



Title: Diagnosis and Treatment of Autism: Guidelines and Clinical Effectiveness

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Context and policy issues:

Autism is a neurodevelopmental disorder characterized by a triad of deficits involving communication, reciprocal social interaction, and restricted and repetitive patterns of behavior, interests and activities.¹ Mental retardation (IQ<70) is associated with 70% of cases and seizures are associated with 33% of cases. Autism is classified within a clinical spectrum of disorders known as pervasive developmental disorders (PDDs) as defined in the *Diagnostic and Statistical Manual of Mental Disorders, fourth edition text revision (DSM-IV-TR)* and the International Statistical Classification of Diseases and Related Health Problems, tenth edition revised (ICD-10).^{2,3} In clinical practice, professionals may use different terms interchangeably to refer to children with similar presentations.¹ Autism spectrum disorder (ASD) is synonymous with the broad category of PDDs described in the DSM-IV² and ICD-10,³ and includes autistic disorder, pervasive developmental disorder-not-otherwise specified (PDD-NOS)/atypical autism, Asperger disorder/syndrome, Rett's syndrome/disorder, and childhood disintegrative disorder.^{1,4} Abbreviations used in this report are listed in Appendix A. A comparison of ICD-10 and DMSIV diagnoses is provided in Appendix B.⁴ While there are no definitive medical tests to indicate the presence of any form of ASD, diagnosis can be made by three years of age based on the presence or absence of specific behaviors that are used as diagnostic criteria. DSM-IV-TR criteria for the diagnosis of autistic disorder, Asperger's disorder, PDD-NOS, Rett's disorder, and childhood disintegrative disorder are reported in Appendix C.

The median rate of autistic disorder in epidemiological studies is five cases per 10,000 individuals (range 2 to 20 cases per 10,000 individuals).² In 2003, approximately 69,000 Canadians (one case in 450 individuals) were reported to have autism or any other developmental disorder.⁵ The prevalence of ASD is reported at 27.5 per 10,000 individuals.⁶ This is comprised of a prevalence of 10 per 10,000 for autism, 15 per 10,000 for PDD-NOS and 2.5 per 10,000 for Asperger's syndrome.⁶ The Autism Society of Canada suggests the number of school age children with autism has increased in Saskatchewan, Quebec and British

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Columbia.⁵ An epidemiological study conducted at the Montreal Children's Hospital reported a prevalence rate of 0.68% (1 case per 147 individuals).⁵ ASDs are three times more common among boys than girls.⁴ It is unclear whether this higher rate of autism compared to previous years reflects a change in incidence, an increase in prevalence, greater awareness, improved detection, or broadened diagnostic criteria.

Behavioral interventions have become the predominant treatment approach for promoting the social, adaptive, and behavioral functioning of children with autism based on its effectiveness demonstrated in empirical studies.^{5,7,8} Behavioral interventions are specific approaches used to help individuals acquire or change behaviors by reinforcing adaptive responses and suppressing maladaptive behaviors.⁹ Early intensive behavioral intervention (IBI) is a generic term for therapeutic approaches that teach small, measurable units of behavior in a systematic way.¹⁰ Skills are broken down into small steps and taught by presenting an instruction. Prompts are added if needed, and appropriate responses are followed by consequences that function effectively as reinforcers. Learning takes place over repeated trials, after which, prompts and reinforcers are reduced. Behavioral therapies may be viewed in terms of their position on a continuum of highly structured discrete trial training behavioral approaches guided by a therapist, to social pragmatic developmental approaches where teaching follows the child's interests and is embedded in daily activities in a natural environment (Appendix D).¹⁰ While therapy may be provided for up to 40 hours per week, controversy exists regarding the intensity required to achieve a positive outcome and the efficacy of one approach compared to another.^{9,10}

IBI involving trained staff can cost \$C57,000 (range \$C30,000 to \$C80,000) per child per year, including infrastructure and operating costs.⁵ Most provinces in Canada have agreed to partially fund therapy for preschool children.⁵ For example, in British Columbia and New Brunswick, a preschool child may receive up to \$C20,000 per year for IBI therapy. Funding for school-age children is available in British Columbia, but it is significantly less than that for preschool children.⁵ In other provinces, IBI funding for school-age children is either not offered, or is integrated with other autism special education programs.¹¹

Each province may include or exclude a specific therapy in its insured non-core services, which explains variations in provincial treatment programs (Appendix E).⁵ In March 2005, the Ontario Superior court of Justice ruled that, by ending funding for its IBI program when children reached six years of age, the Government of Ontario violated the rights of 35 children. In 2006, the Government of Ontario won the appeal when Ontario's highest court deemed the government's refusal to pay for children older than five years of age was based on expert evidence and human resource shortage, not age discrimination.^{12,13} Provincial health care funding is often based on evidence of effectiveness of particular therapies but most studies of IBI are conducted in preschool children.

The diagnosis and treatment of autism can be controversial, and it is therefore necessary to review the available guidelines and evidence regarding diagnosis and treatment of autism using behavioral interventions.

Research questions:

1. What are the guidelines for the diagnosis and treatment of autism?
2. What is the clinical effectiveness of various behavioral interventions (ABA, PRT, Lovaas therapy, TEACCH, LEAP, Rutgers, Denver and autism preschool) compared to any other behavioral therapies for improving long term communication and socialization skills?

Methods:

A limited literature search was conducted on key health technology assessment resources, including OVID's Pre-Medline, Medline, Embase, PsycInfo, and Eric, Pubmed, the Cochrane Library (Issue 1, 2008), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, EuroScan, international HTA agencies, and a focused Internet search. Results include articles published between 2003 and the April 2008, and are limited to English language publications only. Filters were applied to limit the retrieval to health technology assessment (HTA), systematic reviews, and guideline studies. This search was supplemented by hand searching the bibliographies of selected papers.

Two reviewers (LM and KC) independently screened citations and selected guidelines, HTAs and systematic reviews on the diagnosis and treatment of children with autism. HTAs and systematic reviews were included if they reported on the clinical effectiveness of behavioral interventions for improving long term communications and socialization skills in children with autism. Relevant full-text articles were reviewed independently and discrepancies were resolved by discussion until consensus was reached. Only the most recent of duplicate reports by the same study group was incorporated into the synthesis of evidence. One reviewer (LM) used the Appraisal of Guidelines for Research and Evaluation (AGREE) and the Oxman and Guyatt index of scientific quality of research reviews to guide the appraisal of guidelines and systematic reviews, respectively.

Summary of findings:

Seven guidelines,^{1,6,8,14-17} three systematic reviews,¹⁸⁻²⁰ and one health technology brief²¹ met the inclusion criteria for this report. A Canadian guideline reported on the diagnosis of children with autism,¹ three guidelines reported on diagnosis and behavioral interventions,^{8,14,15} and three reported on behavioral interventions and program quality.^{6,16,17} The systematic reviews evaluated behavioral approaches, parent implemented early intervention and cognitive behavioral therapy in children with ASD.¹⁸⁻²⁰ A New Zealand health technology brief reported the evidence for the effectiveness of behavioral and skill-based early intervention in children with ASD.²¹ Guidelines are detailed in Appendix F; systematic reviews and health technology briefs are detailed in Appendix G.

Guidelines for diagnosis of autism

In 2003, the British Columbia ASD Standards and Guidelines Working Group developed minimum standards for diagnosing ASD in children under the age of six.¹ The objective of the guideline was to increase consistency in the diagnostic process and assist in establishing eligibility for intervention services.¹ The guidelines specify that children aged three and older can be diagnosed with PDD based on DSM-IV and ICD-10 criteria, but identification of subtypes within ASD may not be adequately reliable.¹ ASD includes all of the DSM-IV and ICD-10 categories comprising autistic disorder; PDD-NOS/atypical autism; Asperger's disorder/syndrome; Rett's syndrome/disorder; and childhood disintegrative disorder.¹

Early identification, assessment and diagnosis is a tiered process in British Columbia.¹ It is recommended that all children, under the age of six years, undergo general developmental surveillance by primary care practitioners to monitor social communication.¹ Recommended developmental screening tools for use by primary care practitioners include:

- the Parents' Evaluations of Developmental Status;
- the Ages and Stages Questionnaire: Social Emotional;
- the BRIGANCE Screens; and
- the Child Development Inventories.¹

If ASD is suspected, it is recommended that the primary care practitioner employ ASD screening instruments and refer the child for auditory and language assessments. The following screening instruments may be used with caution:

- the Checklist for Autism in Toddlers (CHAT) or the Modified CHAT (M-CHAT), for children near 18 months of age;
- the Screening Test for Autism in Two-Year Olds (STAT)
- the Autism Screening Questionnaire (ASQ), for children under six years of age; and
- as an alternative to screening tools, the primary care provider may systematically inquire about the development of language, social abilities, joint attention skills and pretend play.¹

In British Columbia, a multidisciplinary diagnostic assessment involving psychology, speech-language, medical evaluation, occupational therapy, psychiatry, and other specialty assessments is conducted if ASD is still suspected. A standardized diagnostic interview with the primary caregiver and observation of social and communicative behavior and play are components of diagnostic assessment. Recommended instruments include:

- The Autism Diagnostic Interview-Revised (ADI-R);
- The Autism Diagnostic Observation Schedule-Generic (ADOS-G); and
- The Childhood Autism Rating Scale (CARS)¹

Psychological assessments may include tests of cognitive and adaptive functioning. Tests of cognitive functioning suitable for use with preschool children with ASD may include one of:

- Weschler Preschool and Primary Scale of Intelligence-R (WPPSI-R);
- Stanford Binet Intelligence Scale Fourth Edition (SBI-4);
- Leiter International Performance Scale (revised norms);
- Bayley Scales of Infant Development, Second Edition;
- Mullen Scales of Early Learning; and
- The Infant Psychological Development Scale.¹

Specific instruments to assess adaptive functioning include:

- Vineland Adaptive Behaviors Scales;
- Scales of Independent Behavior-Revised; and
- AAMR Adaptive Behavior Scales¹

Standardized communication assessment includes one of:

- Communication and Symbolic Behavior Scales;
- Mullen Scales of Early Learning;
- MacArthur Communicative Development Inventory
- Preschool Language Scales;
- Clinical Evaluation of Language Fundamentals-Preschool; and,
- Reynell Developmental Language Scale¹

Occupational therapy may use the following to assess sensory and perceptual processing:

- Dunn Sensory Profile;
- Dunn Infant Toddler Sensory Profile;

- Analysis of Sensory Behavior Inventory;
- Motor-Free Visual Perception Test;
- Developmental Test of Visual Perception; and
- Test of Visual Perceptual Skills¹

Adaptive functioning may be assessed using the following:

- Canadian Occupational Performance Measure;
- Wee Functional Independence Measure;
- Pediatric Evaluation of Disability Index;
- Vineland Adaptive Behavior Scales; and
- Coping Inventory and Early Coping Inventory for Children¹

The diagnosis of ASD is clinical, based on DSM-IV-TR or ICD-10 criteria. There is no specific test or instrument that confirms or excludes ASD as a diagnosis. Children are eligible for ASD intervention services if a multidisciplinary assessment by the pediatrician, psychologist, or psychiatrist results in a diagnosis of ASD.¹ The British Columbia Working Group noted that, while it is important to identify children with ASD as early as possible, no single instrument has demonstrated the sensitivity and specificity required for general screening purposes. Screening instruments may be considered as practice options as a means of clinical clarification but no single measure should determine whether a child is referred for further assessment.¹

Guidelines for diagnosis and treatment of autism

In 2008, AETNA reviewed their policy regarding procedures and services medically necessary for the assessment and treatment of autism and other PDDs.⁸ If a child does not babble or gesture by 12 months of age, provide two-word spontaneous phrases by 24 months, or loses any language or social skills at any age, the following services may be included in the assessment and treatment of the child's condition:

- Parent and/or child interview, genetic counseling for parents of child with autism
- Medical evaluation, blood lead levels, phenylketonuria and metabolic testing
- Electroencephalogram (EEG) for seizure detection
- Speech-language and audiological hearing evaluation
- Genetic testing for fragile X in the presence of mental retardation
- Behavior modification and psychotherapy
- Intensive educational interventions in which the child is engaged in systematically planned and developmentally appropriate educational activity toward identified objectives, including speech-language therapy to improve communication skills. There is insufficient evidence for the superiority of any particular intensive educational intervention strategy (applied behavioral analysis (ABA), structured teaching, or developmental models) over other intensive educational intervention strategies.
- Alternative and augmentative communication aids
- Physical and occupational therapy⁸

In 2007, the Scottish Intercollegiate Guidelines Network (SIGN) issued a guideline for health professionals to improve the assessment and management of ASD.¹⁴ The objective was to improve consistency in referral pathways, service provision, and the range of healthcare and professionals involved in managing children and youth up to 18 years of age.¹⁴ The aim of the guideline was to provide the evidence base and recommendations to inform clinical assessment and intervention.

Population screening for ASD is not recommended, but CHAT or M-CHAT can be used to identify an increased risk of ASD.¹⁴ There is limited evidence on the reliability and validity of the existing classification systems, ICD-10 and DSM-IV.¹⁴ Three studies suggested the use of DSM-IV and ICD-10 criteria improved the reliability of the diagnostic process; however, current criteria for Asperger's syndrome and autism have poor discriminant validity. The guidelines working group noted that accurate diagnosis of ASD can be difficult and it was only possible to interpret and generalize from studies where the approach to diagnosis was clearly stated.¹⁴ Studies differed in terms of how diagnosis was made, which made it difficult to compare or combine results of studies.

The guidelines recommended that all professionals diagnosing ASD should consider using ICD-10 or DSM-IV.¹⁴ The ADI-R, Diagnostic Interview for Social and Communication Disorders (DISCO), and the Developmental, Dimensional and Diagnostic Interview (3di) are reliable diagnostic instruments.¹⁴ ASD-specific diagnostic instruments including CARS and ADOS-G may be used to improve diagnostic reliability.¹⁴ Children with ASD should be considered for assessment of intellectual, neuropsychological, adaptive functioning, occupational therapy, audiological status and Fragile X DNA analysis.¹⁴ SIGN recommended further research to validate screening instruments, minimum age for diagnostic reliability, reliability and validity of classification systems and the use of parallel assessment tools.¹⁴

The SIGN guideline recommended behavioral interventions be considered to address a range of behaviors in children with ASD to reduce symptom frequency and severity, and develop adaptive skills.¹⁴ This recommendation was based on a systematic review of 251 studies that concluded focal behavioral interventions consistently result in positive behavioral outcomes across a range of target areas when aberrant behaviors, language, daily living, academic and social skills are considered.¹⁴ Based on evidence from two systematic reviews, it was recommended that facilitated communication not be used as a means of communication for children with ASD.¹⁴

In 2004, the New Mexico Public Education Department issued recommended practices in behavioral and communication approaches for use within early intervention and/or preschool special education.¹⁵ The guideline was developed for use by personnel in early intervention and education agencies serving children up to eight years old. Developmental pediatricians, psychologists, psychiatrists or neurologists may make a diagnosis of autism for children, aged two to three years old, based on DSM-IV criteria.¹⁵ Children with any ASD should undergo a multidisciplinary evaluation of social, behavioral, language, communication, and cognitive skills. Upon diagnosis with ASD, all children are eligible for special education services and entry into intervention programs.¹⁵ The guideline recommended that children with ASD should be systematically engaged in teaching opportunities organized around 15 to 20 minute intervals at a minimum of 25 hours per week, 12 months per year. Objectives for children with ASD should be observable, measurable, documented, targeted for completion within one year, and add to the child's participation in education, community and family life.¹⁵ Teaching strategies from ABA have proven effective for a variety of children with ASD, including:

- Discrete Trial Training (DTT): stimulus, response, and consequence (positive reinforcer)
- Pivotal Response Training (PRT): teaching in natural environments to increase independence
- Incidental Teaching: child is offered the opportunity to explore their interests
- Activity Based Instruction: instruction embedded within an activity
- Peer Mediation: peers help increase social, language or play skills in children with ASD
- Functional Routines: systematic instruction in meaningful family routines

- Treatment and Education of Autistic and related Communications Handicapped Children (TEACCH): structured teaching in physical classroom structure, daily schedule, individual work systems, and visual structure
- Picture Exchange Communication System (PECS): children give a picture of a desired object to communicate
- Social Stories: social stories describe a situation and describe desired behavior and acceptable coping strategies

Ontario issued autism intervention program guidelines in 2006 to govern delivery of evidence based IBI.¹⁶ The program confirms eligibility, and assesses the intensity, setting, and duration of IBI services for children with autism.¹⁶ Once eligibility is established, the program provider completes baseline skill assessments and evaluates the child's progress every six months.¹⁶ The guidelines suggested there is no clear evidence base for setting optimal intensity, setting(s), or duration of intervention and that clinical decisions should be based on a periodic review by the clinical team and family.¹⁶ Guidelines suggested that intensity (range 20 to 40 hours per week) depends on the quality of intervention provided.¹⁶ The exact number of hours should be determined by clinical assessment based on the individual's goals. The child's tolerance for intervention, developmental level, progress, and family participation should be considered in evaluating intensity. Programs are expected to use a variety of settings to maximize generalization.¹⁶

Regional programs and private IBI providers are required to deliver IBI services that:

- Are a direct service to the child;
- Have a level of service determined by clinical assessment;
- Are delivered by trained staff based on curriculum to meet the child's goals;
- Involve parents to teach them to supplement at home;
- Use ABA based methods, including DTT, small group instruction, activity-based learning, and incidental teaching;
- Plan for and support transition to school and coordinate with other services; and
- Are sensitive to parents' values and preferences, cultural context and language.¹⁶

Regional programs provide funding for services they determine to be adequately clinically supervised and funding levels are reviewed every six months. When a family moves outside the boundaries of service by a program, continued IBI service in the new home region is not guaranteed.¹⁶

In 2004, the Canadian Pediatric Society (CPS) released a position statement to describe and review the effectiveness of interventions targeted for global improvement of ASD symptoms.⁶ Lovaas therapy is an operant-conditioning behavioral model where desired behavior is reinforced and unwanted behavior is ignored. DTT is conducted consisting of presentation of a stimulus, followed by the child's response and consequences. CPS noted methodological flaws in the primary study of Lovaas, as it did not compare different therapies, but instead, compared level of intensity of the same treatment. Implementation of therapy was inadequately documented, assessment was not uniform, and randomization may have been flawed.⁶ Normalized teaching was found to be more effective than DTT for the outcome of language, according to a review of eight single case studies and two group comparison studies.⁶ Learning Experiences: an alternative program for preschoolers and their parents (LEAP), Floor Time and TEACCH were not critiqued due to a paucity of controlled trials.⁶

CPS recommended between 15 hours to 40 hours per week of individualized programming with all of these programs. It was noted that all of the studies lack control groups with the exception

of one study of the TEACCH program. However, the study was flawed by nonrandom group assignment and unblinded assessors. None of the treatment models have been compared with one another. CPS recommended that a minimum of 15 hours per week of structured, individualized teaching be provided to children with autism. The family should be involved in service provision, program evaluation and adjustments should be made to meet the child's needs.⁶ Based on reviewing existing studies, CPS recommended that funded programs for children with autism should include a research arm to address outstanding questions regarding clarification of the common effective elements of treatment, optimal age and IQ range of children, optimal intensity, duration of treatment, parent involvement, and magnitude of effectiveness of these programs.⁶

The New Jersey Autism Program Quality Indicators was issued in 2004 to guide educators and parents and describe effective models of educating students with ASD.¹⁷ While the guidelines are not specifically linked to successful outcomes, they are thought to represent best practices from clinical experience and research findings.¹⁷ It was recommended that children with autism receive a minimum of 25 hours per week of ABA and an individualized education program of 210 days per year.¹⁷ Students should participate in instruction focusing on communication and socialization. Curriculum should include written objectives conducted in a range of naturalistic settings.¹⁷ Instructional methods should have documented effectiveness and reflect empirically validated practices. The two most commonly used methods are ABA and Developmental Individual-Difference Relationship-Based Model (DIR)/Floor Time. An ABA program typically uses a range of teaching tools to develop different skills. DTT may be used to help children understand the names of objects, while a verbal behavior approach supports more spontaneous speech.¹⁷ Program evaluation should aggregate student outcomes, parent satisfaction, and staff input.¹⁷

Systematic reviews

In 2007, Lucket *et al.*¹⁸ systematically reviewed the evidence for the effectiveness of behavioral interventions in promoting play in children with autism. True play is voluntary, flexible, spontaneous and actively engages the child in the process rather than an end result.¹⁸ These characteristics of play are not inherently compatible with highly structured teaching techniques that rely on imposed structure, repetition and rewards.¹⁸ Behavioral approaches to treating play based on ABA have expanded to make use of stereotyped behavior, differential reinforcement of behavior, reciprocal imitation, PRT, self-management training, video monitoring and play scripts.¹⁸ Lucket *et al.* searched the PsycInfo data base using key terms related to autism and behavioral approaches and scanned search results for studies that evaluated the effectiveness of behavioral approaches in promoting play. Full-text articles were independently reviewed based on inclusion and exclusion criteria and categorized for meeting hard versus soft claims of promoting play.¹⁸

Thirteen articles met the criteria for study. Four studies (Nietupski -1986, Nuzzolo-Gomez - 2002, Santarcangelo -1987, Stahmner and Schriebman -1992) reported on behavioral approaches (differential reinforcement, DTT, self-management) that claimed to increase "appropriate" play in children with autism.¹⁸ Appropriate play occurs when a toy is used in the manner for which it is intended. Two of four articles, involving self-management and DTT, provided evidence that an intervention using a staged approach encourages children to self-monitor their activities and internalize motivation.¹⁸ The reviewers questioned the extent to which children's preferences were voluntary, rather than conditioned, when they were the result of reinforcement offered by toys.

Six studies (Ingersoll and Schreibman -2002, Stahmer -2004, Lifter -1993, Newman -2000, Stahmer -1995, and Thorp -1995) reported interventions that claimed to increase symbolic (make-believe) play in children with autism.¹⁸ Four of the six studies reported results consistent with the criteria for play using DTT and PRT. Results suggested that children receiving intervention display a degree of freedom from the constraints of reality, voluntariness, internal motivation, flexibility and spontaneity in play.¹⁸

Three articles (Perry -1995, Baker -2000, Jahr -2000) reported interventions (Lovaas, thematic ritualistic activities such as board games, *in vivo* modeling) that claimed to have taught social play to children with autism. Results suggested that children receiving intervention show voluntary participation in that intervention without extrinsic reinforcers.¹⁸

Reviewers concluded that collectively, the thirteen studies reported changes that suggest behavioral approaches may be effective in changing children's disposition toward play.¹⁸ The most successful interventions took a heavily structured approach with reinforcement from the activity or learning/play materials themselves to shape behaviors.¹⁸ Future studies would benefit from RCT design, should include measures of the quality of play in assessing progress, and generalization of skills to new toys, settings and playmates.¹⁸

In 2005, McConachie *et al.*¹⁹ systematically reviewed the evidence for the effectiveness of parent implemented early intervention in preschool children with autism. Training parents as co-therapists affords consistency and ensures that intervention is appropriate in enhancing children's social relationships.¹⁹ Authors searched electronic databases without date or language limits, using key terms related to child, parents, parent training and ASD.¹⁹ The search was designed in consultation with the Cochrane Collaboration Developmental, Psychological and Learning Problems group and unpublished studies were sought. Studies were included if they reported on parent mediated intervention, and concurrent control comparison, in preschool children with autism. Outcomes of interest included developmental progress, parent-child interaction, parents' knowledge, attitudes, stress levels, family functioning and cost-benefit analysis. Critical appraisal included allocation concealment, independent diagnosis and assessment, multiple follow-up measures, length of follow-up, withdrawals and dropouts, and use of standardized tests and diagnostic instruments.¹⁹ Continuous data were analyzed as post-test means and standardized deviations. Due to heterogeneity in interventions and outcomes, only two studies were pooled in a meta-analysis.¹⁹

Four of twelve studies that met the inclusion criteria were RCTs. Two RCTs met randomization criteria, two did not specify the diagnostic tools used, one was an unblinded assessment and only one study carried out long-term follow-up.¹⁹ Methodological weaknesses were also apparent in controlled studies. One study did not specify diagnosis by independent clinician, two did not use independent assessors, and two did not report follow-up data.¹⁹

A meta-analysis of results of the MacArthur Communication Development Inventory from two RCTs (Aldred -2004, Drew -2002) showed significant effects in favor of treatment on words understood ($p=0.02$, WMD 75.84, CI[10.95, 140.72]) and on words said ($p=0.04$, WMD 69.66, CI [2.39, 136.94]).¹⁹ A randomized study by Smith *et al.* 2000 showed children receiving ABA achieved a standard mean difference of 19.33, CI[3.7, 24.92] on IQ (Stanford-Binet Intelligence Scale, or Bayley Scales of Infant Development-Mental Index) compared with parent trained children.¹⁹ Children in the ABA group also scored higher on the Miller-Palmer Scale of Mental Tests ($p=0.04$). Parental reports of children's behavior problems decreased significantly ($p=0.005$, mean difference 6, CI [1.81, 10.19]) as well as reports of obsessions and rituals in the parent training group at 18 months.¹⁹

Overall, the reviewers concluded that parent training can successfully contribute to intervention for children with ASD; however, comparison between two approaches does not tell us about the effectiveness of parent's involvement and studies reviewed are methodologically flawed.¹⁹

In 2004, White conducted a Succinct and Timely Evaluated Evidence Review (STEER) of cognitive behavioral interventions for children with ASD.²⁰ Cognitive behavioral therapy (CBT) was used to identify and correct distortions in thinking. Therapy comprised assessment of the problem, affective education, cognitive restructuring, anxiety management, self-reflection, and practice of the principles in daily situations.²⁰ Electronic databases were searched and controlled studies and case series of CBT involving five subjects or more were reviewed.

One RCT (Sofronoff *et al.* 2003) and one case series (Bauminger 2002) met the criteria for inclusion. An RCT of 65 children aged 10 to 12 years old with Asperger's syndrome were randomized to CBT, CBT involving parents as co-therapists, or wait list. While many outcome measures were used, only three were reported.²⁰ It is not clear on what basis the outcomes were selected for presentation. The RCT found that CBT increased the number of positive solutions the child was able to provide to the "James and the Maths test" assessment post-intervention. Any significant differences between groups could be due to chance as the inclusion and exclusion criteria were not explicit, no description of randomization was given, and it was not clear whether assessors were routinely blinded during assessment.²⁰ The case series included 15 high functioning children diagnosed with autism that received CBT three hours per week for seven months. Children showed significantly more positive social interaction with peers after CBT (mean number of positive interactions in 15 minutes: 6.09 at baseline versus 12.0 after CBT, $p < 0.001$).²⁰ Changes in social cognition, emotional understanding and social functioning were assessed. The study was of weak design and changes observed cannot be conclusively attributed to the intervention rather than natural development, learning or extra attention in the intervention group.²⁰ The systematic reviewer concluded that there is no reliable evidence to suggest CBT produces clinically important effects in children with ASD.

Health technology briefs

New Zealand published a technology brief in 2004 to summarize the evidence for effectiveness of behavioral and skill-based early interventions for children with ASD.²¹ Technology briefs are rapid assessments of the best evidence on a topic but they are less rigorous than systematic reviews.²¹ Appraised evidence is limited to systematic reviews, meta-analysis, evidence-based clinical practice guidelines, HTAs and RCTs.²¹ Bibliographic databases were searched for primary and secondary research published between December 2003 and January 2007. Evidence on formal behavioral skill based interventions for children (age ≤ 8 years old) with ASD were selected for review if 70% of the study population had ASD classified by DSM-IV or ICD-10 and effectiveness measures related to behavioral change were reported.²¹ Studies with fewer than five participants in treatment or control arms and articles published in languages other than English were excluded. Appraisal results were presented in evidence tables and selected studies were assessed and classified based on a hierarchy of evidence by the National Health and Medical Research Council.²¹

Ten articles met the inclusion criteria for study. Five primary studies, conducted in a variety of settings, were all level III.2 evidence. This comprises evidence obtained from comparative studies, including systematic reviews of such studies, with concurrent controls and allocation not randomized, cohort studies, case control studies or interrupted time series with a control group.²¹ Three studies were conducted in the United Kingdom, one in the United States and one in Norway. A multi-cohort by Bibbey *et al.* (2002) found parent managed IBI was less effective than clinic-based, professionally directed programs.²¹ An RCT by Smith *et al.* (2000)

found that the intensive treatment group out-performed the parent training group on measures of intelligence, visual spatial skills, language and academics, but not on adaptive functioning or behavior problems.²¹ An RCT by Drew *et al.* (2002) showed modest improvement in communication for parent training compared to usual care.²¹ A comparative study by Eikeseth *et al.* (2002) showed children receiving IBI made significantly larger improvements in IQ, language expression, comprehension and communication at one year follow-up compared to those receiving usual care.²¹ In a study by Salt *et al.* (2002), children in a Scottish program based on a social developmental approach improved significantly in measures of joint attention, social interaction, imitation, daily living skills and adaptive behavior compared to controls.²¹ The synthesis reports that these studies of different types of behavioral interventions across different settings led to selected gains in specific areas, but further research is needed to address methodological limitations and replicate these findings.²¹ Studies with larger sample sizes, from multisite collaborations using identical methods and outcome measures are required to provide more precise estimates of effectiveness.²¹

Five secondary reviews summarizing or critically appraising studies of highest quality were also assessed in the technology brief.²¹ In evaluating Lovaas therapy, Bassett *et al.* (2000) suggested that Lovaas's claims of achieving normal developmental placement in schools following therapy are uncorroborated by independent research. Due to methodological flaws, the findings of Lovaas (1987) and McEachin (1993) cannot be regarded as conclusive.²¹ Diggle *et al.* (2003) reviewed two studies on parent mediated intervention but results were inconclusive. While some evidence favored early intervention, the small number of studies, differing approaches, intensity, and duration lend caution.²¹ Finch and Raffael (2003) suggested children receiving IBI show positive gains in IQ, class placement and adaptive behaviors but the authors of the review stated that it is difficult to conclude that IBI is effective for all children with autism.²¹ Ludwig and Harstall (2001) summarized recent IBI reviews (Lovaas therapy, Rutgers, Denver, TEACCH) and concluded that evidence is limited regarding the effectiveness of one intervention compared to another due to methodological limitations in existing studies.²¹ McGahan (2001) systematically reviewed the literature, summarized five existing reviews and reached the same conclusion as Ludwig and Harstall (2001). McGahan (2001) suggested study design could benefit from the inclusion of an adequate control group and consistent outcome measures should be used for all study participants, administered by the same, blinded assessor at the beginning and end of the study. All five reviews noted the lack of well-conducted research and all concluded that there is insufficient evidence to draw conclusions regarding best practice.²¹ Researchers have yet to establish the amount and intensity of any form of early comprehensive therapy and overall outcome.²¹

The New Zealand review concluded that, while children improve in functioning with IBI, it remains to be determined if any one early and/or intensive intervention program is more effective than another. Primary studies included in the technology brief covered a range of interventions and comparisons and it is not clear whether definition of IBI, parent training or parent managed behavioral therapy were uniform across studies.²¹

Assessment of the quality of the guidelines and systematic reviews

Clinical guidelines

The Appraisal of Guidelines for Research and Evaluation (AGREE) was used to grade the quality of the guidelines. The Canadian guideline for the diagnosis of ASD was developed with consensus by professional groups.¹ The objective, clinical questions, methods, population for which the guideline is meant, and target users were well described. It is unclear whether patients' preferences were sought, whether it was piloted among target users, or whether it was

independent from the funding body. Conflicts of interest were not reported. While there is an explicit link between the recommendations and supporting evidence, the methods used to search for evidence and criteria for selecting evidence were not reported. The guidelines were peer reviewed by experts prior to publication and reference is made to using the most current DSM and ICD diagnostic criteria. Recommendations are specific, easily identifiable and supported with reference tools for application. Potential barriers to use have been discussed but cost implications and monitoring criteria are not reported.

The objective, clinical questions, population, and target users of the AETNA guideline were well defined. It was not clear whether relevant professional groups assisted guideline development or whether patients' views and preferences were sought. While the evidence supports the recommendations, the search methods, selection criteria, methods for formulating the recommendations and peer review were not reported. The guideline is updated as new evidence arises. Different options for management were clearly described and key recommendations were evidence-based. No information was provided regarding organizational barriers or associated costs in implementing recommendations. AETNA is an American diversified health care benefits company providing a range of traditional and consumer directed health care insurance products and services. The guideline was not editorially independent of the funding body.

The objective, clinical questions, population, scope and target users of the SIGN guideline were well defined. Recommendations were developed with representation from relevant professional groups and patients' and families' views and preferences were sought in focus groups. The guideline was piloted, audit procedures were reported, and evidence is updated every three years. While recommendations were well defined and supported by graded evidence, methods of searching and selecting the evidence were not clearly reported. Tools for application of the guideline were also provided. The guideline was piloted and peer reviewed by experts. Implementation, resource implications, audit and updating processes were reported.

New Mexico's guidelines list ABA approaches but provide little guidance regarding the choice of approach other than the fact that intervention should be specialized to meet individual needs. Overall objectives, clinical questions, population, and the target audience were well described. Relevant professional groups contributed to guideline development and parents' perspectives were considered. A list of best practice guidelines supports the recommendations; however, the methods used to search, select and synthesize the evidence were not reported. Tools were provided to support implementation of the guideline and organizational and cost implications were mentioned. There was no reference to auditing or updating procedures. The guideline was developed under a grant from the United States Department of Education; however, the contents were not assumed to be endorsed by the Federal Government.

Ontario's guidelines for intervention recommended that children with autism receive between 20 and 40 hours of IBI based on best practices.¹⁶ The objectives, clinical questions, population, and target audience were well defined. The Ministry of Children and Youth Services issued the guidelines and committed to auditing and revising them. While parents' perspectives were considered, consultation with relevant professional groups and pilot testing were not reported. Key recommendations were clear and consistent with other recommendations referenced in this report, but no supporting evidence was provided within the guideline itself. There was no reference to literature searching, selection of evidence or process by which the guidelines were developed. Organizational and cost implications were addressed.

The objectives, clinical questions, population, and target audience for the CPS guideline were clear. Relevant professional groups were involved in developing the guidance and parents'

perspectives were considered. Recommendations evidence-based and identified through a targeted literature search; however, inclusion criteria and methods for formulating recommendations were not fully reported. Various behavioral interventions were cited but little guidance was provided regarding choice of intervention, other than the fact that therapy should be at least 15 hours per week and based on a child's individualized needs. Peer review, auditing and updating procedures, barriers to implementation, cost implications, funding and conflicts of interest were not reported.

The New Jersey guidelines recommended a minimum of 25 hours per week of individualized instruction involving ABA and DIR/Floor Time. Overall objectives, clinical questions, population, and target audience were well defined. Relevant professional groups were involved in developing the guidelines and families' perspectives were considered. While recommendations were evidence-based, the methods used to search, select and synthesize evidence were not clearly reported and reference to ABA is buried in the appendix. New Jersey guidelines were peer reviewed but auditing and updating processes, implementation costs, and implications were not reported. Funding and conflicts of interest were not reported.

Systematic reviews and technology briefs

The Oxman and Guyatt index of scientific quality of research reviews was used to guide the assessment of the quality of the systematic reviews. A systematic review by Lucket *et al.*¹⁸ (2007) concluded that the most effective behavioral interventions for promoting play are those that build upon children's existing abilities or rely on the motivating activities themselves rather than external rewards. As a result of limited searching, relevant studies may be missing from the review. Two reviewers independently selected studies based on selection criteria set *a priori* and the degree of agreement between reviewers in classifying studies is reported. The criteria used for assessing study validity were not reported. The evidence presented supports conclusions by the systematic reviewers.

The systematic review by McConachie concluded that parent training successfully contributed to intervention for children with ASD.¹⁹ The systematic review is founded on a well designed search strategy with well defined inclusion and exclusion criteria for study. The process by which studies were selected and means for consensus was not reported. All studies were appraised for allocation concealment, independent diagnosis and assessment, multiple follow-up measures, length of follow-up, withdrawals and dropouts, and use of standardized tests and diagnostic instruments. Methods used to combine findings were clearly stated and studies were combined appropriately based on the primary research question. The evidence cited supports conclusions by the systematic reviewers.

The systematic review by White concluded that there is no reliable evidence to suggest CBT is clinically effective in children with ASD.²⁰ While the systematic review contains a comprehensive search strategy and inclusion and exclusion criteria for study, there is potential for bias in the selection of studies based on a single reviewer. STEERs are conducted using validated search strategies, data extraction and peer review; however, they are descriptive in nature and rarely employ meta-analysis.²⁰ Criteria for assessing the validity of included studies were not explicitly reported in the methods; however, the validity of all studies was assessed using appropriate criteria. The evidence supports conclusions by the systematic reviewer.

The New Zealand technology brief concluded that while children with autism exhibit functional gains with IBI, it remains to be determined whether one early and/or intensive intervention program is more effective than another.²¹ The brief was based on a reasonably comprehensive literature search. While study inclusion and exclusion criteria were listed, the number of

reviewers, degree of agreement between reviewers, means of resolving discrepancies in study selection and data extraction were not reported. Possible bias and error exists in the selection of studies and reporting of results. An overestimate of effect may result when publications in languages other than English are excluded. While primary evidence was ranked in terms of hierarchy, no formal appraisal tools were used to assess the validity of included studies. The evidence cited supported conclusions made by the authors of the review.

Conclusions and implications for decision or policy making:

The British Columbia Guidelines Working Group recommended that the diagnosis of ASD be based on current DSM-IV-TR or ICD-10 diagnostic criteria.¹ While there is no specific test or instrument to confirm or exclude ASD as a diagnosis, multidisciplinary assessment is recommended and tools are provided to support the application of the guideline.¹ AETNA recommended that children that do not babble or gesture by 12 months of age, provide two-word spontaneous phrases by 24 months, or lose language or social skills at any age undergo medical evaluation, speech-language and audiological evaluation, and fragile X testing in the presence of mental retardation.⁸ AETNA also recommended intensive educational interventions that engage the child in systematically planned developmental objectives including speech-language therapy to improve communication skills. It was noted that there is insufficient evidence for the superiority of any particular intensive intervention strategy over other intensive intervention strategies.⁸ SIGN recommended that all professionals diagnosing ASD consider using ICD-10 or DSM-IV and further research is needed regarding validation of screening instruments, minimum age for reliable diagnosis, reliability and validity of existing classification systems and the use of parallel assessment tools.¹⁴ SIGN recommended that behavioral interventions be considered to reduce the frequency and severity of ASD symptoms, and develop adaptive skills. New Mexico suggested behavioral and communication approaches be used within early intervention and/or preschool education.¹⁵ The guideline recommended that children with ASD should be systematically engaged in a minimum of 25 hours per week of ABA.¹⁵ Ontario's guidelines recommended that children with autism receive 20 to 40 hours of IBI per week based on best practices.¹⁶ It is noted that there is no evidence base to determine the optimal intensity, setting(s), or duration for intervention.¹⁶ The CPS recommended that a minimum of 15 hours per week of structured, individualized teaching be provided to children with autism.⁶ The family should be involved in service provision, program evaluation and adjustments should be made to meet the child's needs.⁶ The New Jersey Program Quality Indicators recommended that children with autism receive a minimum of 25 hours per week of ABA and a curriculum with written objectives to be conducted in a range of naturalistic settings.¹⁷

A systematic review of 13 studies suggested behavioral approaches may be effective in changing children's disposition toward play.¹⁸ The most successful interventions took a heavily structured approach with reinforcement from the activity or the play/learning materials themselves in shaping behavior.¹⁸ A systematic review of twelve studies concluded that parent training can successfully contribute to intervention for children with ASD, but primary studies are methodologically flawed and a comparison of two approaches does not tell us about the effectiveness of parent's involvement.¹⁸ Finally, upon systematically reviewing four studies, another study concluded that there is no reliable evidence to suggest CBT is clinically effective in children with ASD.²⁰ Researchers reviewing five secondary reviews and five primary studies as a systematic review concluded that while children improve in functioning with IBI, it remains to be determined whether any one early and/or intensive intervention program is more effective than another.²¹

The guidelines for diagnosis of autism made similar recommendations. Four guidelines recommended that a diagnosis of autism be based on the current criteria specified in the DSM-IV-TR or ICD-10 and that a multidisciplinary assessment be conducted.^{1,8,14,15} Six guidelines, two systematic reviews, and one technology brief recommended that behavioral interventions be considered to address a range of behaviors in children with ASD to reduce the frequency and severity of symptoms, and increase the development of adaptive skills.^{6,8,14-19,21} The CPS recommended a minimum of 15 hours per week of structured, individualized teaching while most guidelines recommended a minimum of 25 hours per week.^{6,15,17} Guidance from Ontario noted that there is no evidence base to determine the optimal intensity, setting(s), or duration for intervention.¹⁶ Overall, the systematic reviews largely concur in their conclusions, suggesting ABA can improve aspects of function in children with ASD. It does not appear as though one intensive behavioral approach is more effective than another and uncertainty exists regarding the intensity and program components required to elicit positive outcomes and whether older children would achieve similar gains. The CPS recommended that funded programs for children should include a research arm addressing questions regarding the common effective elements of treatment, optimal age and IQ range, optimal intensity, duration of treatment, parent involvement, and magnitude of effectiveness of these programs.

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Appendix A: Abbreviations

3di	Developmental, Dimensional and Diagnostic Interview
ABA	Applied behavioral analysis
ADI-R	Autism Diagnostic Interview-Revised
ADOS-G	Autism Diagnostic Observation Schedule-Generic
AGREE	Appraisal of Guidelines for Research and Evaluation
ASD	Autism spectrum disorder
ASQ	Autism Screening Questionnaire
CARD	Centre for Autism and Related Disorders
CARS	Childhood Autism Rating Scale
CBT	Cognitive behavioral therapy
CHAT	Checklist for Autism in Toddlers
CI	Confidence interval
CPS	Canadian Pediatric Society
CRD	Centre for Reviews and Dissemination
DISCO	Diagnostic Interview for Social and Communication Disorders
DSM-IV-TR	Diagnostic and Statistical Manual of Mental disorders, fourth edition, text revision
DT-TB	Discrete Trial Training Behavior
DTT	Discrete Trial Training
EEG	Electroencephalogram
HTA	Health technology assessment
IBI	Intensive behavioral intervention
ICD-10	International Statistical Classification of Diseases and Related Health Problems, tenth revision
ILT	Incidental Language Teaching
IQ	Intelligence quotient
ITTT	Takes Two To Talk Finally

LEAP	Learning Experiences: an Alternative Program for preschoolers and parents
M-CHAT	Modified Checklist for Autism in Toddlers
NLP	Natural Language Paradigm
PDD	Pervasive developmental disorder
PDD-NOS	Pervasive developmental disorder not otherwise specified
PECS	Picture Exchange Communication System
PRT	Pivotal Response Training
RCT	Randomized controlled trial
SBI-4	Stanford Binet Intelligence Scale Fourth Edition
S-P/D	Social-Pragmatic Developmental approach
SCERTS	Social-Communication, Emotional Regulation and Transactional Support
SIGN	Scottish Intercollegiate Guidelines Network
STAT	Screening Test for Autism in Two-Year Olds
TEACCH	Treatment and Education of Autistic and related Communications Handicapped Children
WMD	Weighted Mean Difference
WPPSI-R	Weschler Preschool and Primary Scale of Intelligence-R

Appendix B: Comparison of ICD-10 and DSM IV Diagnoses⁴

ICD-10	DSM-IV
Childhood autism	Autistic disorder
Rett's syndrome	Rett's disorder
Other childhood disintegrative disorder	Childhood disintegrative disorder
Asperger's syndrome	Asperger's disorder
Atypical autism Other pervasive developmental disorder Pervasive developmental disorder, unspecified	Pervasive developmental disorder not otherwise specified (including atypical autism)
Overactive disorder with mental retardation and stereotyped movements	No corresponding diagnosis

Appendix C: DSM-IV-RT Diagnostic Criteria

Table 1: DSM-IV-TR Diagnostic Criteria for Autistic Disorder

Diagnosis is based on the presence of a total of six or more items from criterions 1, 2, and 3, with at least two from criterion 1 and one each from criterions 2 and 3	
Criterion 1 (n≥2)	Qualitative impairment in social interaction: a) Marked impairment in the use of multiple nonverbal behaviors b) Failure to develop peer relationships appropriate to developmental level c) Lack of spontaneous seeking to share enjoyment and interests with others d) Lack of social or emotional reciprocity
Criterion 2 (n≥1)	Qualitative impairments in communication: a) Delayed or lack of development of spoken language b) Marked impairment in the ability to initiate or sustain conversation c) Stereotyped or repetitive use of language d) Lack of varied, spontaneous play appropriate to developmental level
Criterion 3 (n≥1)	Restricted, repetitive and stereotyped patterns of behavior, interests and activities a) Preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal in intensity or focus b) Inflexible adherence to specific, non-functional routines or rituals c) Stereotyped and repetitive motor mannerisms d) Persistent preoccupation with parts of objects
Criterion 4 (n≥1)	Delays or abnormal functioning in the following prior to age 3 years: a) Social interaction b) Language as used in social communication c) Symbolic or imaginative play
Criterion 5	The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder.

Adapted from DSM-IV-TR²

Table 2: DSM-IV-TR Diagnostic Criteria for Asperger's Disorder

Diagnosis is based on the presence of at least 2 items from criterion 1, one item from criterion 2 and fulfillment of criterions 3, 4, 5, and 6	
Criterion 1 (n≥2)	Qualitative impairment in social interaction: a) Marked impairment in the use of multiple nonverbal behaviors b) Failure to develop peer relationships appropriate to developmental level c) Lack of spontaneous seeking to share enjoyment and interests with others d) Lack of social or emotional reciprocity
Criterion 2 (n≥1)	Restricted, repetitive and stereotyped patterns of behavior, interests and activities a) Preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal in intensity or focus b) Inflexible adherence to specific, non-functional routines or rituals c) Stereotyped and repetitive motor mannerisms d) Persistent preoccupation with parts of objects
Criterion 3	The disturbance causes clinically significant impairment in social, occupational, or other important areas of functioning
Criterion 4	There is no clinically significant delay in language
Criterion 5	There is no clinically significant delay in cognitive development
Criterion 6	Criteria are not met for another specific PDD or Schizophrenia

Adapted from DSM-IV-TR²

Table 3: DSM-IV-TR Diagnostic Criteria for PDD-NOS

Diagnosis is based on the presence of criterion 1 or 2	
Criterion 1	Severe and pervasive impairment in the development of reciprocal social interaction associated with impaired communication skills
Criterion 2	Presence of stereotyped behavior, interests and activities but does not meet criteria for autistic disorder due to late age of onset, atypical or sub-threshold symptoms

Adapted from DSM-IV-TR²

Table 4: DSM-IV-TR Diagnostic Criteria for Rett's Disorder

Diagnosis is based on the presence of all items of criterion 1 and onset of all items of criterion 2 after a period of normal development	
Criterion 1	All of the following: a) Normal prenatal and perinatal development b) Normal psychomotor development through the first 5 months c) Normal head circumference at birth
Criterion 2	Onset of all of the following after normal development: a) Deceleration of head growth from 5 to 48 months b) Loss of acquired hand skills from age 5 to 30 months c) Loss of social engagement d) Poorly coordinated gait or trunk movements e) Severely impaired expressive and receptive language, psychomotor retardation

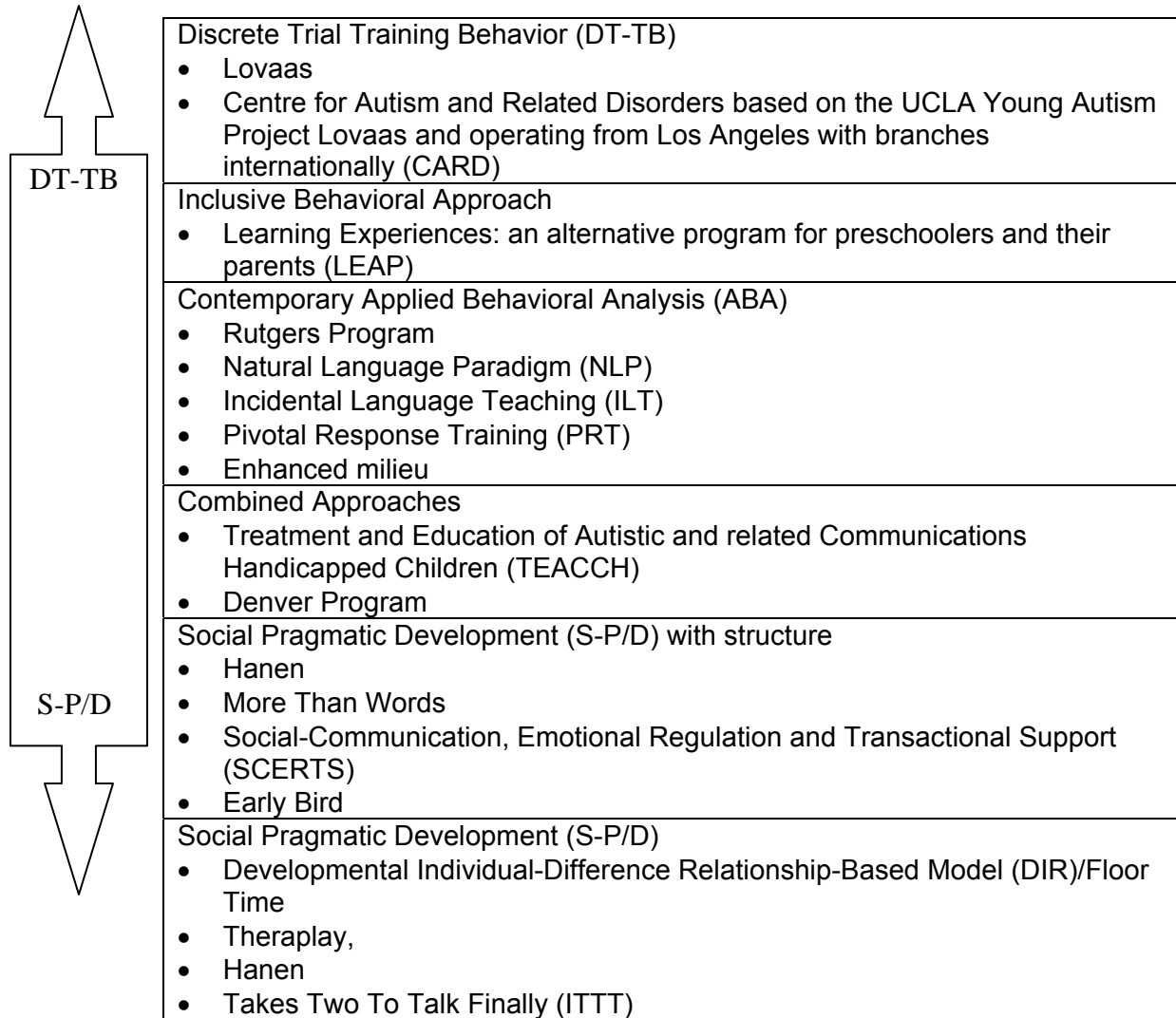
Adapted from DSM-IV-TR²

Table 5: DSM-IV-TR Diagnostic Criteria for Childhood Disintegrative Disorder

Diagnosis is based on the presence of criterion 1, at least two items from criterions 2 and 3 and criterion 4	
Criterion 1	Normal development for the first 2 years, manifested as age-appropriate communication, social relationships, play and adaptive behavior
Criterion 2 (n≥2)	Clinically significant loss of acquired skills before 10 years of age: a) Expressive or receptive language b) Social skills or adaptive behavior c) Bowel or bladder control d) Play e) Motor skills
Criterion 3 (n≥2)	Abnormalities of functioning in the areas of: a) Qualitative impairment in social interaction b) Qualitative impairment in communication c) Restricted, repetitive and stereotyped patterns of behavior, interests, and activities
Criterion 4	Disturbance is not accounted for by another specific PDD or by Schizophrenia

Adapted from DSM-IV-TR²

Appendix D: Continuum of Discrete-Trial Training Behavioral to Social-Pragmatic Developmental Approaches



Adapted from Roberts 2004¹⁰

Appendix E: Canadian Survey of Behavioral Intervention Services

Province	Intervention	Cost (CAN \$)
British Columbia	Community program for children under 6 years old – Ministries of Education, Health, and Children and Families 20 hours per week of IBI based on scientific research and best practice	\$3.42 million; ⁹ \$20,000 per child per year ⁵
Alberta	Home early intervention from birth to 3.5 years – Ministry of Health Up to 40 hours per week of IBI for preschool children	\$40,000 to \$60,000 per child per year
Saskatchewan	Home, centre and community pilot program including behavior modification typical of Lovaas for preschool children–Saskatoon Health District One year pilot school based program, one hour per day twice a week –Saskatoon District Health, Autism Treatment Services of Saskatchewan and five school divisions	\$25,000 per child per year \$57,000 per six children
Manitoba	St. Amant Centre ABA program provides 35 to 40 hours of ABA per week to preschool and school aged children – Healthy Child Manitoba ⁹	\$57,000 per child per year ⁵
Ontario	Nine regional centers provide 20 to 40 hours per week of IBI to children under 6 years old - Ministry of Community & Social Services	\$19 million annualized funding
Quebec	Behavioral interventions, Zelazo (behavioral/developmental approach), TEACCH, Montreal Children’s Hospital provides ABA ⁹	\$15,000 to \$55,000 per year for personnel ⁵
New Brunswick	IBI	\$20,000 per child per year ⁵
Nova Scotia	Mount Saint Vincent University Child Study Center ABA preschool program –Departments of Health, Education, community Services & IWK Health Centre for Children	\$70,000 provides one third of the cost of therapy for 3 children
Prince Edward Island	Home behaviorally based program, 10 hours per week for preschool children –Health Transition Fund for the Autism Integration Project	ABA funding for any family with a child with autism
Newfoundland	Community-based intervention from birth to 5 years –direct Home Services Program Pilot to evaluate effectiveness of Lovaas/ABA (30 hours per week) and discrete trial therapy and Zelazo	\$975,000 required for 2 years of therapy for 35 children
Yukon Territory	Two children are diagnosed with autism but no therapies are being provided that resemble ABA/Lovaas/IBI	No reference to funding
Northwest Territories	Five children with autism live with their families and undergo behavioral management rather than IBI but some children are referred to Alberta for IBI	No reference to funding
Nunavut	No specific behavioral therapy services, referred to Edmonton, Winnipeg, Ottawa, or Montreal –Department of Health and Social Services, or Education	Funding for out of territory assessment and placement

Adapted from McGahan 2001⁹

Appendix F: Guidelines on the Diagnosis and Treatment of Children with Autism

Source	Aim	Method	Guidance	Recommendations and Limitations
Guidelines on Diagnosis				
British Columbia ASD Standards and Guidelines Working Group 2003 ¹	Provide minimum standards for diagnosis to establish eligibility for ASD intervention services for children ≤ 6 years old	Literature review and expert consensus	<p>All children undergo surveillance of social and communication development by primary care practitioners.</p> <p>If ASD is suspected, the primary care practitioner employs ASD screening instruments and refers the child for auditory and language assessments.</p> <p>A multidisciplinary diagnostic assessment involving psychology, speech-language, medical evaluation, occupational therapy, psychiatry, and other specialty assessments is conducted if ASD is still suspected.</p>	<p>Children ≥ 3 years can be diagnosed with PDD using current DSM-IV and ICD-10 criteria. Identification of subtypes may not be adequately reliable.¹</p> <p>ASD includes all DSM-IV and ICD-10 categories comprising autistic disorder; PDD-NOS/atypical autism; Asperger's disorder/syndrome; Rett's syndrome/disorder; and childhood disintegrative disorder.¹ No specific test or instrument confirms or excludes ASD diagnosis.</p> <p>A child is eligible for intervention services if the multidisciplinary assessment by the pediatrician, psychologist, or psychiatrist results in a diagnosis of ASD.¹</p> <p>It is not clear whether patient's preferences were considered, guidelines were piloted among target users, or whether it is editorially independent from the funding body. Conflicts of interest were not reported.</p> <p>While recommendations are evidence-based, the search and selection criteria were not reported.</p>

HEALTH TECHNOLOGY INQUIRY SERVICE (HTIS)

Source	Aim	Method	Guidance	Recommendations and Limitations
Guidelines on Diagnosis and Treatment				
Aetna, USA 2008 ⁸	Establish procedures and services medically necessary for assessment and treatment of autism and other PDDs	Literature review	<p>Parent and/or child interview, Medical evaluation Electroencephalogram (EEG) Fragile X test Speech-language and audiological hearing evaluation Behavior modification and psychotherapy Intensive interventions Alternative and augmentative communication aids Physical and occupational therapy⁸</p> <p>Filipek 2000, NAS 2001, Delprato 2001, Boyd and Corley 2001, Ludwig and Harstall 2001, Bassett 2000, Smith 1999, McGahan 2001, Doughty 2004, SIGN 2007)</p>	<p>Intensive educational interventions where the child is engaged in systematically planned and developmentally appropriate educational activity toward identified objectives, including speech-language therapy to improve communication skills</p> <p>There is insufficient evidence for the superiority of any particular intensive educational intervention strategy (ABA, structured teaching, or developmental models) over other intensive educational intervention strategies.⁸</p> <p>It is not clear whether professional groups assisted guideline development or patient's views and preferences were sought.</p> <p>While the recommendations are evidence-based, the search methods, selection criteria, methods for formulating recommendations and peer review are not reported.</p> <p>No information is provided regarding organizational barriers or associated costs in applying the recommendations but guidance is linked to the funding body.</p>

Source	Aim	Method	Guidance	Recommendations and Limitations
SIGN Scotland 2007 ¹⁴	Provide the evidence base and recommendations to inform clinical service provision regarding assessment and clinical intervention for ASD in children up to 18 years of age.	Literature review Focus groups	<p>Three studies suggested the use of DSM-IV and ICD-10 criteria improve the diagnostic reliability however, current criteria for Asperger's syndrome and autism have poor discriminant validity.</p> <p>The ADI-R, DISCO and 3di are reliable diagnostic instruments.¹⁴</p> <p>ASD-specific diagnostic instruments including CARS and ADOS-G may be used to improve diagnostic reliability.¹⁴</p> <p>A systematic review of 251 studies concluded focal behavioral interventions consistently result in positive behavioral outcomes across a range of target areas when aberrant behaviors, language, daily living, academic and social skills were considered.¹⁴</p>	<p>The guidelines recommend professionals diagnosing ASD should consider using ICD-10 or DSM-IV.¹⁴</p> <p>Accurate diagnosis of ASD can be difficult and it was only possible to interpret and generalize from studies where the diagnostic approach was clearly stated.¹⁴ Studies differed in terms of how diagnosis was made which made it difficult to compare or combine results of studies.</p> <p>SIGN recommended further research regarding validation of screening instruments, minimum age for reliable diagnosis, reliability and validity of existing classification systems and the use of parallel assessment tools.¹⁴</p> <p>The SIGN guideline recommended behavioral interventions be considered to reduce ASD symptom frequency and severity and develop of adaptive skills.¹⁴</p> <p>While recommendations are well defined and supported by graded evidence, methods of searching and selecting the evidence are not clearly reported.</p>

Source	Aim	Method	Guidance	Recommendations and Limitations
<p>New Mexico Public Education Department 2004¹⁵</p>	<p>Recommend practices in behavioral and communication approaches for use within early intervention or preschool education for children up to eight years of age.</p>	<p>Literature review, consultation</p>	<p>Developmental pediatricians, psychologists, psychiatrists or neurologists may diagnose autism in children aged two to three years old based on DSM-IV criteria.¹⁵</p> <p>Children with any ASD undergo a multidisciplinary evaluation of social, behavioral, language, communication, and cognitive skills. Upon diagnosis, all children are eligible for special education services and entry into intervention programs.¹⁵</p> <p>Various applied behavior approaches include: DTT, PRT, incidental teaching, activity based instruction, peer mediation, functional routines, TEACCH, PECS and social stories.</p>	<p>The guideline recommended that children with ASD should be systematically engaged in teaching opportunities organized around 15 to 20 minute intervals at a minimum of 25 hours per week, 12 months per year.¹⁵</p> <p>Objectives for children with ASD should be observable, measurable, documented, targeted for completion within one year, and add to the child's participation in education, community and family life.¹⁵</p> <p>The methods used to search, select and synthesize the evidence are not reported.</p> <p>Little guidance is provided regarding the choice of a particular approach other than the fact that intervention should be specialized to the needs of the individual.</p> <p>There is no reference to auditing or updating procedures.</p> <p>The guideline was developed under a grant from the United States Department of Education; however, the contents are not assumed to be endorsed by the Federal Government.</p>

HEALTH TECHNOLOGY INQUIRY SERVICE (HTIS)

Source	Aim	Method	Guidance	Recommendations and Limitations
Guidelines on Intervention				
Ontario Ministry of Children and Youth Services 2006 ¹⁶	Govern delivery of evidence based IBI.	Not reported	<p>Program confirms eligibility, and assesses the intensity, setting, and duration of IBI services.¹⁶ Skill assessments and progress evaluations are made every six months.¹⁶</p> <p>The child's tolerance for intervention, developmental level, progress, and family participation should be considered in evaluating intensity.</p> <p>Regional programs provide funding for services and review them every six months.¹⁶</p>	<p>The guidelines noted there is no clear evidence base for setting optimal intensity, setting(s), or duration of intervention and that clinical decisions should be based a periodic review by the clinical team and family.¹⁶</p> <p>Intensity (range 20 to 40 hours per week) depends on the quality of intervention provided.¹⁶ The exact number of hours should be determined by clinical assessment. Programs are expected to use a variety of settings to maximize generalization.¹⁶</p> <p>Regional programs and private IBI providers are required to deliver IBI services based on ABA principles. Parents should be involved to supplement at home. Programs should support transition to school and coordinate with other services.¹⁶</p> <p>While parents' perspectives were considered, consultation with relevant professional groups and pilot testing were not reported.</p> <p>No supporting evidence was provided within the guideline to support key recommendations. There was no reference to literature searching, selection of evidence or process by which the guidelines were developed.</p>
CPS Canadian 2004 ⁶	Review the status of the evidence regarding the effectiveness of main educational interventions for children with autism	Literature search	<p>Lovaas therapy is an operant-conditioning behavioral model where desired behavior is reinforced and unwanted behavior is ignored. DTT is conducted</p>	<p>The recommended amount of intervention with all of these programs ranges from 15 hours to 40 hours per week and programming is individualized.</p> <p>CPS noted that all of the studies lack control group comparison with the exception of one study of the TEACCH program. However, the study was flawed by nonrandom group assignment and unblinded assessors.</p>

HEALTH TECHNOLOGY INQUIRY SERVICE (HTIS)

Source	Aim	Method	Guidance	Recommendations and Limitations
			<p>consisting of presentation of a stimulus, followed by the child's response and consequences.</p> <p>Normalized teaching was found to be more effective than DTT for the outcome of language according to a review of eight single case studies and two group comparison studies.⁶</p>	<p>None of the treatment models have been compared with one another.</p> <p>CPS recommends that a minimum of 15 hours per week of structured, individualized teaching be provided to children with autism.</p> <p>LEAP, Floor Time and TEACCH were not critiqued due to a paucity of controlled trials.⁶</p> <p>Recommendations are supported by evidence identified through a targeted literature search; however, inclusion criteria and methods for formulating recommendations are not fully reported.</p> <p>Various behavioral interventions were cited but little guidance was provided regarding choice of intervention, other than the fact that therapy should be at least 15 hours per week and based on a child's individualized needs.</p> <p>Peer review, auditing and updating procedures, barriers to implementation, cost implications, funding, and conflicts of interest are not reported.</p>
<p>New Jersey Autism Program Quality Indications 2004¹⁷</p>	<p>Guide educators and parents in effective models of educating students with ASD.¹⁷</p>	<p>Panel of experts in education, medicine and psychology reviewing best practice models.</p>	<p>ABA and DIR/Floor Time are most common. An ABA program typically uses a range of teaching tools to develop different skills. DTT may be used to help children understand the names of objects, while a verbal behavior</p>	<p>It is recommended that children with autism receive a minimum of 25 hours per week of and an individualized education program of 210 days per year.¹⁷</p> <p>Students should participate in instruction that focusing on communication and socialization. Curriculum should include written objectives and be conducted in a range of naturalistic settings.¹⁷</p> <p>Instructional methods should have documented effectiveness and reflect empirically validated practices.</p>

Source	Aim	Method	Guidance	Recommendations and Limitations
			<p>approach supports more spontaneous speech.¹⁷</p>	<p>Program evaluation should aggregate student outcomes, parent satisfaction, and staff input.¹⁷</p> <p>While recommendations were evidence based, the methods used to search, select and synthesize evidence were not clearly reported and reference to ABA was buried in the appendix.</p> <p>New Jersey guidelines were peer reviewed but auditing and updating processes, implementation costs, implications are not, funding and conflicts of interest were not reported.</p>

ASD: autism spectrum disorder; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders; ICD-10: International Statistical Classification of Diseases and Related Health Problems; PDD: pervasive developmental disorder, PDD-NOS: pervasive developmental disorder-not otherwise specified

Appendix G: Systematic Reviews and Technology Briefs on the Diagnosis and Treatment of Children with Autism

Source	Objective	Inclusion and Exclusion Criteria	Results and Authors Conclusions	Limitations
Systematic Reviews on Behavioral Interventions				
Lucket <i>et al.</i> 2007 ¹⁸ Australia	Assess the evidence of effectiveness of behavioral interventions for promoting play in children with autism. ¹⁸	<p>PsycInfo data base was searched using key terms related to autism and behavioral approaches.</p> <p>Studies were selected if they evaluated the effectiveness of behavioral approaches in promoting play.</p> <p>Full-text articles were independently reviewed based on inclusion and exclusion criteria and categorized for meeting hard versus soft claims of promoting play. Inter-rater agreement was 89%.¹⁸</p>	<p>Thirteen articles met the criteria for study. Four studies reported on behavioral approaches (differential reinforcement, DTT, self-management) that claimed to increase “appropriate” play in children with autism.¹⁸ Six studies reported interventions that claimed to increase symbolic (make-believe) play in children with autism.¹⁸ Three articles reported interventions (Lovaas, thematic ritualistic activities as board games, <i>in vivo</i> modeling) that claimed to have taught social play to children with autism. Collectively, the thirteen studies report changes that suggest behavioral approaches may be effective in changing children’s disposition toward play.¹⁸</p> <p>Reviewers concluded that the most effective behavioral interventions for promoting play are those that build upon children’s existing abilities or rely on the motivating activities themselves rather than external rewards.</p>	<p>It is possible that relevant studies may have been missed from this review due to limited searching of a single database.</p> <p>While evidence presented supports conclusions by the authors, criteria for assessing the validity of primary studies was not reported.</p>

Source	Objective	Inclusion and Exclusion Criteria	Results and Authors Conclusions	Limitations
<p>McConachie <i>et al.</i> 2005¹⁹ United Kingdom</p>	<p>Systematically review the evidence for the effectiveness of parent implemented early intervention in preschool children with autism.</p>	<p>Studies were included if they reported on parent mediated intervention, concurrent control comparison, in preschool children with autism.</p> <p>Outcomes of interest included child developmental progress, parent-child interaction, parents' knowledge, attitudes, stress levels, family functioning and cost-benefit analysis.</p>	<p>Twelve studies met inclusion. Two RCTs met randomization criteria, two did not specify the diagnostic tools used, one was an unblinded assessment and one study conducted long-term follow-up.¹⁹</p> <p>A meta-analysis of results of the MacArthur Communication Development Inventory from two RCTs showed significant effects in favor of treatment on words understood (p=0.02, WMD 75.84, CI[10.95, 140.72]) and on words said (p=0.04, WMD 69.66, CI [2.39, 136.94]).¹⁹</p> <p>A randomized study by Smith <i>et al.</i> 2000 showed children receiving ABA achieved a standard mean difference of 19.33, CI[3.7, 24.92] on IQ (Stanford-Binet Intelligence Scale, or Bayley Scales of Infant Development-Mental Index) compared with parent trained children.¹⁹ Children in the ABA group scored higher on the Miller-Palmer Scale of Mental Tests (p=0.04). Behavior problems decreased significantly (p=0.005, mean difference 6, CI [1.81, 10.19]).¹⁹</p> <p>Reviewers concluded that parent training contributes to intervention for children with ASD; however, comparison between approaches does not tell us about the effectiveness of parent's involvement and studies reviewed are methodologically flawed.¹⁹</p>	<p>The process by which studies were selected and means for consensus was not reported</p>

Source	Objective	Inclusion and Exclusion Criteria	Results and Authors Conclusions	Limitations
White 2004 ²⁰ United Kingdom	Assess the effects of cognitive behavioral therapy in children with ASD. ²⁰	Studies were included that specified CBT and included all controlled studies and cases series with five subjects or more.	<p>One RCT and one case series met the inclusion criteria. An RCT of 65 children with Asperger's aged 10 to 12 years old were randomized to CBT, CBT involving parents as co-therapists, or wait list. While many outcome measures were used, only three were reported.²⁰ The RCT found that CBT increased the number of positive solutions the child was able to provide to the "James and the Maths test" assessment post-intervention. Any significant differences between groups could be due to chance, as inclusion and exclusion criteria were not explicit, no description of randomization was given, and it was not clear whether assessors were routinely blinded during assessment.²⁰</p> <p>The case series included 15 high functioning children diagnosed with autism that received CBT three hours per week for seven months. Children showed significantly more positive social interaction with peers after CBT (mean number of positive interactions in 15 minutes: 6.09 at baseline versus 12.0 after CBT, $p < 0.001$).²⁰ Changes in social cognition, emotional understanding and social functioning were assessed. The study was of weak intervention rather than natural development, learning or extra attention design and changes observed can not be conclusively attributed to the in the</p>	While the systematic review by White contains a comprehensive search strategy and inclusion and exclusion criteria for study, there is potential for bias because the selection and reporting of studies was conducted by a single reviewer.

Source	Objective	Inclusion and Exclusion Criteria	Results and Authors Conclusions	Limitations
			<p>intervention group.²⁰</p> <p>The systematic reviewer concluded that there is no reliable evidence to suggest CBT is clinically effective in children with ASD.</p>	
Health Technology Briefs on Behavioral Interventions				
New Zealand HTA Technology Brief 2004 ²¹	Summarize the evidence for effectiveness of behavioral and skill-based early interventions for children with ASD. ²¹	<p>Included:</p> <p>Design: primary and secondary research</p> <p>Population: children ≤8 years of age with ASD diagnosed by DSM-IV/ICD-10 criteria</p> <p>Intervention: behavioral and skill-based early intervention</p> <p>Outcome: behavioral change</p> <p>Excluded: studies with n≤5 in each group, non-English publications</p>	<p>Ten articles met the inclusion criteria for study. Five primary studies, conducted in a variety of settings, were all level III.2 evidence.²¹ Review authors report primary studies involving different types of interventions across different settings lead to gains, but further research is needed to address methodological limitations and replicate these findings.²¹ All five reviews noted the lack of well-conducted research and all concluded there is insufficient evidence to allow conclusions regarding best practice.²¹</p> <p>Reviewers concluded that while children improve in functioning with IBI, it remains to be determined if any one early and/or intensive intervention program is more effective than another.</p>	<p>Technology briefs are rapid assessments of the best evidence but they are less rigorous than systematic reviews.²¹</p> <p>Appraised evidence is limited to systematic reviews, meta-analysis, evidence-based clinical practice guidelines, HTAs and RCTs.²¹</p> <p>Studies included cover a range of interventions and it is not clear whether definitions were uniform across studies.²¹</p> <p>Possible bias and error exists in the selection of studies and reporting of results. No formal appraisal tools were used to assess study validity.</p> <p>An overestimate of effect may result by excluding non-English publications.</p>

ABA: applied behavioral analysis; ASD: autism spectrum disorder; CBT: cognitive behavioral therapy; CI: confidence interval; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders; DTT: discrete trial training; IBI: intensive behavioral intervention; ICD-10: International Statistical Classification of Diseases and Health Related Problems; IQ: intelligence quotient; RCTs: randomized controlled trials; WMD: weighted mean difference