

# Evidence-Based Interventions for Autism Spectrum Disorders

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## PREFACE

Autism is a neurodevelopmental disorder that challenges families and professionals to find effective interventions that can improve the lives of individuals with autism spectrum disorders. Due to the difficulty in finding interventions that work and that are readily available regardless of geographic location or financial resources, the field has nurtured many popular interventions that lack support from scientific research. At the same time, each child or adult with autism is unique, and some of the research strategies that have formed the foundation of traditional treatment research (such as randomized controlled trials) have been difficult to complete with large samples of participants with autism. For this reason, the interventions reviewed in this summary were evaluated in relation to several accepted standards of scientific quality and included both randomized group studies and carefully controlled single-subject research designs.

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## DEFINING AUTISM SPECTRUM DISORDERS

Autism spectrum disorders (ASDs) are a group of neurodevelopmental disabilities defined by significant impairments in social interaction, deficits in communication, and the presence of rigid behaviors and restricted interests. The thinking and learning abilities of people with ASDs can vary – from gifted to severely limited. ASD typically begins before the age of 3 and can create challenges throughout a person's life. ASD occurs in all racial, ethnic, and socioeconomic groups and is at least four times more likely to occur in males than females.

The primary ASDs are Autistic Disorder (or “autism”), Asperger’s Disorder, and Pervasive Developmental Disorder - Not Otherwise Specified (PDD-NOS). These conditions share many of the same behaviors, but they differ in terms of when the behaviors start, how severe they are, and the precise pattern of problems. Other disorders often listed as a PDD include Rett’s Disorder and Childhood Disintegrative Disorder, although these disorders may no longer be included on the “spectrum” as new diagnostic criteria for ASD are developed.

### **Autistic Disorder**

Autistic Disorder or “autism” is defined by qualitative impairments in three areas of function: (1) social interaction, (2) communication, and (3) restricted repetitive and stereotyped patterns of behavior, interests, and activities. Common symptoms include poor eye contact, poor “reading” of social cues, failure to develop peer relationships, lack of social or emotional reciprocity, delayed speech development, difficulty sustaining conversation, lack of make-believe play, repetitive motor mannerisms, and rigid adherence to routines. Symptoms are present before 3 years of age. As many as 60-75% of children with Autistic Disorder also have intellectual disabilities, but some children with Autistic Disorder can develop average or even superior intellectual abilities. Even in children with intellectual disabilities, there may be isolated skills that are highly developed (such as in music, math, or memory).

### **Asperger’s Disorder**

Asperger’s Disorder or Asperger Syndrome is defined by impairments in social interaction combined with restricted or repetitive patterns of behavior, interests, and activities. Common symptoms include poor “reading” of social cues, failure to develop typical peer relationships, lack of emotional reciprocity, intense interests or preoccupations, and rigid adherence to routines. Children with Asperger Syndrome do not show general impairments in language or overall cognitive development, although impairments in visual-motor skills and pragmatic (social) language are common.

### **Pervasive Developmental Disorder - Not Otherwise Specified (PDD-NOS)**

The diagnosis of PDD-NOS is appropriate when there is severe and pervasive impairment in the development of reciprocal social interaction associated with impairment in either verbal or nonverbal communication skills or with the presence of stereotyped behavior, interests, and activities, but the criteria are not met for a more specific disorder. This diagnosis is often used when a child shows several symptoms consistent with an ASD, but does not meet the full criteria for either Autistic Disorder or Asperger's Disorder.

### **Other Pervasive Developmental Disorders**

The essential feature of Childhood Disintegrative Disorder is a marked regression in multiple areas of functioning following a period of at least 2 years of apparently normal development. After the first 2 years of life (but before age 10), the child shows a clinically significant loss of previously acquired skills in at least two of the following areas: expressive or receptive language, social skills or adaptive behavior, bowel or bladder control, play, or motor skills. Rett's Disorder or Rett Syndrome, which is a genetic disorder that occurs almost exclusively in girls, involves the development of multiple specific deficits following a period of normal early functioning. Between 5 and 48 months of age, the child with Rett Syndrome shows a slowing of head growth, loss of previously acquired purposeful hand skills, the development of stereotyped hand movements (e.g., hand wringing), a loss of social engagement, poorly coordinated gait or trunk movements, and severely impaired language and psychomotor skills.

### **Causes of Autism**

No one knows for sure what causes autism, but scientists believe that both genes and the environment play a role. Research has shown that autism tends to run in families. Among identical twins, if one child has autism, then the other is likely to be affected 75-90% of the time. Parents who have a child with an ASD have a 2-10% chance of having a second child who is also affected. Some parents worry that vaccines cause autism, but the scientific evidence does not support this theory. There is some evidence that exposure to factors in the environment (such as viruses or infections) may play a role in causing some forms of autism. It is important to recognize that autism is a brain-based disorder and is not caused by inadequate parenting; however, parents can play an important role in planning and carrying out interventions after an ASD is identified.

### **Prevalence**

In 2009, the Centers for Disease Control and Prevention reported data on autism prevalence that concluded that the prevalence of autism had risen to 1 in every 110 American children, with rates of 1 in every 70 boys and 1 in every 315 girls. In Iowa, as

many as 6,500 children may have an ASD, although only a smaller number are formally diagnosed and identified for services.

### **Lifetime Costs**

The Autism Society of America estimates that the lifetime cost of caring for a child with an autism spectrum disorder ranges from \$3.5 million to \$5 million. Based on these estimates, the United States is facing almost \$90 billion annually in costs for autism spectrum disorders. These costs include research, insurance costs and non-covered expenses, Medicaid waivers for autism, educational spending, housing, transportation, employment, therapeutic services, and caregiver costs. Lifetime medical costs alone are roughly twice those of a typical American, and lost productivity and caregiving costs for dependent adults with a severe ASD can exceed the costs of childhood care and treatment.

## ASSESSMENT OF AUTISM SPECTRUM DISORDERS

Early identification is a key to early intervention, which has been shown to have a significantly positive effect on long-term outcomes for children with ASD. Early signs of autism are often noticed by 18 months of age, or even earlier. Some early signs or “red flags” that a child may have an ASD include the following:

- Lack of or delay in spoken language
- Repetitive use of language
- Little or no eye contact
- Lack of interest in other children
- Lack of spontaneous or make-believe play
- Persistent fixation on parts of objects
- Poor response to his/her name
- Fails to imitate caregivers
- Motor mannerisms (e.g., hand-flapping)
- Fails to point or show joint attention

Appropriate treatment of ASD should begin with a careful assessment to determine the child’s specific strengths and needs. There are no specific medical tests for diagnosing autism although there are genetic tests for some disorders that may be associated with behaviors on the autism spectrum. An accurate diagnosis is based on systematic interviewing, observation, and assessment of the child's communication, social interaction, behavior, and developmental level. In addition to assessing the key symptoms of autism, a review of sleep, feeding, coordination problems, and sensory sensitivities is often recommended. Medical factors that may be causing pain or irritability should be recognized and treated whenever possible. Seizures are found in 11-39% of individuals with ASD, and electroencephalography (EEG) should be considered if there is a concern about possible seizures. Although neuroimaging is not currently used routinely as part of diagnostic evaluation, an MRI can be conducted if concerns about identifiable neuropathology in brain structure are present. A metabolic workup and genetic testing for syndromes with autism-like features (e.g., Fragile X, neurofibromatosis, tuberous sclerosis, velocardiofacial syndrome, 15q duplications, and Angelman syndrome) is often appropriate. Consultation with specialists may be necessary to assess for neurological (neurologist), genetic (clinical geneticist), gastrointestinal (gastroenterology), speech (speech/language pathologist), or motor concerns (physical or occupational therapist).

Several screening and assessment tools have been developed to specifically assess for the presence of ASD in children and adolescents. Use of brief autism screening checklists such as the Modified Checklist for Autism in Toddlers (M-CHAT) at ages 18-

24 months can be very helpful in early identification of an ASD by health care providers or early educators. Although ASD screenings may be completed by a number of different professionals (e.g., primary care physicians, speech pathologists, teachers, etc.), the diagnosis of ASD should typically be made by a psychologist, psychiatrist, or developmental-behavioral pediatrician who has been trained in the diagnosis of ASD. Observation tools such as the Autism Diagnostic Observation Schedule (ADOS) and structured diagnostic interviews such as the Autism Diagnostic Interview – Revised (ADI-R) are often used to provide additional rigor to the assessment of ASD.



## INTERVENTIONS FOR AUTISM SPECTRUM DISORDERS

### **Need for Evidenced-Based Interventions**

Identifying effective medical and behavioral treatments for neurodevelopmental disorders should be based on a solid foundation of scientific evidence. This tradition of scientific investigation has long been a foundation of modern medicine, and the need for identifying evidence-based treatments has received increasing recognition in the field. In addition, as part of legislation under the No Child Left Behind Act (NCLB, 2002), the field of education also requires the use of “effective interventions” to support learning. These interventions can only be validated through “scientifically based research.” The call for the use of interventions that have proven their effectiveness is particularly important for the ASD community, which has long been plagued by the use of unsupported and often controversial interventions. In fact, it has been suggested that the uncritical use of unproven “miracle” interventions has encouraged unrealistic, implausible, and unhealthy expectations about treatment results and have ultimately impeded the progress of identifying effective interventions for children and adolescents with ASD (Simpson, 2005).

### **Identifying Effective Interventions**

One major barrier to the adoption of evidenced-based practices for ASD is the lack of consensus on how to identify and evaluate scientifically valid and effective interventions. According to NCLB, “scientifically based research” is defined as “research that involves the application of rigorous, systematic, and objective procedures to obtain reliable and valid knowledge” (NCLB, 2002). For a practice to be judged as scientific, it must meet particular standards, reliably yield positive results, and survive a rigorous peer review process. In addition, scientifically based practices are validated by means of specific “gold standard” research designs that include random samples of subjects that are assigned to control and experimental groups or a series of replications of well-controlled studies using rigorous single-subject designs. However, the scientific method of validation has sometimes been criticized as being too narrow and as having a negative effect on ASD research because of the methodological restrictions that make this type of research difficult to conduct in many real-life settings. The following guidelines (Simpson, 2005) provide a balanced perspective for evaluating ASD interventions:

- Just because a website or brochure lists an intervention as “evidence-based” or “research-based” does not make it true. It may take careful investigation to determine whether a treatment truly has been validated.

- Rigorous methods of determining a treatment’s validity can take several forms when conducted appropriately, including but not limited to single-subject design, correlational studies, quasi-experimental design, and randomized controlled trials.
- Information about a treatment’s effectiveness that comes from a single source that is not supported by other research, lacks peer review, and comes primarily from testimonials rather than empirical validation should be viewed with extreme caution.
- It is important to consider the match between the needs of the individual with ASD and the focus of the intervention.
- It is important to consider the potential risks (e.g., cost, time commitment, adverse effects, impact on quality of life, etc.) of interventions.
- There is no single universally effective intervention for all children with ASD. The best programs often incorporate several research-based interventions and attend to the individual needs of children with ASD and their families.

### **Basic Principles of Effective Early Intervention**

The American Academy of Pediatrics (Meyer, Johnson, and the Council on Children with Disabilities, 2007) has made a clear statement about the basic principles that underlie effective ASD interventions: “There is a growing consensus that important principles and components of effective early childhood intervention for children with ASDs include the following:

- Entry into intervention as soon as an ASD diagnosis is seriously considered rather than deferring until a definitive diagnosis is made;
- Provision of intensive intervention, with active engagement of the child at least 25 hours per week, 12 months per year, in systematically planned, developmentally appropriate educational activities designed to address identified objectives;
- Low student-to-teacher ratio to allow sufficient amounts of 1-on-1 time and small-group instruction to meet specific individualized goals;
- Inclusion of a family component (including parent training as indicated);
- Promotion of opportunities for interaction with typically developing peers to the extent that these opportunities are helpful in addressing specific educational goals;
- Ongoing measurement and documentation of the individual child’s progress toward educational objectives, resulting in adjustments in programming when indicated;
- Incorporation of a high degree of structure through elements such as predictable routine, visual activity schedules, and clear physical boundaries to minimize distractions;

- Implementation of strategies to apply learned skills to new environments and situations (generalization) and to maintain functional use of these skills; and
- Use of assessment-based curricula that address:
  - functional, spontaneous communication;
  - social skills, including joint attention, imitation, reciprocal interaction, initiation, and self-management;
  - functional adaptive skills that prepare the child for increased responsibility and independence;
  - reduction of disruptive or maladaptive behavior by using empirically supported strategies, including functional assessment;
  - cognitive skills, such as symbolic play and perspective taking; and
  - traditional readiness skills and academic skills as developmentally indicated."

### **Research on ASD Interventions**

In this analysis of ASD interventions, the focus was on identifying treatments that are based on strong scientific evidence. Medical, behavioral, cognitive, and educational interventions were reviewed. This analysis relied on data obtained from five primary sources of consensus judgments about ASD treatments: (1) the American Academy of Pediatrics (AAP) Council on Children with Disabilities, (2) the National Autism Center (NAC), (3) the Association for Science in Autism Treatment (ASAT), (4) the National Professional Development Center (NPDC) on Autism Spectrum Disorders, and (5) the detailed 2005 review of ASD interventions completed by Simpson and his colleagues. The NPDC review in particular establishes a balanced view of how to combine the results of randomized, quasi-experimental, and single-subject studies to establish an evidence base for a particular type of treatment or for a specific intervention strategy.

For the purposes of this analysis, we have categorized each type of ASD treatment into one of four categories based on the scientific evidence supporting the treatment:

1. ***Significant scientific evidence*** if there is significant and convincing empirical efficacy and support for the treatment.
2. ***Promising or emerging scientific evidence*** if there is some scientific support for the treatment having efficacy and utility with individuals with ASD, but the evidence is not yet convincing without further replication through quality research.
3. ***Limited scientific evidence*** refers to treatments that currently lack objective and convincing supporting evidence and thus have undetermined utility and efficacy.

4. *Not recommended* practices are those determined to lack efficacy and to be potentially harmful based on available data.

The following is a summary of the results of this analysis and a brief description of each type of intervention reviewed. When there was general consensus among the five data sources, classification decisions regarding specific interventions were straightforward. Additional analysis and explanation were required when there were differing conclusions among the five sources or when it was necessary to clarify the conditions under which a treatment could be confidently recommended for use. We also supplemented the conclusions reached by each data source when additional new findings have clarified the conclusions for a particular type of treatment. The data sources often varied in how specific interventions were defined or labeled, as well as in the content and scope of the scientific evidence that was reviewed to validate each intervention. Despite these variations in approach, there was still substantial agreement among the consensus sources.

### **Interventions Supported by Significant Scientific Evidence**

#### ***Applied Behavior Analysis (ABA)***

ABA is defined as the process of applying behavioral principles to change specific behaviors and simultaneously evaluating the effectiveness of the intervention. ABA emphasizes both prevention and remediation of problem behavior. Significant attention is given to the social and physical environment, including the antecedent conditions and consequences that elicit and maintain behavior. Numerous empirical studies have documented the effectiveness of ABA with individuals with ASD. These interventions should typically be provided under the supervision of a trained behavioral psychologist or behavior analyst. Research suggests that the best outcomes occur when ABA is initiated early in development, preferably prior to 5 years of age. There is an ongoing debate about the amount of ABA needed in order for it to be optimally effective, with recommendations typically ranging from 15 to 40 hours per week, depending on whether ABA is being applied to comprehensive educational programming in the schools or to a targeted behavioral treatment program. Training caregivers to provide ABA in the home or community settings is an important part of most ABA programs, and teleconsultation is proving to be a useful and effective strategy for providing ABA in rural or other underserved areas. In fact, ABA delivered through as little as 1 hour per week of parent training can be effective in reducing behavior problems and building social communication in children with ASD. This intervention can be used with all ages and ability levels, and ABA principles are often included as part of effective early intensive intervention programs. The following specific ABA interventions are described in greater detail (although this is not an exhaustive list):

**Discrete Trial Training (DTT)** is grounded in behavioral learning theory and applied behavior analysis, and it is sometimes referred to as “Lovaas therapy” in reference to Ivar Lovaas at UCLA, who was a strong early proponent of using DTT with children with autism. Using this intervention, a discriminative stimulus is presented, the child responds, and then the child receives a consequence (e.g., reward) based on the response. DTT often incorporates the use of errorless learning, shaping, modeling, prompting, fading, correction, and reinforcement to encourage skill acquisition. It is especially well-suited for skills that can be taught in small, repeated steps. Research indicates that DTT can produce powerful behavioral outcomes in the areas of language, motor skills, imitation and play, emotional expression, academics, and the reduction of self-stimulatory and aggressive behaviors. Special training is necessary to deliver DTT interventions, and hiring a DTT trained therapist to provide 25-40 hours of therapy per week can be expensive. This intervention can be used with all ages and ability levels.

**Functional Communication Training (FCT)** is a behavioral methodology that replaces disruptive or inappropriate behavior with more appropriate and effective communication. After the communicative “functions” of disruptive behaviors are determined through functional behavioral analysis, socially appropriate behaviors are taught as replacements for problem behaviors. FCT has a strong research base, especially using single-subject research designs, and FCT has been shown to significantly reduce problem behavior and to increase communication and social interaction. This intervention is very effective with young children with limited cognitive and language skills, but it can be used with individuals of all ages. When delivered through weekly training sessions with parents/caregivers and their children, FCT can be a very effective and efficient intervention strategy for reducing problem behavior and increasing communication and social behavior.

**Pivotal Response Training (PRT).** The NPDC describes PRT as a systematic method for applying the scientific principles of ABA. PRT builds on a child’s initiative and interests, which makes it particularly effective in developing communication, play, and social behaviors. This strategy enhances the pivotal learning variables of motivation, responding to multiple cues, self-management, and self-initiation, which serves to influence target behaviors within a natural setting. Research has supported the effectiveness of PRT in increasing motivation and improving language and play skills. It is recommended that PRT be implemented by caregivers and teachers in natural contexts; it is considered cost- and time-efficient. This intervention can be used with preschool-aged children through adults with mild cognitive impairments and with those who have at least a minimal level of receptive and expressive language.

**Antecedent-Based Interventions.** In applying ABA techniques, it is important not only to provide reinforcement or punishment after a behavior has occurred, but also to set up antecedent conditions that increase the likelihood of success and reduce the probability of problem behaviors occurring. Specific antecedent procedures that are frequently used for ASD include choice, behavioral momentum, cueing and prompting, modifying task demands, errorless learning, priming, non-contingent reinforcement, and time delay. These types of interventions can be used with all ages and ability levels.

**Other Specific ABA Strategies.** A wide range of specific ABA techniques have received significant empirical support, and comprehensive treatment programs typically make use of a “package” that includes several of these evidence-based ABA strategies. Examples of these methods include prompting, time delay, reinforcement, extinction, task analysis, response interruption/redirection, and differential reinforcement.

### *Early Intensive Interventions*

Intensive early intervention programs that provide ABA strategies, often in combination with developmental approaches, have been shown to produce improvements in behavior, communication, and cognitive abilities. Lovaas-based approaches (as described above in the discussion of discrete trial training) are the most widely used and have the strongest research base thus far for programs of this type. A randomized controlled trial of the Early Start Denver Model, which uses a combined ABA-developmental model, has also produced positive outcomes for young children with ASD. A successful randomized trial for the Learning Experiences and Alternative Program for Preschoolers and Parents (LEAP) has been completed as well. Although these studies are not without methodological limitations, the NAC review designated comprehensive behavioral treatment for young children using programs of this type as an “established treatment.”

### *Social Skills Training*

Deficits in social interaction are core problems in ASD. There is good evidence that interventions to directly train social skills can be effective, and increasing prosocial behaviors is typically a primary outcome in ABA interventions. Both the NCPC and the NAC standards also consider the use of social narratives/stories to be useful tools for social skills training. The use of peer-mediated interventions to build social skills is well established as well. There is evidence that specific aspects of social interaction (e.g., eye contact, joint attention, verbal greetings, etc.) can be learned with focused training. The NCPC analysis documents solid evidence for the effectiveness of social

skills training groups, although the NAC standards consider a “social skills package” to be an emerging rather than well-established practice.

### *Cognitive-Behavioral Therapy*

The scientific basis for the use of cognitive behavior therapy (CBT) with adolescents and adults with mood or adjustment problems is extensive and diverse. In fact, CBT is one of the most widely used non-pharmacologic treatments for individuals with mental and emotional disorders, especially depression, and its use with individuals with autism spectrum disorders is growing. CBT focuses on replacing negative or ineffective patterns of thought and behavior with structured strategies that are effective in improving mood and adaptive functioning.

In the autism research base, the scientific evidence for the effectiveness of "self-management," a type of CBT, is described by the NPDC-ASD as follows: “Self-management interventions help learners with ASD learn to independently regulate their own behaviors and act appropriately in a variety of home, school, and community-based situations. With these interventions, learners with ASD are taught to discriminate between appropriate and inappropriate behaviors, accurately monitor and record their own behaviors, and reward themselves for behaving appropriately. As learners with ASD become more fluent with the self-management, some of the implementation responsibilities shift from teachers, families, and other practitioners to the learners themselves.”

The ASAT, NAC, and NPDC treatment reviews all list self-management as an intervention with a well-established evidence base. Other forms of CBT have not been studied as extensively in ASD as has self-management, but scientific data supporting CBT have also been established by studies that adapt traditional CBT approaches to ASD populations for the management of anxiety, depression, and social deficits. CBT is especially appropriate for use with older children and adolescents or adults with Asperger's syndrome or high functioning autism, for whom the cognitive demands of the therapy are manageable. To maximize effectiveness, it is important to rely on structured behavioral principles as much as possible and to use higher-level cognitive strategies only to the extent allowed by the cognitive abilities of the client/patient.

### *Medication*

The use of pharmacological treatments for symptoms of ASD is both common and challenging. Several psychiatric disorders in children are successfully treated by medications, and many of these disorders have symptoms that overlap with those seen in children with ASD (e.g., hyperactivity, inattention, tics, obsessive-compulsive behaviors, depression, anxiety, sleep problems, etc.). However, there are no medications that directly treat the social and language impairments seen in individuals with ASD. The medications used most frequently for children and adults with ASD include

antipsychotics (e.g., risperidone), selective serotonin reuptake inhibitors (SSRIs) to treat mood and repetitive behaviors, and stimulants and other medications used to treat attention deficits and hyperactivity. The evidence base is good for using atypical antipsychotics (e.g., risperidone and aripiprazole) to treat challenging and repetitive behaviors, but there are also significant side effects associated with the use of these drugs. There are some well-designed studies supporting the use of SSRIs and stimulants with patients with ASD, but the evidence base is not as strong as for the antipsychotic medications.

### *Other Evidence-Based Interventions*

Several other types of interventions for ASD have an established evidence base and are used in combination with other effective treatments. The NCPC describes many of these in detail, but they are also described briefly below:

**Augmentative and Alternative Communication (AAC)** devices and tools can help compensate for expressive communication deficits. These interventions range from the use of sign language to picture systems and more complex electronic communication devices. Many children with autism will not develop functional speech, and the use of AAC is indicated in this population to enhance communication abilities. This type of intervention can be used with individuals with communication deficits at any age.

**Picture Exchange Communication System (PECS)** is an augmentative communication strategy designed for individuals with expressive language deficits. Individuals are trained to exchange picture cards for desired items, which the therapist pairs with a verbal label for the item. In addition to targeting communication skills, PECS also reinforces attempts to initiate social contact in children with ASD. Empirical studies have documented an increase in functional communication following this intervention, especially when used as part of ABA treatment. This therapy can be used at any ages and all ability levels.

**Modeling**, especially using video technology to record actions for later review, can provide a visual model to assist in building skills in communication, play, or social interaction.

**Visual Supports**, including the use of schedules and structured work tasks presented visually, are effective for individuals with ASD across many work and learning environments.

**Computer-Aided Instruction** can assist individuals with ASD in learning communication and academic skills.

**Parent-Implemented Intervention** is a core component of many evidence-based interventions for ASD, including functional communication training and social skills training.



## **Interventions with Promising or Emerging Evidence**

### ***Developmental Relationship-Based Treatment***

These treatment programs may be referred to by other names such as Floortime, DIR (Differential, Individual differences, Relationship-based), or Relationship Development Intervention (RDI). Floor time seeks to facilitate the acquisition of social-communicative skills through intensive child-directed play and positive interactions. It is recommended that this strategy be integrated with other therapies (e.g., speech therapy and occupational therapy). Floor time has become a popular intervention among parents, but it continues to lack scientific evidence. This treatment is intended for young children, but can be used in some form with all ages and ability levels.

### ***Play Therapy***

Learning play skills is important for children with ASD, and providing guided opportunities for play-based interactions with peers is an important part of social skills training, which is an evidence-based intervention. However, traditional insight-oriented play therapy, where the child is expected to “act out” or “work through” internal conflicts, is generally not effective for children with ASD. Some play-oriented strategies can be helpful in fostering social communication when used to complement other evidence-based interventions.

### ***Supportive Therapies***

There are several types of “supportive” therapies that have strong proponents and some data to suggest that they may be effective with some individuals with ASD. The National Autism Center review designated music therapy and massage therapy as emerging treatments. Other therapies with some support include art therapy and pet/animal therapy although the scientific evidence supporting these interventions is not strong. Even without additional scientific evidence to support these therapies, it is likely that activities that are fun and engaging will provide opportunities for reinforcement, relaxation, and social interaction for individuals with ASD.

## **Interventions with Limited Scientific Evidence**

### ***Sensory Integration (SI)***

The use of sensory integration (SI) therapy for treatment of ASD has been both popular and controversial. Many children with ASD are believed to have a form of sensory integration dysfunction, defined as neural dysfunction that causes the nervous system to inefficiently receive and process incoming information, which may lead to hypersensitivity or hyposensitivity to sensory input, unusually high or low activity levels, coordination problems, delays in speech or motor skills, and/or behavior

problems. In SI, a child's individual sensory needs are evaluated, and a program of sensory therapies (e.g., riding scooter boards, swinging, jumping on trampolines, wearing weighted vests, wrapping in fabric) is developed and prescribed as a "sensory diet." Most SI therapy is implemented by occupational therapists. Proponents of this therapy argue that sensory integration therapy results in improved mental processing and organization of sensations, although this is difficult to measure objectively. Despite its widespread use, SI is most often considered a "complementary and alternative medicine" (CAM) treatment rather than an accepted treatment methodology, and the neurodevelopmental theories underlying SI are not generally accepted by medical scientists. The American Academy of Pediatrics (AAP) has summarized the scientific findings on SI by stating that "the efficacy of SI therapy has not been demonstrated objectively."

Four out of five of the primary data sources analyzed for this study do not consider SI therapy as an evidence-based treatment for ASD. Although Simpson's review was the only one to list SI as a potentially "promising" practice, this assertion was apparently based on its widespread use and not on the adequacy of scientific data to support it. In fact, Simpson summarizes the data on SI as follows: "SI techniques have not been thoroughly investigated for scientific effectiveness" and "minimal research has reported positive effects of SI therapy to date." Consistent with this conclusion, the ASAT review of the SI literature concludes that there are too few well-designed studies to draw conclusions and that professionals should present SI as "untested." Although there is some evidence that active gross-motor activities may affect children with ASD differently than table-based fine-motor activities, a recent published study on the effects of weighted vests, a common part of SI therapy for ASD, failed to find outcomes supporting SI treatment.

Given the scarcity of scientific evidence supporting SI (and some evidence that it is not effective), the use of SI therapy for ASDs must be considered an intervention with "limited scientific evidence" currently. However, it is important to recognize that other OT treatments focused on improving practical functions (e.g., ADLs, feeding, writing, etc.) are a mainstay of therapy for a range of neurodevelopmental disorders, and children with ASDs should not be excluded from access to those interventions. Also, some of the activities emphasized in SI therapy may benefit children in becoming more physically active or accepting a wider range of sensory experiences when used as part of a comprehensive ASD intervention program. As the AAP states, " 'Sensory' activities may be helpful as part of an overall program that uses desired sensory experiences to calm the child, reinforce a desired behavior, or help with transitions between activities." However, SI theory and specific effects of SI-based therapies lack supporting evidence from well-designed studies.

### ***Auditory integration training (AIT)***

AIT is a controversial intervention that purports to remediate problems with sound sensitivity and auditory processing, with the result of improved behavior, communication, and quality of life. Although several studies have been conducted, there is currently no scientific evidence that AIT retrains auditory systems of individuals with ASD with the result of improved functioning.

### ***Nutritional Supplements***

Megavitamin therapy is based on the hypothesis that symptoms of ASD may be related to biochemical errors resulting in nutritional deficiencies. Typical supplements for this population include vitamin B6, magnesium, vitamin C, and vitamin A. There are several reports that megavitamin supplements may benefit some children with ASD, but this treatment currently lacks scientific support through well-controlled research. Although vitamins can be obtained over the counter, it is recommended that a physician be involved if this intervention is being considered. There are significant questions about the safety of large doses of certain vitamins.

### ***Gluten- and Casein-Free Diet***

Gluten is a protein found in plants including wheat, barley, oats, rye and their derivatives. Casein is a protein found in cow's milk. In some severe cases, an inability to properly metabolize these proteins can lead to serious gastrointestinal or neurological problems. It has been proposed that ASD symptomology may be associated with this process, and thus a gluten- and casein-free diet has been suggested as a treatment for ASD. A few studies have suggested that long-term elimination of gluten and casein from a diet may result in behavioral improvements in children with ASD. It is strongly recommended that a physician be consulted to test for possible food allergies prior to beginning this diet. This type of intervention can be very stressful for the family and has yet to be established as an empirically valid intervention.

### ***Facilitated Communication (FC)***

Facilitated communication was designed to be an augmentative communication strategy that involves the use of a "facilitator" who gently provides hand-over-hand physical assistance to individuals with disabilities as they type (or point to pictures) to communicate. This method can be used with individuals of all ages who are otherwise unable to effectively communicate using speech. Facilitated communication is a highly controversial technique due to concerns that the facilitator may actually guide the individual's responses. Testimonials have reported this to be a highly effective intervention, while blinded objective analyses have consistently failed to find empirical support for this method. In addition, some false claims of abuse have been initiated

through FC, and many courts no longer allow testimony through FC to be admitted as evidence in court.

### **Interventions that are Not Recommended**

#### ***Holding Therapy***

Holding therapy is designed to restore and strengthen the bond between the child and caregiver through forced physical proximity and eye contact. The child is expected to initially reject this treatment but will then develop closeness with the caregiver after realizing that his/her anger cannot break the parent-child bond. This treatment has several risks, including possible physical and psychological harm to the child and parent, and it has not received empirical support.

#### ***Secretin***

Secretin is a gastrointestinal peptide hormone that has received attention as a potential “cure” for autism. Controlled research indicates that secretin has no benefit for individuals with ASD, and individuals with ASD should not be exposed to a treatment that has been shown to not be effective.

#### ***Chelation for Neurotoxicity***

It has been hypothesized that environmental exposure to toxic metals or to a mercury compound (thimerosal) used in some vaccinations may cause or contribute to the development of autism. Despite empirical evidence that does not support this theory, along with the removal of thimerosal from virtually all vaccines, many parent groups continue to believe that vaccines cause autism. Chelation therapy, a potentially dangerous treatment for mercury or other heavy metal poisoning, is sometimes used with children with ASD. Some parents have chosen not to vaccinate their children due to the fear that vaccinations may cause ASD, thus leaving them vulnerable to developing several preventable diseases. Because of the dangers of chelation and the lack of a medical reason to perform the procedure, chelation for ASD in the absence of high levels of heavy metals is not recommended.

### **Using these Findings for Treatment Planning**

Based on this review of ASD interventions, it is clear that intensive, highly structured programs based on the principles of applied behavior analysis are the gold standard for autism treatment. Early intervention is effective, so it is essential that the primary focus of parents and professionals is on the child’s acquisition of communication, social, play, and academic skills. If biological interventions are attempted, medical professionals should be involved and detailed data should be taken to document the effects, both positive and negative, of the biological intervention on the

child. Certainly, scientifically-based practices are most strongly recommended, but several interventions designated as “promising” may also be beneficial for some individuals with ASD. Currently, interventions labeled as having “limited supporting evidence” or “not recommended” cannot be recommended as ASD treatments due to lack of empirical support and/or risk for harm. It is likely that no single intervention is going to be sufficient in treating the symptoms of ASD; therefore, it is recommended that an individualized program of services be developed to meet the child’s developmental, educational, behavioral, emotional, and social needs. A comprehensive treatment program for a child with ASD should include behavioral, speech and language, and educational interventions; pharmacological treatment of specific symptoms may also be appropriate. The effectiveness of all interventions a child receives should be evaluated regularly and adjusted as necessary. Finally, it is clear that the field of ASD would benefit significantly from continuing research into the effectiveness of proposed ASD interventions.

## SUMMARY OF EVIDENCE-BASED TREATMENTS FOR AUTISM SPECTRUM DISORDERS

Each person with ASD is unique, and intervention plans must be individualized based on the needs of the individual and family. Early intervention can make a significant difference in improving cognitive and social development for children with ASD, and intensive, highly structured educational programs based on the principles of applied behavior analysis (ABA) are the gold standard for early autism treatment. The primary focus should be on the child's acquisition of communication, social, play, and academic skills. A national consensus has been reached that structured programming should be provided throughout the year at an intensity of at least 25 hours per week. ABA techniques, such as functional analysis and functional communication training (FCT), have been demonstrated to be effective in reducing disruptive and oppositional behavior and increasing communication and social behavior. Social skills training is important in reducing social deficits in ASDs, and effective approaches include FCT and other ABA methods, peer-based intervention strategies, and social skills groups. Use of cognitive behavior therapy, especially structured "self-management" programs designed for higher functioning children/adolescents or adults with ASD, can support management of anxiety, depression, anger control, and social skill development. Medication cannot cure ASD, but it can help provide control over symptoms such as aggression, mood problems, rigid behavior, and attention deficits. Medical care may also be needed to manage associated problems with seizures, gastrointestinal problems, dietary imbalances, or disrupted sleep patterns. Targeted therapies (e.g., speech/language, OT) can be used to increase communication skills and to improve independence in activities of daily living. "Sensory" activities may be reinforcing for some children and may help them become more physically active or accept a wider range of sensory experiences. Anecdotal reports have promoted the use of chelation to remove heavy metals or the use of gluten/casein free diets or nutritional supplements to help individuals with ASD, but scientifically valid research to support these treatments is lacking and concerns about safety are significant.

As is true for any individual with a serious neurodevelopmental disability, providing a "medical home" that can ensure care coordination, parent training, and family support is critically important to a comprehensive plan of care. For adults with ASD, vocational training, job coaching, and interventions to improve social and behavioral adjustment are crucial to support independence in living and working in community settings. Although distinctions have been made between ASD services that are "habilitative" (building new skills) or "rehabilitative" (restoring lost skills), legal decisions have questioned the use of these distinctions. Current thinking supports the

need for preventive, medical, and remedial services when these interventions have been recommended by a health care practitioner for the reduction of a physical or mental disability and for ensuring the best possible level of functioning. Whenever possible, recommended services should be based on proven interventions with a strong evidence base, such as those recommended in this analysis.

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