Clinical Practice Guideline: **Autism Spectrum Disorder (ASD) – Outpatient Rehabilitation Services (Speech, Physical, and Occupational Therapy)**

Date of Implementation: **April 18, 2013**

Effective Date: **April 16, 2026**

Product: **Specialty**

Related Policies:
CPG 135: Physical Therapy Medical Policy/Guideline
CPG 149: Sensory Integrative (SI) Therapy
CPG 155: Occupational Therapy Medical Policy/Guideline
CPG 166: Speech-Language Pathology/Speech Therapy Guideline
CPG 270: Cognitive Rehabilitation
CPG 287: Stuttering Devices and Altered Auditory Feedback (AAF) Devices
CPG 288: Augmentative and Alternative Communication (AAC) and Speech Generating Devices (SGD)
CPG 289: Voice Therapy
CPG 290: Auditory Integration Therapy – Facilitated Communication
CPG 291: Oral Sensorimotor Therapy and Myofunctional Therapy

Table of Contents

GUIDELINES

American Specialty Health – Specialty (ASH) considers certain procedures and services medically necessary for assessment and treatment of autism and other pervasive developmental disorders (PDD) when the member meets **any of the criteria** listed below:

- Any loss of any language or social skills at any age; or
- No 2-word spontaneous (not just echolalic) phrases by 24 months; or
- No babbling by 12 months; or
- No gesturing (e.g., pointing, waving bye-bye) by 12 months; or
- No single words by 16 months.

The following services may be included in the assessment and treatment of the member's condition when the **above** criteria are met:

- Evaluation by a speech and language pathologist (SLP); with speech therapy per evaluation results;
- Occupational and/or physical therapy;
- Autism-specific developmental screening (CPT code 96110, e.g., Checklist for Autism in Toddlers [CHAT], Pervasive Developmental Disorder Screening Test-II) and CPT codes 96112, and 96113, (e.g., Autism Behavior Checklist [ABC], Childhood Autism Rating Scale [CARS]).

ASH considers a speech generating device for autism spectrum disorder (ASD) as medically necessary when **ALL of the following** criteria are met:

- The member has a permanent and severe expressive speech impairment;
- A speech evaluation, conducted by a SLP, has documented the severity of the member's disability specific to their primary language;
- Other forms of treatment have failed, are contraindicated or are otherwise not appropriate;
- Speaking needs cannot be met using natural communication methods;
- A speech generating device is available in the individual's primary language;
- The device is being requested for the purpose of speech generation only.

Multi-purpose, general consumer electronic devices such as personal digital assistants (PDAs), computers, tablet devices (e.g., iPads), smart phones, electronic mail devices and pagers, are not medical in nature and thus are considered not medically necessary.

ASH considers the following procedures and services **unproven** because the peer-reviewed medical literature does not support the use of these procedures and services in the assessment and treatment of autism and other pervasive developmental disorders (this list may not be all-inclusive):

Assessment:

- Allergy testing (including food allergy for gluten, casein, candida, and other molds; allergen specific IgG and IgE)
- Artificial intelligence-based devices (e.g., Canvas Dx) for diagnosis of ASD
- Blood metabolite testing (e.g., NPDX ASD test)
- Blood levels of methylation capacity (e.g., methionine, S-adenosylmethionine (SAM), S-adenosylhomocysteine (SAH), and the SAM/SAH ratio) as biomarkers for diagnosis and therapeutic targets of ASD
- Celiac antibodies testing
- Ciliary neurotrophic factor (as a biomarker for ASD)
- EarliPoint test (an eye-tracking test) for the diagnosis of autism spectrum disorder
- Electronystagmography (in the absence of dizziness, vertigo, or balance disorder)

- Erythrocyte glutathione peroxidase studies
- Event-related brain potentials
- GABA receptor polymorphisms testing
- Genetic panels of autism
- Genetic testing for ABCA12, COX10, DRD2, MTHFR, RELN, SLC25A12 and UGT2B15 for diagnosis of autism and other pervasive developmental disorders and their drug treatment
- Glutamatergic candidate genes testing
- Gut microbiota profiles and nuclear factor kappa B as diagnostic biomarkers of ASD
- Hair analysis
- Heavy metal testing
- Homocysteine testing
- Immunologic or neurochemical abnormality testing
- Intestinal permeability studies
- Latent class analysis (for determination of psychosis-related clinical profiles in children with autism spectrum disorders)
- Magnetoencephalography/magnetic source imaging
- Measurement of androgen levels (blood, saliva, or urine) for the diagnosis of ASD
- Measurement of citrate synthase enzyme activity
- Measurements of plasma oxytocin (OXT) and vasopressin (VP) levels
- Measurements of plasma central carbon metabolites (e.g., alpha-ketoglutarate, alanine, lactate, phenylalanine, pyruvate, and succinate) (including the NPDX ASD Test (NeuroPointDX))
- Measurement of urine oligosaccharides for screening/diagnosis of ASD
- Micronutrient tests such as vitamin levels
- Mitochondrial disorders (lactate and pyruvate) testing
- Neuroimaging studies such as CT, fMRI, MRI, MRS, PET, and SPECT
- Nutritional testing
- Olfactory function testing
- Provocative chelation tests for mercury
- Saliva analysis (e.g., Clarifi ASD, Quadrant Biosciences, Inc.)
- Serum cytokine and growth factor levels
- Stool analysis
- Tests for amino acids (except quantitative plasma amino acid assays to detect phenylketonuria), fatty acids (non-esterified), organic acids, citrate, silica, urine vanillylmandelic acid
- Tests for trace metals (e.g., aluminum, cadmium, chromium, copper, iron, lead, lithium, magnesium, manganese, nickel, selenium, zinc)
- Tests for single-nucleotide polymorphisms within the OXT and VP receptor genes

- Thyroid function tests
- Tympanometry (with no hearing loss)
- Urinary peptide tests
- Use of biomarkers of mitochondrial dysfunction for the management of ASD

Treatment

- Acupuncture
- Anti-fungal medications
- Anti-viral medications
- Auditory integration training (auditory integration therapy)
- BioMat
- Chelation therapy
- Craniosacral therapy
- Dietary and nutritional interventions like elimination diets (e.g., gluten and milk elimination, supplements, vitamins, minerals)
- Electro-convulsive therapy (for the treatment of autistic catatonia)
- Emotion recognition training
- Facilitated communication
- GABAergic agents (e.g., acamprosate, arbaclofen, and valproic acid)
- Herbal remedies
- Hippotherapy (equestrian therapy)
- Holding therapy
- Immune globulin infusion
- Manipulative therapies
- Massage therapy
- Methyl B12
- Memantine
- Neurofeedback/EEG biofeedback
- Nutritional supplements (e.g., dimethylglycine, glutathione, magnesium, megavitamins, omega-3 fatty acids, and high-dose pyridoxine)
- Nutritional therapy (e.g., casein-free and gluten-free diets, ketogenic and modified Atkins diets)
- Oxytocin
- Prebiotic / probiotic therapy
- Quantum Reflex Integration
- Secretin infusion
- Stem cell transplantation
- Systemic hyperbaric oxygen therapy
- Tomatis sound therapy
- Transcranial direct current stimulation

- Vision therapy
- Vitamins and minerals (e.g., calcium, germanium, magnesium, manganese, selenium, tin, tungsten, vanadium, zinc)
- Weighted blankets/vests/mattress technology

ASH typically considers services that are considered primarily educational or training in nature or related to improving academic or work performance **not medically necessary**; including the following services for the assessment and/or treatment of ASD (this list may not be all-inclusive):

- Education and achievement testing, including Intelligence Quotient (IQ) testing
- Educational interventions (e.g., classroom environmental manipulation, academic skills training)

ASH typically considers neuropsychological testing for the assessment and/or treatment of ASD **not medically necessary** because such testing is considered educational in nature and/or not medically necessary.

The U.S. Preventive Services Task Force (USPSTF) published a recommendation statement for ASD screening in young children, specifically ages 18 to 30 months. There is insufficient evidence to assess the balance of benefits and harms of screening for ASD in those with no concerns raised by parents or clinicians (USPSTF, 2016). This recommendation is currently being updated.

In addition, coverage of intensive behavioral interventions and/or treatment of ASD may be governed by state and/or federal mandates. Please refer to the applicable benefit plan document to determine terms, conditions, and limitations of coverage. Services provided by a psychiatrist, psychologist or other behavioral health professionals may be subject to the provisions of the applicable behavioral health benefit.

Assessment and treatment for comorbid behavioral health and/or medical diagnoses and associated symptoms and/or conditions may be covered under applicable medical and behavioral health benefit plans.

DESCRIPTION/BACKGROUND

Autism Spectrum Disorder (ASD) is a developmental disability characterized by impairments in reciprocal social communication and social interaction, and restricted, repetitive patterns of behavior, interests, or activities. Deficits often occur across multiple contexts and may result in challenges spanning several areas of functioning. Symptoms associated with ASD must be present in the early developmental period but may not be identified until later. The presentation, impact, and severity of characteristics associated with ASD may vary greatly amongst individuals who meet criteria for the diagnosis.

The precise etiology of ASD is unknown, although there appears to be a high heritability linked with it. In 15-20% of individuals with autism, the etiology can be identified; however, the cause remains unknown for many. This is a field of active research.

Associations between ASD and a number of health conditions have been proposed. Several other disorders are correlated with ASD, including, but not limited to:

- Epilepsy or seizure disorder
- Tuberous sclerosis
- Fragile X syndrome
- Intellectual disability

Children with autism need a thorough and complete evaluation and specialized language services, behavioral, and educational programs. Early identification/diagnosis and proper treatments can help youth with autism tremendously. Child and adolescent psychiatrists are trained to diagnose autism, and to help families design and implement an appropriate treatment plan. They can also help families cope with the stress which may be associated with having a child with autism.

Although there is no cure for autism, appropriate specialized treatment provided early in life can have a positive impact on the child's development and produce an overall reduction in disruptive behaviors and symptoms.

Formal Assessment

According to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-IV, 2013), published by the American Psychiatric Association, diagnostic criteria include:

Diagnostic criteria for Autism Spectrum Disorder from:
Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)

A. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history (examples are illustrative, not exhaustive; see text of DSM-5)
   1. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.
   2. Deficits in nonverbal communicative behaviors used for social interaction, ranging for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a lack of facial expressions and nonverbal communication.
   3. Deficits in developing, maintaining, and understanding relationships, ranging for example, from difficulties adjusting behavior to suit various social

Diagnostic criteria for Autism Spectrum Disorder from: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)
contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers. Specify current severity: **Severity is based on social communication impairments and restricted, repetitive patterns of behavior.**
B. Restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following, currently or by history (examples are illustrative, not exhaustive; see text of DSM-5): 1. Stereotyped or repetitive motor movements, use of objects, or speech (e.g., simple motor stereotypies, lining up toys or flipping objects, echolalia, idiosyncratic phrases). 2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior (e.g., extreme distress at small changes, difficulties with transitions, rigid thinking patterns, greeting rituals, need to take same route or eat same food every day). 3. Highly restricted, fixated interests that are abnormal in intensity or focus (e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests). 4. Hyper- or hypo reactivity to sensory input or unusual interest in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling, or touching of objects, visual fascination with lights or movement). Specify current severity: **Severity is based on social communication impairments and restricted, repetitive patterns of behavior.**
C. Symptoms must be present in the early developmental period (but may not be fully manifested until social demands exceed limited capacities or may be masked by learned strategies in later life).
D. Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.

Diagnostic criteria for Autism Spectrum Disorder from:
Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)

E. These disorders are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay. Intellectual disability and autism spectrum disorder frequently co-occur; to make comorbid diagnosis of autism spectrum disorder and intellectual disability, social communication should be below that expected for general developmental level.

The DSM-5 notes that "individuals with a well-established DSM-IV diagnosis of autistic disorder, Asperger's disorder, or pervasive developmental disorder not otherwise specific should be given the diagnosis of autism spectrum disorder. Individuals who have marked deficits in social communication, but whose symptoms do not otherwise meet criteria for autism spectrum disorder, should be evaluated for social (pragmatic) communication disorder."

A comprehensive evaluation that includes a multi-disciplinary team is necessary for diagnosis and treatment of children with ASD. Professionals include pediatricians, psychologists, neurologists, speech-language pathologists, physical and/or occupational therapists, and other professionals who diagnose and treat children with ASD. Early identification and treatment have been shown to result in improved management of ASD.

Additional screening might be needed if a child is at high risk for developmental problems because of preterm birth or low birth weight or if they have a parent or sibling with an autism spectrum disorder.

American Academy of Pediatrics (AAP) 2020 Clinical Report on Identification, Evaluation, and Management of Children With Autism Spectrum Disorder notes the following:

- Metabolic Testing: The yield of routine metabolic testing for children with ASD is low and not recommended for regular use. However, large population-based studies are lacking, so accurate prevalence and diagnostic yield estimates are not available. There is no evidence at this time for routine testing of hair, blood, or urine for environmental toxins or heavy metals outside of laboratory screening for lead exposure.
- Electroencephalogram (EEG): An EEG is not recommended as a routine baseline evaluation in the absence of clinical concern about seizures, atypical regression, or other neurologic symptoms on history or examination that would suggest an EEG is indicated.
- Genes, Environmental Exposures, and ASD: The potential environmental factors that may be related to increased reported prevalence of ASD is an area of active study that, as yet is without firm conclusions.

- Genes, Immunologic Exposures, and ASD: Unless otherwise indicated (e.g., history suggestive of autoimmune or immunologic disorder), no immune testing is recommended in the etiologic workup of a child with ASD (Hyman et al., 2020).

American Academy of Pediatrics (AAP) 2020 Clinical Report on Identification, Evaluation, and Management of Children With Autism Spectrum Disorder states that "The scientific literature does not support an association of vaccination as an environmental factor that increases the risk for ASD. Children with ASD should be vaccinated according to the recommended schedule" (Hyman et al., 2020).

The American Academy of Child & Adolescent Psychiatry (AACAP) 2022 Policy Statement on Autism and Vaccines states "Multiple studies conducted in several different countries have demonstrated that there is no causal association between vaccines or their preservatives and ASD. Further, vaccines do not change the timing of the onset of ASD symptoms, nor do they affect the severity of ASD symptoms. Even in families who have a greater risk for ASD, such as those who already have a child with ASD, there is no increased likelihood that the second child will have ASD if vaccinated" (AACAP, 2022).

Centers for Disease Control and Prevention (CDC) states that diagnosing autism spectrum disorder (ASD) can be difficult because "there is no medical test, like a blood test, to diagnose the disorder" (2023).

The use of tests such as hair analysis for trace elements, celiac antibodies, allergy testing (particularly food allergies for gluten, casein, candida and other molds), immunologic or neurochemical abnormalities, micronutrients (e.g., vitamin levels), intestinal permeability studies, stool analysis, urinary peptides, mitochondrial disorders (e.g., lactate and pyruvate), thyroid function tests, erythrocyte glutathione peroxidase studies have not been well studied and no strong conclusions can be made regarding clinical utility for such testing (Chaves-Gnecco and Feldman, 2023).

A study based on evidence that dysregulation of branched-chain amino acids (BCAAs) may contribute to the behavioral characteristics of ASD tested whether dysregulation of amino acids (AAs) was a pervasive phenomenon in individuals with ASD (Smith et al., 2019). Reports within the study resulted from the Children's Autism Metabolome Project (CAMP), a large-scale effort to define autism biomarkers based on metabolomic analyses of blood samples from young children. Dysregulation of AA metabolism was identified by comparing plasma metabolites from 516 children with ASD with those from 164 age-matched typically developing children recruited into the CAMP. The ASD subjects were stratified into subpopulations based on shared metabolic phenotypes associated with BCAA dysregulation. Groups of AAs with positive correlations were identified that were, as a group, negatively correlated with BCAA levels in ASD. Imbalances between these two groups of AAs identified three ASD-associated amino acid dysregulation metabotypes.

The combination of glutamine, glycine, and ornithine amino acid dysregulation metabotypes identified as dysregulation in AA/BCAA metabolism that is present in 16.7% of the CAMP subjects with ASD and is detectable with a specificity of 96.3% and a positive predictive value of 93.5% within the ASD subject cohort.

There is insufficient evidence in the published peer-reviewed medical literature to support provocative chelation tests for mercury in the assessment of ASD. There has been interest in the relationship of heavy metals, in particular mercury and the etiology of ASD. Testing for heavy metals (e.g., arsenic, barium, beryllium, bismuth, antimony, and mercury) is not supported by evidence in the peer-reviewed medical literature.

Wong et al. (2024) published 2023 clinical practice guidelines on autism spectrum disorder in children and adolescents in Singapore. The guidelines were written to assist professionals who are involved in the surveillance, screening, diagnosis, intervention and long-term management of children and adolescents on the autism spectrum; as well as for caregivers. For a summary of all guidelines in the 10 identified areas, visit https://www.ams.edu.sg/view-pdf.aspx?file=media%5c6903_fi_880.pdf&ofile=2023+CPG+on+ASD+in+Children+and+Adolescents+Executive+Summary.pdf.

According to the Autism Research Institute, some of the more commonly used autism screening tools are:

- Modified Checklist for Autism in Toddlers: Revised (M-CHAT), is a popular 20-question test designed for toddlers between 16 and 30 months old.
- The Ages and Stages Questionnaire: (ASQ) is a general developmental screening tool that examines developmental challenges at specific ages.
- Screening Tool for Autism in Toddlers and Young Children: (STAT) is an interactive screening tool comprising of twelve activities that assess play, communication, and imitation.
- Parents' Evaluation of Developmental Status: (PEDS) is a general developmental parent interview designed to identify delays in motor, language, self-help, and more.

If the results of an autism screening indicate a child shows some signs of autism, a pediatrician will likely refer the family to a specialist for a more formal evaluation.

The American Academy of Neurology (AAN) and Child Neurology Society (CNS) have developed evidenced-based guidelines for the screening and diagnosis of autism. These parameters include the following developmental and assessment screening instruments that may be used in the evaluation process:

- The Ages and Stages Questionnaire
- The BRIGNACE® screens

- The Child Development Inventories
- The Parents' Evaluation of Developmental Status

The AAN/CNS guidelines also state that screening for autism should be performed on all children failing routine developmental monitoring procedures and may include these tools:

- Checklist for Autism in Toddlers (CHAT): This test is used for children 18 months of age.
- Autism Screening Questionnaire: This test is used for children four years of age and older.

A comprehensive list of screening tools can be found at https://www.cdc.gov/autism/hcp/diagnosis/screening.html.

Treatments

There are no medical interventions that are effective in achieving a cure for autism; however, the condition may be managed through a combination of behavioral, dietary, pharmacological, and educational interventions. The American Academy of Child & Adolescent Psychiatry (AACAP) practice parameters note that treatments proposed should be based on solid, high-quality empirical evidence. According to AACAP guidelines, educational services (e.g., including special education, some forms of behavior modification and other services) play a central and integral role in ASD treatment. Psychosocial interventions should include parent training with behavior modification techniques and referral to support groups. It's highlighted in the literature that there is no one-size-fits-all approach for individuals with ASD. While many methods lack extensive research, some have more compelling evidence suggesting their usefulness. However, study designs often limit the generalizability of findings.

Research suggests that early intervention is most successful when it involves multiple disciplines; including but not limited to behavioral therapy, physical and occupational therapy, and speech-language therapy. To be most effective, those health care professionals providing the intervention should be highly trained in treating ASD. The therapy must be guided by specific and well-defined learning objectives, and the child's progress in meeting these objectives should be regularly evaluated and recorded. The intervention should focus on the core areas affected by autism. These include social skills, language and communication, imitation, play skills, daily living, and motor skills. The program should provide the child with opportunities to interact with typically developing peers (if possible) and must actively engage parents in the intervention, both with decision making and treatment delivery (Hyman et al., 2020).

Non-biological interventions used for symptoms of ASD are popular and have also been increasingly studied. There has been conflicting evidence regarding the effect of music therapy, yoga, massage, and equine-assisted therapy on the symptoms of ASD in children,

but evidence does not support these therapies for treatment of the core deficits of ASD at this time. Existing studies are insufficient to support dance therapy, drama therapy, and chiropractic therapy. Medical interventions used for nonstandard purposes also are sometimes prescribed for symptoms of ASD. Clinical trials do not support the use of antifungal agents, immunotherapy, or hyperbaric oxygen treatment, and concern for safety, in addition to lack of supporting data, cautions against chelation therapy for children with ASD (Hyman et al., 2020).

Specific Strategies

Behavioral Treatments

This behavioral treatment information is included as informational only. Behavioral treatments referred to in this section are not applicable to the rehabilitation providers (i.e., PT, OT, SLP, AT) to which this policy applies. Applied Behavior Analysis (ABA) is a treatment approach for people with ASD that has become widely accepted among health care professionals. It encourages positive behaviors and discourages negative behaviors with a goal of improving various skills. ABA methods are used to increase and maintain desirable adaptive behaviors, reduce interfering maladaptive behaviors, or narrow the conditions under which they occur, teach new skills, and generalize behaviors to new environments or situations. ABA-based intervention effectiveness has been documented in single-subject studies and in some controlled studies that use early intensive behavioral intervention programs in university or community settings (AAP). Study design limitations reduce the ability to definitively confirm use of ABA as a treatment intervention for children with ASD; however, it is widely accepted in its use. Results of the research suggest that children who receive this early intensive behavioral treatment show gains in IQ, language, academic performance, adaptive behaviors, and in some social behavior as well relative to control groups. Health care practitioners who provide this treatment must be board certified in this specialty area. Different types of ABA include:

- Discrete trial training (DTT) – uses a series of trials to teach steps of a behavior. Positive reinforcement is used to reward correct answers and behaviors.
- Early intensive behavioral intervention (EIBI) – used for very young children.
- Pivotal response training – aims to increase motivation to learn, communication initiation and ability to monitor their behavior. Positive changes are expected to have effects on other behaviors.
- Verbal behavior intervention (VBI) – focuses on teaching verbal skills.

Other types of treatment include:

- Developmental, Individual Differences, Relationship-Based Approach (DIR®; also called "Floortime"). Floortime focuses on emotional and relational development (feelings, relationships with caregivers). It also focuses on how the child deals with sights, sounds, and smells.
- Treatment and Education of Autistic and related Communication-handicapped Children (TEACCH). TEACCH uses visual cues to teach skills. For example,

picture cards can help teach a child how to get dressed by breaking information down into small steps.

- The Early Start Denver Model (ESDM) is an intensive intervention that uses a developmental approach. The program encompasses a developmental curriculum that defines the skills to be taught at any given time and a set of teaching procedures used to deliver this content. This early intervention program integrates a relationship-focused developmental model with the well-validated teaching practices of ABA.

These comprehensive programs for the management of autism spectrum disorders are distinguished by theoretical orientation, with some programs being behaviorally oriented and others being developmentally oriented. Behavioral approaches use certain techniques or strategies, collectively referred to as applied behavioral analysis (ABA), in a systematic manner to produce observable and socially significant changes in a child's behavior and skills. Most developmental approaches do not rely on a specific set of strategies or techniques to modify behaviors or teach new skills. Instead, developmental programs organize a child's environment to encourage or facilitate communicative and social interactions.

Rehabilitation Services

Therapeutic interventions covered by this guideline should be part of a multi-component ASD treatment program including occupational and physical therapy. Occupational and physical therapy may be necessary to address specific fine or gross motor deficits or a comorbid physical impairment when there is potential for functional improvements.

Occupational Therapy

Occupational therapy (OT) teaches skills that help the individual live as independently as possible. Within the context of autistic spectrum disorders, OT is provided to promote development of self-care and play skills, fine motor skills (e.g., dressing, eating, bathing, writing, personal hygiene) and relating to others. They also focus on sensory motor skills that include balance (vestibular system), awareness of body position (proprioceptive system), and touch (tactile system). Occupational therapists can also assist in classroom modifications to improve attention and organization. Sensory dysfunction will also be addressed by occupational therapists to improve deficits in neurologic processing and integration of sensory information to allow better environmental interactions through adaptations. These sensory-focused treatments may be helpful as part of an overall therapeutic program. For additional information, see the *Occupational Therapy Medical Policy/Guideline (CPG 155 – S) and CPG 149: Sensory Integrative (SI) Therapy* clinical practice guideline.

Physical Therapy

Physical therapy teaches motor skills and motor planning. Gross motor skills, muscle weakness, and gait will also be addressed. Physical therapy for children with autistic spectrum disorders focuses on developing strength, coordination, and movement. Physical therapists work on improving gross motor skills, such as running, reaching, and lifting. Physical therapists work on improving function of the body's larger muscles through physical activities including exercise and massage. For additional information, see the *Physical Therapy Medical Policy/Guideline (CPG 135 – S)* clinical practice guideline.

An example of two types of therapy that have been proposed to benefit ASD include:

- CranioSacral Therapy: CranioSacral therapy is a form of manual treatment that involves using gentle pressure on the plates of the patient's skull. There is a lack of evidence to support the efficacy of this treatment for ASD and it would be considered unproven.
- Equestrian Therapy: Equestrian therapy, also referred to as therapeutic riding or hippotherapy is proposed to offer a person with a disability, including ASD, a means of physical activity that aids in improving balance, posture, coordination, the development of a positive attitude and a sense of accomplishment. McDaniel Peters and Wood (2017) completed a review of the literature and notes that it offers proof of concept that equine-assisted interventions can benefit children and adolescent with autism. Authors support continued investigation with improved methodology. Thus, there is insufficient published evidence regarding the effects of this therapy in children with ASD. Anecdotal evidence states otherwise, with promising stories of improved behaviors of children with ASD. Dimolareva and Dunn (2020) assessed the effectiveness of Animal-Assisted Interventions (AAIs) on social interaction, communication, and global Autism symptoms. A total of 1,447 studies were returned, of which 16 (n = 489) met the inclusion criteria. The meta-analyses indicated small effect sizes related to improvements in social interaction and communication and reduction in ASD symptoms. Additionally, there was little evidence for a relationship between dosage and effect size. In conclusion, AAIs appear to offer small improvements in social interaction and communication for children with autism, which may be comparable to activities used in active control conditions.

Speech Therapy

Speech therapy helps to improve communication skills. Communication deficits are often present with ASD; however, speech-language pathology treatment may be considered behavioral. Often children with ASD communicate in ineffective ways that are reflected in their behavior. The communication problems of ASD and pervasive developmental disorders (PDD) vary, depending upon the intellectual and social development of the individual. Some patients may be unable to speak, whereas others may have rich vocabularies and are able to talk about topics of interest in great depth. Although there is a

variation, many individuals with ASD will have minimal or no problem with pronunciation; however, most will have difficulty effectively using language. For additional information, see the *Speech-Language Pathology/Speech Therapy Guidelines (CPG 166 – S)* clinical practice guideline.

Patterns of language use and behaviors that are often found in children with ASD include:

- Repetitive or rigid language; includes saying things out of context in conversation or echolalia, where words are repeated over and over, or verbose in limited areas of interest.
- Difficulty with pragmatics of language—the system that combines language components in functional and socially appropriate communication, they often do not respond to others.
- Poor nonverbal conversation skills: Children may not use gestures, such as pointing at objects and may avoid eye contact and misread social cues.

When these deficits overlap with an impairment of speech due to a separate neurological cause, speech therapy may also be medically necessary. If speech is not possible, other forms of communication will be focused upon. When ASD or some other developmental disability is suspected, an assessment by speech-language pathologist may be part of the comprehensive evaluation. It has been noted in the literature that there is no single approach that is best for all individuals with ASD. Given the variable nature of ASD, treatment has to be variable. Some individuals with ASD need highly structured behavior modification programs to note improvement, while others do better in-home based programs in real-life scenarios. According to guidelines from the American Speech-Language-Hearing Association, individuals with ASD may demonstrate a need for speech-language pathology services due the pervasive nature of the social communication impairment, regardless of age, cognitive abilities, or performance on standardized testing of formal language skills. Although there is a range of assessment and intervention approaches, empirical evidence is not yet available to predict which specific approaches will be the most effective given the unique characteristics and challenges of individuals with ASD and their families. There is no single method that is equally effective for all individuals with ASD, and not all individuals in current outcome studies have benefited to the same degree.

Speech-Language Pathology (SLP) treatment is most likely to be effective when delivered in close collaboration with teachers, support personnel, families, and peers as opposed to traditional, pull-out, low-intensity service delivery.

A comprehensive speech and language evaluation of the patient and his or her speech and language potential is required before a full treatment plan is developed. As part of the

evaluation, standardized assessment tests should be used for evaluations to identify and quantify impairment and may include the following:

- Receptive-Expressive Emergent Language Scale (REEL): infants (birth to three years)
- Test of Language Development (TOLD): school-age children
- Porch Index of Communication Ability (PICA): adults
- Boston Diagnostic Aphasia Examination: adults
- Peabody Picture Vocabulary Test (PPVT): for all ages
    - Preschool Language Scale (PLS) – (birth through 5 years)
    - Social Language Development Test (elementary – ages 6-12) and adolescent
    - The Comprehensive Assessment of Spoken Language (CASL) (ages 3-21 years)

A hearing test may also be conducted to determine if the child is experiencing mild hearing loss as a result of ear infections or allergies or for some other reason. If a hearing loss is identified, medical management and monitoring is important to minimize any further effects on language learning. Comorbid psychiatric disorders, environmental deprivation, intellectual disability, and selective mutism should all be considered in cases of language delay.

Ongoing assessment is critical to guide program and goal planning. These include:

- To determine the individual's level of social communication skills;
- To identify learning objectives that are priorities within natural communication contexts;
- To examine the influence of those who are communicating with the individual with ASD and subsequent learning environment.

Assessment strategies should not rely solely on standardized, norm-referenced tools. Information should be gathered across natural social contexts, involving primary caregivers and communication partners (e.g., teachers, parents) in the assessment process. Intervention goals should incorporate the functional use of the individual's full communication abilities using a multimodal communication system. Decisions regarding the integration of other forms of communication should be individualized based on the specific capabilities and contexts of communication, as well as cultural considerations. In educational settings, augmentative communication devices may be provided as part of the management of ASD. The National Research Council (NRC) notes that "for children with autism who do not acquire functional speech or have difficulty processing and comprehending spoken language, AAC, and assistive technology (AT) can be useful components of an educational program" (NRC, 2001). At the time of this review, the report also emphasizes that there is relatively little systematic research to elucidate the characteristics of children and the components of AAC and AT that may interact to produce

effective or ineffective intervention. AAC ranges from supporting existing speech or developing independent use of a nonverbal symbol system such as sign language, symbols displayed on a communication board and voice output devices with synthesized and digitized speech. AT is defined as a device or service that is commercial, hand-made, or customized and is used to support or enhance the functional capabilities of an individual with disabilities (NRC, 2001). Currently, the American Speech-Language-Hearing Association (ASHA) states that individuals with autism may benefit from use of AAC (2024).

Augmentative and Alternative Communication: Augmentative and alternative communication (AAC) include all forms of communication (other than oral speech) that are used for expression. AAC includes:

- Unaided communication systems which rely on the user's body to convey messages—examples include gestures, body language, and/or sign language.
- Aided communication systems require the use of tools or equipment in addition to the user's body.
    - Aided communication methods can range from paper and pencil to communication books or boards to devices that produce voice output (speech generating devices or SGD's) and/or written output.
    - Electronic communication aids allow the user to use picture symbols, letters, and/or words and phrases to create messages.
        - A Picture Exchange Communication System (PECS) uses picture symbols to teach communication skills with the individual taught to use picture symbols to ask and answer questions and hold a conversation. Language and communication interventions (PECS and Responsive Education and Prelinguistic Milieu Training [RPMT]) demonstrate short-term improvement in word acquisition without effect durability and should be studied further. The PECS method incorporates ABA and other developmental principles.

The American Academy of Child & Adolescent Psychiatry (AACAP) guidelines regarding assessment of children, adolescents and adults with ASD note that educational services (e.g., including special education, some forms of behavior modification and other therapy services) are the central and integral aspect of the treatment for ASD (Volkmar et al., 2014).

Other interventions that have shown little or insufficient evidence of effectiveness in the treatment of children with autism thus far, are auditory integration training (also referred to as auditory integration therapy [AIT]), cognitive rehabilitation, facilitated communication, and vision therapy.

The Agency for Healthcare Research and Quality's report on comparative effectiveness of therapies for children with ASDs (2014) has the following conclusions:

- Early intensive behavioral and developmental interventions such as the UCLA/Lovaas Model of Applied Behavior Analysis improve cognitive, language, and adaptive outcomes in certain subgroups of children (Low confidence scale).
- The evidence is insufficient to understand the effectiveness, benefits, or adverse events from any other behavioral interventions.
- The evidence is insufficient to understand the effectiveness, benefits, or adverse events from any educational intervention.
- The evidence is insufficient to understand the effectiveness, benefits, or adverse events from any allied health or complementary and alternative medicine intervention. The CAM interventions included acupuncture and massage. Specifically, all studies of sensory integration and music therapy were of poor quality, and two fair-quality studies of auditory integration showed no improvement associated with treatment. Occupational and physical therapy were not considered within the allied health interventions, but rather therapies such as facilitated communication, music therapy, and leisure/recreation programs were considered.

In 2014, AHRQ published a systematic review that updated the behavioral intervention portion of the comprehensive review of therapies for children with ASD that was published in 2011 (Weitlauf et al., 2014). The review focused on behavioral treatments for children ages two through twelve with age two at risk of a diagnosis of ASD. The study designs included randomized controlled trials, prospective and retrospective cohort studies, and nonrandomized controlled trials. Sixty-five unique studies comprising 48 randomized trials and 17 nonrandomized comparative studies (19 good, 39 fair, and 7 poor quality) published since the prior review were included. The quality of studies improved compared with that reported in the earlier review; however, assessment of the strength of evidence (SOE), confidence in the stability of effects of interventions in the face of future research, remains low for many intervention/outcome pairs. Early intervention based on high intensity applied behavior analysis over extended timeframes was associated with improvement in cognitive functioning and language skills (moderate SOE for improvements in both outcomes) relative to community controls in some groups of young children. The magnitude of these effects varied across studies, potentially reflecting poorly understood modifying characteristics related to subgroups of children. Early intensive parent training programs modified parenting behaviors during interactions; however, data were more limited about their ability to improve developmental skills beyond language gains for some children (low SOE for positive effects on language). Social skills interventions varied in scope and intensity and showed some positive effects on social behaviors for older children in small studies (low SOE for positive effects on social skills). Studies of play/interaction-based approaches reported that joint attention interventions may demonstrate positive outcomes in preschool-age children with ASD when targeting joint attention skills

(moderate SOE); data on the effects of such interventions in other areas were limited (low SOE for positive effects on play skills, language, social skills). Studies examining the effects of cognitive behavioral therapy on anxiety reported positive results in older children with IQS ≥70 (high SOE for improvements in anxiety in this population). Smaller short-term studies of other interventions reported some improvements in areas such as sleep and communication, but data were too sparse to assess their overall effectiveness. Authors concluded that the growing evidence base suggests that behavioral interventions can be associated with positive outcomes for children with ASD. Despite improvements in the quality of the included literature, a need remains for studies of interventions across settings and continued improvements in methodologic rigor. Substantial scientific advances are needed to enhance our understanding of which interventions are most effective for specific children with ASD and to isolate elements or components of interventions most associated with effects.

Lounds Taylor et al. (2012) systematically reviewed evidence on therapies for adolescents and young adults (ages 13 to 30) with ASD. Authors focused on the outcomes, including harms and adverse effects, of interventions addressing the core symptoms of ASD; common medical and mental health comorbidities occurring with ASD; the attainment of goals toward functional/adult independence; educational and occupational/vocational attainment; quality of life; access to health and other services; and the transitioning process (i.e., process of transitioning to greater independent functioning). They also addressed the effects of interventions on family outcomes including parent distress and satisfaction with interventions. They identified 32 unique studies, most of which were poor quality. Five studies, mostly of medical interventions, were fair quality, and none were good. In behavioral literature, studies of group- and computer-based interventions reported short-term gains in social skills. Two poor-quality studies of educational interventions reported some gains in vocabulary and reading. Four small studies investigated disparate interventions addressing highly specific adaptive/life skills with some positive results in studies typically of short duration. Studies of vocational interventions, all of poor quality, reported that on-the job supports may promote employment in the community. Little evidence supports the use of medical interventions in adolescents and young adults with ASD; however, antipsychotic medications and serotonin reuptake inhibitors were associated with improvements in specific challenging behaviors. Similarly, little evidence supports the use of allied health interventions including facilitated communication. Authors concluded that there is very little evidence available for specific treatment approaches in this population; this is especially the case for evidence-based approaches to support the transition of youth with autism to adulthood. Of the small number of studies available, most were of poor quality, which may reflect the relative newness of the field. Five studies, primarily of medical interventions, had fair quality. Behavioral, educational, and adaptive/life skills studies were typically small and short term and suggested some potential improvements in social skills and functional behavior. Small studies suggested that vocational programs may increase employment success for some individuals. Few data

are available to support the use of medical or allied health interventions in the adolescent and young adult population. The medical studies that have been conducted focused on the use of medications to address specific challenging behaviors, including irritability and aggression, for which effectiveness in this age group is largely unknown and inferred from studies including mostly younger children.

National Institute for Health and Clinical Excellence (NICE, 2021) published guidelines for the management and support of children and young people on the autism spectrum. The recommendations for treatment include:

Psychosocial interventions

- Consider a specific social-communication intervention for the core features of autism in children and young people that includes play-based strategies with parents, caregivers, and teachers to increase joint attention, engagement and reciprocal communication in the child or young person. Strategies should:
    - Be adjusted to the child or young person's developmental level
    - Antipsychotics
    - Antidepressants
    - Anticonvulsants
    - Exclusion diets (such as gluten- or casein-free diets)

Interventions that should not be used for autism in children and young people:

- Neurofeedback to manage speech and language problems in children and young people with autism;
- Auditory integration training to manage speech and language problems in children and young people with autism;
- Omega-3 fatty acids to manage sleep problems in children and young people with autism;
- The following interventions should not be used to manage autism in any context in children and young people:
    - Secretin
    - Chelation
    - Hyperbaric oxygen therapy

NICE (2017) also published clinical guidelines for the recognition, referral, diagnosis, and management of adults on the autism spectrum. The guidelines include the following recommendations:

Psychosocial interventions for the core symptoms of autism

- For adults with autism without a learning disability or with a mild to moderate learning disability, who have identified problems with social interaction, consider:
  - A group-based social learning program focused on improving social interaction;
  - An individually delivered social learning program for people who find group-based activities difficult;
- Social learning programs to improve social interaction should typically include:
  - Modeling;
  - Peer feedback (for group-based programs) or individual feedback (for individually delivered programs);
  - Discussion and decision-making;
  - Explicit rules;
  - Suggested strategies for dealing with socially difficult situations;
- Do not provide facilitated communication for adults with autism.

Psychosocial interventions focused on life skills

- For adults with autism of all ranges of intellectual ability, who need help with activities of daily living, consider a structured and predictable training program based on behavioral principles.
- For adults with autism without a learning disability or with a mild to moderate learning disability, who are socially isolated or have restricted social contact, consider:
  - A group-based structured leisure activity program;
  - An individually delivered structured leisure activity program for people who find group-based activities difficult.
- A structured leisure activity program should typically include:
  - A focus on the interests and abilities of the participant(s);
  - Regular meetings for a valued leisure activity;
  - For group-based programs, a facilitator with a broad understanding of autism to help integrate the participants;
  - The provision of structure and support.
- For adults with autism without a learning disability or with a mild to moderate learning disability, who have problems with anger and aggression, offer an anger management intervention, adjusted to the needs of adults with autism.

- Anger management interventions should typically include:
  - Functional analysis of anger and anger-provoking situations;
  - Coping-skills training and behavior rehearsal;
  - Relaxation training;
  - Development of problem-solving skills.
- For adults with autism without a learning disability or with a mild learning disability, who are at risk of victimization, consider anti-victimization interventions based on teaching decision-making and problem-solving skills.
- Anti-victimization interventions should typically include:
  - Identifying and, where possible, modifying and developing decision-making skills in situations associated with abuse;
  - Developing personal safety skills;
- For adults with autism without a learning disability or with a mild learning disability, who are having difficulty obtaining or maintaining employment, consider an individual supported employment program.

Biomedical (pharmacological, physical, and dietary) interventions and the core symptoms of autism

- Do not use the following:
  - Anticonvulsants for the management of core symptoms of autism in adults;
  - Chelation for the management of core symptoms of autism in adults;
  - The following interventions for the management of core symptoms of autism in adults:
    - Exclusion diets (e.g., gluten- or casein-free and ketogenic diets);
  - Vitamins, minerals, and dietary supplements (e.g., vitamin b6 or iron supplementation) drugs specifically designed to improve cognitive functioning (e.g., cholinesterase inhibitors) for the management of core symptoms of autism or routinely for associated cognitive or behavioral problems in adults;
  - Oxytocin for the management of core symptoms of autism in adults;
  - Secretin for the management of core symptoms of autism in adults;
  - Testosterone regulation for the management of core symptoms of autism in adults;
  - Hyperbaric oxygen therapy for the management of core symptoms of autism in adults;
  - Antipsychotic medication for the management of core symptoms of autism in adults;
  - Antidepressant medication for the routine management of core symptoms of autism in adults.

Weitlauf et al. (2017) evaluated the effectiveness and safety of interventions targeting sensory challenges in children with ASD in an update of the AHRQ document

"Interventions Targeting Sensory Challenges in Children with Autism Spectrum Disorder." Studies comparing interventions incorporating sensory-focused modalities with alternative treatments or no treatment were included. Studies had to include at least 10 children with ASD ages 2–12 years. Authors identified 24 unique comparative studies (17 newly published studies and 7 studies addressed in the 2011 review of therapies for children with ASD). Populations, intervention approaches, and outcomes assessed varied across studies. Relative to usual care or other interventions, sensory integration–based approaches improved measures related to sensory and motor skills in the short term. Environmental enrichment improved nonverbal cognitive skills in treated children compared with standard care in two small RCTs. Four small RCTs of auditory integration–based approaches reported mixed results. Studies of music therapy used different protocols and addressed different outcomes, precluding synthesis. Massage improved ASD symptom severity and sensory challenges versus a waitlist control condition. Additional RCTs of interventions with sensory-related components (tactile stimulation exercises, weighted blankets) reported few significant differences between treatment groups. Authors concluded that some interventions targeting sensory challenges may produce modest short-term (<6 months) improvements, primarily in sensory-related outcomes and outcomes related to ASD symptom severity; however, the evidence base for any category of intervention is small, and durability of effects beyond the immediate intervention period is unclear. Sensory integration–based approaches improved outcomes related to sensory challenges (low SOE) and motor skills (low SOE), and massage improved sensory responses (low SOE) and ASD symptoms (low SOE). Environmental enrichment improved nonverbal cognitive skills (low SOE). Auditory integration–based approaches did not improve language outcomes (low SOE). Some positive effects were associated with other approaches studied (music therapy, weighted blankets), but findings in these small studies were not consistent (insufficient SOE). Data on longer term results are lacking, as are data on characteristics that modify outcomes, effectiveness of interventions across environments or contexts, and components of interventions that may drive effects. In sum, while some therapies may hold promise and warrant further study, substantial needs exist for continuing improvements in methodologic rigor in the field.

Williamson et al. (2017) evaluated the comparative effectiveness and safety of medical interventions (defined broadly as interventions involving the administration of external substances to the body or use of external nonbehavioral procedures to treat symptoms of ASD) for children with ASD in another AHRQ publication. Comparative studies of medical interventions that included at least 10 children with ASD were included. Populations, treatment approaches, and outcomes assessed varied across studies. Relative to placebo, seven studies addressing risperidone or aripiprazole reported statistically significant improvements in challenging behavior in the short term (<6 months) but also clinically significant harms. RCTs addressing methylphenidate (*n*=2), atomoxetine (*n*=2), and guanfacine (*n*=1) reported significant improvements in hyperactivity, with frequent harms. Omega-3 fatty acids (4 RCTs) were not associated with changes in challenging

behavior. N-acetylcysteine and tetrahydrobiopterin were not associated with improvements in social skills and symptom severity, respectively. Despite the number of RCTs with low or moderate risk of bias addressing nutritional supplements or specialized diets, evidence is insufficient for all clinical efficacy and harms outcomes because few, small studies addressed each diet or supplement. Similarly, although 14 RCTs with low or moderate risk of bias compared risperidone plus an adjunct medication with risperidone plus placebo, few addressed the same adjunct agents. Studies of hyperbaric oxygen therapy versus sham treatment using differing protocols reported conflicting results. Fourteen studies addressed other interventions, most evaluated in only one study, and typically reported some positive treatment effects on sleep, ASD symptoms, or language. Authors concluded that risperidone and aripiprazole ameliorated challenging behaviors in the short term, but with clinically significant side effects (high SOE). Methylphenidate and atomoxetine were also associated with improvements in hyperactivity in small short-term RCTs (low SOE), with improvements maintained over 6 months for atomoxetine (low SOE for longer term effects). Methylphenidate was associated with clinically significant harms (low SOE), while atomoxetine was associated with clinically moderate harms (low SOE). Omega-3 fatty acid supplementation, N-acetylcysteine, and tetrahydrobiopterin failed to show benefits (low SOE). Evidence for other interventions and outcomes studied was insufficient. While the conduct of studies has improved considerably over time (i.e., growing number of RCTs and use of standardized measures), data on longer term (≥6 months) results and harms of most interventions are lacking. Similarly, more research is needed to understand characteristics of the child or treatment that modify outcomes, whether effectiveness of interventions generalizes across different settings such as the home or school, and how components of interventions may drive effects.

Trzmiel et al. (2019) aimed to assess the effectiveness of Equine-Assisted Activities and Therapies (EAAT) in ASD patients based on a review of the literature. A total of 15 studies with 390 participants (aged: 3-16 years) were included. The interaction between psychosocial functioning and EAAT was investigated in most studies. Improvement was reported in the following domains: socialization, engagement, maladaptive behaviors, and shorter reaction time in problem-solving situations after EAAT. The meta-analysis revealed no statistically significant differences for the effects investigated. Authors concluded that despite the need for further, more standardized research, the results of the studies included in this review allow the conclusion that EAAT may be a useful form of therapy in children with ASD.

Perryman et al. (2020) summarized the benefits of treatment options for persons with ASD. Focused areas and concurrent treatment identified were related to social anxiety, social pragmatic function and poor mental health, which are common in this group. The research assessed the benefit of group therapy (cognitive behavioral therapy [CBT] intervention) to improve social anxiety symptoms/social functional and secondarily on mood endorsed outcomes. Participants between 16 and 38 responded to pre and post surveys related to the

focus areas and concurrent treatments. The results noted statical significance for decreased social anxiety. The research was limited by study design without a control group or follow up. However, CBT intervention for persons with ASD noted positive reported outcomes which improved overall functioning. Additionally, control studies and follow up is warranted to address and assess the long-term functional impact and changes.

In the updated guideline from the American Academy of Pediatrics (2020), early intervention usually includes applied behavior analysis, which focuses on learning and reinforcing acceptable behaviors while extinguishing problematic behaviors. Authors report that applied behavior analysis improves cognitive skills and behavior but is an intensive process that typically requires many hours per week of patient participation. Early intervention that includes applied behavior analysis improves cognitive functioning and language skills, with better results from more intense therapy. Nearly all children with ASD require school-based assistance through an individualized education program, which often includes educational interventions, speech therapy, and occupational therapy. Up to 30% of children with ASD never acquire verbal speech; some will use augmented and alternative communication that includes a picture exchange communication system or speech-generating devices. About two-thirds of preschool children with ASD require occupational therapy for motor, strength, and adaptive skill. Authors state that other treatments proposed for ASD, including antifungal agents, immunotherapy, or hyperbaric oxygen, do not have evidence of benefit. There is also caution against using chelation therapy because of ineffectiveness and a risk of harm. Given parents and caregivers search for treatments, it is imperative that treatments with little or negative evidence are discussed and often require shared decision-making with parents or caregivers. This updated AAP guideline continues to recommend universal screening for ASD at the 18- and 24-month visits in contrast to the USPSTF findings of insufficient evidence to recommend for or against screening. The American Academy of Family Physicians continues to endorse the USPSTF recommendation. A recent intervention that achieved 91% screening in a medical system with 26,000 children showed the limitations and advantages of ASD screening (Guthrie et al., 2019). Only 39% of children with autism were identified by screening, yet those who were identified by screening were diagnosed an average of seven months earlier.

In the clinical report 'Identification, Evaluation, and Management of Children with Autism Spectrum Disorder,' Hyman et al. (2020) notes there is an increasing evidence base to support behavioral and other interventions to address specific skills and symptoms. Shared decision-making calls for collaboration with families in evaluation and choice of interventions. The goals of treatment of children with ASD are to (1) minimize core deficits (social communication and interaction and restricted or repetitive behaviors and interests)1 and co-occurring associated impairments; (2) maximize functional independence by facilitating learning and acquisition of adaptive skills; and (3) eliminate, minimize, or prevent problem behaviors that may interfere with functional skills. Treatments should be individualized, developmentally appropriate, and intensive, with performance data relevant

to treatment goals to evaluate and adjust intervention. All interventions should be based on sound theoretical constructs, rigorous methodologies, and objective scientific evidence of effectiveness. Since the publication of the 2007 AAP clinical reports on autism, substantial published literature has examined the effectiveness of interventions. Interventions for children with ASD are provided through educational practices, developmental therapies, and behavioral interventions. Treatment strategies may vary by the age and strengths and weaknesses of the child. For example, intervention for a toddler with a recent diagnosis of ASD may include behavioral and developmental approaches (individually or in the context of comprehensive approach) and, as he or she progresses, involvement in a specialized or typical preschool program. For older children, intervention is more likely to occur in educational settings, with the integration of behavioral and developmental therapies to promote skill development. The report describes the Comprehensive Treatment Model (CTM) which uses a central conceptual framework to address a broad array of symptoms and is designed to address specific skill(s) or symptom(s). This model addresses multiple therapeutic goals over a period of time. Provision of services may occur in individual instruction or class settings (specialized or inclusive), should include parents, and may involve technology-assisted intervention. Applied behavior analysis (ABA), developmental approaches, and/or naturalistic approaches may be used in CTMs. Examples of CTMs include early intensive behavioral intervention, Treatment and Education of Autistic and Related Communication-Handicapped Children (TEACCH), and the Early Start Denver Model (ESDM). Focused intervention practices such as physical and occupational therapy are designed to address a single or limited range of skills, such as increasing social communication or learning a specific task and may be delivered over a short period of time. Focused intervention practices may be behavioral, developmental, and/or educational. According to authors, these focused interventions may be effective for promoting skill development and communication.

Dandil et al. (2020) assessed the literature for cognitive remediation (CR) interventions in ASD. Thirteen studies were reviewed (4 RCTs, 2 non-randomized control trials, 4 case series, 2 feasibility studies and 1 case study). The authors stated that overall, results suggested CR interventions are potentially effective in improving social cognition and cognitive functioning in ASD. There are several limitations to this publication. The total number of participants was not provided. The article was a narrative synthesis of included studies. The authors stated that several methodological challenges made it difficult to appraise empirical studies comprehensively. Also, the authors noted that future RCTs are needed with larger sample sizes.

The American Academy of Neurology 2020 Practice Guideline on Treatment for Insomnia and Disrupted Sleep Behavior in Children and Adolescents with Autism Spectrum Disorder states:

- Clinicians should counsel children and adolescents with ASD and sleep disturbance (as appropriate) and their parents that there is currently no evidence to support the

routine use of weighted blankets or specialized mattress technology for improving disrupted sleep (Level B; Level B corresponds to the helping verb should. Such recommendations are more common, as the requirements are less stringent but are still associated with confidence in the rationale and a favorable benefit–risk profile).

Clinicians should counsel that there is currently no evidence to support the routine use of weighted blankets or specialized mattress technology for improving disrupted sleep. If asked about weighted blankets, clinicians should counsel that the trial reported no serious adverse events with blanket use and that blankets could be a reasonable nonpharmacologic approach for some individuals (Williams Buckley et al., 2020).

Wu et al. (2021) compared the relationship of receptive language (RL) and expressive language (EL) abilities with motor functioning in toddlers with ASD aged 24 to 36 months and their peers with typical development (TD). Furthermore, the study compared multidimensional motor functioning in toddlers with ASD with delayed RL and EL development and toddlers with ASD and typical RL and EL development. The predictive powers of the motor skills were examined for the group with delayed RL and EL development. The language abilities of 38 toddlers with ASD and 38 age-matched toddlers with TD were evaluated using the Receptive and Expressive Language Subscales of the Mullen Scale of Early Learning, and their motor skills were assessed using the Peabody Developmental Motor Scales, Second Edition. Significant correlations between language ability and motor functioning were observed in the ASD and TD groups. The ASD group with delayed RL and EL development had lower scores for multidimensional motor functioning than the ASD group with typical RL and EL development and the TD group. Moreover, the risks of delayed EL and RL development could be predicted by the lower motor scores in toddlers with ASD. Authors concluded that the positive correlation between language abilities and motor functioning in toddlers with ASD indicated potential connections between the early onsets of motor and speech-language impairments in these toddlers. The results may have implications for the development of motor-based interventions targeting language development in young children with ASD.

Amonkar et al. (2021) conducted a comprehensive quantitative and qualitative review of the evidence to date on the effects of CMT on multiple systems in individuals with ASD. The strongest evidence, both in terms of quantity and quality, exists for music and martial arts-based interventions followed by yoga and theater, with very limited research on dance-based approaches. The review of 72 studies (N = 1,939 participants) across participants with ASD ranging from 3 to 65 years of age suggests that at present there is consistent evidence from high quality studies for small-to-large sized improvements in social communication skills following music and martial arts therapies and medium-to-large improvements in motor and cognitive skills following yoga and martial arts training, with insufficient evidence to date for gains in affective, sensory, and functional participation

domains following CMT. Although promising, the review serves as a call for more rigorous high-quality research to assess the multisystem effects of CMT in ASD. Chan et al. (2021) quantitatively aggregated data from existing controlled trials to provide an up-to-date inquiry into the effectiveness of physical activity interventions on communication and social functioning in autistic children and adolescents. They included 12 trials involving 350 participants (8 trials reported communication outcomes and 11 trials reported social functioning outcomes) and found small to moderate benefits on communication and social functioning. Further analyses showed that the benefit of physical activity interventions is greater in younger participants. Results of this study suggest that physical activity interventions are effective in improving communication and social functioning in autistic children and adolescents, and early participation in the interventions can be more beneficial. Given their affordability, versatility, and efficacy, physical activity interventions could be considered a cost-effective option for autism spectrum disorder management in the future.

Wang et al. (2021) aimed to summarize the effectiveness and safety of acupuncture in the treatment of ASD through literature analysis and evaluation. The effects of acupuncture treatment for ASD were determined using the following indicators: childhood autism rating scale (CARS), autism behavior check list (ABC), Reynell developmental language scale (RDLS), and functional independence measure of children (WeeFIM). Based on the results of each indicator, this study suggested that acupuncture could effectively treat ASD. However, acupuncture methods and prescriptions at this stage remain heterogeneous, and acupuncture treatment operations require standardization. Studies using rigorous and standard research designs are needed to draw stronger conclusions about the advantages of using acupuncture to treat children and adolescents with ASD.

Liang et al. (2022) aimed to synthesize available empirical studies concerning the effects of exercise interventions on executive functions (EFs) in children and adolescents with ASD in a systematic review and meta-analysis. In total, 14 articles underwent systematic review, and 7 were selected for meta-analysis. Chronic exercise interventions had a small to moderate positive effect on overall EFs in children and adolescents with ASD. Regarding domain specific EFs, chronic exercise interventions had a small to moderate positive effect on cognitive flexibility and inhibitory control. However, this review found a non-significant effect size on working memory.

Daniolou et al. (2022) aimed to investigate the efficacy of early interventions in improving the cognitive ability, language, and adaptive behavior of pre-school children with ASDs through a systematic review of randomized controlled trials (RCTs). In total, 33 RCTs were included in the meta-analysis using the random effects model. The total sample consisted of 2,581 children (age range: 12-132 months). Early interventions led to positive outcomes for cognitive ability, daily living skills, and motor skills, while no positive outcomes were found for the remaining variables. However, when studies without the blinding of outcome

assessment were excluded, positive outcomes of early interventions only remained for daily living skills and motor skills. Although early intervention might not have positive impacts on children with ASDs for several outcomes compared to controls, these results should be interpreted with caution considering the great variability in participant and intervention characteristics.

Geretsegger et al. (2022) reviewed the effects of music therapy, or music therapy added to standard care, for autistic people. The present version of this review on music therapy for autistic people is an update of the previous Cochrane review update published in 2014 (following the original Cochrane review published in 2006). All RCTs, quasi-randomized trials and controlled clinical trials comparing music therapy (or music therapy alongside standard care) to placebo therapy, no treatment, or standard care for people with a diagnosis of autism spectrum disorder were considered for inclusion. They included 16 new studies in this update which brought the total number of included studies to 26 (1,165 participants). These studies examined the short- and medium-term effect of music therapy (intervention duration: 3 days to 8 months) for autistic people in individual or group settings. Twenty-one studies included children aged from 2 to 12 years. Five studies included children and adolescents, and/or young adults. Severity levels, language skills, and cognition were widely variable across studies. Measured immediately post-intervention, music therapy compared with placebo therapy or standard care was more likely to positively affect global improvement and to slightly increase quality of life. In addition, music therapy probably results in a large reduction in total autism symptom severity. Authors concluded that findings of this updated review provide evidence that music therapy is probably associated with an increased chance of global improvement for autistic people, likely to help them to improve total autism severity and quality of life and probably does not increase adverse events immediately after the intervention. The certainty of the evidence was rated as moderate for these 4 outcomes. No clear evidence of a difference was found for social interaction, non-verbal communication, and verbal communication measured immediately post-intervention. For these outcomes, the certainty of the evidence was rated as 'low' or 'very low'. Compared with earlier versions of this review, the new studies included in this update helped to increase the certainty and applicability of this review's findings through larger sample sizes, extended age groups, longer periods of intervention and inclusion of follow-up assessments, and by predominantly using validated scales measuring generalized behavior (i.e. behavior outside of the therapy context). The applicability of the findings is still limited to the age groups included in the studies, and no direct conclusions can be drawn about music therapy in autistic individuals above the young adult age. More research using rigorous designs, relevant outcome measures, and longer-term follow-up periods is needed to corroborate these findings and to examine whether the effects of music therapy are enduring.

Art therapy, or the therapeutic use of art making, has been proposed to address the symptoms of individuals with ASD. The effectiveness of this varied therapy has not been

demonstrated in large, well-designed clinical trials in published peer-reviewed scientific literature (Bernier et al., 2022).

Salehinejad et al. (2022) evaluated the efficacy and safety of transcranial direct current stimulation (tDCS) in major neurodevelopmental disorders (ADHD, autism, and dyslexia) in a systematic review. The authors identified 11 RCTs of tDCS application in children and adolescents with ASD. The authors noted that although preliminary results appear promising, results cannot establish clinical efficacy of tDCS unless proved in large clinical trials with robust experimental design. Large-scale RCTs and translational studies covering the range from basic neurophysiology to application in cognitive-clinical neuroscience are required. Furthermore, stimulation protocols applied in the most studied neurodevelopmental disorders show symptom-specific stimulation protocols that take disorder-specific conditions into account need to be developed.

Huashuang et al. (2022) assessed the prevalence of adverse events (AEs) related to Transcranial Magnetic Stimulation (TMS) in ASD. A total of 11 studies were included in the meta-analysis. The authors found the overall prevalence of reported AEs of TMS among ASD was 25% (headache: 10%; facial discomfort: 15%; irritability 21%; pain at the application site: 6%; light-headedness or dizziness: 8%).

Holloway et al. (2023) described current motor learning strategies used to optimize acquisition, retention, transfer, and generalizability of motor tasks in children with ASD. Children with ASD display motor difficulties that may impact social and communication interactions and participation in everyday activities. These difficulties may be related to a difference in the way they learn new skills. Therefore, strategies to support motor learning to optimize skill acquisition and retention may be beneficial. Twenty-two articles met eligibility criteria. Most articles examined strategies that manipulated the instruction of tasks, with few articles examining feedback or practice. Skill acquisition was the most represented motor learning outcome, with fewer studies examining retention, transfer, or generalizability. Authors concluded that positive results in 95% of the articles suggest that the use of support strategies to optimize motor learning is feasible and beneficial for children with ASD, and that modifications to instruction, feedback, and practice schedules should be considered in motor interventions.

Linden et al. (2023) reported results from a meta-analysis of 71 randomized controlled trials including 3,243 participants. The primary analysis objective was to compare relative benefits and harms of different interventions to improve mental health of autistic people. The types of interventions (either alone or in combination) reviewed included the following:

- drugs such as selective serotonin reuptake inhibitors (SSRIs), serotonin and norepinephrine reuptake inhibitors (SNRIs), antipsychotics, antioxidants, other medications such as oxytocin, anti-diuretic hormone (ADH).

- psychological therapies such as cognitive behavior therapy, mindfulness-based therapy, counselling.
- behavioral therapies such as social skills training and applied behavioral analysis.
- miscellaneous interventions such as music therapy, parent psychoeducation, dietary supplements.
- wait-list (i.e. no additional intervention or placebo intervention until measurement of the outcomes).

The primary outcomes included anxiety or depression using any validated measure, overall health-related quality of life using any validated measure, and serious adverse events. Sample sizes in the trials varied from 11 to 223 participants. Only 6 trials had sample sizes of 100 or more participants. The follow-up period in the trials ranged from 1 month to 24 months. Only 1 trial had a follow-up longer than 12 months. Overall, the reviewed evidence indicated considerable uncertainty about the effects of different interventions for mental health conditions in people with autism. Available evidence suggests that some forms of cognitive behavioral therapy may decrease anxiety and depression scores in children and adults with autism; mindfulness therapy may decrease anxiety and depression scores in adults with autism and previous mental health conditions; and behavioral interventions may provide some benefit for depression in children with autism. The authors noted that few trials specifically studied mental health conditions in people with autism, and those that existed were at high risk of bias. The risk of bias assessment highlighted low study quality, small sample sizes resulting in insufficient statistical power, a lack of blinding of participants and researchers, and few RCTs comparing different interventions (Linden et al., 2023).

Hirota and King (2023) summarized the evidence on the diagnosis and treatment of ASD. The estimated prevalence of ASD has been increasing in the US, from 1.1% in 2008 to 2.3% in 2018, which is likely associated with changes in diagnostic criteria, improved performance of screening and diagnostic tools, and increased public awareness. No biomarkers specific to the diagnosis of ASD have been identified. Common early signs and symptoms of ASD in a child's first 2 years of life include no response to name when called, no or limited use of gestures in communication, and lack of imaginative play. The criterion standard for the diagnosis of ASD is a comprehensive evaluation with a multidisciplinary team of clinicians and is based on semi-structured direct observation of the child's behavior and semi-structured caregiver interview focused on the individual's development and behaviors using standardized measures, such as the Autism Diagnostic Observation Schedule-Second Edition and the Autism Diagnostic Interview. These diagnostic measures have sensitivity of 91% and 80% and specificity of 76% and 72%, respectively. Compared with people without ASD, individuals with ASD have higher rates of depression (20% vs 7%), anxiety (11% vs 5%), sleep difficulties (13% vs 5%), and epilepsy (21% with co-occurring intellectual disability vs 0.8%). Intensive behavioral interventions, such as the Early Start Denver Model, are beneficial in children 5 years or younger for improvement

in language, play, and social communication (small to medium effect size based on standardized mean difference). Pharmacotherapy is indicated for co-occurring psychiatric conditions, such as emotion dysregulation or attention-deficit/hyperactivity disorder. Risperidone and aripiprazole can improve irritability and aggression (standardized mean difference of 1.1, consistent with a large effect size) compared with placebo. Psychostimulants are effective for attention-deficit/hyperactivity disorder (standardized mean difference of 0.6, consistent with a moderate effect size) compared with placebo. These medications are associated with adverse effects including, most commonly, changes in appetite, weight, and sleep. Authors concluded ASD affects approximately 2.3% of children aged 8 years and approximately 2.2% of adults in the US. First-line therapy consists of behavioral interventions, while co-occurring psychiatric conditions, such as anxiety or aggression, may be treated with specific behavioral therapy or medication.

Sandbank et al. (2023) summarized the breadth and quality of evidence supporting commonly recommended early childhood autism interventions and their estimated effects on developmental outcomes in an updated systematic review and meta-analysis. Authors concluded that the available evidence on interventions to support young autistic children has approximately doubled in 4 years. Some evidence from randomized controlled trials shows that behavioral interventions improve caregiver perception of challenging behavior and child social emotional functioning, and that technology-based interventions support proximal improvements in specific social communication and social emotional skills. Evidence also shows that developmental interventions improve social communication in interactions with caregivers, and naturalistic developmental behavioral interventions improve core challenges associated with autism, particularly difficulties with social communication. However, potential benefits of these interventions cannot be weighed against the potential for adverse effects owing to inadequate monitoring and reporting.

Wu et al. (2024) investigated the effectiveness of physical exercise therapy (PET) for individuals with ASD in a systematic review and meta-analysis, providing evidence-based support for clinical and scientific research. A total of 28 RCTs comprising 1081 participants were analyzed. Of these, only three studies met high-quality standards. Compared to control groups, PET showed improvement in at least one core symptom of autism, including Motor Performance, Restricted Repetitive Behaviors, Social Dysfunction. Authors concluded that PET may offer benefits in reducing the overall severity and associated symptoms in individuals with ASD. However, given the high overall risk of bias in the included studies, these findings should be interpreted with caution.

Santos et al. (2024) evaluated the impacts of behavioral therapies applied in healthcare settings for patients with ASD in a systematic review. Randomized clinical trials and observational studies demonstrated improvements in cognitive and verbal components of patients who received behavioral therapies in therapeutic settings. These results indicate a

positive impact of both cognitive-behavioral therapy and Early Start Denver Model (ESDM) on the development of patients' skills. Among the cognitive-behavioral therapies, the one based on the MASSI protocol did not impact the reduction of anxious symptoms. As for cognitive-behavioral therapy, one study demonstrated that the Behavioral Intervention for Anxiety in Children with Autism (BIACA), when compared to the Coping Cat protocol, improves cognition and reduces anxiety symptoms. Despite these results, further randomized clinical trials comparing behavioral therapies with one another are needed. Authors concluded that in the context of behavioral therapy within a healthcare setting, the Early Start Denver Model (ESDM) showed improvements in the cognitive, verbal, and social aspects of the evaluated patients. Improvement in scores sometimes is achieved independently of the group and related to the time of interventions.

Chen et al. (2024) carried out a systematic review for randomized controlled trials (RCTs) regarding non-invasive brain stimulation (NIBS) for reducing autistic symptoms. Sixteen articles (N = 709) met the inclusion criteria for network meta-analysis. Fourteen active NIBS interventions, including transcranial direct current stimulation (tDCS), repetitive transcranial magnetic stimulation, and transcranial pulse stimulation were analyzed. Only anodal tDCS over the left dorsolateral prefrontal cortex paired with cathodal tDCS over an extracephalic location (atDCS_F3 + ctDCS_E) significantly improved autistic symptoms compared to sham controls. None of the NIBS interventions markedly improved social-communication symptoms or restricted/repetitive behaviors in autistic participants. Moreover, no active NIBS interventions exhibited significant dropout rate differences compared to sham controls, and no serious adverse events were reported for any intervention.

Patten et al. (2024) authored practice guidelines for occupational therapy practitioners to support interventions that promote subjective well-being among autistic people and their families through optimal engagement and participation in occupations. These Practice Guidelines are informed by systematic reviews to expand knowledge of interventions that promote access, inclusion, engagement, and optimal participation in occupations that are meaningful to autistic people. Their intent was to foster occupational therapy practitioners' clinical decision-making and reasoning when working with autistic people and their care partners. These Practice Guidelines were developed on the basis of four systematic reviews, supporting evidence and literature, along with continued revisions and integration through an iterative and collaborative process. A total of 98 articles were included in the systematic reviews, which are the foundation for practice recommendations in these guidelines. Forty-eight of the systematic review articles were used to inform the clinical recommendations included in these Practice Guidelines. Recommendations included the following: Strong to moderate evidence indicates the need for multidisciplinary, goal-oriented interventions to support autistic people in different contexts. Although there is only emerging evidence in the inclusion of autistic people's strengths, interests, and perspectives to guide occupational therapy interventions, such practices can enhance the

delivery of neurodiversity-affirming and trauma-informed practices. In addition, evidence is needed to support participation in activities of daily living (ADLs) for autistic youths. Authors recommend the use of strengths-based language to describe autistic people and the use of environmental adaptations, care partner education, and coaching to enhance occupational therapy service delivery. Authors concluded that the literature is sparse regarding neurodiversity-affirming and trauma-informed practices for autistic youths, as well as for participation in activities of daily living (ADLs). These Practice Guidelines provide new information on positive mental health development; self-determination; ADLs, instrumental ADLs, play, and leisure occupations for children, adolescents, and adults; person-centered planning for adolescents and adults; and rest and sleep. Information on health management is also provided.

Kou et al. (2024) investigated the efficacy of physical activity for autism spectrum disorder (ASD) in clinical settings. They performed a network meta-analysis to evaluate the effect of various exercise interventions on sociability and communication in individuals with ASD. Their aim was to identify the exercise modalities most conducive to enhancing these essential skills. They included 38 original studies published between 2009 and 2024, with a total of 1,382 participants analyzed for sociability outcomes. Results indicated that sports games, combination therapy, group ball sports, and outdoors were more effective than passive controls. A total of 25 original literatures were included in the analysis of communication ability, involving 904 subjects, and the results showed that combination therapy, sports games, group ball games, outdoor exercise, and mind-body exercise, all of which were more effective than passive controls. Authors concluded that physical exercise plays a significant role in alleviating symptoms and enhancing sociability and communication in individuals with ASD. Findings highlight that sports games, combination therapy, team ball sports, and outdoor exercise are particularly effective in improving sociability. In terms of communication skills, combination therapy, sports games, team ball sports, outdoor exercise, and mind-body exercise demonstrated the most substantial benefits. These results provide a robust foundation for future interventions aimed at improving the quality of life for individuals with ASD.

Leonardi et al. (2025) assessed the impact of multisensory environment interventions in autism in a systematic review and to provide guidelines. A total of 1,247 unique records were screened for eligibility, and 10 studies were included. Four studies reported reductions in stereotypic behavior frequency in children and adults; while other studies suggest positive effects on sustained attention, and aggressive and sensory behaviors. Overall, there was insufficient evidence due to the paucity of literature, the significant variation between interventions, and the small sample sizes. Future research should aim to develop a structured intervention approach to address the common limitations of the included designs.

Hankus et al. (2025) reviews the potential impact of EEG findings on the development, behavior, sleep, and seizure occurrence in ASD patients. Additionally, it evaluated whether routine EEG testing is warranted for all ASD patients, particularly in the absence of clinical seizures. The review focused on EEG abnormalities, both epileptiform and non-epileptiform, in individuals with ASD. The analysis also included a critical assessment of whether EEG abnormalities correlate with specific ASD symptoms, such as cognitive impairment, speech delay, or behavioral issues. EEG abnormalities were reported in 23-80% of ASD patients, indicating a broad range of findings. Despite their frequent occurrence, the evidence linking these abnormalities to specific clinical symptoms remains inconclusive. Some studies suggest an association between epileptiform patterns and more severe ASD traits, while others do not confirm this. Furthermore, the effectiveness of anticonvulsant treatment in children with EEG abnormalities and no seizures remains uncertain, with limited supporting data. Authors concluded that given the uncertain relationship between EEG findings and ASD symptoms, routine EEG testing for all children with ASD appears unnecessary. EEG should be considered primarily when epilepsy is clinically suspected.

Gao et al. (2025) evaluated the effect of exercise interventions on behavioral, motorial, and psychosocial health outcomes in autistic children, as well as to determine the quality of evidence for each outcome. Authors conducted an umbrella review of meta-analyses investigating the associations between exercise interventions and health outcomes in autistic children from inception to November 27, 2024. Following exercise interventions, maladaptive behavior showed a substantial improvement. However, no discernible impact on stereotyped behavior was observed. Sensitivity analysis revealed that all overall effect sizes indicated statistically significant differences, even though the reanalysis of meta-analyses showed no significant effectiveness of exercise interventions on social communication, social skill, social function, and motor skills. Exercise interventions are suggested to improve maladaptive behaviors and may help with social communication, social skills, social function, and motor skills. The evidence for the effectiveness of exercise interventions in reducing stereotyped behaviors is weak, but it still merits investigation.

Zhang et al. (2025) examined the effects of four types of exercise interventions-Isolation of Fundamental Movement Skills (FMS-I), Combination of Fundamental Movement Skills (FMS-C), Fine Motor Movement (FMM), and Specialized Movement Skills (SMS)-on the core symptoms of ASD in children aged 3-12, including social communication deficits and stereotyped and repetitive behaviors. Included studies compared exercise interventions with control groups and assessed at least one core symptom of ASD. The systematic review included 26 studies encompassing 878 children, with 19 studies eligible for NMA. Ranking probabilities indicated that FMS-I emerged as the most promising intervention for addressing social communication deficits and stereotyped and repetitive behaviors. The FMS-C showed potential for enhancing overall features. To conclude, exercise

interventions should be grounded in FMS, transitioning from isolated movements to integrated actions, to enhance the overall behavior of children with ASD.

Li et al. (2025) conducted a systematic review on the effects of physical activity on motor, communication, social, and executive function in children with autism spectrum disorder. Thirty-three randomized controlled trials involving 1,083 participants were included. Two reviewers independently performed the study selection, data extraction, quality assessment, and meta-analysis. The meta-analysis revealed significant effects of physical activity on motor ability, social ability, and executive function. The ability to communicate also improved, although not significantly. Subgroup analyses suggested that sessions under 60 min, delivered three or more times per week for no more than 10 weeks, were generally more effective. However, longer durations and periods benefited executive function, whereas lower frequencies favored motor ability. Authors concluded that this study found that physical activity has a positive effect on increasing communication, social, motor, and executive function capabilities in children with ASD. However, disparities in optimal effects observed across communication, social, motor, and executive functioning outcomes are contingent upon intervention duration, frequency, and period.

Shi et al. (2025) investigated the effects of Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH) on social functioning in individuals with autism spectrum disorders (ASD). Eleven studies involving 701 ASD individuals were included in this study. The TEACCH group had significantly higher socialization score, Cognitive Performance Scale score, and fine motor score but significantly lower Autism Behavior Checklist score, Childhood Autism Rating Scale score, and Autism Treatment Evaluation Checklist score compared to the control group. There were no significant differences in other outcome measures. Authors concluded that TEACCH is a promising intervention for improving the social skills, cognitive performance, and fine motor functions of ASD individuals. However, further studies are warranted to confirm the effectiveness of TEACCH on ASD core symptoms.

Wang et al. (2025) examined the efficacy and sustained impact of exercise therapy on enhancing executive function among children and adolescents diagnosed with autism spectrum disorder (ASD). Identified randomized controlled trials focusing on the effects of exercise therapy on the enhancement of executive function in children and adolescents with ASD were included. Sixteen studies were systematically evaluated and included in the meta-analysis, revealing that exercise therapy led to a significant improvement in executive function among children and adolescents with ASD, along with some evidence of sustained improvement. Subgroup analyses indicated that exercise did not significantly enhance executive functioning in preschool-aged patients with ASD, and working memory did not exhibit a significant improvement across various dimensions of executive functioning. Furthermore, no differences were observed in analyses of different exercise cycles, exercise characteristics, or the use of medication among subjects. Authors

concluded that exercise interventions improve executive function in children and adolescents with ASD, with sustained post-intervention effects. Limited impact on working memory and observed heterogeneity highlights the need for more precise intervention designs and rigorous research.

Li et al. (2025) assessed and compared the effectiveness of different non-pharmacological interventions for executive function in children and adolescents with autism spectrum disorder (ASD). A total of 23 RCTs involving 1,004 children and adolescents with ASD were included. This study showed that exercise intervention had relatively strong advantages in improving overall executive function and inhibitory control, and also had certain effects on cognitive flexibility and working memory in children and adolescents with ASD. Cognitive-behavioral intervention performs better in terms of working memory. Cognitive-behavioral intervention and executive function task training also demonstrated positive effects on executive function rehabilitation. Authors concluded that this study indicates that different rehabilitation methods have a significant impact on overall executive function and its various dimensions. In clinical practice, exercise, cognitive-behavioral intervention, and executive function task training are actively recommended. However, the effectiveness of combining different intervention strategies or using novel AI rehabilitation tools for executive function rehabilitation remains to be explored in randomized controlled trials with larger sample sizes.

Li et al. (2026) investigated the effects of an exercise intervention on inhibitory control (IC) function in children and adolescents with ASD and to explore the underlying mechanisms. Overall, the combined effect of exercise intervention on IC in children and adolescents with ASD was statistically significant in the intervention group compared to the control group. Subgroup analysis revealed that, in terms of movement patterns, martial arts interventions appeared to be more effective in enhancing IC, while ball sports and combined sports did not show significant effects. Interventions with shorter session durations (≤45 minutes), more frequent weekly sessions (>2), and shorter intervention cycles (≤4 weeks) tended to demonstrate slightly better outcomes, although not all subgroup differences reached statistical significance. Authors concluded that exercise interventions have a significant impact on IC in children and adolescents with ASD. Martial arts interventions may be more beneficial for improving IC in children and adolescents with ASD. Similarly, shorter sessions, higher weekly frequency, and shorter overall intervention cycles tended to yield somewhat better effects. However, given the variation in the number and quality of included studies, these findings must be further validated by more scientifically objective randomized controlled trials.

In summary, rehabilitation therapy, including speech, PT, and OT, should be included in the multi-disciplinary team-based approach for individuals with ASD. Speech-language pathologists focus on language and communication skills; physical therapists emphasize gross motor skills and planning, muscle weakness, and coordination; and occupational

therapists work with individuals with ASD to improve their self-care activities, with emphasis on fine motor skills. They also seek to improve sensory dysfunction and assist with environmental modifications for improved behavior and learning.

PRACTITIONER SCOPE AND TRAINING

Practitioners should practice only in the areas in which they are competent based on their education, training, and experience. Levels of education, experience, and proficiency may vary among individual practitioners. It is ethically and legally incumbent on a practitioner to determine where they have the knowledge and skills necessary to perform such services and whether the services are within their scope of practice.

It is best practice for the practitioner to appropriately render services to a member only if they are trained, equally skilled, and adequately competent to deliver a service compared to others trained to perform the same procedure. If the service would be most competently delivered by another health care practitioner who has more skill and training, it would be best practice to refer the member to the more expert practitioner.

Best practice can be defined as a clinical, scientific, or professional technique, method, or process that is typically evidence-based and consensus driven and is recognized by a majority of professionals in a particular field as more effective at delivering a particular outcome than any other practice (Joint Commission International Accreditation Standards for Hospitals, 2020).

Depending on the practitioner's scope of practice, training, and experience, a member's condition and/or symptoms during examination or the course of treatment may indicate the need for referral to another practitioner or even emergency care. In such cases it is prudent for the practitioner to refer the member for appropriate co-management (e.g., to their primary care physician) or if immediate emergency care is warranted, to contact 911 as appropriate. See the *Managing Medical Emergencies in a Health Care Facility (CPG 159 – S)* clinical practice guideline for information.

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