Outcome of comprehensive psycho-educational interventions for young children with autism

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Abstract

This paper evaluates comprehensive psycho-educational research on early intervention for children with autism. Twenty-five outcome studies were identified. Twenty studies evaluated behavioral treatment, 3 studies evaluated TEACCH and 2 studies evaluated the Colorado Health Sciences Project. Outcome studies are graded according to their scientific value, and subsequently graded according to the magnitude of results documented in the studies. Based on the available evidence, treatment recommendations are made and practice parameters are suggested.
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Autism is a Pervasive Developmental Disorder characterized by severe impairment in social interaction and communication along with high rates of ritualistic and stereotyped behavior (DSM-IV; APA, 1994). It is one of the most common developmental disorders. The prevalence rate for all forms of Pervasive Developmental Disorder is estimated to be around 3–11 per 1000, and childhood autism is estimated to have a prevalence of approximately 1–4 per 1000 (Baird et al., 2006; Fombonne, 2003). Researchers have shown that 50–80% of children with autism have mental retardation (Baird et al., 2006; Fombonne, 1999), and that the majority will require professional care throughout their lives (Billstedt, Gillberg, & Gillberg, 2005).

Although specific causes of the condition have not yet been identified, researchers have suggested that genetic, epigenetic and/or environmental factors are involved (Bailey et al., 1995; Freitag, 2007; Muller, 2007; Volkmar, Lord, Bailey, Schultz, & Klin, 2004). Currently, researchers are searching for medical and biomedical treatments that are effective, safe, and generally accepted (c.f., Pangborn & Baker, 2005). However, the only drug approved for autism

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by the U.S. Food and Drug Administration (FDA) is risperidone (FDA, October 6, 2006). Risperidone may be used to treat aggression, self-injury, and temper tantrums, but it does not address the core deficits of the autistic disorder, that is, the deficits in social interaction, communication and stereotyped behaviors. Hence, medical treatments are not a substitute for psycho-educational interventions, which currently is the benchmark intervention for autism (Filipek, Steinberg-Epstein, & Book, 2006; Howlin, 2005).

A wide variety of psycho-educational interventions for children with autism have been proposed, and many proponents have claimed beneficial effects (Dawson & Osterling, 1997; Howlin, 2005; Smith, 1999). In 1999, the National Research Council (NRC) commissioned a systematic review of psycho-educational interventions for children with autism. The committee concluded that there is a great need for more knowledge about which interventions are most effective (Lord et al., 2002, p. 349). Subsequently, a working group supported by the National Institute of Mental Health (NIMH) was formed to develop guidelines for designing research studies for psycho-educational interventions for individuals with autism (Lord et al., 2005; Smith et al., 2007). Building on the recommendations made by the NRC and the NIMH working groups, the present paper provides a systematic evaluation of comprehensive psycho-educational programs for children with autism.

In addition to building on the recommendations made by the NRC and the NIMH working groups, the current review includes recent studies not previously reviewed, it includes a more systematic approach to evaluating outcome studies than those suggested by the NRC and the NIMH groups, and it evaluates treatment effect. Finally, based on the available evidence, treatment recommendations are made and practice parameters are suggested.

1. Method

1.1. Search methods

Three different search methods were used to identify all relevant outcome studies. First, electronic searches on Medline (U.S. National Library on Medicine), ERIC (U.S. Department on Education), and PsycLit (American Psychological Association) were conducted. Second, recent publications (e.g., Smith, 1999; Suozzi, 2004; Volkmar et al., 2004) were inspected to confirm that the computer search identified all relevant studies. Finally, researchers known to be involved in outcome research were contacted by e-mail and asked to provide references on outcome studies recently published or in press. This search method produced a large number of studies, many which were not appropriate for the current review. To be included in the current review, the following criteria had to be met: (a) study was published in a peer-reviewed journal; (b) children had a mean age of 6 years or less at intake; (c) participants received comprehensive psycho-educational interventions; (d) studies contained outcome data. Comprehensive psycho-educational interventions were defined as interventions addressing all three-core deficits in autism. That is, the interventions addressing social behaviors, communication and ritualistic/stereotyped behaviors.

1.2. Criteria for assigning scientific merit

Outcome studies were graded according to their *scientific value* and according to the *magnitude of results* documented in the studies. Scientific Merit was evaluated based on: (a) diagnosis, (b) study design, (c) dependent variables and (d) treatment fidelity. Four levels were used to describe scientific merit: Level 1 represented the highest possible rating; Level 2

represented a moderate scientific merit; Level 3 represented a low scientific merit, and finally, Insufficient Scientific Value (ISV) was assigned to studies where the evidentiary support was so low that outcome data gave insufficient scientific meaning.

The criteria for Scientific Merit were as follows.

1.2.1. Level 1

1.2.1.1. Diagnosis. To obtain Level 1 status, the participants must have been diagnosed according to current international standards, that is, either according to the ICD-10 or DSM-IV criteria (or DSM-III criteria for studies conducted prior to the publication of DSM-IV). Further to ensure objectiveness of the diagnosis, the diagnosis must have been set by clinicians who were independent of the study or the diagnosis must have been based on well-researched diagnostic instruments including ADI-R (Lord, Rutter, & LeCouteur, 1994), ADOS-G (Lord et al., 2000), or CARS (Schopler, Reichler, & Rennner, 1988).

1.2.1.2. Design. In addition, Level 1 status required a randomized study design, that is, the participants must have been assigned randomly to two or more study groups.

1.2.1.3. Dependent measures. Level 1 rating also requires that the intake and outcome measures assessed both intellectual and adaptive functioning. The instruments used to assess these skills must be normed and standardized. The IQ score must be derived from both language/communication skills as well as visual spatial or performance skills (e.g., including Wechsler tests, Bayley Scales of Infant Development, Stanford–Binnet; excluding Merrill–Palmer and Leiter International Performance Scales). In addition, to ensure objectiveness of the assessments, blind or independent assessors must have conducted the assessments.

1.2.1.4. Treatment fidelity. Finally, assessment of treatment fidelity was required to obtain Level 1 status, or if not directly assessed, treatment must be described in treatment manuals.

1.2.2. Level 2

Criteria for achieving Level 2 Scientific Merit were identical to that of Level 1 except that the study design was *not* random. That is, each participant did not have an equal chance of entering either of the study groups. Group assignment based on, for example, participants' geographical location, parental choice or availability of treatment personnel is examples of non-random group designs.

1.2.3. Level 3

Criteria for achieving Level 3 status were as follows.

1.2.3.1. Diagnosis. Diagnosis (based on the ICD-10 or DSM-IV criteria) was not blind or independent; or diagnosis was not based on diagnostic instruments (i.e., ADI-R, ADOS-G, or CARS); or diagnosis was independent or blind but not based on ICD-10 or DSM-IV (or DSM-III for older studies); or study failed to specify which diagnostic system was used.

1.2.3.2. Design. Retrospective (archival) studies with comparison group, or single-case experimental studies where outcome measures were assessed pre and post.

1.2.3.3. Dependent measures. Intake and outcome measures did *not* assess both intellectual and adaptive functioning, or measures were not normed and standardized.

1.2.3.4. Treatment fidelity. Insufficient assessment of treatment fidelity or treatment not based on treatment manuals. Level 3 classification was given when one or more of the above criteria is met.

1.3. Insufficient scientific value (ISV)

Studies classified as ISV with pre–post designs without a comparison group, retrospective (archival) studies without comparison group, or pre–post designs without single-case control.

1.4. Criteria for deciding magnitude of results

In this section, criteria for evaluating magnitude of treatment effect are described. Treatment effect is graded into four levels, where Level 1 represents the highest possible rating and Level 4 represents the lowest rating.

1.4.1. Level 1

To obtain Level 1 status regarding magnitude of results, significant group differences on IQ *and* Adaptive Functioning (deviation or ratio scores) must be reported. This was considered a minimum criterion. A better and more complete assessment battery would include measures of empathy, personality, school performance, friendship, and information regarding diagnostic changes.

1.4.2. Level 2

Level 2 status required significant group differences on *either* IQ *or* adaptive functioning (deviation or ratio scores). For both Level 1 and 2, the IQ measure must be based on language/communication skills in addition to visual spatial or performance skills (e.g., including Wechsler tests, Bayley Scales of Infant Development, Stanford–Binet; excluding the Merrill–Palmer Scale of Mental Tests and the Leiter International Performance Scales).

1.4.3. Level 3

Level 3 status required significant group differences on developmental (or mental) age, or significant group differences (or significant group differences on improvement) on assessment instruments that are not normed and standardized.

1.4.4. Level 4

Studies reporting significant pre-post improvements.

In this review, only Levels 1–3 scientific evidence studies are evaluated according to magnitude of treatment effect. Studies classified with Insufficient Scientific Value are excluded because for methodological reasons they did not allow reliable conclusions regarding outcome to be drawn.

2. Classification of studies based on scientific merit and magnitude of results

The search criteria described above identified 25 outcome studies. Twenty studies evaluated interventions based on Applied Behavior Analysis (ABA) treatment, 3 studies evaluated Project TEACCH and 2 studies evaluated the Colorado Health Sciences Model. These treatment approaches are described in Table 1. Table 2 describes each of the studies and their ratings according to scientific merit and magnitude of results.

Table 1
Description of psycho-educational programs subjected to outcome research

TEACCH	TEACCH (Treatment and Education of Autistic and Communication Handicapped Children) was founded at the University of North Carolina in 1966 by Eric Schopler (Schopler & Reichler, 1971). Several hundred research studies have been conducted by or in collaboration with Division TEACCH. Today, it is the most influential special education program for children with autism, and is used world wide. It aims at addressing multiple problems such as communication, cognition, perception, imitation and motor skills. The program emphasizes teaching in multiple settings with the involvement of several teachers.
	TEACCH was traditionally used in segregated self-contained classrooms for children with autism, but recently, focus has been shifted towards exposing children with autism to inclusive settings with typically developing children (Lord & Schopler, 1994). In addition, emphasis has been placed on home programming using parents as co-therapists (Ozonoff & Cathcart, 1998). The TEACCH approach has been described in numerous manuals and books (cf., Mesibov, Shea, & Schopler, 2005; Schopler & Mesibov, 1995), and typically contains the following five components:
	1. Focus on structural teaching. Typically, a teacher and a teacher assistant have the responsibility of teaching five children with autism. Focus is placed on teaching children independent work skills.
	2. Strategies to enhance visual processing are emphasized including (a) the physical (ecological) structure of the classroom, (b) the use of visual activity schedule to help children anticipate future events (c) a visual organization of the work materials to teach the learning tasks and their sequences, and (d) a visual system to teach complicated skills such as language and imitation.
	3. Program involves the teaching of a communication system based on gesture, pictures, signs, or printed words.
	4. Program involves teaching pre-academic skills (colors, numbers, shapes, drawing, writing, and assembly).
	5. Parents are encouraged to work as co-therapists with their child in the home using the same techniques and materials as employed during the TEACCH clinic sessions.
The Denver Model	The Denver Model was developed by Sally Rogers and colleagues in the 1980s (Rogers et al., 2006; Rogers, Hall, Osaki, Reaven, & Herbison, 2001). The program provides more than 20 h per week of systematic instruction to children from ages 2 to 5 years. The program is a developmental play-based approach, based on Piaget's theory of cognitive development. Piaget focused on how children explore their environments to construct schemas about how the world works and how to reason about it. In addition to Piaget, the Colorado Health Science Program also used Mahler's psychoanalytic theory of child development. Mahler's theories centered on how children establish a sense of identity and an understanding of others through interactions with caregivers. The Colorado Health Science Program also utilizes the INREAL pragmatic based communication program (Weiss, 1981), which aims to enhance functional communication in the context of naturally occurring activities. Finally, the program use behavior analytic techniques for example to reduce aberrant behaviors. The Denver Model is offered as a comprehensive, eclectic ''best practice'' approach with a broad theoretical underpinning.

Table 1 (*Continued*)

Applied–Behavior–Analytic Interventions (ABA)	Interventions based on ABA was pioneered by Ivar Lovaas and colleagues in the 1960s (Ferster & DeMyer, 1961; Lovaas & Simmons, 1969; Wolf, Risley, & Mees, 1964), and rests on several hundred clinical studies published in peer-reviewed journals (Matson, Benavidez, Compton, Paclawskyj, & Baglio, 1996; Newsom & Rincover, 1989; Suozzi, 2004). Building on this body of knowledge several empirically supported treatment manuals has been published to guide the practitioners in designing effective programs for children with autism (Leaf & McEachin, 1999; Lovaas, 1977, 2003; Lovaas et al., 1981; Maurice, 1996; Maurice, Green, & Foxx, 2001). ABA focuses on remediating the children's delays in communication, social and emotional skills and place great focus on integrating the children with typical peers in typical settings. ABA programs are based on principles derived from laboratory and applied research on learning psychology (Catania, 1998; Cooper, Heron, Heward, 1987). One working hypothesis is that children with autism have a biological based learning/developmental deficit, and that principles derived from learning psychology may facilitate acquisition of adaptive skills and a facilitate reduction of aberrant behaviors. Moreover, it is argued that some children may overcome their learning deficit, enabling them to acquire behaviors exhibited by typical children and eventually to learn from typical (non-behavioral) education (Lovaas, 2003). Important components include: 1. Early intervention. Treatment onset as early as possible in the child's life, preferably before the child is 3.5-years-old, though treatment of older children has also been documented effective. 2. Parent involvement. Parents are trained to be co-therapists and parents to facilitate generalization and maintenance of new skills. 3. Mainstreaming children with typically developing children. 4. Intensive one-to-one teaching. Research has shown that 30–40 h per week of one-to-one intervention for at least 2 years may be required to produce maximum effect. 5. Comprehensiveness of program. The program target and teach skills within all areas of functioning such as language and communication, play, social skills, leisure activities, pre-academic and academic skills, self-help skills, and social–emotional skills. In addition, the program focuses on reducing aberrant behaviors such as aggressive behaviors, attention deficits, and stereotyped behaviors and ritualistic behaviors. 6. Individualized programming. Based on an assessment of each individual child, existing strengths of children are accommodated and efforts are made to remediate weaknesses.

2.1. Level 1 scientific merit

As can be seen in Table 2, only one Level 1 study was identified. The study was conducted by Smith, Groen and Wynn (2000) and was designed to evaluate ABA treatment. Results showed that the ABA treatment group scored significantly higher as compared to the parent training control group on intelligence, visual–spatial skills, language and academics, though not adaptive functioning. Because the study did not show significant group differences on adaptive functioning, the study received Level 2 magnitude-of-results rating. Though the Smith et al. study is the best designed outcome study conducted to date, the study has limitations, such as a relatively small sample size ($n = 28$). Also, the participants received less intensive intervention than is considered optimal (c.f., Eledevik, Eikeseth, Jahr, & Smith, 2006; Lovaas, 1987), and this may have affected the results.

Table 2
Evaluation of scientific merit and treatment effect

Reference	Description	Scientific merit	Treatment effect
Smith, Groen, and Wynn (2000)	Examined effects of ABA treatment for children with autism and children with PDD-NOS. Mean intake age was 36 months. The diagnosis was set by an independent agency and based on the DSM-III criteria. Participants were matched on pre-treatment IQ and randomly assigned by an independent statistician to either an ABA treatment ($n = 15$) group or to a parent training group ($n = 13$). Participants in ABA group (seven with autism, eight with PDD-NOS) received a mean of 24.5 h per week of one-to-one ABA treatment during the first year of intervention with a gradual reduction of treatment hours over the next 2 years. Participants in the control group (seven with autism, six with PDD-NOS) received 3–9 months of parent training for several hours per week. Measures included IQ, visual–spatial IQ, language functioning, adaptive functioning, socio-emotional functioning, academic achievement, class placement progress in treatment, and parent evaluation. Tests were carried out by independent assessors. There were no significant differences at intake on any of the measures. At follow-up the ABA treatment group scored significantly higher as compared to the parent training group on IQ, visual–spatial skills, language (assessed the by score combining comprehension and expression), school placement and academics, though not adaptive functioning and socio-emotional functioning. The ABA treatment group gained an average of 16 IQ points ES = 1.43. By comparison, the parent training group lost one IQ point. Children with PDD-NOS gained more than those with autism. Twenty-seven percent of the children in the ABA group achieved average post-treatment scores and were succeeding in regular education classrooms.	1	2
Eikeseth et al. (2002, 2007)	Compared effects of ABA and eclectic treatment for children with autism. Mean intake age was 5.5 years. The diagnosis was set by an independent agency and based on the ICD-10 criteria, and confirmed by the ADI-R. Group assignment to either an ABA treatment group ($n = 13$) or to an eclectic treatment group ($n = 12$) was based on availability of ABA supervisors and performed by a person who was independent of the study. Participants in the ABA treatment group received 28 h per week of one-to-one ABA treatment during the first year of intervention with a gradual reduction of treatment hours over the next 2 years. Participants in the eclectic group received 29 h per week of one-to-one eclectic treatment with a gradual reduction of treatment hours over the next 2 years. Measures included IQ, language functioning, adaptive functioning, maladaptive behavior and socio-emotional functioning. Tests were carried out by independent assessors. There were no significant differences at intake on any of the measures. Follow-up assessment—conducted approximately 3 years after the treatment begun—showed that the ABA treatment group scored significantly higher as compared to the eclectic treatment group on intelligence, language, adaptive functioning, maladaptive functioning and on two of the subscales on the socio-emotional assessment (social and aggression). The ABA treatment group gained an average of 25 IQ points, ES = 2.21; 12 points in adaptive functioning ES = 1.35. By comparison, the eclectic treatment group obtained average change of +7 points in IQ, − 10 points in Adaptive Functioning. Seven of 13 children in the ABA group who scored within the range of mental retardation at intake scores within the average range (≥ 85) on both IQ and verbal IQ at follow-up, compared to 2 of 12 children in the eclectic treatment group.	2	1

| Howard et al. (2005) | Compared effects of three treatment approaches on children with autism or PDD-NOS. Twenty-nine children received 25–40 h per week one-to-one ABA treatment. A comparison group ($n = 16$) received 30 h per week of one-to-one or two-to-one eclectic intervention in public special education classrooms. A second comparison group ($n = 16$) received 15 h per week public early intervention in small groups. Mean intake CA = 36 months. The diagnosis was set by an independent agency and based on the DSM-IV criteria. Measures included IQ, language functioning, and adaptive functioning. Tests were carried out by independent assessors. There were no significant differences at intake on any of the measures. Follow-up assessment – conducted approximately 14 months after the treatment begun – showed that the ABA treatment group scored significantly higher scores as compared to the two comparison groups on all measures. There were no statistically significant differences between the mean scores of the two comparison groups. The ABA treatment group gained an average of 31 IQ points, ES = 1.73, 11 points in adaptive functioning, ES = 0.94. The comparison groups obtained average change of +9 points in IQ, −2 points in Adaptive Functioning. Learning rates at follow-up were also substantially higher for children in the ABA group than for participants in either of the other two comparison groups. | 2 | 1 |
| Cohen et al. (2006) | Compared effects of ABA treatment with special education provided at local public schools for children with autism or PDD-NOS. Participants' mean age when the treatment begun was unspecified, but the mean age at diagnosis was 31.2 months (range 18–48 months) and all participants were less than 48 months by the onset of treatment. The diagnosis was set by an independent agency, based on the DSM-IV criteria and confirmed by the ADI-R. Group assignment to either an ABA treatment group ($n = 21$, 20 with autism and 1 with PDD-NOS) or to an eclectic treatment group ($n = 21$, 14 with autism and 7 with PDD-NOS) was based on parental preference. Participants in the ABA treatment group received 35–40 h per week of one-to-one ABA treatment provided in a community setting. Participants in the comparison group received public community Services. The child/teacher ratios varied from one-to-one to three-to-one. Classes operated for 3–5 days per week, for up to 5 h per day. Speech, occupational, and behavioral therapy varied from 0 to 5 h per week. Three of the children spent brief sessions (up to 45 min per day) mainstreamed in regular education. Measures included IQ, visual IQ, language functioning, and adaptive functioning. Assessments were carried out by independent assessors. There were no significant differences at intake on any of the measures, though the groups differed on some of the demographic variables. Most notably, the ABA group had significantly more children with autism (and less with PDD-NOS) as compared to the comparison group. Follow-up assessment – conducted approximately 3 years after the treatment begun – showed that the ABA treatment group scored significantly higher as compared to the two comparison groups on IQ and adaptive functioning, though not on visual IQ and language (language comprehension was marginally significant with $p = 0.06$). The ABA treatment group gained an average of 25 IQ points, ES = 1.52, 10 points in adaptive functioning, ES = 1.23. By comparison, the eclectic treatment group obtained average change of 4 points in IQ, −3 points in Adaptive Functioning. Six of the 21 ABA treated children were fully included into regular education without assistance, and 11 others were included with support; in contrast, only 1 comparison child was placed primarily in regular education. | 2 | 1 |

Table 2 (*Continued*)

Reference	Description	Scientific merit	Treatment effect
Remington et al. (2007)	Compared effects of ABA with treatment as usual for children with autism. Mean intake age was 37 months. The diagnosis was set by an independent agency and based on the ICD-10 criteria, and confirmed by the ADI-R. Group assignment to either an ABA treatment group ($n = 23$) or to a treatment as usual group ($n = 21$) was based on parental choice. Participants in the ABA treatment group received 25.6 h per week of one-to-one ABA for 2 years. Participants in the comparison group received standard provision from the local education authorities. Number of one-to-one treatment hours in the treatment as usual group was unspecified. Measures included IQ, language functioning, adaptive functioning, rating scales and observation measures for child behavior, and self-report measure of parent well being. Tests were carried out by one of the authors of the study, but the assessor was not informed regarding which group the participants belonged to. There were no significant differences at intake on any of the measures. Follow-up assessment showed that the ABA treatment group scored significantly higher as compared to the comparison group on intelligence, but not on language functioning or adaptive behavior (as measured by standard scores). The ABA treatment group gained an average of 12 IQ points, ES = 0.72, whereas children in the comparison group lost, on average, two IQ points. Children in the ABA group showed an advantage over the comparison group in language functioning at follow-up, as more children in the ABA group reached basal on the Reynell comprehension and expression scales post treatment. The ABA group showed significantly better score on responding to joint attention as compared to the comparison group, but not in initiating joint attention. No other significant changes were reported in child outcome. On parental outcome, no significant group differences were found except that fathers of children in the ABA group showed higher degree of depression at follow-up.	2	2
Lovaas (1987) and McEachin et al. (1993)	The seminal outcome study examining effects of ABA treatment for children with autism. Nineteen children received 40 h per week of one-to-one ABA treatment for a minimum of 2 years. A comparison group ($n = 19$) received 10 h or less per week one-to-one ABA treatment. Mean intake was CA = 33.3 months. A second comparison group ($n = 21$) came from the same agency that diagnosed the majority of the other participants and had received services generally available for children with autism in the area. The diagnosis for all percipients was set by an independent agency and based on the most current DSM system available at the time of the study. Intake measures included IQ and behavioral observations. Follow-up measures included IQ, adaptive behavior, personality and school placement. Assessment of best outcome participants was carried out by independent and blind assessors. There were no significant between group differences at intake on any of the measures. Follow-up assessment – conducted when the children averaged 11.5 years of age – showed that the ABA treatment group scored significantly higher as compared to the comparison groups on IQ, adaptive functioning and school placement, but not on the personality measures. The ABA treatment group gained an average of 31 IQ points, 11 points in adaptive functioning. The comparison groups obtained average change of +9 points in IQ, −2 points in Adaptive Functioning. Forty seven percent of the children in the ABA group achieved average post-treatment scores and was succeeding in regular education classrooms.	3	2

Magiati et al. (2007)	Compared outcome of parent managed ABA treatment to autism-specific nursery provision for pre-school children with autism spectrum disorders. In the parent managed program, the families located and recruited consultants and therapists and managed the child's program. The parent managed program is different to the clinic based or school programs described above. Mean intake age was 40 months. The diagnosis of autism or autistic spectrum disorders was set by an independent agency. Diagnostic system not specified, but diagnosis was confirmed by the ADI-R in the majority of the cases. Measures included IQ (as measured in many cases by the Merrill–Palmer Scale of Mental Tests), language, play, adaptive behavior and severity of autism. Both groups showed improvements in age equivalent scores but not on standard scores. At follow-up, there were no significant group differences in cognitive ability, language, play or severity of autism.	3	3
Mukaddes et al. (2004)	Examined effects of TEACCH provided to children with autism as compared to children with reactive attachment disorder. Mean intake age was 43.2 months for the children with autism and 48.4 months for the children with reactive attachment disorder. The diagnosis was based on DSM-IV and performed by two independent clinicians. Ten boys with autism and 11 children with reactive attachment disorder (nine boys and two girls) were included in the study. Group assignment was based on the participant's diagnosis. The measure was the Ankara Developmental Screening Inventory, which assesses parental reports of children's social, language/cognitive, social/self-care, fine motor and gross motor functioning. There was no information regarding whether or not the assessment was conducted independently or blindly. At intake, there were no significant differences between the two groups on raw scores on any of the four subscales or the total score of the measure. Following 14, 45-min sessions of psycho-educational treatment the children with reactive attachment disorder showed greater improvement than the autism group in their total development score, on the language–cognitive subscale, and in social/self-care abilities, but not on the fine or gross motor subscales. Both groups showed significant improvements in raw scores on all subscales and on the total developmental score following the intervention.	3	3
Ozonoff and Cathcart (1998)	Examined effects of a TEACCH based home program for children with autism. Mean intake age was 53.4 months. Participants were diagnosed with autism, but no information was provided regarding diagnostic system, whether or not the diagnosis was set independently, or whether any diagnostic instruments were used. The first 11 participants volunteering for the study were assigned to the intervention group and the latter 11 participants endured the comparison group. Participants were matched on age, pretest PEP-R scores, severity of autism, and time to follow-up. Averages of 10 hands-on training sessions over a period of 4 months were provided to the child and the family by trained graduate students. Parents were encouraged to work with the child between sessions, but number of such one-to-one teaching sessions provided by the parents was unspecified. Participants in both groups attended a day-care treatment program. Measure was PEP-R, but assessment was not blind or independent. Children in the treatment group improved significantly more (as measured by months) than those in the control group on the PEP-R subtests of imitation, fine motor, gross motor, and nonverbal conceptual skills, as well as in overall PEP-R scores, but not on the other subtests.	3	3

Table 2 (*Continued*)

Reference	Description	Scientific merit	Treatment effect
Eldevik et al. (2006)	Compared effects of low intensity ABA and low intensity eclectic treatment for children with autism. Mean intake age was 51 months. The diagnosis was based on the ICD-10 criteria. Study design was retrospective. An examination of each child's treatment record and a questionnaire completed by case supervisors determined group assignment. Children who had received treatment based only on ABA constituted the ABA group ($n = 13$). Children who had received a combination of two or more types of treatment comprised an eclectic group ($n = 15$). Group assignment was blind. Participants in the ABA treatment group received 12.5 h per week of one-to-one ABA treatment for 20 months. Participants in the eclectic group received 12 h per week of one-to-one eclectic treatment for 21 months. Measures included IQ, nonverbal intelligence, language functioning, adaptive functioning, psychopathology (no words, affectionate, toy play, peer play, stereotypes, temper tantrums, toilet trained, sum pathology). Diagnosis and assessment was not provided independently, but may be considered blind since the study was archival and hence not planned at the time of diagnosis and assessment. There were no significant differences at intake on any of the measures. Follow-up assessment showed that the ABA treatment group scored significantly higher as compared to the eclectic treatment group on intelligence, language, but not on adaptive functioning. On the pathology scale, the ABA group scored higher than the eclectic group on, affectionate, toy play, peer play, toilet trained, and sum pathology, but not on no words, temper tantrums, or stereotypes. The ABA treatment group gained an average of 8.2 IQ points, ES = 0.54. By comparison, the eclectic treatment group lost and average of 2.9 IQ points. The degree of mental retardation was reduced for 38% of the children in the ABA group, as compared to 7% in the eclectic group. Gains were more modest than those reported with children receiving more intensive behavioral treatment, and it is unclear whether they were clinically significant.	3	2
Sallows and Graupner (2005)	Examined effects of ABA treatment and parent managed ABA treatment for children with autism. Mean intake age was 36 months. The diagnosis was set by an independent agency, based on the DSM-IV criteria and confirmed by the ADI-R. Participants were matched on pre-treatment IQ and randomly assigned by an independent statistician to either an ABA treatment ($n = 13$) group or to parent managed ABA treatment ($n = 10$). Participants in ABA group received a mean of 37.6 h per week of one-to-one treatment for 2 years. Participants in the parent managed ABA control group received a mean of 31.3 h per week of one-to-one treatment for 2 years. It is unclear whether this difference in treatment intensity is statistically significant. Number of one-to-one hours decreased over the next 2 years as the children entered school. Measures included measures of IQ, visual–spatial IQ, language functioning, adaptive functioning, socio-emotional functioning and autism symptoms (ADI-R). Pretests were carried out by the second author prior to group assignment. Posttests were conducted independently. There were no significant differences at intake on any of the measures. At follow-up there were no significant differences between groups at pre- or posttest. Combining children in both groups, pretest to posttest gains were significant for IQ, language comprehension and ADI-R Social Skills and ADI-R Communication, but not on visual–spatial IQ, expressive language, adaptive behavior, socio-emotional functioning, and ADI-R Rituals. All children in both groups gained an average of 25 IQ points, ES = 2.56. Forty-eight-percentage of all children in both groups showed rapid learning, achieved average post treatment scores and were succeeding in regular education classrooms.	3	1

Smith, Buch, and Gamby (2000)	Examined effects of parent managed ABA intervention for children with autism or PDD-NOS. Mean intake age was 36 months. The diagnosis was set by an independent agency and based on the DSM-III criteria. Six boys (four with autism) participated in the study. A multiple-baseline design across participants was used to assess children's progress in treatment. Participants were randomly assigned to a baseline condition lasting 1, 3 or 5 months. Participants and therapists received six 1-day workshops over a 5-month period, with additional consultations over the next 2–3 years. During the first 3 months of treatment, participants received a mean of 26.2 h of one-to-one treatment per week. Measures included IQ, language, adaptive functioning, and progress in treatment. Five of six children rapidly acquired skills when treatment begun, but only two of six children improved on standardized tests conducted 2–3 years into treatment.	3	4
Weiss (1999)	Examined effects of 2 years of 1:1 ABA treatment for children with autism ($n = 20$). Initial acquisition of skills was correlated with later learning rates, severity of autism symptomatology and adaptive behavior profiles 2 years into treatment.	3	3
Birnbrauer and Leach (1993)	Examined effects of 18 h per week of 1:1ABA treatment for 2 years for children with autism ($n = 9$). Comparison with children not qualifying for study ($n = 5$). Mean intake age was 39 months. The diagnosis was set by an independent agency and based on the DSM criteria. Fourteen children participated in the study. A one-group pretest–posttest design was used. In addition a multiple-baseline design across behaviors was used to help demonstrate relationship between treatment effect and program intervention. Participants received a mean of 18 h per week of one-to-one ABA treatment for a period of 2 years. Measures included IQ, language functioning, and adaptive functioning, school placement and parent's skills in behavioral techniques. Assessments of IQ, language functioning, and adaptive functioning was carried out independently. Results indicate significant change between intake and follow-up in mental age, developmental language functioning, and developmental adaptive functioning. In addition integrated school placement increased, and parents improved their skills in using behavioral techniques.	3	3
Sheinkopf and Siegel (1998)	Examined effects of ABA treatment for children with autism and children with PDD-NOS. Mean intake age was 34 months. The diagnosis was made by consensus from two or more independent clinic staff and was based on the DSM-III criteria. Study design was retrospective. Participants were matched on pre-treatment CA, mental age, interval between pre- and post-assessments, diagnosis and sex. Eleven children (10 with autism) received ABA treatment and 11 children (10 with autism) received services available in the child's local community. Participants in ABA group received a mean of 19.5 h per week of one-to-one ABA treatment for an average of 15.7 months. Measures included IQ and autism symptoms. Assessments may be considered blind since the study was archival and hence not planned at the time of diagnosis and assessment. There were no significant differences at intake on any of the measures. At follow-up the ABA treatment group scored significantly higher as compared to the comparison group on both measure. The ABA treatment group gained an average of 26.9 IQ points. By comparison the comparison group gained two IQ points.	3	3
Andersen et al. (1987)	Examined effects of ABA treatment for children with autism. Mean intake age was 43 months. The diagnosis was set by an independent agency and based on the DSM (1980) criteria. Fourteen children participated in the study. A one-group pretest–posttest design was used. In addition a multiple-baseline design across behaviors was used to help demonstrate relationship between treatment effect and program intervention. Participants received a mean of 20 h per week of one-to-one ABA treatment for a period of 2 years. Measures included IQ, language functioning, and adaptive functioning, school placement and parent's skills in behavioral techniques. Assessments of IQ, language functioning, and adaptive functioning was carried out independently. Results indicate significant change between intake and follow-up in mental age, developmental language functioning, and developmental adaptive functioning. In addition integrated school placement increased, and parents improved their skills in using behavioral techniques.	3	3

Table 2 (*Continued*)

Reference	Description	Scientific merit	Treatment effect
Lord and Schopler (1989)	TEACCH for unspecified number of hours and for unspecified time ($n = 72.3$-year-old and $n = 70.4$-year-old). Pre–post design without single-case control.	ISV	Na
Rogers et al. (1986)	Colorado Health Science Program for 22.5 h per week ($n = 13$) for 5 months. Pre–post design without single-case control.	ISV	Na
Rogers and DiLalla (1991)	Colorado Health Science Program for 22.5 h per week ($n = 49$) for 6.4 months. Pre–post design without single-case control.	ISV	Na
Bibby et al. (2002)	Parent managed ABA intervention for unspecified number or hours per week of 1:1 treatment for at 2 years and 6 months. Pre–post design without single-case control.	ISV	Na
Handleman et al. (1991)	ABA. Children working in self-contained (n = unspecified) or integrated classrooms (n = unspecified) for 11 months.	ISV	Na
Harris et al. (1990)	ABA. Children working in self-contained (n = unspecified) or integrated classrooms (n = unspecified) for 11 months. Pre–post design without single-case control.	ISV	Na
Harris et al. (1991)	ABA. Children working in self-contained (n = unspecified) or integrated classrooms (n = unspecified) for 11 months. Pre–post design without single-case control.	ISV	Na
Hoyson et al. (1984)	ABA. 15 h per week of intervention in class of typically developing children ($n = 6$) for 9 months. Some 1:1 treatment. Pre–post design without single-case control.	ISV	Na
Luiselli et al. (2000)	ABA for 14 h per week of 1:1 for 9 months ($n = 16$). Pre–post design without single-case control.	ISV	Na

Level 1 Scientific Merit represents the highest possible rating; Level 2 represents a moderate scientific merit; Level 3 represents a low scientific merit. ISV describes scientific merit so low that outcome data gives insufficient scientific meaning. Levels 1–3 Scientific Merit studies were evaluated for Treatment Effects. Level 1 Treatment Effect represents the highest possible rating; Level 2 represents a moderate treatment effect; Level 3 represents a low treatment effect, and Level 4 represents the lowest treatment effect.

2.2. Level 2 scientific merit

Four Level 2 studies were identified (Cohen, Amerine-Dickens, & Smith, 2006; Eikeseth, Smith, Jahr, & Eledevik, 2002, 2007; Howard, Sparkman, Cohen, Green, Stanislaw, 2005; Remington et al., 2007). All four studies evaluated ABA treatment. Three of the studies showed that the participants in the ABA treatment groups scored significantly higher on intelligence, language and adaptive functioning as compared to comparison group children (Cohen et al., 2006; Eikeseth et al., 2002, 2007; Howard et al., 2005). Consequently these three studies received Level 1 magnitude-of-results rating. The Remington et al. study found that children in that ABA treatment group scored significantly higher as compared to children in the comparison group on intelligence, but not on adaptive functioning and language (as measured by standard scores). Hence this study received Level 2 magnitude-of-results rating. All four studies gained Level 2 Scientific Merit classification because they lacked a randomized study design: Three studies (Cohen et al., Howard et al., Remington et al.) based group assignment on parental preference. This because treatment was funded by public agencies required to offer free and appropriate services to all children. Unfortunately, group assignment based on parental preference may results in study groups that differ on important variables (e.g., parental involvement), and this may, in turn, affect outcome. Eikeseth et al. based group assignment on availability of ABA supervisors as judged by a director of the habilitation service who was independent of the study. Hence, group assignment was not based on any child or family characteristics. Yet, group assignment was still not random.

In the Cohen et al. (2006), Eikeseth et al. (2002, 2007) and Howard et al. (2005), and Remington et al. (2007) studies pre-treatment test scores reviled no significant group differences on any of the outcome variables suggesting that the groups were similar at intake measures. In the Cohen et al. study, the groups differed on other pre-treatment variables potentially influencing outcome: The ABA group had more children with autism and fewer with PDD-NOS than did the comparison group, a difference which may have favored the comparison group (Smith, Groen, & Wynn, 2000). Also, the ABA group had more two-parent families than the comparison group, which may have favored the experimental group. However, when statistically controlling for family variables, results continued to show improved outcomes in the ABA group as compared to the comparison group.

A shortcoming of the Eikeseth et al. study was that the teachers in the ABA group received more intensive supervision (up to 10 h per week) as compared to the teachers in the eclectic treatment group (2 h per week). However, the ABA teachers had no prior knowledge of ABA treatment before entering the study. Because of this, they required intensive supervision and training so they could provide proper behavioral treatment. The teachers in the eclectic group, in contrast, had prior training in special education methods, and hence might have required less intensive supervision.

2.3. Level 3 scientific merit

Eleven outcome studies received Level 3 evidence support. Two studies evaluated TEACCH (Mukaddes, Kaynak, Kinali, Besikci, & Issever, 2004; Ozonoff & Cathcart, 1998), and both studies received Level 3 magnitude-of-results rating. Ozonoff and Cathcart did not specify which diagnostic system the children's diagnosis was based on, whether or not the diagnosis was set independently, or whether any diagnostic instruments was used. Also, number of one-to-one teaching sessions provided by the parents was unspecified. The first 11 participants volunteering

for the study were assigned to the intervention group and the latter 11 participants were assigned to the comparison group. Hence, group assignment was not random. The measure was not performed blind or independently and did not include adaptive functioning. Children in the treatment group improved significantly more, as measured by months, than those in the control group on the PEP-R subtests of imitation, fine motor, gross motor, and nonverbal conceptual skills, as well as in overall PEP-R scores, but not on the other subtests. Mukaddes et al. based group assignment on the participant's diagnosis (reactive attachment disorder vs. autism). The measure was the Ankara Developmental Screening Inventory, which assesses parental reports of children's social, language/cognitive, social/self-care, fine motor and gross motor functioning. There was no information regarding whether or not the assessment was conducted independently or blindly. At intake, there were no significant differences between the two groups on raw scores on any of the four subscales or the total score of the measure. At follow-up, children with reactive attachment disorder showed greater improvement than the autism group in their total development score, on the language–cognitive subscale, and in social/self-care abilities, but not on the fine or gross motor subscales. Both groups showed significant improvements in raw scores on all subscales and on the total developmental score following the intervention.

The remaining nine studies evaluated ABA treatments (Andersen, Avery, DiPietro, Edwards, & Christian, 1987; Birnbrauer & Leach, 1993; Eldevik et al., 2006; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993; Magiati, Charman, & Howlin, 2007; Sallows & Graupner, 2005; Sheinkopf & Siegel, 1998; Smith, Buch, & Gamby, 2000; Weiss, 1999).

The Lovaas (1987) and McEachin et al. (1993) studies received Level 3 scientific merit because intake measures did not include Adaptive functioning. Andersen et al., Birnbrauer and Leach, and Sheinkopf and Siegel lacked assessment of Adaptive functioning. Sheinkopf and Siegel and Eldevik et al. used archival design. Sallows and Graupner (2005) was designed as a randomized study comparing clinic-directed ABA treatment to intensive parent-directed ABA treatment. In addition they employed a multiple-baseline design across participants. Children in both treatment groups made significant improvements on cognitive, language, adaptive, social, and academic measures between intake and follow-up. However, differences between the two treatment groups at follow-up were nonsignificant. Because of these nonsignificant group differences, the study is more appropriately described as a pre–post design with single-case control (multiple-baseline design across participants) rather than a randomized study.

Magiati et al. (2007) examined effects of a parent managed ABA program compared to an autism-specific nursery provision. In the parent managed program, the families located and recruited a consultant to provide overall directions of the child's program. In addition they hired therapists to provide the one-to-one teaching of the child. This type of program has been described by Bibby, Eikeseth, Martin, Mudford, and Reeves (2002) and is different from the clinic based or school based programs described above. Measures included IQ, language, play, adaptive behavior and severity of autism. Neither groups improved on standard scores on any of the measures (though improvement was observed on in age equivalent scores for participants in both groups). Moreover, there were no significant group differences in cognitive ability, language, play or severity of autism at follow-up. Neither the parent managed ABA program nor the autism-specific nursery provision was effective. Thus, a high number of one-to-one treatment (32.4 h of one-to-one per week, on average, for the parent managed ABA group) is by itself not sufficient to produce significant and meaningful gains. A reason for this may be that the therapists received too little supervision, which in the Magiati study ranged from monthly to six-monthly as compared to, for example, up to 10 h per week in the Eikeseth et al. (2002) study. This study received Level 3 scientific merit because IQ was assessed for many of the participants using the

Merrill–Palmer Scale of Mental Tests. This test emphasize almost entirely visual–spatial. A shortcoming of the Magiati et al. study was that the groups differed at intake on IQ, adaptive functioning and parental education. Moreover, treatment was not monitored by the investigators and there was no quality control measures on treatment.

2.4. Insufficient scientific value

Nine outcome studies were classified as having insufficient scientific value. Six studies evaluated ABA programs (Bibby et al., 2002; Handelman, Harris, Celbiberti, Lilleheht, & Tomchek, 1991; Harris, Handleman, Gordon, Kristoff, & Fuentes, 1991, Harris, Handleman, Kristoff, Bass, & Gordon, 1990; Hoyson, Jamieson, Strain, 1984; Luiselli, Cannon, Ellis, Sisson, 2000), one evaluated TEACCH (Lord & Schopler, 1989), two evaluated the Colorado Health Science Program (Rogers & Dilalla, 1991; Rogers, Herbison, Lewis, Pantone, & Reiss, 1986). All studies used a pre–post design without single-case control or comparison group.

3. Discussion

This paper evaluates comprehensive psycho-educational research on early intervention for children with autism and examines to what extent treatment effect has been documented in outcome studies. Twenty-five outcome studies were identified. As shown in Table 2, 20 studies evaluated ABA treatment, 3 studies evaluated TEACCH and 2 studies evaluated the Colorado Health Sciences Project. Interestingly, no other psycho-educational approaches have been subjected to outcome research according to the above criteria. Outcome studies identified in the present report were graded according to their scientific value, and according to the magnitude of results documented in the studies. For scientific merit, studies were graded into four levels. One study received Level 1 scientific merit (the highest possible rating) and four studies received Level 2 scientific merits. All these studies evaluated ABA treatment. Eleven outcome studies received Level 3 evidence support. Nine of the 11 studies evaluated ABA treatments and 2 studies evaluated TEACCH. Finally, nine outcome studies were classified as having insufficient scientific value. One evaluated TEACCH, two evaluated the Colorado Health Science Program, and six evaluated ABA.

Evaluating magnitude of treatment effects, four ABA studies received Level 1 rating demonstrating that children receiving ABA made significantly more gains than control group children on standardized measures of IQ, language and adaptive functioning (Cohen et al., 2006; Eikeseth et al., 2002, 2007; Howard et al., 2005; Sallows & Graupner, 2005). Several studies also included data on maladaptive behavior, personality, school performance and changes in diagnosis. Three studies received Level 2 rating (Eldevik et al., 2006; Lovaas, 1987; Smith, Groen, & Wynn, 2000), demonstrating that ABA treated children made significantly more gains than the comparison group on one standardized measures of IQ *or* Adaptive Functioning. Finally, five ABA studies and two TEACCH studies received Level 3 rating.

Note that other randomized control studies examining "non-comprehensive" interventions have been published. For example, Drew et al. (2002) and Aldred, Green, and Adams (2004) examined effects of parent-delivered pragmatic language interventions for children with autism and Jocelyn, Casiro, Beattie, Bow, and Kneisz (1998) examined effects of a intervention consisting of lectures and on-site consultations to day-care centers. Because these studies fail to meet the definition of comprehensive interventions they are not include in this review.

This present review has several limitations, and one is based on the limitations that are inherent in the current method for classification based on scientific merits. Other variables could be included and emphasized such as statistical alpha and beta errors. Yet another way of evaluating outcome studies is to apply the criteria for ''well-established'' or ''probably efficacious'' psychosocial interventions described by Chambliss et al. (1996) and Chambliss and Hollon (1998), which are as follows:

1. ''Well-established'' requires treatment manuals, and clearly specified subject groups, and either: (a) two independent well-designed group studies showing the treatment to be better than placebo or alternative treatment or equivalent to an established effective treatment; (b) or nine or more single subject design studies using strong designs and comparison to an alternative treatment.
2. ''Probably efficacious'' requires clearly specified subject groups (treatment manual preferable but not required), and: (c) either two studies showing better outcomes than a no-treatment control group; (d) or two strong group studies by the same investigator showing the treatment to be better than placebo or alternative treatment or equivalent to an established treatment; (e) or three or more single subject design studies that have a strong design and compare the intervention to another intervention.

Based on these guidelines interventions based on ABA will be considered ''Well Established''. TEACCH and Colorado Health Science model will be considered neither ''Well Established'' nor ''Probably efficacious''.

Other limitations with the current review are those inherent in the classification of magnitude of results (Matson, 2007). In this review, gains in ratio or deviation scores based on IQ and adaptive functioning was used. A more comprehensive assessment battery would include measures of empathy, personality, school performance, friendship, and information regarding diagnostic changes. Nevertheless, emphasis on different classification aspects would not change the main conclusions of the present report, but it could alter the classification status on some studies.

3.1. Future directions

Future research could consider the following:

1. There is a need for additional outcome research. The fact that only three psycho-educational approaches have been subjected to outcome research illustrates this issue's urgency. Study designs should meet Level 1 standards. In cases where it is unethical to conduct randomized studies, for example, because progress is measured several years into treatment, Level 2 standards should be met (cf., Lord et al., 2005). A solution to this ethical dilemma may be to conduct short term randomized studies comparing benchmark ABA treatment to other treatment approaches. A trial period of 6–8 months may well be ethical. After completion of such a relatively brief trial period, the participants who had received the less effective intervention could get immediate access the intervention that was demonstrated more effective.
2. Whenever an approach is documented effective, there is a need to identify effective treatment parameters and mechanisms responsible for change (Kazdin & Nock, 2003). Such studies should be a priority for ABA researchers.

3. There is a need to identify characteristics that interact with outcome. Variables interacting with outcome could be social (e.g., family variables, socio-economic status) behavioral (e.g., level of functioning or severity of ''autistic symptoms'') and/or medical/biological/toxicological (e.g., genetics, immune system, infection, porphyrin status).
4. There is a need to improve treatment for those children who respond less favorable.
5. Research could examine the efficacy of biomedical treatments in combination with psychosocial treatments.
6. Research could examine the generalizability and transportability of interventions shown to be efficacious in controlled research settings to applied settings.
7. Research could be conducted to examine the efficacy of psycho-educational treatments with older children and adults.
8. Research could develop criteria for discontinuing or changing treatment approach.
9. Research could be conducted to examine the cost-effectiveness and cost–benefits of the interventions.

4. Conclusions and practice parameters

Practice parameters are graded into *recommended parameters* and *guideline parameters*, adapted from Eddy (1992). To achieve status as a *recommended practice parameter*, a Level 1 evidence study addressing the specific question, or overwhelming Level 2 evidence is required. A recommended practice parameter is a therapeutic strategy that reflects a high degree of clinical certainty.

To be considered a *guideline*, a therapeutic strategy that reflects a moderate degree of clinical certainty, implies the existence of Level 2 evidence or consensus of Level 3 evidence.

4.1. Recommended practice parameter

1. ABA treatment is demonstrated effective in enhancing global functioning in pre-school children with autism when treatment is intensive and carried out by trained therapists (one Level 1 study, four Level 2 studies, Cohen et al., 2006; Eikeseth et al., 2002, 2007; Howard et al., 2005; Remington et al., 2007; nine Level 3 studies, Andersen et al., 1987; Birnbrauer & Leach, 1993; Eldevik et al., 2006; Lovaas, 1987; and Sallows & Graupner, 2005; Sheinkopf & Siegel, 1998; Smith, Buch, & Gamby, 2000; McEachin et al.,1993; Magiati et al., 2007; Weiss, 1999).
2. ABA treatment is demonstrated effective in enhancing global functioning in children with PDD-NOS (one Level 1 study; Smith, Groen, & Wynn, 2000).

4.2. Guideline practice parameter

1. ABA can be effective for children who are up to 7 years-of-age at intake (one Level 2 study; Eikeseth et al., 2002, 2007).

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References

Aldred, C., Green, J., & Adams, C. (2004). A new social communication intervention for children with autism: Pilot randomised controlled treatment study suggesting effectiveness. *Journal of Child Psychology and Psychiatry, 45*, 1420–1430.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.

Andersen, S. R., Avery, D. L., DiPietro, E. K., Edwards, G. L., & Christian, W. P. (1987). Intensive home-based early intervention with autistic children. *Education and Treatment of Children, 10*, 352–366.

Bailey, A., Le Couteur, A., Gottesman, I., Bolton, P., Simonoff, E., Yuzda, E., et al. (1995). Autism as a strongly genetic disorder: evidence from a British twin study. *Psychological Medicine, 25*, 63–77.

Baird, G., Simonoff, E., Pickles, A., Chandler, S., Loucas, T., Meldrum, D., et al. (2006). Prevalence of disorders of the autism spectrum in a population cohort of children in South Thames: the Special Needs and Autism Project (SNAP). *Lancet, 15*, 210–215.

Bibby, P., Eikeseth, S., Martin, N. T., Mudford, O., & Reeves, D. (2002). Progress and outcomes for children with autism receiving parent-managed intensive intervention. *Research in Developmental Disabilities, 22*, 425–447.

Billstedt, E., Gillberg, C., & Gillberg, C. (2005). Autism after adolescence: population-based 13- to 22-year follow-up study of 120 individuals with autism diagnosed in childhood. *Journal of Autism and Developmental Disorders, 35*, 351–360.

Birnbrauer, J. S., & Leach, D. J. (1993). The Murdoch Early Intervention Program after 2 years. *Behavior Change, 10*, 63–74.

Catania, A. C. (1998). *Learning* (4th ed.). Englewood Cliffs, NJ: Prentice Hall.

Chambliss, D. L., & Hollon, S. D. (1998). Defining empirically supported therapies. *Journal of Consulting and Clinical Psychology, 66*, 7–18.

Chambliss, D. L., Sanderson, W. C., Shoham, V., Bennett Johnson, S., Pope, K. S., Crits-Christoph, P., et al. (1996). An update on empirically validated therapies. *The Clinical Psychologist, 49*, 5–18.

Cohen, H., Amarine-Dickens, M., & Smith, T. (2006). Early intensive behavioral treatment: Replication of the UCLA Model in a community setting. *Developmental and Behavioral Paediatrics, 27*, 145–155.

Cooper, J. O., Heron, T. E., & Heward, W. L. (1987). *Applied behavior analysis*. New Jersey: Prentice Hall.

Dawson, G., & Osterling, J. (1997). Early intervention in autism. In M. Guralnick (Ed.), *The effectiveness of early intervention*. Baltimore: Brookes.

Drew, A., Baird, G., Baron-Cohen, S., Cox, A., Slonims, V., Wheelwright, S., et al. (2002). A pilot randomized control trial of a parent training intervention for pre-school children with autism: Preliminary findings and methodological challenges. *European Child and Adolescent Psychiatry, 11*, 266–272.

Eddy, D. M. (1992). *A manual for assessing health practices and designing practice policies: The explicit approach*. Philadelphia, PA: American College of Physicians.

Eldevik, S., Eikeseth, S., Jahr, E., & Smith, T. (2006). The effects of low-intensive behavioral treatment for children with autism and mental retardation. *Journal of Autism and Developmental Disorders, 36*, 211–224.

Eikeseth, S., Smith, T., Jahr, E., & Eledevik, S. (2002). Intensive behavioral treatment at school for 4–7-year-old children with autism: A 1-year comparison controlled study. *Behavior Modification, 26*, 49–68.

Eikeseth, S., Smith, T., Jahr, E., & Eledevik, S. (2007). Outcome for children with autism who began intensive behavioral treatment between age four and seven: A comparison controlled study. *Behavior Modification, 31*, 264–278.

FDA (October 2, 2006). ''*FDA Approves the First Drug to Treat Irritability Associated with Autism, Risperdal*''. Press release. Retrieved on 2006-10-02.

Ferster, C. B., & DeMyer, M. K. (1961). The development of performances in autistic children in an automatically controlled environment. *Journal of Chronic Diseases, 13*, 312–345.

Filipek, P. A., Steinberg-Epstein, R., & Book, T. M. (2006). Intervention for autistic spectrum disorders. *NeuroRx, 3*, 207–216.

Fombonne, E. (1999). The epidemiology of autism: A review. *Psychological Medicine, 29*, 769–786.

Fombonne, E. (2003). Epidemiological surveys of autism and other pervasive developmental disorders: An update. *Journal of Autism and Developmental Disorders, 33*, 365–382.

Freitag, C. M. (2007). The genetics of autistic disorder and its clinical relevance: A review of the literature. *Molecular Psychiatry, 12*, 2–22.

Handleman, J. S., Harris, S. L., Celbiberti, D., Lilleheht, E., & Tomchek, L. (1991). Developmental changes in preschool children with autism and normally developing peers. *Infant Toddler Intervention, 1*, 137–143.

Harris, S. L., Handleman, J. S., Gordon, R., Kristoff, B., & Fuentes, F. (1991). Changes in cognitive and language functioning of preschool children with autism. *Journal of Autism and Developmental Disorders, 21*, 281–290.

Harris, S. L., Handleman, J. S., Kristoff, B., Bass, L., & Gordon, R. (1990). Changes in language development among autistic and peer children in segregated and integrated preschool settings. *Journal of Autism and Developmental Disorders, 20*, 23–31.

Howard, J. S., Sparkman, C. R., Cohen, H. G., Green, G., & Stanislaw, H. (2005). A comparison of intensive behavior analytic and eclectic treatment for young children with autism. *Research in Developmental Disabilities, 26*, 359–383.

Howlin, P. (2005). The effectiveness of interventions for children with autism. *Journal of Neural Transmission, 69*(Supplementum), 101–119.

Hoyson, M., Jamieson, B., & Strain, P. S. (1984). Individualized group instruction of normally developing and autistic-like children: A description and evaluation of the LEAP curriculum model. *Journal of the Division of Early Childhood, 8*, 157–181.

Jocelyn, L. J., Casiro, O. G., Beattie, D., Bow, J., & Kneisz, J. (1998). Treatment of children with autism: A randomized controlled trial to evaluate a caregiver-based intervention program in community day-care centers. *Developmental and Behavioral Pediatrics, 19*, 326–334.

Kazdin, A. E., & Nock, M. K. (2003). Delineating mechanisms of change in child and adolescent therapy: Methodological issues and research recommendations. *Journal of Child Psychology and Psychiatry, 44*, 1116–1129.

Leaf, R., & McEachin, J. (1999). *A work in progress: Behavior management strategies and a curriculum for intensive behavioral treatment of autism*. New York: DRL Books LLC.

Lord, C., Bristol-Power, M., Cafiero, J. M., Filipek, P. A., Gallagher, J. J., Harris, S. L., et al. (2002). Editorial preface. *Journal of Autism and Developmental Disorders, 32*, 349–350.

Lord, C., Risi, S., Lambrecht, L., Cook, E. H., Jr., Leventhal, B. L., DiLavore, P. C., et al. (2000). The autism diagnostic observation schedule-generic: A standard measure of social and communicative deficits associated with the spectrum of autism. *Journal of Autism Developmental Disorders, 30*, 205–223.

Lord, C., Rutter, M., & Le Couteur, A. (1994). Autism diagnostic interview-revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *Journal of Autism Developmental Disorders, 24*, 659–685.

Lord, C., & Schopler, E. (1989). The role of age at assessment, developmental level, and test in the stability of intelligence scores in young autistic children. *Journal of Autism and Developmental Disorders, 19*, 483–499.

Lord, C., & Schopler, E. (1994). TEACCH services for preschool children. In S. Harris & J. Handleman (Eds.), *Preschool education programs for children with autism* (pp. 87–106). Austin, TX: Pro-Ed.

Lord, C., Wagner, A., Rogers, S., Szatmari, P., Aman, M., Charman, T., et al. (2005). Challenges in evaluating psychosocial interventions for autistic spectrum disorders. *Journal of Autism and Developmental Disorders, 35*, 695–708.

Lovaas, O. I. (1977). *The Autistic child: Language development through behavior modification*. New York: Irvington.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*, 3–9.

Lovaas, O. I. (2003). *Teaching individuals with developmental delays: Basic intervention techniques*. Austin, TX: Pro-Ed.

Lovaas, O. I., Ackerman, A., Alexander, D., Firestone, P., Perkins, M., & Young, D. B. (1981). *Teaching developmentally disabled children: The ME Book*. Austin, TX: Pro-Ed.

Lovaas, O. I., & Simmons, J. Q. (1969). Manipulation of self-destruction in three retarded children. *Journal of Applied Behaviour Analysis, 2*, 143–157.

Luiselli, J. K., Cannon, B. O., Ellis, J. T., & Sisson, R. W. (2000). Home-based behavioral intervention for young children with autism/pervasive developmental disorder. A preliminary evaluation of outcome in relation to child age and intensity of service delivery. *Autism, 4*, 426–438.

Magiati, I., Charman, T., & Howlin, P. (2007). A two-year prospective follow-up study of community-based early intensive behavioural intervention and specialist nursery provision for children with autism spectrum disorders. *Journal of Child Psychology and Psychiatry, 48*, 803–812.

Matson, J., Benavidez, D., Compton, L., Paclawskyj, J., & Baglio, C. (1996). Behavioral treatment of autistic persons: A review of research from 1980 to the present. *Research in Developmental Disabilities, 17*, 433–465.

Matson, J. L. (2007). Determining treatment outcome in early intervention programs for autism spectrum disorders: A critical analysis of measurement issues in learning based interventions. *Research in Developmental Disabilities, 28*, 207–218.

Maurice, C., Green, G., & Foxx, R. M. (Eds.). (2001). *Making a difference: Behavioral intervention for autism*. Austin, TX: Pro-Ed.

Maurice, C. (Ed.), Green, G., & Luce, S. (Co-Eds.). (1996). *Behavioral intervention for young children with autism: A manual for parents and professionals*. Austin, TX: PRO-ED.

McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American Journal on Mental Retardation, 97*, 359–372.

Mesibov, G. B., Shea, V., & Schopler, E. (2005). *The TEACCH approach to autism spectrum disorders*. New York: Springer Publishers.

Mukaddes, N. M., Kaynak, F. N., Kinali, G., Besikci, H., & Issever, H. (2004). Psychoeducational treatment of children with autism and reactive attachment disorder. *Autism, 8*, 101–109.

Muller, R. A. (2007). The study of Autism as a distributed disorder. *Mental Retardation and Developmental Disabilities Research Reviews, 13*, 85–95.

Newsom, C., & Rincover, A. (1989). Autism. In E. J. Mash & R. A. Barkley (Eds.), *Treatment of childhood disorders* (pp. 286–346). New York: Guilford.

Ozonoff, S., & Cathcart, K. (1998). Effectiveness of a home program intervention for young children with autism. *Journal of Autism and Developmental Disorders, 28*, 25–32.

Pangborn, J., & Baker, S. M. (2005). *Autism: Effective biomedical treatments*. Boston: DAN!.

Remington, B., Hastings, R. P., Kovshoff, H., degli Espinosa, F., Jahr, W., Brown, T., et al. (2007). A field effectiveness study of early intensive behavioral intervention: Outcomes for children with autism and their parents after two years. *American Journal of Mental Retardation, 112*, 418–438.

Rogers, S. J., & DiLalla, D. L. (1991). A comprehensive study of the effects of a developmentally based instructional model on young children with autism and young children with other disorders of behaviour and development. *Topics in Early Childhood Special Education, 11*, 29–47.

Rogers, S., Hall, T., Osaki, D., Reaven, J., & Herbison, J. (2001). The Denver model: A comprehensive, integrated educational approach to young children with autism and their families. In J. Handleman & S. Harris (Eds.), *Preschool education programs for children with autism*. Austin: Pro-Ed.

Rogers, S. J., Hayden, D., Hepburn, S., Charlifue-Smith, R., Hall, T., & Hayes, A. (2006). Teaching young nonverbal children with autism useful speech: A pilot study of the Denver Model and PROMPT interventions. *Journal of Autism and Developmental Disorders, 36*, 1007–1024.

Rogers, S. J., Herbison, J., Lewis, H., Pantone, J., & Reiss, K. (1986). An approach for enhancing the symbolic, communicative, and interpersonal functioning of young children with autism and severe emotional handicaps. *Journal of the Division for Early Childhood, 10*, 135–148.

Sallows, G. O., & Graupner, T. D. (2005). Intensive behavioral treatment for children with autism: Four-year outcome and predictors. *American Journal of Mental Retardation, 110*, 417–438.

Schopler, E., & Mesibov, G. B. (Eds.). (1995). *Learning and cognition in autism*. New York: Plenum Press.

Schopler, E., & Reichler, R. J. (1971). Parents as cotherapists in the treatment of psychotic children. *Journal of Autism and Childhood Schizophrenia, 1*, 87–102.

Schopler, E., Reichler, R. J., & Renner, B. R. (1988). *The childhood Autism rating scale (CARS)*. Los Angeles, CA: Western Psychological Services.

Sheinkopf, S. J., & Siegel, B. (1998). Home-based behavioral treatment of young children with autism. *Journal of Autism and Developmental Disorders, 28*, 15–23.

Smith, T. (1999). Outcome of early intervention for children with autism. *Clinical Psychology: Science and Practice, 6*, 33–49.

Smith, T., Buch, G. A., & Gamby, T. E. (2000a). Parent-directed, intensive early intervention for children with pervasive developmental disorder. *Research in Developmental Disabilities, 21*, 297–309.

Smith, T., Groen, A. D., & Wynne, J. W. (2000b). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal on Mental Retardation, 105*, 269–285.

Smith, T., Scahill, L., Dawson, G., Guthrie, D., Lord, C., Odom, S., et al. (2007). Designing research studies on psychosocial interventions in Autism. *Journal of Autism and Developmental Disorders, 37*, 354–366.

Suozzi, J. M. (2004). Behavioral and educational interventions for young children with autism. In V. B. Gupta (Ed.), *Autistic spectrum disorders in children* (pp. 165–182). New York: Marcel Dekker, Inc.

Volkmar, F., Lord, C., Bailey, A., Schultz, R. T., & Klin, A. (2004). Autism and pervasive developmental disorders. *Journal of Child Psychology and Psychiatry, 45*, 135–170.

Weiss, R. (1981). INREAL intervention for language handicapped and bilingual children. *Journal of the Division of Early Childhood, 4*, 40–51.

Weiss, M. J. (1999). Differential rates of skill acquisition and outcomes of early intensive behavioral intervention for autism. *Behavioral Interventions, 14*, 3–22.

Wolf, M. M., Risley, T., & Mees, H. (1964). Application of operant conditioning procedures to the behavior problems of an autistic child. *Behaviour Research and Therapy, 1*, 305–312.