with Children: Used to assess working alliance of parents with the primary early intervention therapist at the end of the 12 weeks. Davis, Kuhn, and Carter (2006) adapted an existing scale to create this scale specifically for early intervention, and they reported "strong internal consistency among scale items (alpha = 0.91) and variability in the range of reported scores" (as cited in Rogers et al., 2012).

Children Intervention Hours: Amount of intervention per week was gathered at T1 and T2 by telephone interview using an adapted CPEA Intervention History interview (unpublished). Parents indicated types of intervention the child received, beginning and ending treatment dates, number of hours received weekly, and number of adults and children present during each intervention. Types of interventions included: applied behavior analysis, occupational therapy, physical therapy, speech/language therapy, Treatment and Education of Autistic and related Communication Handicapped Children, Developmental Individual Differences Relationship-based approach, play therapy, home session with infant-toddler educators, and infant-toddler treatment groups. Hours of P-ESDM were included for children in the experimental group. Excluded were nutritional interventions, day care, and community recreation classes. At T1, amount of intervention included all hours by all types of intervention up to that point, and at T2, amount of intervention included the average number of hours received by all types of intervention between T1 and T2. The authors calculated intensity of each intervention: "the number of weeks in length between the date began and date ended, minus the length of breaks in weeks, multiplied by the number of hours per week the child received it, and then multiplied by the ratio of adults to children in the intervention. (For example, 8 weeks of 1:1 treatment 4 hours per day, 5 days per week = 160 hours. Eight weeks of group treatment 4 hours per day, 5 days per week, with an adult:child ratio of 1:3 = 53.33 hours)" (Rogers et al., 2012, pp 6-7).

Main Findings

Descriptive data

Most demographic child and family variables were distributed equally between the two groups (Table 3).

Effects of group assignment on child behavior

Both groups demonstrated improvements in Mullen scores of approximately 10 points in verbal developmental quotient (DQ) and 4 to 5 points in overall DQ, as well as decreases in the ADOS Social Affect scores. The community group demonstrated greater improvement than the P-ESDM group in the Modified ADOS Social Affect scores at T2 (estimated difference between groups 3.43, SD=1.72, p=.05) (Table 4). Baseline age was a predictor of scores for Mullen DQ (estimated effect -1.20, p=0.002) regardless of adjustments for group assignment and other baseline variables. This indicated younger toddlers demonstrated greater improvements in the Mullen DQ.

Table 4

Means and standard deviations for all time 1 and time 2 all child variables, with effect sizes, by group. (Table taken from Rogers et al., 2012, p. 17)

	P-ESDM group		P-ESDM group		P-ESDM group	Community group		Community group		Comm. Group
	Visit 1		Visit 2			Visit 1		Visit 2		
Measures	mean	*SD*	mean	*SD*	Cohen's d	mean	*SD*	mean	*SD*	Cohen's d
Modified ADOS Social Affect	29.45	9.16	26.61	10.14	−0.37	34.14	8.69	27.33	10.62	−0.63
ADOS–Restrictive and Repetitive	3.92	2.01	3.96	1.86	0.02	4.31	1.92	3.82	2.04	−0.22
Mullen DQ	64.88	17.22	69.82	17.90	0.44	63.08	15.93	67.92	17.93	0.37
Mullen Verbal DQ	47.78	22.19	56.65	23.65	0.56	44.45	20.37	54.35	21.94	0.53
Mullen Nonverbal DQ	80.96	16.68	81.98	14.82	0.08	80.73	15.51	80.57	18.45	−0.01
MCDI part I: Phrases understood	8.22	7.02	12.73	9.11	0.62	9.38	7.95	14.77	8.14	0.87
MCDI part I: Vocabulary Comprehension	64.53	65.73	106.51	96.81	0.66	70.31	78.34	125.72	106.39	0.84
MCDI part I: Vocabulary Production	12.24	35.60	42.27	61.99	0.69	12.44	39.72	38.87	73.71	0.57
MCDI part II: Total Gestures	19.89	10.12	28.02	12.62	0.83	20.33	11.15	29.79	13.51	1.02
VAB II: Communication	67.66	13.19	72.55	12.06	0.69	67.29	11.05	74.29	14.55	0.84
VAB II: Daily Living Skills	83.07	12.40	82.25	13.82	−0.08	83.21	10.60	84.04	13.50	0.08
VAB II: Socialization	76.68	8.74	77.32	9.19	0.08	77.95	8.01	78.67	10.78	0.07
VAB II: Adaptive Behavior Composite	76.76	10.30	77.43	9.59	0.10	78.22	8.88	80.33	11.34	0.29
Imitative Sequences	3.78	3.12	4.58	3.45	0.22	2.53	2.60	3.76	3.44	0.37
Mean Social Orient l	0.47	0.33	0.47	0.28	−0.02	0.41	0.29	0.43	0.35	0.06
Mean Nonsocial Orient	0.65	0.30	0.74	0.28	0.27	0.62	0.35	0.60	0.37	−0.06
Mean Orient to Joint Attention	0.35	0.35	0.34	0.29	−0.03	0.28	0.33	0.34	0.34	0.18

Note: ADOS = Autism Diagnostic Observation Schedule; DQ = Developmental Quotient; MCDI = MacArthur-Bates Communicative Development Inventory; P-ESDM = Parent delivery–Early Start Denver Model; VAB II = Vineland Adaptive Behavior Scales–II.

Effect of intervention hours on change in child outcomes

Child intervention hours. "At T1, there was no significant difference in the amount of cumulative treatment hours received by children in the two groups (community group mean=11.06 (SD=3.13), P-ESDM 16.16 (4.97), p=.38). Twelve weeks later, at T2, there was a significant difference in the number of treatment hours children were receiving weekly (P-ESDM 1.48 (1.96); community group 3.68 (3.91), p<.05" (Rogers et al., 2012, p. 7) (Table 3). Intervention hours ranged from 0 to 15.9.

Relationships between hours of intervention and severity of ADOS scores and severity of Mullen DQ. "There was no relationship between severity of ADOS scores and severity of Mullen DQ on number of hours of treatment at either time point (all r^2 values less than absolute value of 0.20)…A set of linear models was built to predict the change in the outcome scores using the hours of independent intervention per week at Time 2, with T1 baseline hours of intervention, age, and modified ADOS Social Affect as independent covariates" (Rogers et al., 2012, p. 9) (Table 5). After adjusting for intervention hours, the group differences in ADOS Social Affect score reported in Table 2 was no longer significant.

Effects of intervention hours in pooled sample. After adjustments for baseline age, ADOS and baseline value of the specific score, "intervention hours had a significant main effect on the change scores for ADOS Restrictive and Repetitive, Mullen Overall DQ, Mullen Verbal DQ, MCDI Vocabulary Comprehension, and Nonsocial Orienting" (Rogers et al., 2012) (Table 5).

Effects of intervention hours by group assignment. Intervention hours were associated with child outcomes for MCDI vocabulary comprehension and production in the P-ESDM group, and the authors reported the association may have been due small sample sizes. Intervention hours were significantly associated with group assignment for MCDI vocabulary production. "Although more intervention hours resulted in some improvement in child outcomes, such as Mullen overall DQ and Verbal DQ, its effect on modified ADOS social affect was ambiguous, with a worse effect in P-ESDM group (estimated effect=0.65, p>.05) and an improved effect in community group (estimated effect=0.56, p>.05). Because our trial was not designed to evaluate its effect on child outcomes, we should interpret these results with caution" (Rogers et al., 2012, p. 9) (Table 5).

Table 5

Overall and group stratified effect of independent intervention hours on follow-up child outcomes, adjusting for baseline age, modified Autism Diagnostic Observation Schedule social affect and baseline child outcomes, n=98. (Table taken from Rogers et al., 2012, p. 18)

	Overall	P-ESDM Group	Community Group	Interaction *p* value
	Coefficient (95% CI)	Coefficient (95% CI)	Coefficient (95% CI)	
Modified ADOS Social Affect	−0.46 (−0.99,0.07)	0.65 (−0.46,1.76)	−0.56 (−1.22,0.11)	0.166
ADOS Restrictive and Repetitive	−0.11 (−0.22,0.00)*	−0.1 (−0.34,0.14)	−0.08 (−0.22,0.06)	0.737
Mullen DQ	0.78 (0.08,1.47)*	1.52 (−0.05,3.09)	0.63 (−0.25,1.51)	0.289
Mullen Verbal IQ	1.09 (0.11,2.06)*	2.15 (−0.04,4.33)	0.81 (−0.4,2.03)	0.258
Mullen Nonverbal IQ	0.43 (−0.27,1.13)	0.75 (−0.75,2.25)	0.36 (−0.57,1.3)	0.644
MCDI words and Gestures part I: Phrases understood	0.13 (−0.3,0.55)	−0.14 (−1.19,0.92)	0.07 (−0.42,0.57)	0.702
MCDI words and Gestures part I: Vocabulary Comprehension	4.22 (0.15,8.3)*	9.99 (1.34,18.65)*	1.31 (−4.09,6.72)	0.06
MCDI words and Gestures part I: Vocabulary Production	1.31 (−1.45,4.07)	9.36 (3.74,14.97)*	−0.96 (−4.47,2.54)	0.005
MCDI words and Gestures part II: Total Gestures	0.33 (−0.29,0.94)	0.53 (−0.92,1.98)	0.14 (−0.65,0.93)	0.507
Imitative Sequences Score	0.17 (−0.03,0.37)	0.02 (−0.47,0.52)	0.23 (−0.01,0.46)	0.469
Social Orient Average Score	0 (−0.02,0.01)	−0.02 (−0.06,0.02)	0 (−0.03,0.02)	0.616
Nonsocial Orient Average Score	−0.02 (−0.04,0.00)*	−0.03 (−0.07,0.01)	−0.02 (−0.03,0)	0.403
Joint Orient: Average Score	0 (−0.02,0.02)	0.01 (−0.03,0.05)	−0.01 (−0.03,0.02)	0.494

Note: ADOS = Autism Diagnostic Observation Scale for Toddlers; DQ = Developmental Quotient; MCDI = MacArthur-Bates Communicative Development Inventory; P-ESDM = Parent Delivery–Early Start Denver Model.

**p* value ≤ 0.05

Moderators of child change

Imitation and Social Orienting were not found to influence the association between group assignment and Mullen and ADOS scores at T2 in the P-ESDM group contrary the authors' hypothesis. They found, however, Imitation and Nonsocial Orienting had main effects for the pooled sample. Nonsocial Orienting also significantly predicted changes in Mullen DQs and decreases in Modified ADOS Social Affect score; whereas, Social Orienting significantly predicted reduction of ADOS Restrictive and Repetitive Behavior score and may be due to correlations among the variables (Table 6).

Table 6

Main effect of baseline variables on change scores on Autism Diagnostic Observation Schedule (ADOS) and Mullen Developmental Quotient (DQ), adjusting for baseline age and baseline scores. (Table taken from Rogers et al., 2012, p. 19)

Change in Outcome	Baseline variable as predictor	Estimated coefficient (SE)	*p* value
Modified ADOS Social Affect	Modified ADOS Social Affect	−0.26(0.11)	0.022
	ADOS Restrictive and Repetitive	0.33(0.44)	0.457
	Mullen DQ	−0.11(0.07)	0.136
	Imitation Score	−0.3(0.33)	0.362
	Social Orient Score	−5.25(2.93)	0.077
	Nonsocial Orient Score	−7.5(2.80)	0.009
	Joint Attention Score	−4.92(2.82)	0.085
ADOS Restrictive and Repetitive	ADOS Restrictive and Repetitive	0.25(0.10)	0.014
	Modified ADOS Social Affect	0.02(0.02)	0.371
	Mullen DQ	−0.01(0.02)	0.444
	Imitation Score	0(0.07)	0.971

	Social Orient Score	−1.56(0.65)	0.019
	Nonsocial Orient	−0.52(0.62)	0.411
	Joint Attention	−0.39(0.63)	0.536
	Mullen DQ	0.53(0.10)	<0.001
	Modified ADOS Social Affect	−0.09(0.16)	0.598
	ADOS Restrictive and Repetitive	0.04(0.64)	0.947
	Imitation	0.43(0.48)	0.376
	Social Orient	1.79(4.24)	0.675
	Nonsocial Orient	13.04(4.06)	0.002
Mullen DQ	Joint Attention	5.6(4.09)	0.175

Parent acquisition of child-centered interaction and communication skills

Group differences in fidelity scores. "The groups of parents were equivalent at T1, and both groups of parents demonstrated significant gains in use of these interaction skills over the 12-week period. The follow-up score in the P-ESDM group was larger than that of the community group at T2 but was not significant after adjusting for baseline age and ADOS Social Affect score (p=.19). The pre–post differences in the P-ESDM group showed a large effect size (0.57) compared to the community group's moderate effect size (0.37). Parents' T2 scores showed little relationship to their T1 scores, for either group of parents (r=0.28 for each group)" (Rogers et al., 2012, pp. 9-10) (Table 7).

Table 7

Regression analysis of assignment group differences in parent–child interaction scores at Time 1 (T1) and Time 2 (T2). (Table taken from Rogers et al., 2012, p. 20)

	ESDM n=41		Control n=40		
	Mean	*SD*	Mean	*SD*	t-test for group difference, *p* value
T1	40.05	5.93	37.83	6.97	0.127
T2	45.2	8.68	41.18	8.53	0.039
mean change	5.14	9.04	3.35	9.35	0.382
Cohen' s d	0.57		0.36		
t-test comparing T1 and T2, *p*	0.001		0.029		

Note: ESDM = Early Start Denver Model.

Relationship between P-ESDM fidelity scores, child performance, and child change. "There were no significant relationships between parent change scores on the Fidelity measure during the 12 weeks and child change scores during that same period of time" (Rogers et al., 2012, p. 10).

Effect of Group Assignment on Parent Working Alliance

"Parental working alliance with the primary early intervention therapist was measured at the end of the 12-week intervention period. Due to the presence of outliers, we used robust regression (bi-square to predict working alliance adjusting for other covariates. The P-ESDM group parents (mean=5.60, SD=.82) reported a significantly stronger working alliance with their primary therapist than did the community intervention group (mean=5.23, SD=1.1) p value .06" (Rogers et al, 2012, p. 10).

Original Authors' Conclusions

"Parent-implemented intervention studies for early ASD have thus far not demonstrated the large effects seen in intensive treatment studies. Evidence that both younger age and more intervention hours positively affect developmental rates has implications for clinical practice, service delivery, and public policy" (Rogers et al., 2012, p. 2).

Critical Appraisal

Validity

The PEDro scale was used to rate internal validity, statistical reporting and eligibility criteria (external validity).

Internal validity

Criterion	Rating
Criterion1: Random allocation	Yes, experimental group (n=49) and control group (n=49)
Criterion 2: Concealed allocation	No, the authors reported randomization by computer algorithm blocks based on age, gender, and developmental quotient and monitoring for equal samples.
Criterion 3: Baseline similarity	No, the authors reported significant differences at T1 for ADOS Social Affect score. Children in the community intervention had higher mean score indicating more severe symptoms.
Criterion 4: Blinding of subjects	No, parents either received parent training or treatment as usual.
Criterion 5: Blinding of therapists	No, only parents in the experimental group received parent training by the study therapists.
Criterion 6: Blinding of assessors	No, the authors did not indicate if assessors were blinded for each measure. Assessors were blinded to group assignment for coding parent fidelity.
Criterion 7: Measures of key outcomes from more than 85% of subjects	Yes
Criterion 8: Intention to treat analysis	No, the authors did not indicate.

Statistical Reporting

Criterion 10: Between-group statistical comparisons	Yes
Criterion 11: Point measures and measures of variability	Yes

Eligibility criteria	Yes

PEDro score: 4/10

External validity

The eligibility criterion to participate in the study were reported and described clearly.

Interpretation of Results

One hour of parent training over 12-weeks did not result in large effects on child outcomes. Differences between the P-ESDM and community intervention groups on child outcome measures were not found after the 12 week intervention. The authors identified several potential confounders: (a) the community group received significantly more hours of intervention; (b) community-based providers may have coached parents; (c) community-based providers may have implemented similar interventions to P-ESDM; and (d) parents in the P-ESDM were not providing the full dose intervention until they had learned all strategies at weeks 8 and 9. For the pooled sample, the effects of intervention hours were associated with change scores in verbal and nonverbal skills, as well as reduction of autism symptoms. Additionally, two child pre-intervention variables, Social Orienting and Nonsocial Orienting predicted changes in Mullen developmental quotients and autism symptoms measured by the ADOS. Although data not included, the authors reported younger children entering the study made greater gains in child outcomes than children entering closer to 24 months of age.

Parents in both groups demonstrated improvement in use of the intervention techniques; however, fidelity scores of families in

the P-ESDM were not significantly higher than the community intervention group. Finally, parents in the P-ESDM group who were coached in delivering the intervention significantly reported a stronger working relationship with their primary therapist.

Summary/Conclusion

Parents in the P-ESDM group demonstrated fidelity in their use of intervention techniques with one-hour per week of systematic coaching by a therapist who had demonstrated treatment fidelity. However, the difference between the P-ESDM and community intervention groups was not significant. Children entering the study at younger ages made greater outcome gains than those who were older. Children who received more hours of intervention made greater gains in child outcomes and reduction in autism symptoms.

IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH

Given the study results, early identification of children, even as young a one who are at risk for ASD, and early intervention are essential. Rather than lengthy wait lists for diagnostic evaluations and intervention services, public policy should support timely access. Young children benefit from increased hours of intervention, and systematic coaching of parents to implement intervention techniques during daily routines and activities provides increased natural learning opportunities. Preservice personnel and community providers may value learning strategies for coaching parents in the use of ASD related intervention techniques. Further research is needed to understand (i.e., quantity and quality) parents' use of intervention techniques in the home.

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