Autism Spectrum Disorder (ASD)

Indexing Metadata/Description

› **Title/condition:** Autism Spectrum Disorder (ASD)
› **Synonyms:** Autism; autism, infantile; infantile autism; Kanner syndrome; autistic disorder
› **Anatomical location/body part affected:** Autism spectrum disorder (ASD) affects the entire individual
› **Area(s) of specialty:** Pediatric rehabilitation, neurological rehabilitation, home health
› **Description**
  • ASD encompasses a continuum of neurodevelopmental disorders that are characterized by impairment in social skills and communication, along with stereotyped repetitive behavior\(^{98,99}\)
  • ASD is the term that is now being used for the diagnoses that in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)* and ICD-10 were included under the term pervasive development disorder (PDD). According to the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)*, which came out in May 2013, ASD encompasses the following diagnoses that were previously classified as PDD:\(^{65}\)
    – Autism
    – Asperger syndrome (or Asperger’s disorder)
    – Pervasive developmental disorder-not otherwise specified (PDD-NOS)
    – Childhood disintegrative disorder
  • The elimination of autism, Asperger syndrome, PDD-NOS, and childhood disintegrative disorder as separate entities is due to the inconsistent distinction between them\(^{65}\)
  • In an Australian study of 210 individuals who met *DSM-IV* criteria for autistic disorder, only 57.1% met *DSM-5* criteria for ASD diagnosis. High-functioning individuals were less likely to meet the *DSM-5* criteria for ASD, with the most common reason for exclusion being a failure to satisfy all 3 criteria in the social-communication domain\(^{89}\)
› **ICD-9 codes**
  • 299.00 infantile autism, current or active state
  • 299.01 infantile autism, residual state
› **ICD-10 codes**
  • F84.0 childhood autism
  • F84.1 atypical autism
  • F84.3 other childhood disintegrative disorder
  • F84.4 overactive disorder associated with mental retardation and stereotyped movements
  • F84.5 Asperger’s syndrome
  • F84.8 other pervasive developmental disorders
  • F84.9 pervasive developmental disorder, unspecified
› **G-Codes**
  • **Mobility G-code set**
    – G8978, Mobility: walking & moving around functional limitation, current status, at therapy episode outset and at reporting intervals
- G8979, Mobility: walking & moving around functional limitation; projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
- G8980, Mobility: walking & moving around functional limitation, discharge status, at discharge from therapy or to end reporting

**Changing & Maintaining Body Position G-code set**
- G8981, Changing & maintaining body position functional limitation, current status, at therapy episode outset and at reporting intervals
- G8982, Changing & maintaining body position functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
- G8983, Changing & maintaining body position functional limitation, discharge status, at discharge from therapy or to end reporting

**Carrying, Moving & Handling Objects G-code set**
- G8984, Carrying, moving & handling objects functional limitation, current status, at therapy episode outset and at reporting intervals
- G8985, Carrying, moving & handling objects functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
- G8986, Carrying, moving & handling objects functional limitation, discharge status, at discharge from therapy or to end reporting

**Self Care G-code set**
- G8987, Self care functional limitation, current status, at therapy episode outset and at reporting intervals
- G8988, Self care functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
- G8989, Self care functional limitation, discharge status, at discharge from therapy or to end reporting

**Other PT/OT Primary G-code set**
- G8990, Other physical or occupational primary functional limitation, current status, at therapy episode outset and at reporting intervals
- G8991, Other physical or occupational primary functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
- G8992, Other physical or occupational primary functional limitation, discharge status, at discharge from therapy or to end reporting

**Other PT/OT Subsequent G-code set**
- G8993, Other physical or occupational subsequent functional limitation, current status, at therapy episode outset and at reporting intervals
- G8994, Other physical or occupational subsequent functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
- G8995, Other physical or occupational subsequent functional limitation, discharge status, at discharge from therapy or to end reporting

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<thead>
<tr>
<th>G-code Modifier</th>
<th>Impairment Limitation Restriction</th>
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<tr>
<td>CH</td>
<td>0 percent impaired, limited or restricted</td>
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<tr>
<td>CI</td>
<td>At least 1 percent but less than 20 percent impaired, limited or restricted</td>
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<td>CJ</td>
<td>At least 20 percent but less than 40 percent impaired, limited or restricted</td>
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<td>CK</td>
<td>At least 40 percent but less than 60 percent impaired, limited or restricted</td>
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<td>CL</td>
<td>At least 60 percent but less than 80 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CM</td>
<td>At least 80 percent but less than 100 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CN</td>
<td>100 percent impaired, limited or restricted</td>
</tr>
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Reimbursement

- Reimbursement for physical therapy for ASD has been a subject in recent lawsuits and settlements with insurance companies. For example, according to a 2012 settlement, an insurer was required to provide medically necessary physical, occupational, and speech therapy to members denied treatment since January 2009, and to reimburse those who paid for the services themselves. The insurer had claimed it provides coverage for physical, occupational, and speech therapy to address health needs, but not for educational and social purposes. Some of the cases involved therapies for patients with ASD.
- Laws in many states in the United States now require insurance companies to pay for some ASD assessment and treatment, while other states have proposed legislation that is pending. There has been significant resistance to these policy changes from some healthcare companies and advocate groups, citing a lack of high-quality studies addressing behavioral treatments.
- Ten states in the U.S. provide Medicaid Home and Community-Based Services waiver programs for children who are diagnosed with ASD and Medicaid eligible. This federally supported program allows states to provide community-based services to assist individuals with developmental disabilities to live in their community. Each state determines the amount of financial support and type of benefits.
  - Massachusetts is the first state to require participant direction for families of young children with ASD seeking Medicaid Home and Community-Based Services (HCBS) waiver services. Under the Children’s Autism Waiver Program, selected low-income families receive intensive, in-home autism interventions and supports used to supplement special education services available from the school system. Families are provided substantial financial support to select the providers and services.

Presentation/Signs and Symptoms

Presentation
- In the U.S., current estimates are that 1/88 children and 1/54 boys have ASD.
- The worldwide prevalence is about 1%.
  - Prevalence is reported to be increasing at an estimated rate of 10-17% annually.
- ASD is commonly diagnosed around age 4; however, parental unease regarding a child’s behavior generally begins around 12-18 months of age.

Early signs/symptoms
- Impaired social-communication (e.g., respond to name being called)
- Impaired play or adaptive skills (e.g., does not imitate others’ actions)
- Impaired language and cognition (e.g., little to no babbling)
- Regression (e.g., loss of functional skills)
- Impaired visual skills (e.g., impaired tracking)
- Impaired motor skills (e.g., delayed acquisition of walking)
- Impaired sensory integration (e.g., cry when donning clothing)
- Altered eating and sleep habits
- Impaired affective expression (e.g., social smiling, eye contact, nonsocial smiling)

General signs/symptoms
- The extent of symptoms can vary tremendously. There will be some level of impact on social abilities, and response to his or her environment
- Perseverating behaviors and inflexible routines are characteristic of ASD.
- Delay in acquisition of developmental motor milestones.

Specific signs/symptoms
- Social manifestations
  - Little to no eye contact
  - People are regarded in the same manner as objects
  - Lack of interest in shared activities
  - Lack of peer interaction
  - Instability of mood (e.g., out-of-placelaughter)
  - Appear as if they are “in their own world”
- Inability to read the expressions/faces of others or pick up on social cues\(^\text{(6,7)}\)
- Some children may hug, make eye contact, or even smile, but this interaction is only periodically observed\(^\text{(8)}\)
- Inability to empathize\(^\text{(9)}\)

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**Communication manifestations**
- Lack of “joint attention”; the tendency of a child to engage the attention of another person to share enjoyment of objects or events\(^\text{(8)}\)
- The child may point only to ask for something (e.g., a card depicting lunch selections), not to illustrate or explain something\(^\text{(6)}\)
- Inflexibility\(^\text{(98)}\)
- Appearance of being deaf\(^\text{(6)}\)
- Echolalia (repetition of a word or phrase spoken by another person)\(^\text{(6)}\)
- Limitations or delays in expressive and receptive language\(^\text{(6)}\)
- Inability to partake in pretend play\(^\text{(6)}\)
- Hyperlexia or premature decoding ability with little understanding of text\(^\text{(6)}\)
- Referring to self in the third person\(^\text{(6)}\)
- Reversing of pronouns\(^\text{(6)}\)
- Impaired comprehension of irony or sarcasm\(^\text{(5)}\)

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**Behavior/sensory manifestations**
- Sensory integration issues; may have a decreased perception of pain and an increased sensitivity to light touch, for example\(^\text{(5)}\)
- Perseverates\(^\text{(6)}\)
- Lining up of objects\(^\text{(9)}\)
- Preoccupation with components of items\(^\text{(8)}\)
- Enjoyment in watching objects spin\(^\text{(6)}\)
- Intense reactions to change
- Flapping of hands\(^\text{(10)}\)
- Biting\(^\text{(9)}\)
- Head-banging\(^\text{(9)}\)
- Insomnia\(^\text{(11)}\)
- Intense tantrums

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**Motor manifestations**
- Decreased coordination\(^\text{(4,10,12)}\)
- Gait deviations\(^\text{(4,10)}\)
  - Walking on toes\(^\text{(6)}\)
- Atypical posturing\(^\text{(10)}\)
- May present with mild hypotonia\(^\text{(5)}\)
- Delays or deficits in development of motor or physical activity behaviors\(^\text{(66)}\)

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**Causes, Pathogenesis, & Risk Factors**

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**Causes**

- Largely unknown\(^\text{(13)}\)
- Generally accepted that there is an atypical pattern of brain maturation in children with ASD\(^\text{(10)}\)
- Genetics may play a role in the etiology of ASD, although this has yet to be formally established
  - In the case of identical twins, if one twin has ASD, the risk of the other twin being affected by ASD is 36-95\%.\(^\text{(2)}\)
  - In nonidentical twins, the risk is 0-31\%\(^\text{(2)}\)
– For parents who have one child with ASD, the risk in subsequent children is 2-18%\(^{(2)}\).
– Genetic irregularities have been found in all chromosomes except 14 and 20 and in mitochondrial genes in individuals with ASD\(^{(2)}\).

- Gestational factors that could affect neurodevelopment, such as complications during pregnancy and exposure to chemicals\(^{(100)}\).
- Immunological incompatibility (i.e., maternal antibodies directed at fetus) may contribute\(^{(101)}\).

### Pathogenesis

• Largely unknown, although most current theories focus on the disruption of normal cerebral development.
  – It seems likely that ASD’s neurodevelopmental defect is not a single anomaly, and its study therefore occurs in several domains (e.g., genetic, immunopathogenic, neurofunctional).

• Physiological findings
  – Studies have found that the head circumference of children with autism generally has an atypically rapid rate of increase between 6 and 14 months\(^{(8)}\).
  – Toddlers with autism appear to have a larger brain volume with noted enlargement of the cerebellum, amygdala, and cerebrum compared to toddlers without autism\(^{(8)}\).
  – Clinical signs of ASD correlate with abnormal brain development. Research shows there is overgrowth and neural dysfunction at young ages involving an abnormal excess of the number of neurons in the prefrontal cortex. This abnormal neurobiological development has been reported to begin at 8 to 9 months of age\(^{(98)}\).
  – There is increasing evidence of alterations in both grey matter and white matter structure\(^{(99)}\).

### Risk factors

• Males are 3-4 times more likely than females to have ASD\(^{(1)}\).
• Having a sibling with ASD\(^{(3)}\).
  – There is a 5% risk of siblings developing ASD; however, if fragile X syndrome is present, the sibling risk increases to 50%\(^{(98)}\).
  – There is a 70% to 95% concordance rate for ASD in monozygotic twins and a 5% concordance rate in dizygotic twins\(^{(98)}\).
• Certain prenatal complications, including maternal rubella and phenylketonuria (PKU)\(^{(13)}\).
• Prenatal valproate\(^{(67)}\).
• Advanced parental age\(^{(14)}\).
• Genetic factors\(^{(68)}\).
  – The heritability index is reported to be 0.82 to 0.90\(^{(98)}\).
• Certain genetic and chromosomal abnormalities\(^{(2)}\).
  – De novo mutations account for 10% to 20% of ASD cases\(^{(98)}\).
  – Chromosomal abnormalities in 6 major genes have been identified, with as many as 20-30 additional genes, especially the glutamate-related genes playing contributing roles\(^{(98)}\).
  – About 10% of children with ASD are also identified as having Down syndrome, fragile X syndrome, tuberous sclerosis, or other genetic or chromosomal disorders\(^{(2)}\).
• Maternal diabetes\(^{(88)}\).
  – There is a significant association between maternal diabetes and increased risk of ASD in the offspring based on a 2014 systematic review and meta-analysis of the literature\(^{(88)}\).

### Factors not associated with an increased risk of ASD

• No correlation between increased prevalence of ASD and use of measles, mumps, and rubella (MMR) vaccine
  – No association between ASD and MMR vaccine; based on systematic review of 12 articles\(^{(15)}\).
  – No association between ASD and MMR vaccination in retrospective study of 537,303 children\(^{(16)}\).
  – No association between MMR vaccine and PDDs in case-control study involving 1,294 cases and 4,469 controls; 78% vs. 82% had MMR vaccination before diagnosis (or matched age)\(^{(12)}\).
  – No association between MMR vaccine and ASD in community-based case-control study involving 98 cases and 142 controls\(^{(18)}\).
• No association between thimerosal-containing vaccines and ASD
  – No association between ASD and thimerosal-containing vaccines in systematic review of 10 epidemiological studies; studies suggesting association were poor quality, and results could not be interpreted; 2 pharmacokinetic studies found that ethyl mercury has a short half-life, making association improbable\(^{(19)}\)
  – No association between ASD and thimerosal-containing vaccines in cohort of 467,450 children\(^{(20)}\)
  – No consistent association between thimerosal-containing vaccines and any adverse neurodevelopmental outcome in retrospective study of 140,887 children in 3 HMOs\(^{(21)}\)
  – No association between thimerosal-containing vaccines in infants and developmental disorders in prospective United Kingdom cohort of > 14,000 children\(^{(22)}\)
  – No association between thimerosal-containing vaccines in infants and developmental disorders in retrospective U.S. cohort of 109,863 children\(^{(23)}\)
  – Early thimerosal exposure NOT associated with neuropsychological deficits at ages 7-10 years\(^{(24)}\)

• However, a 2011 study reported a positive association between ASD prevalence and childhood vaccination uptake across the U.S., suggesting that further study into the relationship between vaccines and ASD is warranted\(^{(69)}\)

• Infection in the first 2 years of life not found to be associated with ASD\(^{(25)}\)

• No association found between ASD and defined gastrointestinal disorders (celiac disease, necrotizing enterocolitis, chronic diarrhea, malabsorption, food intolerance, recurrent gastrointestinal symptoms)\(^{(26)}\)

• No association found between ASD and neonatal hyperbilirubinemia\(^{(27)}\)

**Overall Contraindications/Precautions**

› Training
  • New clinicians may require training/instruction on the emotional needs of the parents
  • Clinicians should include the family/caregivers in the treatment sessions, explain and demonstrate therapeutic strategies, and provide oral and written instruction as indicated

› No contraindications specific to ASD are listed in the literature reviewed

› Precautions should be taken when treating patients with ASD due to potential for:
  • Wandering behavior
  • Self-injurious behavior
  • Poor safety awareness
  • Poor impulse control
  • Rigid adherence to routines
  • Communication deficits

› If child has a coexisting seizure disorder; seizure precautions apply
  • General guidelines\(^{(28)}\)
    – Eliminate dangerous objects from area
    – Stay with the patient
    – Do not hold down extremities
    – Release restrictive clothing
    – Follow aspiration precautions (i.e., rotate head to side, assess airway, wait for tonic-clonic activity to pass before administering artificial respiration if indicated)

**Examination**

› History
  • History of present illness/injury
    – Etiology of illness/general inquiry
      - What is the current goal of evaluation/treatment?
      - Has the child been officially diagnosed with ASD?
      - At what age was the child diagnosed?
      - How severe is the child’s ASD condition?
      - Who comprises the child’s medical team?
- What signs and/or symptoms does the child present with?

- **Course of treatment**
  - **Medications for current illness/injury**
    - Determine what medications clinician has prescribed; are they being taken as prescribed?
    - There is no standard medication for treatment of ASD
      - Medicines that are sometimes used to treat behaviors related to ASD include selective serotonin reuptake inhibitors (SSRIs) and antipsychotic medicines
      - A 2013 Cochrane review of the literature on the use of SSRIs for patients with ASD found no evidence of an effect of SSRIs in children with emerging evidence of harm. There is limited evidence of the effectiveness of SSRIs in adults with ASD from small studies in which risk of bias is unclear
      - A 2012 systematic review of the literature on medication treatments for patients with autism aged 13-30 years found insufficient strength of evidence for all outcomes associated with medications tested in this population
        - Eight medication studies were identified; only 4 were determined to be of fair quality
        - Main outcomes were the effects on core symptoms of autism and comorbid symptoms and conditions, including sleep disorders, anxiety, hyperactivity, and challenging behavior (e.g., irritability, agitation)
  - **Diagnostic tests completed**
    - Currently there are no definitive tests to confirm the diagnosis of ASD
    - According to the *DSM-5*, to be diagnosed with ASD a patient must present with the following characteristics:
      - Persistent deficits in social communication and social interaction across multiple contexts as manifested by the following:
        - Deficits in social-emotional reciprocity
        - Deficits in communicative behaviors used for social interaction
        - Deficits in developing maintaining and understanding relationships
      - Restricted repetitive patterns of behavior, interests, or activities as manifest by at least two of the following, currently or historically:
        - Stereotyped or repetitive motor movements, use of objects, or speech
        - Insistence on sameness, inflexible adherence to routines, or ritualized patterns
        - Highly restricted fixated interests
        - Hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of environment
      - Symptoms originating in early childhood but may not be fully manifest until social demands exceed capacity (e.g., during middle-school years, later adolescence, or young adulthood). This is a change to the *DSM-IV* criteria for autism that symptoms must be present by the age of 3 years
      - Diagnostic instruments have limitations. An individual’s diagnosis of ASD should never depend on the diagnostic classification of a single measure
    - Typically a developmental pediatrician, pediatric psychiatrist, or psychologist would confirm a diagnosis of ASD. During this process the child may undergo a multidisciplinary evaluation that includes assessment by rehabilitation professionals and a social worker
  - **Home remedies/alternative therapies:** Document any use of home remedies or alternative therapies (e.g., diet modification) and whether or not they help
    - 83% of children with ASD received a range of dietary manipulations including the use of special diets such as a gluten-free, casein-free diet and dietary supplements (micronutrients, vitamins, minerals, and fish oils) based on a survey of 258 parents and 244 healthcare professionals in the United Kingdom. However, researchers concluded there is inadequate evidence to support dietary interventions
    - For many alternative/complementary treatments, evidence does not support their use. Some treatments have greater potential risk either directly (e.g., side effects of compounds) or indirectly (e.g., by diverting financial or psychosocial resources)
  - **Previous therapy:** Document whether patient has had occupational or physical therapy for this or other conditions and what specific treatments were helpful or not helpful
  - **Aggravating/easing factors:** Document strategies that are calming to the child and situations that may induce unwanted behaviors. Document the use of a “sensory diet” (a personalized activity plan designed to provide sensory input throughout the day) prescribed by a healthcare professional
  - **Nature of symptoms:** Document nature of symptoms. See Presentation/signs & symptoms
Pattern of symptoms: Document changes in symptoms throughout the day and night, if any (AM, mid-day, PM, night); also document changes in symptoms due to other external variables.

Sleep disturbance: Document number of wakings/night and any difficulty falling asleep; sleep disturbances are common in children with ASD

- Insomnia is estimated to occur in 44-83% of school-aged children with ASD
- Are any pharmacological or behavioral interventions used to improve insomnia?

Other symptoms: Document other symptoms patient may be experiencing that could be indicative of a need to refer to physician
- Based on a 2014 systematic review, parents of children with ASD report their children having feeding difficulties, with the most common issues being restricted diet variety, food neophobia, food refusal, limiting diet based on texture, and a propensity towards being overweight.

Barriers to learning
- Are there any barriers to learning? Yes__ No__
- If Yes, describe ________________________ (See assessment below)

Medical history
- Past medical history
  - General inquiry
    - What were the initial symptoms/signs of ASD?
    - What formalized testing has the patient undergone, if any?
    - What surgical procedures has the patient undergone, if any?
    - Any recent hospital admissions?
    - Any complications during pregnancy or delivery?
  - Comorbid diagnoses: Ask parent about other problems, including diabetes, cancer, heart disease, psychiatric disorders, orthopedic disorders, etc.
    - It is estimated that 25% of those with ASD have a comorbid seizure disorder and 75% are also diagnosed with developmental delay.
    - Patients with ASD are at risk for developing comorbid psychiatric disorders, especially attention deficit hyperactivity disorder (ADHD), anxiety, bipolar disease, and depression. It is reported that 20-29% of patients are diagnosed with one of these psychiatric disorders.
  - Medications previously prescribed: Obtain a comprehensive list of medications prescribed and/or being taken (including over-the-counter drugs)
  - Other symptoms: Ask parent about other symptoms child may be experiencing

Social/occupational history
- Patient’s/caregiver’s goals: Document what the patient/caregiver/parents hope to accomplish with therapy and in general
- General inquiry
  - Age at which developmental milestones were reached and/or lost
  - Does the family feel that the support they have in place meets their needs?
- Vocation/avocation and associated repetitive behaviors, if any
  - Is the child involved in any recreational or leisure activities?
  - How much daily physical activity does the child habitually perform?
  - Ritualistic and compulsive behaviors are common (103Sadock)
    - The activities and play of children with ASD may be more rigid, repetitive, and monotonous than those of other children.
  - Note any repetitive self-stimulatory or self-injurious behavior.
- Functional limitations/assistance with ADLs/adaptive equipment
  - What ADLs can the child perform?
  - Any adaptive or assistive devices used at home?
- Living environment: Inquire about stairs, number of floors in home, with whom patient lives (siblings/caregivers/group home), etc. Identify if there are barriers to independence in the home; any modifications necessary? How is the child able to negotiate the school environment? Are community resources available and accessible?
Relevant tests and measures: (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting.) Evaluation of the patient with ASD will vary depending on age, severity of symptoms, and the setting in which the patient is currently being evaluated. Standardized assessments paired with clinical observations tend to be the most common methods of evaluation. The clinician should modify the examination as indicated and appropriate; the information listed below is meant to serve only as a guide

• Anthropometric characteristics
  – Measure height and weight and calculate body mass index (BMI)
    - High rates of overweight (BMI > 25) and obesity (BMI > 30) have been reported in children with ASD. In a sample of 376 children with ASD in the United States, 35.1% were overweight or obese\(^{(103)}\)
    - Deficiencies in motor proficiency, leading to inactive behavior, have been implicated\(^{(73)}\)
    - Other factors contributing to unhealthy weight in children with ASD include:\(^{(103)}\)
      - Core symptoms of ASD may impact motivation to participate in structured physical activities with other children
      - Families and therapists may be more likely to use food as a reward in children with ASD due to lack of social motivation
      - Restrictive/repetitive behavior patterns often include selective eating. Children with ASD have been shown to have higher intakes of low-nutrition, energy-dense food
      - ASD comorbidities such as poor sleep quality and mood disorders may be a cause and a consequence of unhealthy weight

• Arousal, attention, cognition (including memory, problem solving)
  – Assess child’s ability to communicate and level of arousal
  – Document length of time child is able to attend to directions and activities, and what strategies may work to assist with redirection to task as appropriate
  – Did strategies such as concise, clear directions, visual schedules, or movement breaks allow for an increase in attention or participation?
  – Document frustration tolerance and presence of impulsivity
  – Is the child able to follow single-step and multistep directions?
  – Document presence and level of eye contact
  – Document if the child becomes overstimulated with movement tasks
  – Document the child’s ability to transition between activities and response to redirection
  – Obtain results of neuropsychological testing completed by other disciplines where available

• Balance: Evaluate balance reactions. Pediatric Balance Scale (PBS) can be used

• Cardiorespiratory function and endurance
  – Monitor breathing to assist with determining fatigue and endurance levels
  – Observe overall endurance through general activities
  – The 6-minute walk for distance test (6MWT) is an appropriate test of endurance for adults with ASD
    - Further research is needed to explore the ability of the 6MWT to measure significant and clinically important changes in chronic pediatric conditions.\(^{(74)}\) Modified test procedures in the pediatric population may be required\(^{(74)}\)

• Functional mobility (including transfers, etc.)
  – Observe child during coordination tasks such as jumping jacks, cross marching, skipping, galloping, standing/hopping on one foot, ability to participate in catching/throwing/kicking a ball, and whether all of these skills are similar to those of peers
  – Document child’s motor planning ability for novel tasks and whether visual demonstrations were required for participation in tasks

• Gait/locomotion: Assess the child’s gait; note any deviations\(^{(21)}\)
  – Gait impairment may be evident with tandem gait, heel, or toe walking
  – Assess coordination with locomotor skills such as running and jumping as able

• Joint integrity and mobility: Document presence of joint laxity or hypermobility

• Motor function (motor control/tone/learning): Assess both fine and gross motor ability. Many standardized neuromotor developmental tests (described below) include standardized tests of gross and fine motor skills
  – Studies indicate that there is a significant difference in the gross motor skills of children with autism and children without autism\(^{(73)}\)
Very young children with ASD have been found to have significant motor delays that become more pronounced with age\(^{(75)}\).

- Motor impairment could be related to corresponding intellectual disabilities; however, the widening of the gap seen suggests that low cognitive abilities are not solely responsible\(^{(75)}\).

- Improvements occur in some motor abilities with age (e.g., imitation capabilities) while other motor abilities do not improve (e.g., diadochokinesis)\(^{(104)}\).

- It is suggested that developmental improvements in imitation abilities are not accounted for by developmental improvements in motor abilities, but may be cognitive in nature and reflect maturational delay\(^{(104)}\).

- Complexity of information processing appears to affect motor performance in patients with ASD when cognitive demand is higher than in pure motor tasks\(^{(104)}\).

- Assess child’s muscle tone. Modified Ashworth Scale may be used. Mild hypotonia may be present.

- During gross motor and fine motor tasks, note presence of the ability to appropriately cross the midline.

- Document any dysmetria and variability of movements.

- Mistimed muscular forces can hamper movement execution\(^{(80)}\).

**Muscle strength**

- Manual muscle testing may be appropriate to test upper and lower extremity strength if the child is able to understand the directions and has no abnormal muscle tone or coordination issues.

- Ask child to get into positions such as prone extension and supine flexion to determine trunk strength.

- May also use functional based tasks to assess strength such as the ability to wheelbarrow walk, hang from a trapeze bar, complete wall push-ups/full push-ups, or propel a scooter board in prone if manual muscle testing cannot be completed effectively.

- Document presence of scapular winging or instability during upper body strengthening activities.

**Neuromotor development**

- Battelle Developmental Inventory – 2nd edition (BDI-2)\(^{(32)}\)

  - Comprehensive assessment tool that assess children up to 8 years of age in 5 areas (i.e., social, motor, adaptive, communication, and cognitive).

  - Sensitivity and specificity has been established.

- Bayley Scales of Infant Motor Development-III (BSID-III)

  - Norm-referenced, standardized developmental assessment tool.

  - Evaluates pediatric development.

  - May be used 16 days of age up to 42 months of age.

  - Direct observation of cognition, language, and motor skills. Caregiver questionnaire component available to supplement adaptive and social-emotional skills.

- Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2)

  - May be used from ages 4-21 years.

  - Evaluates various components of functional development.

- Early Intervention Developmental Profile (EDP)

  - May be used from birth to age 3 years.

  - Evaluates development and identifies areas of delay.

- Mullen Scales of Early Learning (MSEL)

  - May be used from birth to age 68 months.

  - As assessment battery of 124 items broken into several domains, including gross motor function, fine motor skills, visual reception, and receptive language.

- Peabody Developmental Motor Scales, Second Edition (PDMS-2)

  - May be used from birth to age 5 years.

  - Comprised of substantial gross and fine motor scales.

- Pediatric Evaluation of Disability Inventory (PEDI)

  - May be used from age 6 months to 7 1/2 years.

  - Comprised of functional skill, mobility, and social function scales.

- Test of Gross Motor Development-2 (TGMD-2)

  - A norm-referenced measure of common gross motor skills.
May be used to identify children between the ages of 3 and 10 who are significantly behind their peers in gross motor skill development.

The test looks at 12 gross motor skills divided into two subtests:
- Locomotor (run, hop, gallop, leap, horizontal jump, and slide)
- Object Control (striking a stationary ball, stationary dribble, catch, kick, overhand throw, and underhand roll)

Sensory Integration and Praxis Test
- May be used from ages 4-9 years
- Evaluates motor skills, sensory integration, and postural control

**Perception (e.g., visual field, spatial relations)**
- Ocular motor screening for tracking, convergence, saccades, binocularity, eye preference, disassociation of head/eye movements, eye contact
- Document whether the child complains of ocular motor fatigue, and observe for signs of fatigue, such as rubbing eyes, covering eyes, or turning body to compensate for reduced ocular motor skills
- If standardized testing cannot be completed, document the child’s ability to complete puzzles appropriate to his or her age

**Posture:** Document static and dynamic posture in a variety of positions, such as sitting, standing, or during tabletop activities

**Range of motion:** Assess AROM and PROM through functional tasks or formal testing, per child’s level of cooperation

**Self-care/activities of daily living (objective testing)**
- The Canadian Occupational Performance Measure (COPM) can be used
- Child interview as able
- Family/caregiver interview to identify level of performance with tasks that cannot always be observed during an outpatient/school evaluation (e.g., bathing, dressing)
- Document if the child participates in household chores such as cleaning up toys, setting up the table, emptying the dishwasher, laundry, or yard work

**Sensory testing**
- Through interview with the parent and child, as well as clinical observations, evaluate for the presence of sensory processing disorder (SPD) if there are hypo- or hypersensitivities with relation to the tactile system, auditory system, vestibular system, visual system, or oral sensory system that impact the child’s daily function
- The Winnie Dunn Sensory Profile, Winnie Dunn Sensory School Companion, Winnie Dunn Adolescent/Adult Sensory Profile, or Winnie Dunn Short Sensory Profile may assist with determining whether impaired sensory processing is affecting a child’s daily life function utilizing caregiver report in a standardized format
- Perform a gross screen of proprioception and kinesthesia in upper and lower extremities

**Special tests specific to diagnosis**
- Many tools developed for assessing patients with ASD are limited in that they focus on establishing categorical diagnostic status rather than on assessing change over time or treatment response
- Economic, clinician-based, reliable measures of symptomatic and functional change in ASD are scarce
- The Developmental Disabilities Children’s Global Assessment Scale (DD-CGAS) and the OSU Autism Clinical Global Impression (OSU Autism CGI) are 2 scales of psychosocial functioning and clinical severity that have been found to have acceptable interrater reliability even among untrained less experienced clinicians
- Autism Observational Scale for Infants (AOSI)
- Measures multiple areas pertinent to autism and detects atypical findings in the young child
- The evaluated behaviors are scaled from 0 to 3; 0 indicates typical functioning
- Test-retest reliability at 1 year of age is good
- Childhood Autism Rating Scale-Second Edition (CARS 2)
- Assists in quantifying severity of autistic symptoms in conjunction with screening for autism itself
- For children over age 2 years
- ~5 to 10 minutes to administer
- 15 items on scale to evaluate; 2 scales
- Autism Diagnostic Observation Schedule (ADOS)
- Created as a tool to screen for autism
- May be used from toddler years into adulthood
- Takes ~30-45 minutes to administer
- Checklist for Autism in Toddlers (CHAT)\(^{(36)}\)
  - Designed for use at 18-month check-up
  - Screening tool used to detect signs of autism
- Modified Checklist for Autism in Toddlers (M-CHAT)\(^{(34)}\)
  - Encompasses wider scope of developmental domains than the CHAT
  - Caregiver fills out questionnaire; no observational portion
  - Administered at 16 to 30 months
  - Pass or fail. Failing the M-CHAT indicates need for referral for additional testing (e.g., psychologist or developmental pediatrician). M-CHAT is not a diagnostic tool
  - The M-CHAT is reported to have good psychometric properties and can be used for screening purposes in primary settings; however, results of a study conducted in Mexico indicate that there are cultural differences in item responses that make it difficult to compare M-CHAT results internationally\(^{(76)}\)
  - The M-CHAT is reported in Turkey to be a useful tool for screening for ASD in primary care settings based on a 75% positive predictive value. However, the M-CHAT is completed more accurately when healthcare professionals ask the parents the questions instead of the caregivers completing the questionnaire\(^{(91)}\)
- Screening Tool for Autism in Two-Year-Olds (STAT)\(^{(37)}\)
  - Designed to detect indicators of autism
  - Administered at 2-3 years of age
  - 12 items; takes ~20 minutes
- Social Responsiveness Scale (SRS)\(^{(35)}\)
  - Assists in differentiating autism from alternative psychiatric conditions
  - Appropriate from ages 4-18 years
  - Time: ~15 to 20 minutes
  - Quantifies degree of social impairments
  - In a 2014 study, German researchers concluded that ASD, social phobia (SP), and selective mutism (SM) have overlapping scores on the SRS\(^{(92)}\)
    - Subjects included children between the ages of 6 and 18 years: 60 diagnosed with ASD, 38 diagnosed with SP, and 43 diagnosed with SM
    - The greatest overestimation of a diagnosis of ASD was boys with a true diagnosis of SM
    - SRS results need to be interpreted with caution and not used as the sole diagnostic tool
- Baby and Infant Screen for Children with Autism Traits (BISCUIT)\(^{(38)}\)
  - A screening tool that assesses social and communication skills and repetitive behaviors
  - Divergent and convergent validity has been established
  - Assists in the diagnosis of autism and labeling severity
  - Ages 17-37 months
- Children’s Assessment of Participation and Enjoyment/Preference for Activities of Children (CAPE/PAC)
  - A self-rated measure of recreational participation
  - Allows the person administering the test to provide adaptations to the instructions and parents to be proxy reporters for factual questions included
  - In a study conducted in Canada, children with high-functioning autism were able to reliably self-report on their recreational activity using this tool\(^{(77)}\)
    - In terms of content validity, the activities included in the CAPE/PAC appeared to cover the range of recreational activities in which children with high-functioning autism participate
    - Findings supported the use of the CAPE/PAC as a tool to gather recreational participation information from children with high-functioning autism
  - A study conducted in the U.S. found that physical activity measured objectively using accelerometers differed from parent report\(^{(78)}\)
    - According to parental report, children with ASD engaged in fewer physical activities and for less time than did typically developing children. This was not corroborated by accelerometer data
    - This suggests that some of the activity in children with ASD is not captured by standard questionnaire-based measures
Assessment/Plan of Care

› Diagnosis/need for treatment
  • General expert consensus supports that early intervention (birth to age 3 years) can make a dramatic impact on outcomes in a child with ASD.\(^2\) The child may present with fine and gross motor skill delays along with the obvious global communication delays
  • The multiple developmental and behavioral impairments associated with ASD require an interdisciplinary team of healthcare professionals who directly communicate with each other in the coordination of care and services provided to the patient and his or her caregivers
  • Older children and adults with ASD can also benefit from exercise programs, which may be prescribed and/or supervised by a physical therapist

› Rule out
  • Schizophrenia with childhood onset\(^13\)
  • Other early-onset psychoses\(^8\)
  • Congenital deafness\(^13\)
  • Selective mutism\(^8\)
  • Social anxiety\(^8\)
  • Obsessive-compulsive disorder (OCD)\(^8\)
  • Stereotypic movement disorder\(^8\)
  • Mental retardation with behavioral symptoms\(^13\)
  • Developmental language disorder\(^13\)
  • Psychosocial deprivation\(^13\)
  • Disintegrative psychoses\(^13\)
  • Profound lack of stimulation\(^13\)
  • Rett syndrome\(^13\)
  • Fragile X syndrome\(^13\)

› Prognosis
  • ASD is a chronic, lifelong disorder;\(^2\) however, a subset of patients do make improvements significant enough that they no longer meet diagnostic criteria for ASD\(^106\)
    – Even in this optimal outcome group subtle language impairments may persist\(^106\)
  • Based on a United Kingdom prospective study of 85 children diagnosed with ASD at age 2 years and then reassessed 17 years later, 9% of participants had largely overcome core difficulties associated with ASD and no longer retained a diagnosis of ASD\(^84\)
    – Researchers accurately predicted 85% of these subjects intellectual disabilities at age 19 years when assessed at 2 years of age based on verbal and nonverbal IQ scores
  • Using the U.S. National Longitudinal Transition Study-2 data collected on 1,100 high school students who received special education services in the autism category, 81% of these students with ASD enrolled in a 2-year community college at some point in the postsecondary careers\(^83\)
    – Students in the science, technology, engineering, and mathematics (STEM) fields were more likely to persist in a 2-year community college and were twice as likely to transfer from a 2-year community college to a 4-year university than their peers in the non-STEM fields
  • ~ 1/10 children affected will later develop Parkinson’s disease or catatonic traits\(^10\)
  • With early diagnosis and proper treatment intervention and support, children without language and intellectual impairments have a fair to very good prognosis despite persistent ongoing symptoms. The development of oral communication skills and the cognitive and behavioral capacity for inclusion in a typical education setting with typically developing peers is associated with the best outcomes\(^98\)
• Individuals who lack joint attention by the age of 4 years, lack functional speech by the age of 5 years, or present with intellectual disability, seizures, comorbid medical or psychiatric syndromes, and a pervasive lack of social awareness have a poorer prognosis.\(^{(98)}\)

• According to a large survey, a substantial number of children who had received a diagnosis of an ASD at one time were reported to no longer have the disorder.\(^{(39)}\)
  – Based on a cohort study conducted in U.S. in 2007
  – 78,037 children aged 3-17 years were included; results were obtained through (parental) telephone survey
  – 453 (32%) of 1,412 children who had at one point received a diagnosis of an ASD no longer had the condition at the time of the survey

• Early motor delays may be predictive of future communication delays in children at risk for ASD.\(^{(79)}\)

• In a U.S. retrospective study of 535 children with ASD, 70% of children attained phrase speech and 47% attained fluent speech at ≥ 4 years of age. Higher nonverbal IQ and less social impairment were both independently associated with the acquisition of phrase and fluent speech as well as an earlier age at speech acquisition.\(^{(82)}\)

• People with autism are reported to have a mortality risk 2.8 times higher than people without autism of the same age and sex.\(^{(100)}\)
  – Thought to reflect co-occurring medical conditions

• Little is known about aging with autism.\(^{(100)}\)

› Referral to other disciplines

• Speech therapist
• Occupational therapist
• Physical therapist
• Developmental pediatrician
• Audiologist\(^{(2)}\)
• Ophthalmologist\(^{(5)}\)
• Resource specialist within the school system
• Dentist
  – Parents should attempt to locate a dentist with experience evaluating and treating children with special needs, in particular, children with ASD. Most children are treated under general anesthesia or unnecessary sedation; however, dentists and dental hygienists can be educated on how to complete a 10-part oral assessment in children and adults with ASD in order to safely and effectively accommodate these patients.\(^{(96)}\)

• Social workers
• Child psychiatrist
• Clinical neuropsychologist
  – A U.S. study involving 5 families of children with autism assessed how the family members orchestrated their day-to-day life and the emotional impact of raising a child with a severe disability. The authors reported family members may rely on inflexible routines to manage their days and have trouble coming across daily activities that are upbeat and have jovial value.\(^{(40)}\)

  – An association between parental emotional stress and unfulfilled social and psychological needs was reported in a study that interviewed 26 families of adults with ASDs.\(^{(41)}\)

  – Based on study conducted in Spain, for both mothers and fathers of children with ASD, the severity of the disorder and social support played significant roles in the family quality of life. The child’s behavior problems have a negative indirect effect on the family’s quality of life.\(^{(94)}\)

  – Parental stress, particularly on the mother as the primary, daily caregiver, is high. In a Canadian study of mothers of children with ASD, the discontinuity of services was a significant predictor of disrupted employment and/or leisure time for the mother. Occupational imbalance and professional sacrifice was related to mothers’ foregoing participation in personally meaningful occupations in order to focus time on navigating and participating in professional services for their child. Healthcare providers need to remember that family issues, in addition to direct services related to the child specifically, are just as important when promoting family-centered care.\(^{(95)}\)

• Vocational therapy for adults with ASD
Other considerations

• Behavior intervention
  – Applied behavioral interventions may not yield superior outcomes when compared to standard care alone for preschool children with ASDs; however, the authors concluded that more studies with larger sample sizes are warranted\(^{(42)}\)
    - Based on a systematic review of small randomized or quasi-randomized controlled trials
    - Meta-analysis was conducted of 4 of the trials evaluating the effect of applied behavioral interventions (ABI) on children aged 18 months to 6 years with an ASD
  – Comprehensive behavioral intervention may improve outcomes in children with ASDs\(^{(43)}\)
    - Based on a small U.S. randomized trial involving 48 children aged 18-30 months with autistic disorder or PDD-NOS
    - Participants were randomized to one of two interventions and were followed for 2 years
      - Early Start Denver Model (ESDM) intervention – 20 hours/week from clinicians; 5 hours/week from parents; additional community intervention as desired by parents
      - Standard community intervention
    - Results
      - 45/48 children were analyzed
      - ESDM was associated with significantly greater improvement in
        - cognition (measured via the Mullen Scales of Early Learning)
        - adaptive behavior (measured via the Vineland Adaptive Behavior Scales)
        - diagnostic status (shifting from autistic disorder to PDD-NOS)
  – A U.S. case study of twin boys with autism evaluated Applied Behavior Analysis (ABA) intervention against the Developmental Individual-Difference Relationship-Based model (DIR) and reported mixed outcomes\(^{(44)}\)
    - The interventions took place over 9 weeks, 2 hours/week
    - Behavioral outcomes exposed an increase in crying incidents and tantrums with the ABA intervention; none for the child in the DIR intervention
    - The child in ABA demonstrated gains in vocal communication, gestural communication, and social-affective signaling
    - The child in DIR demonstrated gains in symbolic behaviors and reciprocity
    - Both twins demonstrated declines in some areas of communication
  – Parents of a child with autism reported significant improvement in ADLs and communication post ABA intervention\(^{(45)}\)
    - An ABA program in Canada provides 36 hours of treatment/week
    - Parents pledge 5 hours/week of time for training as part of the program
    - Training occurs in the home for the most part, but can move to alternative sites within the community

• Alternative diets
  – A systematic review reports insufficient evidence regarding gluten- and casein-free diets\(^{(46)}\)
    - Based on a Cochrane review
    - Review included 2 randomized trials, which met inclusion criteria, evaluating gluten- and/or casein-free diets in 35 patients with an ASD
    - Meta-analysis was not feasible
    - Diet intervention was associated with the following:
      - Significant improvements in 3 outcomes: overall autistic traits, social isolation, and overall ability to communicate and interact
      - No significant differences were found in 3 outcomes when treatment and control were compared
      - Unable to evaluate 10 outcomes due to skewed data

• Touch/massage therapy
  – Qigong massage, delivered over 5 months, was reported to improve symptoms of ASD\(^{(30)}\)
    - Based on a quasi-randomized controlled trial conducted in the U.S.
    - Involved 46 children with ASD
    - Children were randomized (with some restrictions) to one of two groups
      - Intervention – qigong massage: 20 training and treatment sessions over 5 months; daily massage administered by caregiver; children also received standard care
      - Control – wait list; standard care
    - Results – teachers and parents of the children in the intervention group reported significant improvements in symptoms
- A noncomparative United Kingdom study evaluating the efficacy of touch therapy for children with autism and their parents reported subjective results, including the children having improved tolerance to touch, ADL simplification, parents sensing an increased “closeness” with their children, and children appearing more at ease with themselves.  

- 12 parents and 12 children were included in the study  
- 8 weeks of 1-hour sessions of instruction were provided  

- Music therapy may improve social and communication skills, and behavior in children with autism  

- Based on a systematic review of 20 studies  

- Environmental modifications  
- A noncomparative study conducted in the United Kingdom included 8 children with ASD and evaluated the impact of a new playground design on peer interactions reported significantly increased social initiations and frequency of group play with the new plan.  

  - The new playground had four main objectives  
  - Provide a suitable amount of physical tests (e.g., a climbing wall, which placed a certain level of physical demand on the children in order to foster true physical work)  
  - Provide backing for imaginary play (e.g., play items were straightforward and constant with the thought of affording routine; new playground utilized a train theme)  
  - Provide prearranged flow to playground (e.g., playground was based on a course; the slide rounded to the next pursuit)  
  - Provide observation sites (e.g., a lookout tower to watch and study other children without the pressure of peers too close)  

- Treatment summary  
- There is a significant need for more randomized controlled trials that evaluate the efficacy of various treatment interventions for individuals with ASD  
  - In a 2014 Australian study, ~50% of the 235 occupational therapists who treated patients with ASD indicated they lacked confidence at least some of the time in regards to assessment, intervention, and knowledge of ASD. Experience treating patients with ASD and continuing education were significant predictors of confidence.  

  - Successful treatment of children under 3 years of age involves parental participation, early intervention, increased intensity and duration of treatment, and individualized treatment.  

  - Based on a systematic review of 32 controlled studies  

- Service delivery models/early intervention  
- A home-based intervention program, in conjunction with a center-based program, may further improve cognitive and behavioral development over a center-based program alone.  

  - 59 children participated in the Australian study, 39 of whom had an ASD  
  - The children were randomized to treatment and control groups  
  - The treatment group had a special education teacher come to their home for a total of 40 visits over 1 year in addition to the center-based program  
  - Cognitive and behavioral measures were significantly increased in the treatment group  

  - There is insufficient evidence regarding parent-mediated early intervention for children aged 1-7 years with ASD to shift clinical practice at this time.  

  - Based on a 2002 Cochrane review  
  - Two studies met the inclusion criteria of the systematic review  
  - 1 small trial favored parent training in the areas of child language and maternal comprehension of autism  
  - 1 small trial suggested better child outcomes with intensive professional-delivered intervention over parent-mediated early intervention  

  - There was an inability to draw conclusions from this review, as the 2 studies included differed in many significant ways (e.g., theoretical approach, intensity, duration)  

  - Solid evidence is lacking in regard to various forms of early intervention in the treatment of ASD.  

  - A systematic review reported no meticulously controlled studies found; only one study utilized randomization of those evaluated and a control group  

  - Early intervention often focuses primarily on communication and behavioral concerns  

  - A lack of focus on motor skills and physical activity has been identified.
- Inclusion of gross motor programs into early intervention plans for children with ASD is highly recommended based on results of a study indicating that motor skills become progressively more delayed with age even when controlling for cognitive factors.

- Further research into physical activity programs are needed to assist in identifying the influence of motor performance and physical activities on the physical development of children with ASD.

- Therapeutic exercise
  - Aerobic exercise may improve correct academic responses, but not on-task time or stereotypic behaviors, in children with ASD.
    - Based on a U.S. research study of 9 children ages 3-6 years
    - All children participated in the treatment condition and control condition
    - During the treatment phase, the children participated in 15 minutes of aerobic exercise followed by a classroom task
    - During the control phase, the children participated in a classroom task only
  - Exercise may temporarily decrease stereotypic behaviors in children with ASD.
    - Based on a systematic review
    - Review included 7 studies (of various designs and quality) with a total of 26 child with an ASD
    - The included studies investigated the impact of exercise (e.g., jogging) on stereotypical behavior

- Aquatic therapy
  - Aquatic physical therapy may improve swimming skills and quality of life in children with ASD.
    - Based on a research study of 11 children with ASD who participated in a 10-week aquatic therapy program
    - Based on a research study of 12 children with ASD who participated in either aquatic therapy or usual activity

- Functional training
  - A treadmill walking program for adolescents with autism may reduce BMI and increase exercise capacity.
    - The study took place in Australia and the program was 9 months long
    - 10 subjects were assigned to the intervention (treadmill walking) or control group (leisure activity)
    - Significant improvements in BMI and exercise capacity were noted in subjects who participated in treadmill training
  - A survey of clinicians treating children with autism through aquatic therapy reported subjective findings of improved attention, strength, balance, swimming skills, tolerance to touch, eye contact, and safety in the water.
    - 18 of the returned surveys were included in the results
    - The therapists were based throughout the U.S.

- Hippotherapy
  - Hippotherapy may lead to improvements in symptoms in children with ASD.
    - Based on a pilot, randomized controlled trial in the U.S.
    - Included 34 children with an ASD
    - Participants were randomized to one of two groups
      - Intervention – therapeutic horseback riding; 12 weeks; 1 hour/week
      - Control – waiting list for program
    - Results (results comparing the two groups)
      - The intervention group experienced significantly greater improvements in
        - sensory seeking
        - sensory profile
        - attention and distractibility
        - sensory sensitivity
        - activity level
        - social response scale
        - social motivation
  - Increased frequency of weekly hippotherapy improves the magnitude of aberrant behaviors associated with ASD.
    - Based on a U.S. single-subject design study of 3 boys aged 6-8 years with ASD
    - Frequency at baseline was 1 time a week; treatment intervention increased to 3 and 5 times a week over a 4-week period
    - Counts of target behaviors was based on the Aberrant Behavior Checklist-Community, which assesses behaviors and measures intervention effects of individuals with ASD
- 70% of target behaviors improved during the intervention and 63% of the improved target behaviors persisted during the withdrawal phase of the study
- Increased doses of hippotherapy were significant for magnitude of change, and the effect of these improvements was generalized within the child’s home and community

• Sensory integration therapy
  – A noncomparative U.S. study of 4 children with autism investigating Ayre’s sensory integration-based OT intervention reported no significant change in undesired behavior or task management following the intervention period\(^{(61)}\)
  - Ayre’s sensory integration incorporates tactile, proprioceptive, and vestibular input with the desired outcome of bolstering an individual’s ability to manage the burden or stress of a given situation
  - Subjective reporting of improvements in the children from the clinicians were present in the study
  – Evidence is limited regarding sensory interventions in the treatment of children with ASD; a lack of concrete, objective data in the existing research is reported\(^{(62)}\)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Goal</th>
<th>Intervention</th>
<th>Expected Progression</th>
<th>Home Program</th>
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</thead>
</table>
| Behavioral concerns | Limit behavioral outbursts/coping strategies when they do occur | **Behavior modification**

- Social Communication and Emotional Regulation and implementing Transactional Supports
  – The SCERTS Model\(^{(1)}\)

- A comprehensive approach that assists in promoting emotional regulation and communication\(^{(1)}\)

- An example of a strategy using this model would be the incorporation of breaks into the child’s day allowing for modulated activity and sensory input\(^{(1)}\)

- ABA can have a large role in behavior modification with a significant emphasis placed on rewarding positive behaviors in children with autism\(^{(63)}\)

<p>| Progress each unique child as indicated and appropriate | Implement a home program based on specific needs of child |</p>
<table>
<thead>
<tr>
<th>Developmental delay/motor impairment</th>
<th>Attainment of motor milestones/improve motor skills</th>
<th>Therapeutic modalities</th>
<th>Progress each unique child as indicated and appropriate</th>
<th>Implement a home program based on specific needs of child</th>
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</thead>
<tbody>
<tr>
<td>Neurodevelopmental therapy (NDT) may be used to address motor deficits when impairments are pronounced&lt;sup&gt;62&lt;/sup&gt;</td>
<td>Environmental modifications&lt;sup&gt;49&lt;/sup&gt; may be made that serve to encourage new skill acquisition by challenging the child’s strength and balance</td>
<td>The Treatment and Education of Autistic and related Communication-handicapped CHildren (TEACCH) program may help in the development of motor skills&lt;sup&gt;51&lt;/sup&gt;</td>
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<tr>
<td>The Treatment and Education of Autistic and related Communication-handicapped CHildren (TEACCH) program may help in the development of motor skills&lt;sup&gt;51&lt;/sup&gt;</td>
<td>Treadmill training or aquatic therapy may be implemented (see Treatment summary, above)</td>
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<tr>
<td>Impaired coordination</td>
<td>Improved coordination</td>
<td>Functional training</td>
<td>Progress each unique child as indicated and appropriate</td>
<td>Implement a home program based on specific needs of child</td>
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<td>Fine motor activities as indicated</td>
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<tr>
<td>Overweight and obesity risk</td>
<td>Promotion of healthy weight</td>
<td>Therapeutic exercise, functional training</td>
<td>Progress each unique child as indicated and appropriate</td>
<td>Parents of children with ASD may need help in finding ways to implement these activities in their child’s daily life&lt;sup&gt;103&lt;/sup&gt;</td>
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<tr>
<td>Activities that support healthy weight, including increasing physical activity, reducing screen time, and participating in family meals&lt;sup&gt;103&lt;/sup&gt;</td>
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<tr>
<td>Sensory integration issues</td>
<td>Decreased sensory integration issues</td>
<td><strong>Therapeutic strategies</strong></td>
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<td>Recommendations have been made in the literature on treatment strategies that incorporate ABA concepts and occupational therapy designs. For children with autism, who may experience hypersensitivity to sensory input, the following recommendations were made.(^{[63]})</td>
<td>Progress each unique child as indicated and appropriate</td>
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<td>Lower lighting</td>
<td>Implement a home program based on specific needs of child</td>
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<td>Reduce clutter</td>
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<td>Signal the beginning and end to an undertaking</td>
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<td>Implement “first/then” cards (first we’ll do this…, then we’ll do this…)</td>
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<td>Pictures for communication</td>
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<td>Visual schedules</td>
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<td>Develop a sensory diet</td>
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### Desired Outcomes/Outcome Measures

- **Desired outcomes**
  - Increased receptive language/increased expressive language; increased overall communication
  - Reduced behavioral outbursts/use of coping strategies when they do occur
  - Attainment of motor milestones/improve motor skills
  - Increased physical activity
  - Decreased obesity
  - Improved coordination
  - Implementation of a sensory diet/sensory strategies
  - Improved comprehension

- **Outcome measures**
  - Autism Observational Scale for Infants (AOSI)
  - Childhood Autism Rating Scale (CARS)
  - Social Responsiveness Scale (SRS)
  - Gilliam Autism Rating Scale 2nd Edition (GARS-2)
  - Bayley Scales of Infant Motor Development-III (BSID-III)
  - Bruininks-Oseretksy Test of Motor Proficiency, Second Edition (BOT-2)
  - Early Intervention Developmental Profile (EDP)
  - Peabody Developmental Motor Scales, Second Edition (PDMS-2)
  - Pediatric Evaluation of Disability Inventory (PEDI)
  - Children’s Assessment of Participation and Enjoyment/Preference for Activities of Children (CAPE/PAC)
  - BMI
  - Developmental Disabilities Children’s Global Assessment Scale (DD-CGAS)
  - OSU Autism Clinical Global Impression (OSU Autism CGI)

### Maintenance or Prevention

- Continue physical activity in the community to maintain fitness and maximize functional mobility
- Most children will require some degree of assistance as adults with ASD

- **Employment**
  - Occupational therapists have an important role in empowering the person with autism to obtain employment
    - Potential areas for input by the occupational therapist include
      - Vocational assessments
      - Environmental adaptations
- social skills training
- implementation of assistive technology
- interventions for managing sensory integration issues (e.g., providing weighted clothing, or adjusting lighting)
- visual supports to assist in organization and job function

Several countries/continents have published their own clinical practice guidelines and policy statements regarding identification, evaluation, and treatment intervention for persons with ASD. These are publicly available online.

- In the U.S., these include
  - American Academy of Pediatrics (AAP)
  - Cincinnati Children's Hospital Medical Center
  - Autism Society of Greater Cleveland Autism Task Force
  - Ohio Developmental Disabilities Council Autism Task Force
  - American Academy of Neurology and Child Neurology Society
  - American Occupational Therapy Association
  - American Academy of Child and Adolescent Psychiatry
  - California Department of Developmental Services
  - Academy of Nutrition and Dietetics
- In the United Kingdom, these include
  - National Institute for Health and Clinical Excellence (NICE)
  - Scottish Intercollegiate Guidelines Network (SIGN)
- In Asia, these include
  - Academy of Medicine Singapore/Ministry of Health
- In Australia and New Zealand, these include
  - New Zealand Ministry of Health

Patient Information

› TEACCH Autism Program, www.teacch.com

Coding Matrix

<table>
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<tr>
<th>M</th>
<th>Published meta-analysis</th>
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<tbody>
<tr>
<td>SR</td>
<td>Published systematic or integrative literature review</td>
</tr>
<tr>
<td>RCT</td>
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References


