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Article

Telehealth Parent Training in the Early Start Denver Model: Results From a Randomized Controlled Study

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Abstract

Telehealth training may benefit parents' use of early intervention for children with autism spectrum disorder (ASD). This study is one of the few randomized trials to compare telehealth parent training in the Early Start Denver Model (P-ESDM) with a community treatment-as-usual, early intervention program. Parents were randomized to 12 weekly 1.5-hr videoconferencing sessions with website access to P-ESDM learning resources or to monthly 1.5-hr videoconferencing sessions with website access to alternative resources to support their intervention. Telehealth training facilitated higher parent fidelity gains and program satisfaction for more of the P-ESDM than the community group at the end of the 12-week training and at follow-up. Children's social communication skills improved for both groups regardless of parent fidelity. Findings suggest the feasibility of telehealth training with improved parent intervention usage and satisfaction from the program. However, the impact of these effects on children's development over time is yet to be understood.

Keywords

autism spectrum disorders, parent training, early intervention

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With the newest estimate of 1 in 68 children in the United States with an autism spectrum disorder (ASD; Centers for Disease Control and Prevention, 2014), early intervention has never been more critical to treat the intellectual, communicative, and behavioral deficits that can interfere with later functioning (Mundy & Crowson, 1997). Parents, as their children's first and most natural teacher, have the greatest interest and influence on their long-term growth and development. Practice, theory, and research have all emphasized the importance and efficacy of parent-delivered interventions for children with developmental difficulties early in life (Wallace & Rogers, 2010). Studies of parent–child interactions in ASD have also found that parents can effectively deliver interventions and effect desired child changes in problem behaviors, nonverbal and verbal communication, and appropriate play and imitation skills (Anderson & Romanczyk, 1999; Hancock, Kaiser, & Delaney, 2002; Ingersoll & Gergans, 2007; Koegel, Bimbela, & Schreibman, 1996; Koegel,

Koegel, & Surratt, 1992; Laski, Charlop, & Schreibman, 1988; McClannahan, Krantz, & McGee, 1982; Stahmer & Gist, 2001; Stahmer & Schreibman, 1992).

Through its interactive and multimedia platform, telehealth or communication technologies can integrate principles of adult learning and instructional design to increase parents' understanding, retention, and use of early intervention with children with ASD (Baggett et al., 2010). Thus far, telehealth training ranges from DVD to online text and video modules for parents' self-guided instruction, to live, two-way videoconferencing from their homes, school, or other remote setting with a therapist (Boisvert, Lang, Andrianopoulos, & Boscardin, 2010; Wainer & Ingersoll, 2011). For example, Jang et al. (2012) developed an e-learning or web-based training module to explain applied behavior analysis procedures to parents. Nefdt, Koegel, Singer, and Gerber (2010) used a DVD-based self-directed distance-learning program of 14 training modules with text and audio lecture and video examples to teach pivotal response training (PRT), an evidence-based naturalistic intervention, to 27 primary caregivers of children with ASD. Similarly, Wainer and Ingersoll (2013) developed a self-guided, online instructional program of audio- and video-based modules, short comprehension quizzes, and video clips of adult–child interactions for rating accurate use of reciprocal imitation training, an evidence-based intervention to increase imitation in children with ASD (Ingersoll, 2010; Ingersoll, Lewis, & Kroman, 2007; Ingersoll & Schreibman, 2006). *Enhancing Interactions* is a web-based tutorial developed by Kobak et al. (2011) intended for parents to enhance their child's social communication and decrease problem behaviors within everyday routines.

Other studies have primarily focused on videoconferencing or live two-way communication over the Internet to provide behavioral consultation services in a very effective manner compared with on-site coaching (Gibson, Pennington, Stenhoff, & Hopper, 2010; Machalicek et al., 2009; Suess et al., 2014; Wacker et al., 2013a, 2013b). To date, their work has demonstrated that applied behavioral analysis procedures such as functional analysis or functional communication training are adaptable to most applied situations through videoconferencing training to parents, teachers, and other educational and professional staff and are rated as highly acceptable in lieu of traditional in-person sessions. Thus far, findings generated from telehealth training suggest high parent satisfaction, improved understanding of the content, and child improvement in the targeted area(s) of intervention (Baharav & Reiser, 2010; Jang et al., 2012; Kobak et al., 2011; Nefdt et al., 2010; Vismara, McCormick, Young, Nadhan, & Monlux, 2013; Vismara, Young, & Rogers, 2012; Wainer & Ingersoll, 2013).

The current study adds to this literature with a comparison of how two groups of parents engaged with telehealth training to augment their use of an intervention model without traditional, in-person therapist-delivered coaching. Parents in the Early Start Denver Model parent coaching program (P-ESDM; Rogers, Dawson, & Vismara, 2012) were taught the same developmental, relationship-based principles as the ESDM therapist-implemented model using videoconferencing sessions and website learning tools. Previous publications of P-ESDM learning data demonstrate parents' ability to deliver the set of responsive, sensitive interactive strategies from center-based and telehealth training resources associated with increased child social communication skills (Rogers, Estes, et al., 2012; Rogers et al., 2014; Vismara, Colombi, & Rogers, 2009; Vismara et al., 2013; Vismara et al., 2012). Parents in the comparison group received videoconferencing sessions and website resources geared to treatment-as-usual services accessed from within their communities as part of the Birth to Three Services, Part C federal requirements. The two groups were evaluated at three time points on primary outcome measures of parents' fidelity with the P-ESDM and their engagement and satisfaction with the telehealth training resources followed by secondary changes in children's social communication as a result of parent-implementation. We predicted that greater fidelity, website engagement, and program satisfaction gains would occur for P-ESDM than community-treated parents, which in turn would be more likely to facilitate gains in children's social communication skills.

Materials and Method

Participants

Sixty-one parents contacted the first author to participate from the center's website (52%) or from referrals (48%). Eligibility required (a) children between 18 and 48 months of age, (b) a diagnosis of ASD from the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 2002) by a licensed psychologist or physician, (c) one parent fluent in English and able to participate in all sessions, and (d) Internet in the home. Figure 1 shows the recruitment, dropout, and retention process, resulting in 24 parents and their children (i.e., 14 in treatment, 10 in control) who completed at minimum pre- and post-assessments.

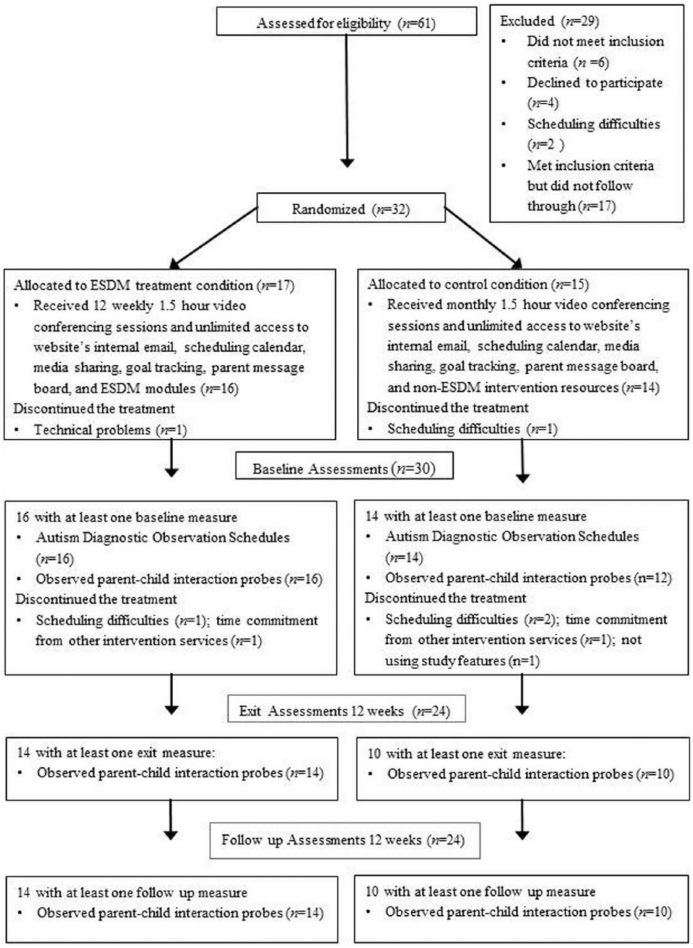

Figure 1. Participant recruitment, enrollment, randomization, and retention.
Note. ESDM = Early Start Denver Model.

Design and Procedure

Data were collected between 2011 and 2012. All research activities were approved by the university's institutional review board (IRB) and adhered to the Health Insurance Portability and Accountability Act (HIPAA) in response to privacy, security, and electronic transaction guidelines. Videoconferencing sessions occurred through the Citrix program GoToMeeting® in accordance with HIPAA to protect the confidentiality and integrity of families' health information through a combination of encryption, strong access control, and other protection methods. Parents connected from their home with a laptop, tablet, or computer and web-camera. Children were randomized in clusters of four to ensure that two were assigned to each group using a computer algorithm based on three pre-specified blocks: 18 to 30 months or 30 to 48

months, gender, and ADOS total cutoff scores of <12 or 12+. Randomization was conducted and monitored by the last author who had no contact with the families or involvement with the intervention delivery or assessment testing. Block assignment attempted to maximize equal samples in both groups (prior to attrition) and not contribute to cohort effects or limit our resource capacity to serve families.

Parent–child assessments were collected at baseline, at the end of the 12-week treatment, and at another 12-week follow-up period. At each point, parents were asked to play with their child as they normally would do so in two 5-min play periods to evaluate parent fidelity performance and child social communication skills in each activity. Parents were asked to carry out one activity with preferred toys or materials that were a part of the child's usual play routines at home, as determined by the family, and the second with a familiar social or physical game typically played by the parent and child but without the use of any materials or toys. Research assistants independently rated and compared 33% of scored probes in random order in addition to reliability checks with the first author on 15% of dependent measures. Raters were blind to the study's hypotheses and group assignment.

P-ESDM intervention. The P-ESDM (Rogers, Dawson, & Vismara, 2012) follows the same science of applied behavior analysis and developmental, relationship-based intervention of the ESDM (Rogers & Dawson, 2010). Its content and approach to parent training develops moments of learning inside the daily interactions and activities that make up a young child's life so as to teach and strengthen different areas of development. These everyday moments, whether involving a snack at the kitchen table, playing with the garden hose, getting dressed, or looking at a picture book, provide opportunities to teach and strengthen children's developmental skills. The P-ESDM videoconferencing sessions and website intended to teach parents how to use the 10 topics to target multiple skills across different areas of development within any particular activity. These topics are attention and motivation, sensory social routines, joint activity routines, nonverbal communication, imitation, joint attention, speech development, functional and symbolic play skills, and the teaching techniques and learning contingencies of applied behavior analysis (see the appendix).

The 12-week, 1.5-hr videoconferencing sessions began with the parents sharing their experience using the last P-ESDM topic introduced, discussed, and practiced during the previous session or in the case of the first session, sharing their overall insight about which P-ESDM topic(s) seemed more or less relevant to their learning needs. Parents were then asked to share an example of using the P-ESDM topic inside an activity with the child or any strategy they may have read about if it was the first session. Next, the parent and therapist reflected about the positive ways in which the parent applied the topic to support the child's social communication skills and ways in which the topic could be expanded or improved in the activity so as to provide further learning opportunities and strengthen or augment the child's behavior. As a next step, the parent may now want to know how to introduce other materials into the activity and ultimately transition away from only playing with the child's highly favored materials. After the parent and therapist discussed strategies to support continued use with the last topic, the therapist introduced the new P-ESDM topic and coached the parent through several activities with the child. The session ended with the parent setting goals of typical activities and moments in which to use the new topic and child behaviors that could be taught, as well as website resources to try before the next session.

Parents accessed the website, *esdmanywhere.org*, from a 128-bit encrypted software program, featuring a (a) scheduling calendar; (b) email for parent–therapist communication; (c) multimedia program to upload files; (d) online posts among parents; (e) goal tracking program to record daily practice of the P-ESDM topics, child behaviors taught, and activities used; (f) modules with text instruction, video examples, practice exercises, and FAQs; and (g) a resource center of website links and tool kits on (i) Individualized Education Programs, (ii) early intervention models and efficacy research, (iii) advocacy information, (iv) community

events, (v) daily life issues, and (vi) family support systems. Therapists viewed parents' website activity so as to stay informed and communicate about their usage in between sessions.

Comparison group. Parents randomized to this group received monthly instead of weekly 1.5-hr videoconferencing sessions and unlimited access to the website minus the P-ESDM content. Parents' participation was geared to understand their engagement patterns with the technology, their interaction style with their children, and child changes across measured outcome variables as a result of treatment-as-usual, community-delivered services compared with the P-ESDM. Parents reported that community services primarily consisted of direct intervention programs, including in-home instruction of applied behavior analysis and center-based speech-therapy sessions, followed by similar services coupled with occupational therapy sessions embedded within children's educational programs.

Parents' videoconferencing sessions and website resources focused exclusively on the existing content of their children's intervention programs rather than introducing the P-ESDM intervention and coaching curriculum. In each videoconferencing session, parents had the option to share learning goals from their child's existing program(s), to discuss ways in which their family might support further practice, and to use the website features related to their learning needs. The website resources offered information about (a) the rights and overall processes involved with Individualized Education Programs; (b) evidence-based intervention approaches and supporting research; (c) advocacy information; (d) autism-related community events; (e) family support networks; and (f) tool kits to manage daily life and self-help issues such as eating meals as a family, toilet training, doctor's visits, and so forth. The therapist's intention was to support the teaching methods and learning goals of the family's original intervention program(s) and not introduce new techniques that might interfere with progress. Once parents completed the 12-week intervention and 3-month follow-up, they received access to the P-ESDM topic modules on the website. This transition also marked the end of tracking their website engagement for data analyses.

Therapist training Sessions were delivered by the first and third author and another therapist, all trained by the model's developers. Training protocols used with families were reviewed and approved by the IRB prior to conducting the study. The therapists followed a set of ethical and practice guidelines developed in prior research using online forums to deliver intervention (see Trepal, Haberstroh, Duffey, & Evans, 2007 for more information), as well as a manualized fidelity checklist on *recommended coaching* practices (i.e., collaboration, active listening, self-reflection, contextual and nonjudgmental feedback) for working with and supporting parents through family-centered practice (Hanft, Rush, & Shelden, 2004; Rush & Shelden, 2005, 2011). All videoconferencing sessions were recorded and at least two sessions per parent were chosen at random and coded using the fidelity checklists by unassigned therapists with strong inter-rater agreement (intraclass correlation coefficient [ICC] = .86) and therapist fidelity at 80% or higher.

Dependent Measures

The study conducted blind observation coding and analyses at the start of the study and at the completion of the 12-week intervention and 3-month follow-up. Primary outcome measures included group differences in parents' P-ESDM fidelity use, website usage, and program satisfaction followed by secondary changes in children's social communication skills as a result of parent-implementation.

Primary Outcome Measures

P-ESDM fidelity. The P-ESDM fidelity tool evaluates the same 13 intervention skills used by therapists based on scores of 1 (i.e., *no competence*) to 5 (i.e., *high competence*; Rogers & Dawson, 2010). These skills define the child-centered, responsive interaction style of the model including (a) management of child

attention; (b-c) quality of behavioral teaching (use of clear antecedent-behavior-consequence events and efficient teaching strategies embedded in the play); (d) adult ability to modulate child affect and arousal; (e) management of unwanted behaviors using positive approaches; (f) quality of dyadic engagement; (g) giving child choices and 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; and (m) smooth transitions between activities that maximize child interest and engagement. Parents with scores of 4 or higher in each play condition at post-treatment and follow-up were considered at fidelity. Inter-rater agreement was defined as raters' scores falling within 1 point on the Likert-type scale for each item. The weighted kappa between raters was .75.

Program website use. Electronic tracking recorded the number of logins and amount of time viewing each website tool once parents completed their final baseline assessment until their last follow-up assessment. Amount of time viewing each website tool was calculated by subtracting the difference between the time stamps associated with each click or navigation from one web page to the next. Time spent refreshing the web page, logging back into the website, or leaving a web page open for more than two standard deviations above the mean amount of parents' view time (M = 5 min, 50 s, SD = 34 min, 57 s) were excluded from our analyses.

Program satisfaction. Parents completed a 20-item, 6-point questionnaire ranging from 0 (*not used*) to 1 (*strongly disagree*) through 5 (*strongly agree*) on (a) the website's ease of use (two items), (b) its intervention content and learning tools (14 items), (c) therapist support during sessions (two items), and (d) parents' confidence to teach new skills to children and to pass on this information to other caretakers (two items). Parent scores were averaged to create a total score. Parents also reported on the benefits and limitations of the website and training experience in an open-ended format.

Social communication behaviors. (a) Spontaneous, unprompted functional verbal utterances of single words or approximations (not echoic or unintelligible utterances) directed to the parent with body orientation to request or comment about an item or action; (b) imitative functional, related play actions on objects and manual actions without objects done within 3 s of the parent's modeled action; and (c) unprompted, nonverbal joint attention behaviors of eye gaze alternation with or without gestures directed to the parent to share interest or enjoyment in the activity. Analysis codes for all behaviors were summed across both parent–child play sessions per time point and calculated into a rate per minute to account for differences in duration of videotaped probes. The mean ICC for frequency of behaviors was .77 (.11), with a range of .60 to .91.

Results

P-ESDM fidelity. Parent fidelity was analyzed within a series of binomial generalized linear models. Model effects (i.e., group assignment, assessment phase, group by time interaction, and parent–child characteristics) were tested using Wald chi-square tests. As shown in Table 2, no one met fidelity during baseline and therefore only post and follow-up time points were included in the model to enhance convergence. At post-treatment, five out of 14 P-ESDM parents met fidelity compared with only two out of the eight comparison parents, $\chi^2(1) = 4.73$, $p < .05$. Four additional P-ESDM parents versus none in the comparison group met fidelity 3 months later at follow-up. In spite of the improved skill usage among parents in the P-ESDM over the comparison group, there was no significant change from post to follow-up,

$\chi^2_{(1)} = 0.93$, $p = .33$, or an interaction between time point and group, $\chi^2_{(1)} = .73$, $p = .33$. Multiple parent and child characteristics as shown in Table 1 were tested within the model of fidelity. Gender was the only variable with a significant effect and was therefore maintained in the model. Female caregivers were more likely to meet fidelity than male caregivers, $\chi^2_{(1)} = 3.93$, $p < .05$.

Table 1. Parent–Child Descriptives.

	Treatment group	
	P-ESDM ($N = 14$) *M* (*SD*)	Community ($N = 10$) *M* (*SD*)
Child's age at enrollment (months)	31.9 (10.4)	27.20 (7.9)
Additional services before the study		
Direct services	53.23 (64.54)	118.39 (235.51)
School services	100.83 (216.31)	121.67 (195.35)
Parenting classes/seminars	0.92 (2.23)	0 (0)
Additional services during treatment		
Direct services	58.07 (81.20)	158.30 (93.38)
School services	66.67 (130.52)	80.56 (187.89)
Parenting classes/seminars	1.50 (5.20)	0 (0)
Additional services during follow-up		
Direct services	59.25 (67.3)	222.04 (219.00)
School services	23.92 (55.97)	66.25 (159.26)
Parenting classes/seminars	0 (0)	0 (0)
Total hours of services	312.38 (331.70)	661.64 (657.99)
	N (%)	*N* (%)
Child's gender		
Male	11 (78.6)	6 (60)
Female	3 (21.4)	4 (40.0)
Child's ethnicity		
Hispanic	1 (92.9)	3 (30)
Non-Hispanic	13 (7.1)	7 (70)
Parent's gender		
Male	3 (21.4)	2 (20.0)
Female	11 (78.6)	8 (80.0)
Family income		
Less than US$75,000	8 (57.1)	4 (40.0)
US$75,000 or more	6 (42.9)	6 (60.0)
Parent's education		
High school	0 (0.0)	2 (20.0)
Some college	2 (14.3)	2 (20.0)
College degree	6 (42.9)	3 (30.0)
Graduate degree	6 (42.9)	3 (30.0)
Parent's employment		
Not employed outside the home	8 (57.1)	5 (50.0)
Part- or full-time employment	6 (42.9)	5 (50.0)
Parent's Internet use		
Low Internet use	7 (50.0)	6 (60.0)
High Internet use	7 (50.0)	4 (40.0)

Note. P-ESDM = parent training in the Early Start Denver Model.

Program website use. Analyses used a linear mixed model approach. Separate models were run for total time, time on each feature with main effects of time and group, and a group by time interaction. P-ESDM parents were more likely to use the website than community parents, $F(1, 33.9) = 21.69$, $p < .001$, and more so during post-treatment than follow-up, $F(1, 33.9) = 11.69$, $p < .01$, as shown in Figure 2. In Table 2, P-ESDM parents interacted most often with the topic modules and more so than the resource center for community parents during post-treatment and not follow-up, $F(1, 27.5) = 12.39$, $p < .01$. This model had a significant interaction effect, $F(1, 27.5) = 6.47$, $p < .05$. P-ESDM parents also spent more time emailing

their therapist, $F(1, 24.5) = 5.16$, $p < .05$, and recording intervention usage and children's learning progress than community parents, $F(1, 27.7) = 7.00$, $p = .01$.

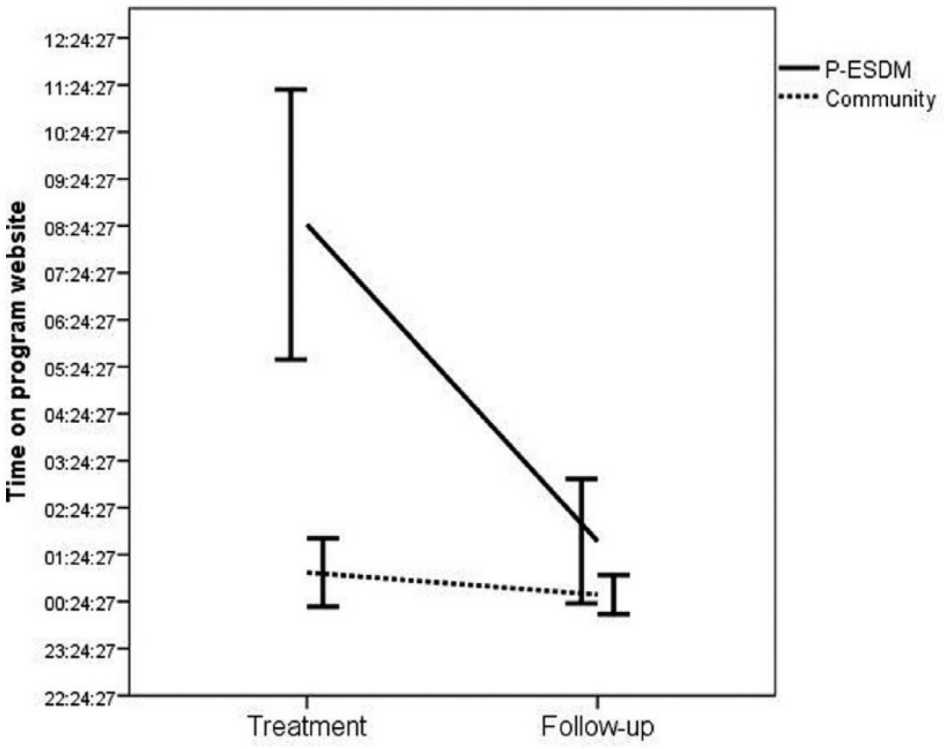

Figure 2. Group engagement time on website.
Note. P-ESDM = parent training in the Early Start Denver Model.

Table 2. Parent Outcome Measures.

	P-ESDM			Community		
	Pre	Post	Follow-up	Pre	Post	Follow-up
Website engagement time *M* (*SD*)						
ESDM topic modules	—	5:01:44 (2:38:22)	1:14:56 (2:55:14)	—	—	—
Goal tracking	—	2:42:51 (2:51:37)	0:38:25 (0:56:43)	—	0:25:18 (0:45:21)	0:17:23 (0:26:03)
Internal email	—	0:55:19 (1:10:16)	0:08:16 (0:12:09)	—	0:12:21 (0:16:30)	0:00:57 (0:00:46)
Autism resources	—	0:09:42 (0:24:48)	0:18:30 (0:23:59)	—	0:21:08 (0:27:05)	0:29:52 (0:37:13)
Message board	—	0:06:32 (0:10:17)	0:12:36 (0:16:27)	—	0:14:19 (0:26:07)	0:06:49 (0:11:00)
Media sharing	—	0:09:55 (0:17:26)	0:00:33 (0:00:19)	—	0:00:24 (0:00:13)	0:00:39 (0:00:05)
Calendar	—	0:01:15 (0:01:37)	0:01:03 (0:00:38)	—	0:02:21 (0:02:19)	0:00:44 (0:00:05)
P-ESDM fidelity						
N met criteria	0	5	9	0	2	2
N did not meet criteria	14	9	5	10	8	8

Note. P-ESDM = parent training in the Early Start Denver Model.

Program satisfaction. P-ESDM parents reported significantly higher satisfaction and confidence from their sessions and website usage than community parents, $F(1, 24) = 11.16$, $p < .01$. They were more likely to notice positive changes in their children's behavior and to feel encouraged by their intervention usage online tracking of progress. Community parents focused on the website resources related to teaching self-help and coping skills to children. Both groups positively rated videoconferencing sessions and felt well-supported by their therapists. Community parents regretted not having weekly sessions as a result of how helpful and productive they found the time with their therapist. Both groups wished for more time throughout to use the

website and the option to communicate directly with other enrolled parents. Two P-ESDM parents reported occasional technical difficulty when they could not log into or use certain features of the website.

Social communication behaviors. The analysis used a linear mixed model approach. Separate models were run for each variable with main effects of group assignment, assessment phase, and a group-by-time point interaction. Chronological age, gender, and total community-delivered intervention hours were also tested within the models as covariates. Age was the only significant covariate within the model of spontaneous communication, $F(1, 69.9) = 18.99$, $p < .001$, in which older children tended to produce more spontaneous communication. Overall, children in the P-ESDM group produced higher rates of imitation, $F(1, 64.5) = 4.83$, $p < .05$; P-ESDM $M = 1.37$, $SD = 1.02$, Community $M = 0.91$, $SD = 0.78$, and both groups increased their imitation across time, $F(2, 45.7) = 4.52$, $p < .05$. There were no significant interaction effects or covariates. There were also no significant main effects, interaction effects, or covariates in the model with initiated joint attention behaviors as the dependent variable.

Discussion

Early intervention models that are both effective and accessible are becoming an ever pressing need as more children with ASD are identified. Telehealth may help parents use early intervention to further their children's learning. The current study tested telehealth parent training in the P-ESDM followed by secondary changes to children's social communication compared with community early intervention.

At baseline, the two groups of parents did not differ across demographic variables presented in Table 1, and all showed low levels of P-ESDM fidelity. At post-treatment, 36% of P-ESDM parents compared with 20% of community treated parents met fidelity. When examined 3 months later at follow-up, 64% of P-ESDM parents met fidelity in contrast to no fidelity change among the community treated parents. This study contributes to the few randomized controlled trials that tested parents' direct ability, rather than mere knowledge, of how to use an intervention with their child from telehealth training. Furthermore, the parent gains reported here are in contrast to Rogers, Estes, et al.'s (2012) randomized controlled findings that showed no fidelity difference among center-based P-ESDM training to treatment-as-usual community early intervention. Although it was not the scope of this study to compare telehealth with center-based training, Rogers, Estes, et al. (2012) discussed the importance of providing parents with additional learning resources and opportunities for practice in order for low-intensity training approaches to produce noticeable behavioral changes. For some parents, telehealth may provide additional supports when the clinician can observe direct interaction skills from the families' home and flexible learning options are available online at any time of day. It will be an important direction in future research to compare the learning benefits with drawbacks of telehealth versus traditional, in-person training.

However, the findings also raise important questions of why not all P-ESDM treated parents benefited and why similar fidelity gains occurred for at least two of the community parents. What we know from the heterogeneity in ASD suggests that any specific intervention may lead to beneficial outcomes in some children but not others. The same can be said with teaching parents to deliver complex intervention strategies intended to target multiple skill domains in young children's development. Not all parents may prefer to use or benefit from telehealth training and may require a more traditional and/or intensive approach to be effective with the intervention (Vismara et al., 2013).

Another consideration may relate to the coaching structure of the telehealth-delivered sessions. P-ESDM parents were exposed to a new P-ESDM topic each week built on the understanding they could use earlier taught concepts without difficulty. This pace may have been difficult for some parents to manage. We also do not know whether parents need to be taught all P-ESDM topics to have a desirable effect on children's learning. There are data from a few randomized controlled studies suggesting that a skill-specific curriculum

may help parents not only improve that targeted behavior but also contribute to other important skills to children's development (Kasari, Freeman, & Paparella, 2006; Kasari, Gulsrud, Freeman, Paparella, & Hellermann, 2012; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Schertz, Odom, Baggett, & Sideris, 2013). A comparison of a skill-focused curriculum with broader developmental content such as the P-ESDM may help to explain *how* and in *what* manner an intervention produces downstream effects from parents' implementation to noticeable developmental outcomes for children with ASD.

For the community treated group, two of the parents' interaction skills naturally met the P-ESDM approach. It is not uncommon for other play-based intervention models to follow children's preferred interests and to use everyday activities to encourage learning. Parents may have observed or received support on how to use similar strategies, given that many Birth to Three Services adopt a family-centered approach from the Part C federal requirements.

Parent gender was the only demographic related to fidelity. Mothers were more likely to reach the criterion for correct implementation of the P-ESDM than fathers. It is difficult to draw firm conclusions about this finding given that more mothers than fathers enrolled in the study, and we did not inquire or assess reasons for which parent chose to participate. This has been the trend with parent training studies in which mothers tend to be the more common intervening parent. Research regarding parent training in ASD among fathers remains sparse for this reason. Parent training studies that have focused on fathers suggest they can be taught skills (i.e., following the child's lead, imitation, animation, narration, expectant waiting) similar to mothers for interacting and promoting social reciprocity skills in their children with autism (Bendixen et al., 2011; Elder et al., 2011). Further study is needed to test training methods with fathers that will solicit and maintain their involvement and the extent to which strategies may need to be tailored to reflect parental gender and roles.

Although P-ESDM treated parents used the website more often and with higher satisfaction, their engagement did not contribute to fidelity. While self-guided instruction may increase parents' understanding of autism intervention (Granpeesheh et al., 2010; Hamad, Serna, Morrison, & Fleming, 2010), how this knowledge transfers directly into actual use of the skills is presently unknown. The literature on adult learning suggests that active participation and comparing current performance with a standard set of skills is critical to understanding something new and becoming good at it (Bransford, Brown, Cocking, & Donovan, 2000; Donovan, Bransford, & Pellegrino, 1999; Knowles, 1984). This may explain why parents spent the most time online using the P-ESDM topics, early intervention resources, and goal tracking program. Interactive tools may help parents process and make sense of the information if and when therapist support (either direct or online) is limited or not available. Currently, we are comparing the standard version of the P-ESDM website (as described in this study) with a new version in which the amount of topic information and ability to track and evaluate intervention usage depends on parents' progress with each topic. Based on how parents identify and report experiences with each topic, the new version of the website customizes feedback to acknowledge or support parents' intervention practice with additional tips. These results may help to uncover program characteristics associated with more effective online learning for parents of children with ASD.

There was no treatment effect for children's social communication. The P-ESDM group demonstrated higher rates of imitation; however, this group difference was consistent across all time points and, therefore, cannot be attributed to the intervention. Both groups increased their rates of imitation at the same rate and older children demonstrated more spontaneous communication. Maturation across the 12-week intervention period may have acted as a confounding variable and contributed to overall skill improvement for both groups. The fact that children were already participating in a number of community programs also made it difficult to tease out effects specific to the P-ESDM. Other randomized controlled studies of parent-mediated interventions have reported similar results of parent behavior change but no overall group

differences on children's developmental scores (Carter et al., 2011; Green et al., 2010; Oosterling et al., 2010; Siller, Hutman, & Sigman, 2013). The absence of a treatment effect brings into question the role of at least short-term parent training models on children's direct symptoms compared with more intensive, therapist-delivered intervention. Rogers, Estes, et al. (2012) proposed that children whose parents take between 8 and 9 weeks to reach fidelity may not receive the "full dosage" of the intervention until the very end of the 12-week measurement period. More time may need to pass for changes in parents' skills to measurably affect child behaviors and to see noticeable gains in children's development from parent-mediated intervention. Further efforts are necessary to continue to improve the ability of early autism intervention programs to support parents, given their greater risk for stress, depression, and feelings of isolation, as well as improve child outcome variables.

Several study limitations are acknowledged. Although all diagnoses were made with the ADOS, there may have been variations in how the protocols were administered by community practitioners, which raises the possibility for inaccurate diagnoses. However, these are the families with whom the intervention is likely to be used in community settings, and therefore, including them potentially increases the ecological validity of the findings. Second, our study resources precluded us from offering weekly sessions to both groups and from directly testing children with standardized measurements. A stronger research design would include the same schedule of videoconferencing sessions between groups to allow for more accurate comparison of fidelity performance and potential gains from children. Third, we were unable to control for group differences in community programs and, as a result, the amount and type of early intervention was highly diverse. Fourth, not all P-ESDM treated parents met fidelity in spite of positive satisfaction ratings with the training and program experience. Perhaps the techniques parents did gain speak to the importance of isolating specific coaching tools and content that help parents transfer knowledge into skilled practice. Finally, the study involved a large number of middle-class, well-educated parents who sought out the treatment, which can be the trend with university research programs (Brookman-Frazee, Vismara, Drahota, Stahmer, & Openden, 2009; Vismara et al., 2009).

Traditionally, parent training has been one mechanism to facilitate the speedy implementation of evidence-based interventions given that many barriers make these services inefficient, inaccessible, and/or unaffordable to families with ASD (Baggett et al., 2010; Boisvert, et al., 2010; Fixsen, Blase, Naoom, & Wallace, 2009; Stahmer & Gist, 2001; Wainer & Ingersoll, 2013). It will be necessary for future research to understand the advantages and appropriate role of telehealth parent training so as to eliminate or at the very least reduce these barriers. Parent training whether provided in-person or remotely is not intended to replace or take over professionally delivered services. Rather, its purpose is to support and equip parents with the tools to intervene and create natural learning moments with their child in addition to or while waiting for more intensive services to begin (Coolican, Smith, & Bryson, 2010; Stahmer & Gist, 2001; Vismara et al., 2009). Although further research is necessary to understand the benefits and limitations of telehealth, its ability to potentially make parent training more available, easier to use, and less expensive is imperative to supporting families with ASD.

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Authors' Note

Laurie A. Vismara, PhD, is now an adjunct professor at York University. Carolyn E. B. McCormick, PhD, is now a post-doctoral fellow at the Rhode Island Consortium for Autism Research and Treatment at Brown University. Katerina Monlux, MS, is now at California State University, Northridge. Anna Nadhan, BS, is now a medical doctoral candidate at the Lewis Katz School of Medicine.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Laurie A. Vismara, PhD, is an author of the parent curriculum used in this study and receives royalties from the sale of this book. No other conflicts of interest exist.

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Appendix

P-ESDM Topic Goals and Strategies.

Topic 1: Step into the spotlight: Capturing your child's attention

Goal: Increase child's attention on parent for learning.

Strategies: Identify and follow the child's interests and reduce outside distractions that may interfere with child's ability to attend and participate in learning opportunities.

Topic 2: Find the smile: Having fun with sensory social routines

Goal: Increase child's positive affect and social communicative behaviors during dyadic social games, songs, and social exchanges.

Strategies: Introduce and build a repertoire of sensory social routines to optimize child's energy level for learning.

Topic 3: It takes two to tango: Building back-and-forth interactions

Goal: Increase opportunities for child learning within daily play and caregiving activities.

Strategies: Create a four-part framework to building joint activities and taking turns with the child; put simple words to games, songs, and activities; create new learning opportunities with additional materials, actions, and steps to the play; end the activity and transition together to the next activity.

Topic 4: Talking bodies: The importance of nonverbal communication

Goal: Increase child's nonverbal communication skills for promoting speech and language.

Strategies: Add gestures, facial expressions, and simple language to family routines and identify communicative opportunities in which the child's body language can be used to express desires, feelings, and interests.

Topic 5: Do what I do: Helping your child learn by imitating

Goal: Increase child's imitation of sounds, gestures, facial expressions, actions, and words.

Strategies: Imitate child's play, sounds/vocalizations, and movements and encourage imitation back from child inside toy play, songs, social games, and other daily activities.

Topic 6: Let's get technical: How children learn

Goal: Teach the basic strategies of applied behavior analysis for enhancing child learning.

Strategies: Identify and use antecedent-behavior-consequence teaching principles for understanding child behavior and teaching new skills.

Topic 7: The joint attention triangle: Sharing interests with others

Goal: Increase child's interest to share objects and activities with others.

Strategies: Give, show, and point to objects and pictures for sharing comments and enjoyment.

Topic 8: It's playtime

Goal: Increase learning opportunities in parent–child toy play and support constructive, varied, and independent toy play.

Strategies: Use play to build new skills, to practice skills already developed, including social skills, and to create new ways to play with toys independently and with others.

Topic 9: Let's pretend

Goal: Develop child's pretend play that is spontaneous, creative, and flexible.

Strategies: Use imitation to teach animate play, symbolic substitution, and combinations of multiple symbolic play actions to make scenes from life activities.

Topic 10: Moving into speech

Goal: Increase child's use and understanding of speech through active engagement with people, their facial expressions, and their gestures.

Strategies: Develop vocal games to increase child's sounds and build up child's vocabulary with more opportunities for listening and responding to language.

Note. P-ESDM = parent training in the Early Start Denver Model.