A systematic review of training programs for parents of children with autism spectrum disorders: Single subject contributions

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Abstract

Aim: The purpose of this systematic review was to examine research utilizing single subject research designs (SSRD) to explore the effectiveness of interventions designed to increase parents’ ability to support communication and social development in children with autism spectrum disorders (ASDs).

Method: Included studies were systematically assessed for methodological quality (Logan et al., 2008; Smith et al., 2007) and intervention effects. Data examining participant characteristics, study methodology, outcomes, and analysis were systematically extracted.

Results: Eleven SSRD parent-training intervention studies examining 44 participants with ASD were included. Overall, the studies were of moderate quality and reported increases in parent skills and child language and communication outcomes.

Interpretation: The results supported by improvement rate difference (IRD) analysis indicated several interventions demonstrated positive effects for both parent and child outcomes. However, limited generalization and follow-up data suggested only one intervention demonstrated parents’ accurate and ongoing intervention implementation beyond training.

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Introduction

Children with autism spectrum disorders (ASD), a class of neurodevelopmental disorders, are at increased risk for difficulties with language, social, and emotional development (Wetherby, 2006). Evidence suggests that, as is the case with typically developing peers, language and social development in children with ASD is influenced by both the amount and type of parent interactions they experience (Siller and Sigman, 2002). Accordingly, education and training programs have been developed for the parents of children with ASD to provide them with knowledge and skills to promote child development and communicative competence (Mahoney et al., 1999). The implementation of such programs has been shown to impact both parent and child behaviours (McConachie et al., 2005; Stahmer and Gist, 2001). For example, positive effects on parent behaviours including decreased parent stress (Moes, 1995) and increased positive affect (Koegel et al., 1996b) have been reported in the literature. Similarly, positive impacts on child behaviours have been documented with regard to increased communication skills (Drew et al., 2002; Stahmer and Gist, 2001), increased vocabulary (Girolametto et al., 2006; McConachie et al., 2005) and increased imitative behaviours (Ingersoll and Gergans, 2007).

Recent reviews of ASD parent training programs have been narrative in nature, often excluding studies utilizing single study research designs (SSRDs) (e.g. Justice and Pence, 2007; Matson et al., 2009; Meadan et al., 2009). In a recent systematic review, Lang et al. (2009) examined 11 parent-training studies; however, the review lacked a systematic examination of the methodological quality of the included studies, which is considered a key component of such a review. A second systematic review examined studies utilizing group designs but excluded SSRDs (McConachie and Diggle, 2007). SSRDs are frequently used to evaluate interventions for individuals with ASD because they can provide clear, visual evidence that an intervention has a replicable effect across a small number of participants (Smith et al., 2007). Multiple SSRDs related to a specific intervention can strengthen empirical support by replicating results across participants with varying backgrounds (e.g. age, education, etc.). SSRDs are also considered the first level of research used to identify ‘treatment responders’ and ‘treatment non-responders’ on an individual basis (Yoder and Compton, 2004: 163). The use of SSRDs is particularly fitting to examine treatments for individuals with ASD, given the wide heterogeneity of this population. Although group designs are necessary to identify the predictors of treatment response (Yoder and Compton, 2004), such designs have ‘revealed little about what specific treatments or components of intervention programs result in clinically significant improvements in communication development’ (Goldstein, 2002: 390). Thus, for the present review, we endeavored to: (1) identify SSRDs that have examined the effectiveness of parent education programs designed to support the language and/or social development of children with ASD and (2) evaluate the methodological quality of the evidence presented in these studies, using two published quality of conduct rating scales (Logan et al., 2008; Smith et al., 2007).
Method
Search strategy
In May 2007, a comprehensive search of 22 electronic databases (e.g. MEDLINE, PsycINFO) covering biomedical, educational, and psychological literature was conducted as part of a systematic review examining social and communicative interventions for individuals with ASD. Hand searches of the Journal of Speech-Language Pathology and Applied Behaviour Analysis (2006), and the Journal of Early and Intensive Behaviour Intervention (2004–2006) were also conducted. In February 2009, the search was updated to include articles from May 2007 to February 2009. In addition, the reference lists of relevant articles and reviews were examined to identify additional articles. Grey literature, such as technical reports and dissertations as well as unpublished documents were not included. A detailed description of the search strings used in MEDLINE and a full list of the electronic databases can be found in Appendix A.

Study selection
Two independent reviewers examined the literature and applied a set of inclusion criteria to determine eligibility of studies for the review. In the case of articles in which multiple experiments were reported (e.g. Koegel et al., 1978), the experiments were separated and evaluated individually for inclusion. The following inclusion and exclusion criteria were applied to all studies:

- Studies that utilized an SSRD (e.g. multiple baseline, repeated measures, or alternating treatment designs) were included. Studies that applied pre-experimental designs (e.g. AB, pre–post test, and case study designs) were excluded (e.g. Girolametto et al., 2006).
- Studies with participants of any age who were diagnosed with autistic disorder/autism, pervasive developmental disorder-not otherwise specified (PDD-NOS), or Asperger’s syndrome were included, regardless of whether they had co-morbid diagnoses (e.g. mental retardation). Studies with individuals with Rett’s disorder or childhood disintegrative disorder (CDD) were excluded, due to the different clinical trajectories of these diagnoses.
- Studies that examined an intervention designed to increase parents’ ability to support their child with ASD were included. Studies examining an intervention designed to increase the skills of teachers or paraprofessionals were excluded (e.g. Russo and Koegel, 1977).
- Studies that specified children’s social and/or vocal communication skills as primary outcomes were included. Studies examining child behaviours other than communication or social skills were excluded (e.g. Wildman and Simon, 1978).
- Studies whose outcomes included at least one measure of parent behaviour were included. Studies that did not provide data specific to parent outcomes were excluded (e.g. Kohler et al., 2001).
- Studies that provided numeric graphical data that could be used to calculate the improvement rate difference (IRD) (Parker et al., 2009) for at least one child and one adult participant were included. Studies in which this information was not available were excluded (e.g. Strain and Danko, 1995).
- Studies that were published in the English language were included; all other studies were not.
Reasons for exclusions were documented. A complete list of included and excluded articles is available from the first author.

**Quality assessment**

The methodological quality of the studies was evaluated by two independent reviewers, using two quality of conduct evaluation scales. The American Academy of Cerebral Palsy and Developmental Medicine (AACPDM) scale (Logan et al., 2008) consists of 14 questions (each assigned one point) that address the selection and description of participants, research design, components of the intervention, and accuracy of measurement. A score of 11 to 14 points indicates a study of strong quality, a score of 7 to 10 points represents a study of moderate quality, and a score of 6 or fewer points represents a study of low quality. To complement this scale, a seven-item quality criteria scale for SSRDs (Smith et al., 2007) was also used to examine indicators that were not included in the AACPDM scale, such as intervention fidelity and generalization of effects. A numeric score for this scale was also calculated. Interrater reliability was 93.9% on the AACPDM scale and 89.8% on the Smith et al. (2007) scale. Disagreements between reviewers were solved through dialog and evaluation by a third reviewer, if necessary (Cochrane Collaboration, 2009).

**Data extraction, analysis, and presentation of results**

Data regarding participant demographics, research design, intervention components, outcomes, analysis, and conclusions were systematically extracted using a pretested data extraction form (Ospina et al., 2008). One reviewer extracted the data and a second reviewer verified the accuracy and completeness of the data. Discrepancies in data extraction were resolved by consensus between the data extractor and the data verifier. Extracted data were summarized in evidence tables. Full copies of the tables may be obtained from the first author. Further, IRD was calculated for all child and parent dependent variables, according to procedures described by Parker et al., (2009). IRD is commonly used in medical research (also termed ‘risk difference’) and can be calculated by visual analysis (Parker et al., 2009). IRD allows one to ‘express the difference in participants’ successful performance (improvement rate) between baseline and intervention phases of a study’ (Parker et al., 2009: 135). Benchmarks to denote the size of the treatment effect are also available with IRD where a large effect equals 0.71 and above, a moderate effect equals 0.51 to 0.70 and a small effect is 0.50 and below (Parker et al., 2009). This nonparametric method was selected in preference to parametric methods, such as regression, because data in the SSRD studies under review did not meet parametric data assumptions of normality, equal variance, and serial independence (Parker et al., 2007).

Debate exists within the extant literature as to which of the several overlapping data methods should be used. Risk difference or IRD has been used widely in evidence-based medical research and has also been recommended by the Cochrane Collaboration (2006), however, it is relatively new to the education field. IRD has multiple advantages in its application to SSRDs including: ease of interpretation as the difference in improvement rates between baseline and treatment phases; hand calculation from visual analysis; limited data distribution assumptions and the ability to calculate confidence intervals due to known distribution; and use in evidence-based medical research (Parker et al., 2009).
IRD is also highly correlated with percentage of all non-overlapping data (PAND), *phi*, and percentage of non-overlapping data (PND) (Parker et al., 2009).

**Results**

The larger systematic review on which this sub-study was based produced 19,514 total citations related to social and communication interventions for individuals with autism. After removal of duplicates, reviews, and irrelevant papers based on titles and abstracts, two reviewers assessed a total of 1009 articles and included 265 of these in the larger review. Of these studies, 11 parent training studies that were conducted between 1988 and 2009 and that met the inclusion criteria were included in this review.

**Participant characteristics**

Forty-seven child participants and their primary caregivers were included in the 11 studies that were reviewed. Forty-four of the children had a diagnosis on the autism spectrum and the other three were diagnosed with mental retardation (Lafasakis and Sturmey, 2007: participant 2), Down syndrome (Lafasakis and Sturmey, 2007: participant 3) and ‘autistic-like symptoms’ (Laski et al., 1988: participant 8). Only data from the 44 individuals with ASD and their primary caregivers (at least one per child) were analyzed in this review. Of the 44 children, 36 were diagnosed with autism, 5 with ASD, 2 with PDD-NOS, and 1 with Asperger’s syndrome. Most diagnoses were made using *Diagnostic and Statistical Manual of Mental Disorders* (DSM)-IV criteria (*n* = 15); however, DSM-IV-TR (*n* = 3) criteria, the Childhood Autism Rating Scale (Schopler et al., 1988) (*n* = 5), and the Autism Diagnostic Observation Schedule (Lord et al., 2003) (*n* = 7) were also used. Diagnoses were made by professionals independent of the intervention study in six of the articles (*n* = 24). Participants were primarily preschool-aged children (*n* = 26); however, the samples varied in chronological age from 10 to 112 months, with a median age of 43 months. Participants’ language levels were derived from standardized tests and reported in seven studies; the difference between participants’ chronological and language age ranged from 6 to 25 months in these studies. Only one participant was reported to have a co-morbid diagnosis of severe mental retardation (Crockett et al., 2007); however, IQ scores reported in Kaiser et al. (2000) using the Merrill-Palmer Scale of Mental Tests (Stutsman, 1948) indicated that an additional two participants (P4 and P6) also had severe mental retardation. Finally, the ethnicity of the participants, which was described in only two studies (Nunes and Hanline, 2007; Vismara et al., 2009), indicated that six participants were Caucasian, two were Hispanic, and one was African American.

Very few studies described characteristics of the primary caregivers who participated in the intervention training, aside from their relationships to the children. The primary caregiver engaged in the training was usually the mother, with the addition of fathers in two studies and one grandmother. Vismara et al. (2009) noted that other caregivers (e.g. babysitters, other family members) were invited to attend the training but did not report whether or not they participated. Four studies described the level of education attained by the primary caregiver (Koegel et al., 2002; Lafasakis and Sturmey, 2007; Nunes and Hanline, 2007; Vismara et al., 2009), indicating that 13 participants had completed high school degrees, 1 had attended some university, and 11 had attained university or college degrees. Two parents held medical degrees and another held a master’s degree.
Socioeconomic status was not reported, aside from two families that were identified as being ‘low income’ (Lafasakis and Sturmey, 2007; Nunes and Hanline, 2007).

**Target behaviours: parents**

The majority of parent/caregiver behaviour outcomes of interest were related to their ability to implement either a manualized intervention program encompassing multiple strategies (e.g. Kaiser et al., 2000; Koegel et al., 2002; Vismara et al., 2009) or to utilize specific techniques or strategies (e.g. Crockett et al., 2007). In the case of two studies (Laski et al., 1988; Rocha et al., 2007), parents’ verbalizations and bids for joint attention with their children were the outcome measures of interest. In two additional studies (Kaiser et al., 2000; Koegel et al., 2002), parent affect during parent–child interactions and parent satisfaction with the procedures were also examined.

**Target behaviours: children**

Child outcomes of interest were related to social skill and/or language/communication skill development. The majority of studies examined the impact of the parent education intervention on both social and communication target skills, including spontaneous verbal utterances, verbal imitation, communication turns, labeling, and appropriate social behaviour (Crockett et al., 2007; Kaiser et al., 2000; Symon, 2005; Vismara et al., 2009). Communication outcomes alone, which included expressive verbal communication, vocalizations, and the frequency of single word utterances, were examined in three studies (Laski et al., 1988; Kashinath et al., 2006; Koegel et al., 2002). Further, social skills including imitation skills (e.g. object, gestural/motor, verbal) were examined in two studies (Ingersoll and Gergans, 2007; Lafaskis and Sturmey, 2007) as well as responding to and initiating joint attention behaviours, which was examined in one other study (Rocha et al., 2007).

**Intervention**

Parents and other primary caregivers were instructed to use a variety of intervention techniques designed to increase the social and/or communication skills of their children with ASD. Four of the articles examined intervention programs which are manualized whereby the intervention procedures are described in a replicable written protocol, including Pivotal Response Treatment (PRT) (Koegel et al., 2002; Symon, 2005), the Natural Language Paradigm (NLP) (Laski et al., 1988), and the Early Start Denver Model (ESDM) (Vismara et al., 2009). Other interventions included discrete trial teaching (DTT) (Crockett et al., 2007; Lafasakis and Sturmey, 2007), Reciprocal Imitation Training (RIT) (Ingersoll and Gergans, 2007), milieu teaching (Kaiser et al., 2000), joint attention training (Rocha et al., 2007), parent-implemented augmentative and alternative communication (AAC) (Nunes and Hanline, 2007) and general case teaching (Kashinath et al., 2006).

**Research design**

All of the studies included in this review utilized a multiple baseline design; eight applied a concurrent multiple baseline design and the remaining three employed non-concurrent multiple baselines (Koegel et al., 2002; Symon, 2005; Vismara et al., 2009). It is notable
that two studies (Ingersoll and Gergans, 2007; Kaiser et al., 2000) employed a randomized multiple baseline design in which participants’ baseline lengths were randomly assigned, thereby increasing the rigor of the design.

**Measures**

Across the studies included in this review, parent behaviours were quantified as frequency counts of correct strategy use or percentages of correct implementation over a set period of time. Child behaviours were measured via frequency counts (e.g. the number of spontaneous verbalizations per session) and/or the percent occurrence of desired behaviours within a set time interval (e.g. the percentage of 30-second intervals during which the child responded to a parent’s bid for joint attention).

Three interventions utilized manualized protocols to measure implementation fidelity of the parent training (for NLP, Koegel et al., 1987; for PRT, Koegel et al., 1989; and for ESDM, Rogers and Dawson, 2010). In these studies, parent implementation fidelity was measured by coding videotapes of parent training sessions in 60-second intervals against the established criteria. In three additional studies (Crockett et al., 2007; Kaiser et al., 2000; Lafasakis and Sturmey, 2007), parent implementation fidelity was examined from videotapes using otherwise unpublished rating scales and coding protocols. In all cases, examination of parent intervention implementation fidelity allowed the researchers to demonstrate that parents learned the intervention strategies and were able to implement them accurately with their children, independent of training sessions, for at least a 10-minute consecutive period. In two studies, parent affect and satisfaction data were collected via a parent report rating scale (Koegel et al., 2002) or a parent satisfaction questionnaire (Kaiser et al., 2000).

**Quality of conduct**

All studies were rated as ‘moderate’ in quality on the 14-point AACPDM scale, with scores ranging from 7 to 10 points (median = 8 points). A score of 10 points, the highest quality of conduct score, was assigned to two studies (Ingersoll and Gergans, 2007; Koegel et al., 2002). A score of 10 points is only one point short of a score of ‘strong’ quality. One study (Crockett et al., 2007) earned the lowest quality score of 7/14 points. On the seven-point Smith et al. (2007) scale, studies obtained scores ranging from 1 to 4 points. Table 1 includes a summary of the overall quality of conduct scores on the AACPDM and Smith et al. scales, and Table 2 summarizes scores for the individual quality criteria found on both rating scales.

**Outcomes**

**Summary.** Each of the included studies examined several parent and several child outcomes, usually across settings, activities, or strategies (see Tables 1 and 3). Five studies (Koegel et al., 2002; Lafasakis and Sturmey 2007; Laski et al., 1988; Symon, 2005) obtained IRD scores of 0.71 or above (reflecting ‘large’ treatment effects (Parker et al., 2009)) post intervention. These studies examined ESDM, PRT, NLP, and DTT interventions; and included parent fidelity and parent verbalization outcomes as well as child imitation, expressive verbal, and social behaviour outcomes. Kaiser and colleagues’ (2000) examination of milieu training received IRD scores of 0.51 to 0.69 reflecting ‘moderate’ treatment effects (Parker et al., 2009) on outcome variables post treatment. Three studies examining DTT (Crockett et al., 2007),
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Design</th>
<th>Intervention</th>
<th>Outcome</th>
<th>IRD and 85% CI</th>
<th>Methodological quality</th>
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<tr>
<td>Crockett et al. (2007)</td>
<td>2 preschool-aged males; autism; P1 co-morbid severe MR</td>
<td>Concurrent MB</td>
<td>Discrete Trial Teaching (Traditional Behavioural)</td>
<td>Correct/Incorrect/ Prompted Responding Including Verbal Imitation, Writing, Labeling</td>
<td>Correct Responding: P1 Across 4 tasks: 0.10 (0.09, 0.12) small P2 Across 3 tasks: 0.50 (0.43, 0.57) small Incorrect Responding: P1 Across 4 tasks: 0.20 (0.17, 0.23) small P2 Across 3 tasks: 0.50 (0.43, 0.58) small Prompted Responding: P1 Across 4 tasks: &lt;0 no effect P2 Across 3 tasks: 0.33 (0.28, 0.38) small</td>
<td>AACMPDM: moderate (7); Smith (1)</td>
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<td>Ingersoll and Gergans (2007)</td>
<td>2 preschool-aged males and 1 preschool-aged female; diagnosed with autism using DSM IV-TR, severity all mild-moderate; Developmental age: P1:15 m, P2:15 m, P3:22 m</td>
<td>Randomized Concurrent MB</td>
<td>Reciprocal Imitation Training (Natural Behavioural)</td>
<td>Spontaneous Imitation (Object and Gesture)</td>
<td>Spontaneous Object Imitation (n = 3): Treatment: 0.25 (0.21, 0.29) small Generalization treatment: 1.00 (0.85, 1.00) large Generalization follow-up: 1.00 (0.85, 1.00) large Spontaneous Gesture Imitation (n = 1): Treatment: 0.62 (0.53, 0.72) moderate Generalization treatment: 1.00 (0.85, 1.00) large Generalization follow-up: &lt;0 no effect</td>
<td>AACPDPM: moderate (10); Smith (2)</td>
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<td>Study</td>
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<td>Kaiser et al. (2000)</td>
<td>6 School age males; independent diagnoses; Autism (3 Participants), Asperger's (1), PDD (2); IQ (Merrill-Palmer): P1:82, P2:85, P3:61, P4:&lt;50, P5:68, P6:&lt;50</td>
<td>Randomized Concurrent MB</td>
<td>Milieu Teaching (Natural Behavioural)</td>
<td>Frequency of Communication Target Use</td>
<td>Frequency of Communication Target Use; Treatment: 0.61 (0.51, 0.69)</td>
<td>AACPDM: Moderate (8); Smith (3)</td>
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<td>Kashinath et al. (2006)</td>
<td>4 Pre school (3 males; 1 female) and 1 school-aged male; autism; severity: P1, P3:mild-moderate, P2, P4, P5:severe</td>
<td>Concurrent MB</td>
<td>General Case Teaching Approach (Natural Behavioural)</td>
<td>Frequency of Child Communication Outcomes (Gestures to Multi Word Vocalizations)</td>
<td>Frequency of Gestures (n = 1); Treatment: 0.33 (0.28, 0.38)</td>
<td>AACPDM: moderate (9); Smith (4)</td>
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<tr>
<td>Koegel et al. (2002)</td>
<td>4 Preschool children and 1 school-aged child (3 females, 2 males); ASD independently diagnosed using DSM-IV</td>
<td>Non concurrent MB</td>
<td>Pivotal Response Treatment (Natural Behavioural)</td>
<td>Verbal Responses</td>
<td>Number of Child Verbal Responses: Treatment: 0.90 (0.76, 1.00)</td>
<td>AACPDM: moderate (10); Smith (4)</td>
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Table 1 Continued

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<th>Study</th>
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<tr>
<td>Lafasakis and Sturmey (2007)</td>
<td>3 preschool-aged males; Diagnosis: P1 autism, P2,P3: No autism; SES: all families low income</td>
<td>Concurrent MB</td>
<td>Behavioural Skills Training, Discrete Trial Training (Traditional Behavioural)</td>
<td>Child's Correct Responding (Imitation) of Physical Model</td>
<td>Gross Motor Imitation: 0.87 (0.74, 1.00) <strong>large</strong></td>
<td>AACPDM: moderate (9); Smith (3)</td>
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<td>Laski et al. (1988)</td>
<td>1 Preschool and 7 school-aged children (7 males, 1 female); Autistic-like (1); independent diagnosis of Autism (7); developmental age: P1:32, P2:37, P3:20, P4:34, P5:37, P6:44, P7:56, P8:79</td>
<td>Concurrent MB</td>
<td>Natural Language Paradigm (Natural Behavioural)</td>
<td>Child Vocalizations</td>
<td>Child Vocalizations: Post treatment: 0.74 (0.63, 0.85) <strong>large</strong> Generalization: 0.68 (0.58, 0.78) <strong>moderate</strong></td>
<td>AACPDM: moderate (9); Smith (3)</td>
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<tr>
<td>Nunes and Hanline (2007)</td>
<td>1 School age male; mild-moderate autism; African American</td>
<td>Concurrent MB</td>
<td>Alternative and Augmentative Communication (Natural Behavioural)</td>
<td>Communication Turns; Imitation; AAC Use Communication Turn: Target: 0.68 (0.58, 0.79) <strong>moderate</strong> Generalization: 1.00 <strong>Large Imitative Response</strong>: Target: 0.09 (0.08, 0.11) <strong>small</strong> Generalization: 0 <strong>no effect</strong> AAC Use: Target: 0.56 (0.48, 0.61) <strong>moderate</strong> Generalization: 0 <strong>no effect</strong></td>
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<td>AACPDM: moderate (8); Smith (3)</td>
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<tr>
<th>Study</th>
<th>Participants</th>
<th>Design</th>
<th>Intervention</th>
<th>Joint attention bids</th>
<th>Phase 1 RJA (A); 0.66 (0.56, 0.73)</th>
<th>Phase 2 RJA (B): 0.52 (0.44, 0.60)</th>
<th>Phase 3 RJA (A): 0.27 (0.20, 0.34)</th>
<th>Phase 4 RJA (A): 0.24 (0.19, 0.29)</th>
<th>Phase 5 RJA (A): 0.28 (0.23, 0.34)</th>
<th>Post RJA: 0.62 (0.52, 0.71)</th>
<th>Follow-up RJA: 0.34 (0.29, 0.39)</th>
<th>Generalization Probe: 0.34 (0.29, 0.39)</th>
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<td>Rocha et al. (2007)</td>
<td>3 Preschool-aged children (2 males, 1 female); independent diagnosis by physician or psychologist of autism; developmental age: P1:18, P2:12, P3:14</td>
<td>Concurrent MB</td>
<td>Joint attention training (Natural Behavioural)</td>
<td>Joint attention bids: RJA</td>
<td>Moderate</td>
<td>Small</td>
<td>Small</td>
<td>Small</td>
<td>Small</td>
<td>Moderate</td>
<td>No effect</td>
<td>Small</td>
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<td>Symon (2005)</td>
<td>2 Preschool males and 1 school-aged male; independent diagnosis of autism using DSM-IV; Caucasian (n = 2); Asian (n = 1);</td>
<td>Non-concurrent MB</td>
<td></td>
<td>Functional Verbal Utterances and Appropriate social behaviour</td>
<td>Treatment: 0.88 (0.75, 1.00)</td>
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<td>Vismara et al. (2009)</td>
<td>Toddler and 7 preschool-aged children; autism; 7 of 8 diagnosed independently by a physician or psychologist using DSM-IV and ADOS; Ethnicity: P1, P2, P4, P6-P8: Caucasian, P3, P5: Hispanic</td>
<td>Non concurrent MB</td>
<td>Early Start Denver Model (Natural Behavioural)</td>
<td>Imitation; Attending Behaviours; initiations</td>
<td>Improvement: With parent (treatment): 0.39 (0.33, 0.45) small With parent (follow-up): 0.72 (0.62, 0.83) large With therapist (treatment): 0.27 (0.23, 0.31) small With Therapist (FU): 0.82 (0.69, 0.94) large Attending: With parent (treatment): 0.84 (0.71, 0.97) large With parent (follow-up): 0.65 (0.55, 0.74) moderate With therapist (treatment): 0.63 (0.53, 0.73) moderate With therapist (follow-up): 0.57 (0.48, 0.66) moderate Child Initiations: With parent (treatment): 0.46 (0.39, 0.53) small With parent (follow-up): 0.74 (0.63, 0.86) large With therapist (treatment): 0.39 (0.33, 0.45) small With therapist (follow-up): 0.13 (0.11, 0.15) small</td>
<td>AACPDM: moderate (8); Smith (4)</td>
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RIT (Ingersoll and Gergans, 2007), joint attention (Rocha et al., 2007) interventions demonstrated ‘small’ effects (IRD at 0.50 or less) for all or the majority of their outcome variables post treatment. Finally, three studies examining AAC (Nunes and Hanline, 2007), ESDM (Vismara et al., 2009) and general case teaching (Kashinath et al., 2006) demonstrated a mix of outcomes. Two studies (Kashinath et al., 2006; Vismara et al., 2009) demonstrate large effects on parent outcomes but mixed (small-moderate) child outcomes (communication, attending, and imitation) immediately post treatment. Nunes and Hanline (2007) found a reversed pattern of effect where small parent gains were demonstrated post intervention with primarily moderate effects for child communication outcomes.

Parents’ fidelity of intervention implementation. Five studies examined parents’ fidelity of intervention strategy implementation as a primary outcome (Crockett et al., 2007; Kaiser et al., 2000; Lafasakis and Sturmey, 2007; Symon, 2005; Vismara et al., 2009) (see Table 3). Both the Vismara et al. (2009) and Symon (2005) studies included rigorous, manualized
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<th>Study</th>
<th>Participants</th>
<th>Design</th>
<th>Intervention</th>
<th>Outcome</th>
<th>IRD and 85% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crockett et al. (2007)</td>
<td>Primary caregiver: mothers</td>
<td>Concurrent MB</td>
<td>Discrete Trial Teaching (DTT)</td>
<td>Accuracy of delivery of four components of DTT</td>
<td>0.37 (0.32, 0.42) small</td>
</tr>
<tr>
<td>Ingersoll and Gergans (2007)</td>
<td>Primary caregiver: mothers</td>
<td>Randomized concurrent MB</td>
<td>Reciprocal Imitation Training (RIT)</td>
<td>Parents’ use of RIT strategies</td>
<td></td>
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<tr>
<td>Kaiser et al. (2000)</td>
<td>Primary caregiver: mothers</td>
<td>Randomized concurrent MB</td>
<td>Milieu Teaching</td>
<td>Parents’ correct use of milieu teaching procedure; parent satisfaction</td>
<td>Correct Use of Four Milieu Procedures: Treatment: 0.54 (0.46, 0.62) moderate</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>Follow-up (6 month): 0.32 (0.27, 0.37) small</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Correct Use of Expansions: Treatment: 0.43 (0.37, 0.48) small</td>
</tr>
<tr>
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<td>Follow-up (6 month): 0.73 (0.62, 0.84) large</td>
</tr>
</tbody>
</table>
Table 3 Continued

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Design</th>
<th>Intervention</th>
<th>Outcome</th>
<th>IRD and 85% CI</th>
</tr>
</thead>
</table>
| Kashinath et al.  | Primary caregiver: mothers | Concurrent MB    | General Case Teaching Approach | Parents’ use of Environmental Arrangement and use of Time Delay          | Trained Routines: 0.85 (0.71, 0.99) large  
                    |               |                 |                              | Generalization: 0.74 (0.64, 0.84) large                        |
| Koegel et al.     | Primary caregiver: 4/5 mother and father, 1/5 mother and grandmother; Parent education: All HS degrees, eight had post HS degree | Non-concurrent MB | Pivotal Response Treatment (PRT) | Parents’ implementation of PRT techniques; Affect during parent-child interaction | PRT Techniques: Treatment: 1.00 (0.85, 1.00) large  
                    |               |                 |                              |                                                                                     | Follow-up (3 month): 1.00 (0.85, 1.00) large |
| Koegel et al.     | Primary caregiver: 4/5 mother and father, 1/5 mother and grandmother; Parent education: All HS degrees, eight had post HS degree | Non-concurrent MB | Pivotal Response Treatment (PRT) | Parents’ implementation of PRT techniques; Affect during parent-child interaction | PRT Techniques: Treatment: 1.00 (0.85, 1.00) large  
                    |               |                 |                              |                                                                                     | Follow-up (3 month): 1.00 (0.85, 1.00) large |
| Lafasakis and     | Primary caregiver: mother; SES: all families low income; Parent education: P1 nurse, P2 college, P3 HS | Concurrent MB | Behavioural Skills Training, Discrete Trial Training (DTT) | Parents’ percentage of correct use DTT strategies | Post training: 1.00 (0.85, 1.00) large  
| Sturmey (2007)    |               |                 |                              |                                                                                     | Generalization: 1.00 (0.85, 1.00) large |
| Laski et al.      | Primary caregiver: 6/7 mother, 1/7 mother and father | Concurrent MB | Natural Language Paradigm (NLP) | Parent Verbalizations | Parent Verbalizations: Post treatment: 0.78 (0.66, 0.80) large  
| (1988)            |               |                 |                              |                                                                                     | Generalization: 0.62 (0.53, 0.71) moderate |
| Nunes and Hanline | Primary caregiver: mother; parent education: HS; SES: low income, unemployed | Concurrent MB | Alternative and Augmentative Communication (AAC) | Caregiver strategies | Environmental Arrangement: Target: 0.55 (0.47, 0.63) moderate  
| (2007)            |               |                 |                              |                                                                                     | Generalization: <0 no effect |
|                   |               |                 |                              |                                                                                     | Mands: Target: 0.08 (0.07, 0.09) small  
|                   |               |                 |                              |                                                                                     | Generalization: 0.50 (0.43, 0.58) small  

(continued)
Table 3 Continued

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Design</th>
<th>Intervention</th>
<th>Outcome</th>
<th>IRD and 85% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocha et al. (2007)</td>
<td>Primary caregiver: 2/3 mother, 1/3 father</td>
<td>Concurrent MB</td>
<td>Joint attention (JA) parent training</td>
<td>Parent bids for JA</td>
<td><em>Mands/Comments with AAC: Target: 0.33 (0.27, 0.39) small</em>  Generalization: &lt;0 <em>no effect</em>  Model: Target: 0.02 (0.01, 0.03) small  Generalization: 0 <em>no effect</em>  Phase 1: 0.33 (0.28, 0.38) small  Phase 2: 0.31 (0.27, 0.36) small  Phase 3: 0.58 (0.49, 0.70) moderate  Phase 4: 0.16 (0.13, 0.18) small  Phase 5: 0.05 (0.04, 0.06) small  Post intervention: 0.31 (0.26, 0.35) small  Follow-up (interval not noted): 0.31 (0.26, 0.36) small  Generalization Probe (Gen P): Gen P treatment: 0.43 (0.36, 0.49) small  Gen P post: 0.63 (0.53, 0.72) moderate  Gen P follow-up (interval not noted): &lt;0 <em>no effect</em>  1.00 (0.85, 1.00) large</td>
</tr>
<tr>
<td>Symon (2005)</td>
<td>Primary caretaker: mothers</td>
<td>Non concurrent MB</td>
<td>Pivotal Response Treatment (PRT)</td>
<td>Parents’ fidelity of implementation of PRT</td>
<td>0.93 (0.79, 1.00) large</td>
</tr>
<tr>
<td>Vismara et al. (2009)</td>
<td>Parent education: P1, P2, P6, P8: College degree; P3, P4, P5: HS diploma, P7: master’s; at least one primary caregiver</td>
<td>Non concurrent MB</td>
<td>Early Start Denver Model (ESDM)</td>
<td>Parents’ acquisition of ESDM techniques</td>
<td></td>
</tr>
</tbody>
</table>

evaluation of fidelity at 60-second intervals. In both studies, parents demonstrated approximately 55–100% correct implementation, with 9/11 parents demonstrating stable fidelity scores of 80% or higher. The other three studies examined parents’ fidelity of implementation of selected milieu teaching strategies (Kaiser et al., 2000) and DTT strategies (Crockett et al., 2007; Lafasakis and Sturmey, 2007). Parents in the DTT studies demonstrated a range of accuracy, achieving 40% to 65% in Lafasakis and Sturmey (2007) and 25% to 100% in Crockett et al. (2007). The Kaiser et al. (2000) study also demonstrated a wide range of implementation of milieu teaching strategies accuracy across sessions (20% to 100%); however, it is notable that 4/6 parents achieved at least 80% fidelity in the final intervention session. Although parent implementation fidelity was not examined as a primary outcome measure in the remaining six studies, two of these studies (Koegel et al., 2002; Rocha et al., 2007) did report non-graphical fidelity data as a secondary variable indicating 70% to 100% fidelity of implementation.

**Generalization of parent strategy use.** Parents’ ability to use the strategies and skills in novel situations, referred to as generalization (see Table 4 for generalization and

<table>
<thead>
<tr>
<th>Article</th>
<th>Duration of intervention</th>
<th>Maintenance assessed?</th>
<th>Generalization assessed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crockett et al. (2007)</td>
<td>12–18 hours (6–9 sessions × 2 hours)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Ingersoll and Gergans (2007)</td>
<td>10.5–14.7 hours (21–22 sessions × 30–40 minutes)</td>
<td>Yes (at 1 month)</td>
<td>Yes (family home)</td>
</tr>
<tr>
<td>Kaiser et al. (2000)</td>
<td>Up to 18 hours (up to 24 sessions × 45 minutes)</td>
<td>Yes (1 per month, 6 months)</td>
<td>Yes (family home)</td>
</tr>
<tr>
<td>Kashinath et al. (2006)</td>
<td>40–60 hours (2 sessions/week for 5–6 months × 60–75 minutes)</td>
<td>No</td>
<td>Yes (different routines)</td>
</tr>
<tr>
<td>Koegel et al. (2002)</td>
<td>25 hours (5 sessions × 5 hours)</td>
<td>Yes (3 to 12 months)</td>
<td>Yes (family home)</td>
</tr>
<tr>
<td>Lafasakis and Sturmey (2007)</td>
<td>Training until parents reached 90% accuracy</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Laski et al. (1988)</td>
<td>1.25–2.25 hours (5–9 sessions × 15 minutes)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Nunes and Hanline (2007)</td>
<td>Approximately 2 hours (2 sessions × average 60 minutes)</td>
<td>No</td>
<td>Yes (different routines)</td>
</tr>
<tr>
<td>Rocha et al. (2007)</td>
<td>17 hours (51 sessions × 20 minutes)</td>
<td>Yes (at 3 months)</td>
<td>Yes (family home)</td>
</tr>
<tr>
<td>Symon (2005)</td>
<td>25 hours (5 sessions × 5 hours)</td>
<td>Yes (between 2 weeks and 3 months)</td>
<td>Yes (family home)</td>
</tr>
<tr>
<td>Vismara et al. (2009)</td>
<td>12 hours (12 sessions × 1 hour)</td>
<td>Yes (at 2 weeks and 1 month)</td>
<td>No</td>
</tr>
</tbody>
</table>
maintenance descriptions) is another important measure of the effectiveness of parent training and was examined in eight studies (Ingersoll and Gergans, 2007; Kaiser et al., 2000; Kashinath et al., 2006; Koegel et al., 2002; Laski et al., 1988; Nunes and Hanline, 2007; Rocha et al., 2007; Symon, 2005). IRD analysis indicated a range of success in generalization. Both PRT studies (Koegel et al., 2002; Symon, 2005), the general case study (Kashinath et al., 2006) and a DTT study (Lafasakis and Sturmey, 2007) obtained parent strategy generalization IRD scores indicating large treatment effects. Both the NLP (Laski et al., 1988) and joint attention (Rocha et al., 2007) studies obtained IRD scores indicating moderate effects post intervention which were not maintained when measured by Rocha et al. (2007) at follow-up. One study demonstrated a mix of success (small to large effects) in parents’ generalization across the RIT program strategies presented (Ingersoll and Gergans, 2007). Finally, the AAC study (Nunes and Hanline, 2007) obtained IRD scores indicating no effect for three parent strategies and small effects for the manding strategy. An IRD score could not be calculated for the generalization probes in the milieu training study (Kaiser et al., 2000) because the generalization sessions were not explicitly identified.

Child outcomes. With regard to child outcomes, several studies obtained IRD scores indicating large treatment effects (see Table 1). The target behaviours that achieved the highest IRD scores post treatment (0.71 and above indicating large effects) were child verbal language, child vocalizations child imitation. Child verbal language outcomes of this magnitude were found across several interventions, including DTT (Lafasakis and Sturmey, 2007), PRT (Koegel et al., 2002; Symon, 2005), and NLP (Laski et al., 1988). Mixed moderate and large effects were found for child communication frequency (Kaiser et al., 2000), child imitation, initiations and attending (Vismara et al., 2009), and communicative verbal and AAC responses (Nunes and Hanline, 2007). Several studies demonstrated mixed moderate and small effects for the following child outcomes: responding to joint attention (Rocha et al., 2007), imitation (Ingersoll and Gergans, 2007). Finally, small or no effects were found for child responding (verbal, written, imitation, labeling) in Crockett and colleagues’ (2007) examination of DTT.

Discussion
The 11 single case studies included in this review examined the impact of parent skill training interventions designed to develop the communication and social skills of children with ASD. The children included in these studies were primarily preschool-aged males diagnosed with autism. Most often, the primary caregiver trained to deliver the intervention was the child’s mother, and most studies included examination of the fidelity of implementation of the intervention strategies by the parent. Child outcome variables of interest were most often verbal utterances and imitation. Assorted degrees of positive effects on both parent and child outcomes were demonstrated for a variety of interventions including AAC, ESDM, DTT, joint attention training, PRT, NLP, milieu teaching, and general case teaching. However, regardless of the intervention, all protocols were delivered in a one-on-one fashion to parents during training that ranged between 2.5 and 25 hours in length. Overall, the studies were of moderate quality on the AACPDM (2004) scale and achieved IRD scores that ranged between ‘large’ to ‘no effect’ with a median IRD score reflecting ‘moderate’ effectiveness (Parker et al., 2009).
Although some child demographic information such as gender, chronological age, diagnosis and co-morbid diagnoses was provided, very little information regarding specific characteristics of the children and their parents/caregivers was available in the 11 studies. Thus, it is difficult to gauge the influence of parent or child characteristics on the reported success of the intervention programs that were examined. Profiles of child responders and non-responders to various intervention programs is a point of interest in the ASD treatment literature and has been examined in relation to at least one of the programs examined in this study (PRT; see Scherer and Schreibman, 2005). Responder profiles for parents and other primary caregivers who engage in training to deliver intervention to their children with ASD may be equally important, in order for clinicians to gain a better understanding of the levels of support and training that parents may require to become proficient interventionists. This information may also be of interest at the level of policy and practice.

The evidence regarding parent change provided by the studies in this review was developed from data primarily taken in clinical settings through in vivo and video coding of 3- to 15-minute observation intervals. This provides the reader with a snapshot of the behaviours of interest often within a contrived setting. It is uncertain how frequently and accurately parents are able to identify opportunities for learning in their day-to-day lives when they are taught strategies and skills only in a structured clinical setting. Few studies included in this review examined the generalization or maintenance over time of parents’ strategy use; the exceptions were the two PRT studies that provided a combination of follow-up and generalization data. PND scores for these studies indicate that PRT-trained families showed the greatest long term, flexible uptake of intervention strategies. It is notable that the two PRT studies included the greatest number of parent training hours (25 hours) (with the exception of Kashinath et al., 2006), a variable that may have influenced parent learning. The impact of longer exposure to expert clinician training on parents’ fidelity of implementation of other intervention protocols should be considered. Overall, the range of success in parents’ attempts to maintain accurate strategy implementation with their children indicates that, although parents demonstrate that they are capable of learning and appropriately applying intervention strategies in supervised clinic settings, their ability to use skills in unsupervised settings is less clear. Additional analysis of the components of intervention maintained by parents in their daily lives may reveal the skills that are maintained and the areas of implementation that require additional support services necessary for parents to maintain a high level of implementation fidelity over time.

A pattern of parent skill and child skill change fitting within Sameroff’s model of transactional development (2009) was found in several of the included studies (e.g. Koegel et al., 2002; Symon, 2005). Congruent with transactional theory, these studies report an increase in child communication and social outcomes as parents demonstrate an increase in their abilities, emphasizing the reflexive role that parents and children can play in each other’s development. Such trends were reported by Koegel et al. (2002) and Symon (2005) where positive changes in child verbal responses (IRD scores indicating large effects) occurred when parents’ skills improved (also IRD large effects).

**Contribution of the current review**

A handful of non-systematic critical reviews (e.g. Justice and Pence, 2007; Matson et al., 2009; Meadan et al., 2009) and two systematic reviews (Diggle et al., 2002; Lang et al., 2009) have previously examined parent training interventions for families of children with ASD.
The reviews each included a different array of studies based on differing inclusion criteria. Studies utilizing group designs were included by Diggle et al. (2002), Justice and Pence (2007) and Matson et al. (2009) while studies examined with SSRDs were included by Lang et al. (2009) and Meadan et al. (2009). Studies utilizing lower quality designs including AB designs (simple baseline designs) were included by Lang et al., (2009). Altogether, the reviews represent a range of interventions and methods of evaluation. Each of the reviews concludes that positive child communication outcomes and parent behaviour outcomes have been reported, however, the small sample sizes and the methodological shortcomings of the included studies limit the strength of the findings. A necessary component of a systematic review is examination of methodological quality via replicable criteria (Cochrane Collaboration, 2009). However, of these reviews, only the current review alongside Diggle et al. (2002) and Justice and Pence (2007) utilize published rating scales to assess the methodological quality of the included studies providing more detailed analysis of the strengths and weaknesses of the included studies. Combined, the past studies that examined methodological quality (Diggle et al., 2002; Justice and Pence, 2007) and the current review recommend increasing the methodological rigour of studies examining parent-training programs, further description of the participants’ characteristics as well as detailed description and evaluation of each of the individual teaching strategies that together make up each of the branded intervention approaches.

Other aspects of methodological rigour that could provide further support for the positive impact of parent-implemented intervention for children with ASD are addressed in the current review. Findings revealed that all 11 studies obtained scores of 7 to 10 points on the AACPDM (2008) indicating ‘moderate’ quality of conduct. The quality of conduct of future studies can be increased by including elements such as blind assessment, stable baseline data, increasing the number of data points per phase to at least five, reporting both inclusion and exclusion criteria, and examining interventionists’ fidelity of implementation of the training protocol. Further, while we might expect SSRDs to provide insight regarding both parent and child characteristics that may have influenced response to intervention, these details were lacking in most of the studies included in this review. Improvements in methodological quality will allow for comparisons across intervention protocols, leading to greater impact on clinical practice.

Recommended clinical practice

Supporting parents and caretakers in the development of the skills necessary to provide intervention supports for their child is one of several recommendations put forth by the National Research Council (2001). The studies included in this review demonstrate that parents have the ability to both acquire and implement intervention strategies with their children with ASD over a short period of time in a clinical setting after one-on-one training. However, the degree to which parents can be expected to extend and modify their usage of the strategies as the needs of their children grow and change over time is uncertain. It is likely that parents will require ongoing training and support in order to show continued success facilitating their child’s social and communication development over time. The amount of training and on-going support is a matter of continued research.

The studies included in this review examined interventions have been developed based on different theoretical frameworks including applied behaviour analytic theory (e.g. Crockett et al., 2007: DTT), while the interventions represent a blend of teaching techniques including
elements of applied behaviour analysis as well as social developmental perspectives that include more naturalistic teaching strategies (e.g. Symon, 2005: PRT). When examining the methods used to train parents, there are a number of similarities across the different approaches. For example, all of the approaches utilize a one-on-one clinician to parent model of teaching opposed to the use of a group training format. Further, each study involved a combination of discussion, skill modeling, review of past material, parent practice time, and in vivo feedback delivered in this one-on-one format. Future studies conducting comparative examinations of various training delivery models may provide understanding of the most efficient and effective methods of delivery.

Study strengths and limitations

The execution of a systematic search protocol is a strength of this study. The search was updated to ensure studies published over the course of the review were examined for inclusion, thereby increasing the relevance of the review. However, the exclusion of dissertations/thesis and other grey literature is a limitation in this study because previous research has reported a publication bias indicating a 9% greater treatment effect in published studies than the grey literature (McAuley et al., 2000).

A further strength of this study is the focus on the contribution of SSRDs to the field of parent intervention skill training. All of the studies utilized a form of multiple baseline design to evaluate the impact of an intervention on a new language or social skill. A multiple baseline design is well suited to establish that a particular intervention creates change in a target behaviour and to provide clear and replicable examinations of treatment effects (Smith et al., 2007).

Future directions

Teaching parents of young children with ASD to implement intervention strategies to increase their children’s communicative and social development is an emerging field. Although many studies have examined the impact of parents’ strategy use on children’s maladaptive behaviours (e.g. Koegel et al., 1996a; Plant and Sanders, 2007; Whittingham et al., 2006), fewer studies have examined the impact on the communication and social domains. In this review, the 11 studies all provided one-on-one intensive coaching for parents. It may be of interest to examine the efficacy of small group delivery of these same intervention protocols to determine if parents can develop skills of equal or greater quality in a group setting. Several studies have demonstrated the positive impact of parent-to-parent support between families of children with ASD, often in the context of support groups (e.g. Luther et al., 2005). The impact of this form of support on the maintenance and generalization of these skills is also needed.

Conclusions

A range of parent education and training programs have been designed to enable parents to support the development of their child’s language and communication skills. Overall, evaluation of these programs using SSRDs has provided evidence parents can learn to accurately implement these strategies for a short period of time. However, parents’ ability to use these skills in their day-to-day lives as their child grows and develops is not well
understood. Further investigation into the characteristics of parents and children that may indicate a positive response to this form of intervention or provide evidence for effective methods of delivery is required to better understand the variability in parent–child response to parent implemented interventions.

Acknowledgements

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References

* Indicates articles included in the review.


