

# Weight Management in Primary Care for Children With Autism: Expert Recommendations

Carol Curtin, PhD,<sup>a,b</sup> Susan L. Hyman, MD,<sup>a,c</sup> Diane D. Boas, MS,<sup>a,d</sup> Sandra Hassink, MD,<sup>a,e</sup> Sarabeth Broder-Fingert, MD,<sup>a,f</sup> Lauren T. Ptomey, PhD,<sup>a,g</sup> Meredith Dreyer Gillette, PhD,<sup>a,h</sup> Richard K. Fleming, PhD,<sup>a,i</sup> Aviva Must, PhD,<sup>a,j</sup> Linda G. Bandini, PhD<sup>a,b,k</sup>

## abstract

Research suggests that the prevalence of obesity in children with autism spectrum disorder (ASD) is higher than in typically developing children. The US Preventive Services Task Force and the American Academy of Pediatrics (AAP) have endorsed screening children for overweight and obesity as part of the standard of care for physicians. However, the pediatric provider community has been inadequately prepared to address this issue in children with ASD. The Healthy Weight Research Network, a national research network of pediatric obesity and autism experts funded by the US Health Resources and Service Administration Maternal and Child Health Bureau, developed recommendations for managing overweight and obesity in children with ASD, which include adaptations to the AAP's 2007 guidance. These recommendations were developed from extant scientific evidence in children with ASD, and when evidence was unavailable, consensus was established on the basis of clinical experience. It should be noted that these recommendations do not reflect official AAP policy. Many of the AAP recommendations remain appropriate for primary care practitioners to implement with their patients with ASD; however, the significant challenges experienced by this population in both dietary and physical activity domains, as well as the stress experienced by their families, require adaptations and modifications for both preventive and intervention efforts. These recommendations can assist pediatric providers in providing tailored guidance on weight management to children with ASD and their families.

<sup>a</sup>Healthy Weight Research Network, University of Massachusetts Medical School, Worcester, Massachusetts; <sup>b</sup>Eunice Kennedy Shriver Center, University of Massachusetts Medical School, Worcester, Massachusetts; <sup>c</sup>University of Rochester Medical Center, Rochester, New York; <sup>d</sup>The Barbara Bush Children's Hospital, Maine Medical Center, Portland, Maine; <sup>e</sup>Institute for Healthy Childhood Weight, American Academy of Pediatrics, Itasca, Illinois; <sup>f</sup>Boston Medical Center and School of Medicine, Boston University, Boston, Massachusetts; <sup>g</sup>University of Kansas Medical Center, Kansas City, Kansas; <sup>h</sup>Children's Mercy Kansas City and School of Medicine, University of Missouri–Kansas City, Kansas City, Missouri; <sup>i</sup>University of Massachusetts Boston, Boston, Massachusetts; <sup>j</sup>School of Medicine, Tufts University, Boston, Massachusetts; and <sup>k</sup>Sargent College of Health and Rehabilitation Sciences, Boston University, Boston, Massachusetts

Drs Curtin, Hyman, Hassink, Broder-Fingert, Ptomey, Gillette, Fleming, Must, and Bandini and Ms Boas wrote the manuscript as part of a subcommittee of the Healthy Weight Research Network; and all the authors conceptualized the approach to and elements of this review and recommendations, contributed content to the initial manuscript, reviewed and revised manuscript drafts, approved the final manuscript as submitted, and agree to be accountable for all aspects of the work.

**DOI:** <https://doi.org/10.1542/peds.2019-1895P>

Accepted for publication Jan 27, 2020

Address correspondence to Carol Curtin, PhD, Eunice Kennedy Shriver Center, University of Massachusetts Medical School, 55 Lake Ave North, Worcester, MA 01655. E-mail: carol.curtin@umassmed.edu

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2020 by the American Academy of Pediatrics

**FINANCIAL DISCLOSURE:** The authors have indicated they have no financial relationships relevant to this article to disclose.

**FUNDING:** Funded by the Healthy Weight Research Network, Health Resources and Services Administration, and Maternal and Child Health Bureau (UA3MC25735).

**POTENTIAL CONFLICT OF INTEREST:** The authors have indicated they have no potential conflicts of interest to disclose.

Evidence from clinical and nationally representative data suggests that children with autism spectrum disorder (ASD) have higher rates of obesity than typically developing (TD) children.<sup>1-10</sup> Evidence exists that elevated weight status in children with ASD begins in early childhood<sup>1,3</sup> and persists through adolescence.<sup>4</sup> Childhood obesity increases the risk for chronic diseases such as diabetes, cardiovascular disease, and certain cancers in adulthood.<sup>11</sup> Adults with ASD have been found to have higher rates of these conditions, so attention to obesity prevention and treatment in childhood has important implications for the future health of this population.<sup>12,13</sup>

Several putative risk factors may contribute to overweight and/or obesity in children with ASD. An estimated 50% to 90% of children with ASD have feeding problems, including selective eating patterns, rituals, food refusal, and limited food repertoire,<sup>14,15</sup> which have been found to persist beyond early childhood.<sup>16,17</sup> Although the relationship between food selectivity and obesity has not yet been established empirically,<sup>18</sup> examining individual eating patterns in children with ASD for low fruit and vegetable intake<sup>15</sup> and high intake of sugar-sweetened beverages and snacks<sup>19</sup> is important for nutritional guidance.

Evidence also suggests that children with ASD engage in less physical activity compared with their TD peers.<sup>20-23</sup> These children frequently have motor skill difficulties, including unevenness or delays in achieving motor milestones, low muscle tone, and postural instability,<sup>24-26</sup> which can adversely affect endurance, balance, and motor planning. Parents of children with ASD have reported several barriers to physical activity for their children, including social skill difficulties, dysregulated behavior, rejection by TD peers, and lack of skill and/or willingness in

adults to provide accommodations.<sup>27</sup> Research has also documented that children with ASD engage in more sedentary behavior than their TD counterparts, which is largely attributable to increased screen time.<sup>28-31</sup>

Children and adults with ASD are often prescribed second-generation antipsychotic (SGA) agents for behavioral problems, irritability, and self-injury. These agents can contribute to rapid weight gain and elevated weight status and, in some cases, metabolic syndrome.<sup>32</sup> Exposure to atypical antipsychotics for at least 3 months has been found to increase risk of diabetes later in life.<sup>33</sup>

The growing literature base that documents the increased risk of obesity in children and youth with ASD constitutes a public health imperative for clinicians and policy makers. In particular, primary care providers have a key role to play in both prevention and intervention efforts. Research suggests that primary care providers would benefit from specific recommendations for obesity prevention and management in children with ASD. Walls et al<sup>34</sup> surveyed 327 general pediatricians using fictional clinical vignettes of children with ASD or dyslexia that were randomly assigned, which were followed by questions about attitudes, practices, self-efficacy, and barriers to obesity management for children with ASD. Most respondents (62%) believed that pediatricians should take primary responsibility for managing overweight and/or obesity in children with ASD, yet only 5.5% felt that pediatricians possessed the appropriate training to do so. Respondents who received the ASD vignette were less likely to rank discussion around screen time or the child's diet as a top priority. Those who received the ASD vignette were also less likely to assess the child's access to healthy food items compared with those who received

the non-ASD vignette. Pediatricians reported several barriers to managing overweight and/or obesity in children with ASD; the barriers most frequently reported were lack of time and the perception that the child's weight was not a concern. Other barriers included lack of support and/or referral services for weight management and lack of effective treatments or therapies for obesity in children in general. Few pediatricians cited a lack of knowledge or skill for weight management, suggesting that they feel they possess the knowledge and skills but may need additional information and support to implement routine and specialized strategies. Pediatricians reported that obesity is more challenging to manage in children with ASD than TD children and tend to refer to dietitians or developmental-behavioral pediatricians (DBPs) for management. However, it appears that DBPs may be unlikely to identify obesity in children with ASD. In another study, Walls et al<sup>35</sup> used data from the medical records of >4000 children with ASD from 3 clinics associated with the Developmental Behavioral Pediatrics Research Network. They found that although a substantial proportion of children met criteria for overweight or obesity, relatively few received a documented International Classification of Diseases, Ninth Revision code for a weight-related concern. These gaps in pediatric practice point to the need for tailored strategies that providers can employ to address obesity in children with ASD.

This set of recommendations was developed to provide guidance for weight management in children and youth with ASD in primary care. At present, no evidence-based treatments for or approaches to weight management in primary care for this population have been developed.<sup>36</sup> However, pediatric providers have indicated a need for guidance to address this issue.<sup>34</sup> The

American Academy of Pediatrics (AAP) 2007 Expert Committee Recommendations on Childhood Obesity<sup>37,38</sup> provide a comprehensive approach for managing childhood obesity. However, they require modification or expansion to be implemented successfully in children with ASD, which this set of recommendations offers, although this does not represent official AAP policy.

## METHODS

The Healthy Weight Research Network (HWRN) (<https://HWRN.org>) was established in 2013 with funding from the Health Resources and Services Administration Maternal and Child Health Bureau. The HWRN comprises an interdisciplinary group of clinical investigators and experts who conduct research on and/or provide obesity treatment for children with ASD and other intellectual and/or developmental disabilities (I/DD). The HWRN is codirected by researchers at the University of Massachusetts Medical School and Tufts University School of Medicine in collaboration with 14 core members throughout the United States.

An HWRN workgroup developed this set of recommendations and included 2 pediatricians, 1 DBP, 2 psychologists, 2 registered dietitians, a clinical social worker who is also a clinical health researcher, and a parent of an individual with I/DD who is also an obesity health educator for individuals with disabilities.

The recommendations were developed via a methodical, deliberative process. Workgroup members participated in monthly conference calls between October 2016 and November 2018. They reviewed relevant extant research that focused on obesity in children with ASD, co-occurring conditions in ASD that were also obesity risk

factors, and best practices in managing obesity in TD children. Clinical consensus was achieved iteratively; the workgroup held extensive discussions focused on developing guidance for pediatric providers in light of the lack of evidence-based weight management or weight loss approaches in primary care for this population. The workgroup concluded that making modifications to and expanding on the comprehensive AAP 2007 Expert Committee Recommendations on Childhood Obesity<sup>37</sup> would be the most appropriate approach. Feedback derived from a series of interviews and focus groups with primary care pediatric providers also informed the development of these recommendations (M. Walls, ZK. Zuckerman, S.B.-F., unpublished data).

Multiple drafts of the recommendations were circulated to all workgroup members for feedback, and changes were discussed during phone calls. Members' feedback and content contributions were incorporated into subsequent written drafts and again reviewed by the members. All workgroup members signified their agreement with and consensus on the final version of the article.

## RECOMMENDATIONS: SCREENING AND ASSESSMENT

### Recommendation 1: Children With ASD Should Be Screened Routinely for Overweight and Obesity

The US Preventive Services Task Force<sup>39</sup> recommends that providers screen for obesity in children 6 years and older and either offer or refer for comprehensive, intensive behavioral intervention to promote improvements in weight status. Universal calculation and classification of BMI is recommended for all well-child visits.<sup>40,41</sup> Although children <6 years old were not included in these recommendations,

they are an important group for obesity prevention and early treatment,<sup>42</sup> as are children with ASD. Some research has shown that elevated weight status among children with ASD begins as early as the preschool years<sup>1,3</sup>; thus, children with ASD should be screened routinely for overweight and obesity starting at 2 years of age.

BMI is correlated with more direct measures of body fat, and BMI classification serves as the first step in assessment of obesity.<sup>39-41</sup> For children in the United States, sex-specific BMI-for-age percentiles are calculated relative to the 2000 US Centers for Disease Control and Prevention growth reference.<sup>43</sup> Child BMI can then be classified as underweight (BMI <5th percentile), healthy weight (BMI fifth percentile to <85th percentile), overweight (BMI 85% to <95%), or obese (BMI ≥95%). The American Heart Association defines severe obesity as a BMI ≥120% of the age- and sex-specific 95th percentile or an absolute BMI ≥35, whichever is lower.<sup>44</sup>

### Recommendation 2: Weight-Related Concerns Should Be Discussed With Parents and Children as Appropriate Given Child Age, Developmental Level, and Readiness for Discussion

Providers might assume that the stress and challenges of supporting a child with ASD would reduce parental concern for child weight status. However, recent research suggests that this may not be the case. Using data from the 2016 National Survey of Children's Health, we found that parents of children with ASD and obesity were more concerned than parents of TD children about their children's weight status.<sup>45</sup> Thus, providers are encouraged to raise the topic of obesity prevention and intervention with families of children and youth with ASD.

Weight bias, teasing, and bullying are often directed at children with

obesity and can affect their emotional, psychological, and social well-being and contribute to additional weight gain. Providers must be positive role models, use nonjudgmental language, and create a nonstigmatizing, safe, and welcoming office environment. A recent small qualitative study by Jachyra et al<sup>46</sup> highlighted the negative experiences of children with ASD about weight-related discussions with their health care providers. They described feelings of anger, frustration, and fear and reported experiencing weight stigma in clinical visits, including lectures and admonishments by providers. Most troubling was that weight-related issues became a repetitive and/or restricted interest for several children who reported body image concerns regarding their elevated weight status. The authors recommended taking a positive, health-oriented approach.

Providers should assess the child's willingness to have weight-related discussions and provide realistic, concrete examples of short-term goals and strategies related to eating and physical activity. Motivational interviewing, which has been shown to be effective for weight management in both adults and children,<sup>47-49</sup> may be useful in children with ASD. Adaptations to motivational interviewing techniques have been suggested by Frielink and Embregts,<sup>50</sup> which have applicability to children with ASD. Such adaptations include using simple, concrete, and clear language expressed in short sentences. Providers should ask only one question at a time and confirm that the patient and provider share the same understanding. Providers can assist patients in answering questions if they do not appear to comprehend questions and should use both verbal and nonverbal means for providing support and encouragement. Patients benefit from having the provider provide frequent summaries of what

is being discussed, and providers can also support patients in providing their own summary of the discussion to ensure clarity. Providers are reminded that patients may have difficulty imagining hypothetical situations, and thus, taking small steps toward behavior change is essential. Providers may also elect to work directly with parents, especially if the children have cognitive or behavioral limitations that might preclude their meaningful involvement in discussions or if there are other reasons why parent-only counseling may be preferable or more feasible. Matheson et al<sup>51</sup> recently showed that parents of young children with ASD could be engaged in implementing behavioral weight loss strategies for their children with successful results. Table 1 contains strategies for providers to encourage families, schools, and other providers to implement that help in supporting children with ASD and their families in adopting healthy lifestyles.

Including weight-related topics as part of each visit can facilitate consistency and avoid surprises or unexpected conversations that can be difficult for children with ASD.<sup>63</sup> The 2007 AAP Expert Recommendations<sup>37</sup> contain specific suggestions for communicating with children and families that are also appropriate for families of children with ASD. This includes asking questions in a nonjudgmental manner and engaging in reflective listening with children and parents to elicit their concerns, beliefs, and values. This approach can help create a supportive forum for discussion and problem-solving and is less likely to prompt defensiveness on the part of children and families.

### **Recommendation 3: Conduct a Comprehensive Assessment of Obesity in Children and Youth With ASD Who Present With an Elevated BMI**

The clinical evaluation of overweight and/or obesity in a child with ASD

should include the same elements of the history and physical examination used for TD children. The review of systems should explore common medical conditions that may also increase obesity risk, including sleep problems, gastrointestinal symptoms, food selectivity, and neurologic disorders. The history should explore the child's growth trajectory and the presence of constitutional symptoms that might suggest thyroid dysfunction or depression. Family factors should be explored, including opportunities for physical activity, mealtime routines, and foods present in the home.

### **Physical Examination**

The physical examination should be informed by the history and include pulse; blood pressure; palpation of the thyroid and abdomen; cardiac and pulmonary examination; evaluation of the skin (including infection in intertriginous regions and acanthosis nigricans), hips, and knees; and neurologic findings that may limit physical activity.

### **Growth Parameters**

Height, weight, pulse, and blood pressure should be measured and BMI should be calculated at all health maintenance and acute visits. Children with ASD may be intolerant of measurement, and fear or anxiety may preclude obtaining these data. Routine exposure to and reinforcement of the examination components, use of visual schedules, and accommodating the communication and sensory needs of the child can facilitate familiarity and thus make the visit easier.

### **Laboratory Testing**

The laboratory workup and monitoring of a child with ASD and obesity is no different from that of TD children. If symptoms suggest a child might have hypothyroidism, thyroid-stimulating hormone should be measured. Blood glucose, lipids, and

**TABLE 1** Strategies for Supporting Children With ASD and Their Families To Adopt Health-Promoting Behaviors

Promoting Healthy Eating	Promoting Physical Activity	Limiting Screen Time
<p>At home</p> <p>Encourage families to:</p> <ul style="list-style-type: none"> <li>Involve children in planning meals, food shopping, and cooking if feasible and if they are of interest to the child.</li> <li>Plan meals to introduce new foods. Include at least one food that the child likes in every meal.</li> <li>Offer healthy snacks.</li> <li>Portion snacks in advance.</li> <li>Act as role models in eating healthy foods.</li> <li>Offer water in lieu of sugar-sweetened beverages. Try flavoring water with fruit and herbs.</li> <li>Use positive language when talking about food and the child's eating habits.</li> </ul> <p>Increase structure around mealtimes</p> <ul style="list-style-type: none"> <li>Display a schedule for meals and snack times.</li> <li>Adjust the schedule if medication impacts the child's appetite.</li> <li>Remove distractions, such as televisions and phones when eating.</li> <li>Offer choices to give the child some control over what they eat.</li> <li>Introduce the child to new foods by letting them first see, smell, then touch and eventually taste it.</li> <li>Consider modifying the texture of foods to align with the child's texture preferences.<sup>62,64–66</sup></li> <li>Avoid using food as a reward.</li> </ul> <p>At child care, preschool, or school</p> <ul style="list-style-type: none"> <li>Monitor food intake; for example, ensure that the child is not eating breakfast at home then again at school.<sup>69</sup></li> <li>Ask for preference assessments to identify the child's preferred activities or items. These can be used as potential nonedible reinforcers to promote the desired behavior(s).</li> <li>Use physical activity as a reward (dancing, outdoor time, or active video games).</li> <li>Review monthly school menus. Try preordering school meals if available.</li> <li>Include healthy eating goals and alternatives to food rewards in IEPs and Transition Plans.</li> </ul> <p>With in-home support staff</p> <ul style="list-style-type: none"> <li>Ask staff to model healthy eating behaviors.</li> <li>Ask staff to put their soda and/or fast food in unlabeled containers (eg, put a soda in a thermos or water bottle so children are not aware of them).</li> <li>Help staff find alternatives to using food as a reward.</li> <li>Include healthy eating goals in Medicaid-reimbursed individual treatment plans.</li> </ul>	<p>At home</p> <p>Encourage families to:</p> <ul style="list-style-type: none"> <li>Consider ways to be active as a family (eg, dance to music, take walks and/or hikes, or play outside games).</li> <li>If appropriate and if perceived as enjoyable, involve the child in physical chores, such as raking leaves or sweeping.</li> </ul> <p>At school<sup>53,58–62</sup></p> <ul style="list-style-type: none"> <li>Explore ways to increase physical activity during the school day (eg, frequent movement breaks and including movement in academics).<sup>53,58–62</sup></li> <li>Recommend that a physical education teacher be included on the child's IEP team.</li> <li>Advocate for the inclusion of physical activity goals in the child's IEP.</li> <li>Consider providing physical education in community-based settings as part of secondary special education transition programming.</li> <li>Request adaptive physical education services if a child is not successful in the general physical education program.</li> <li>Ask about semistructured or structured recess with staff supervision.<sup>62</sup></li> <li>Be sure that recess is not limited or taken away as a punishment.</li> </ul> <p>With in-home support staff</p> <ul style="list-style-type: none"> <li>Encourage parents to ask staff to be active and positive role models.</li> <li>Include physical activity goals in Medicaid-reimbursed individual treatment plans.</li> </ul>	<p>At home</p> <p>Encourage families to:</p> <ul style="list-style-type: none"> <li>Limit the use of screen time as a reward or as a break from caregiving by scheduling it and setting time limits.</li> <li>Limit Internet access.</li> <li>Model healthy behavior; plan and/or take short movement breaks together to reduce sedentary time.</li> <li>Keep all screens out of the child's bedroom.</li> </ul> <p>At school</p> <ul style="list-style-type: none"> <li>Request that the child's teacher provide individualized sensory-motor breaks and/or physical activity to offset instructional time spent using screen-based media.</li> </ul> <p>With in-home support staff</p> <ul style="list-style-type: none"> <li>Encourage parents to ask staff to be active instead of watching television and/or looking at screens during their shift.</li> </ul> <p>Additional resources</p> <ul style="list-style-type: none"> <li>The Let's Go! toolkit for children with intellectual and developmental disabilities: <a href="https://mainehealth.org/lets-go/childrens-program/developmental-disabilities">https://mainehealth.org/lets-go/childrens-program/developmental-disabilities</a></li> <li>Fostering positive wt-related conversations<sup>65</sup> (Holland and Bloorview Kids Rehabilitation Hospital) <a href="https://www.hollandbloorview.ca/sites/default/files/2019-10/WeightRelatedConversationsKTCasebook.pdf">https://www.hollandbloorview.ca/sites/default/files/2019-10/WeightRelatedConversationsKTCasebook.pdf</a></li> <li>Autism Speaks ATN/AIR-P. <i>A Parent's Guide to Exploring Feeding Behavior in Autism</i> <a href="https://www.autismspeaks.org/tool-kit/atnair-p-guide-exploring-feeding-behavior-autism">https://www.autismspeaks.org/tool-kit/atnair-p-guide-exploring-feeding-behavior-autism</a>,<sup>67</sup></li> <li>Chazin and Ledford. Reinforcement on the playground. <i>Evidence-based instructional practices for young children with autism and other disabilities</i>. <a href="http://vk.mc.vanderbilt.edu/ebip/reinforcement-on-the-playground">http://vk.mc.vanderbilt.edu/ebip/reinforcement-on-the-playground</a>.<sup>68</sup></li> <li>Common sense media rates games, videos, and apps on the basis of their educational value and suitability for children at different ages (<a href="http://www.commonsensemedia.org">www.commonsensemedia.org</a>)</li> <li>AAP's obesity algorithm (<a href="http://ohioaap.org/wp-content/uploads/2016/09/1-Algorithm.pdf">http://ohioaap.org/wp-content/uploads/2016/09/1-Algorithm.pdf</a>)</li> <li>AAP Institute for Healthy Childhood Wt (<a href="https://ihcw.aap.org">https://ihcw.aap.org</a>)</li> </ul>

liver enzymes should be measured in all children with obesity.<sup>37,38,70–72</sup>

Genetic testing may be recommended if the etiology is unknown because

ASD may be associated with genetic disorders that may impact growth. Children with general overgrowth, macrocephaly, intellectual disability, or dysmorphic features should be

considered for genetic consultation and testing. Children with ASD may have genetic findings associated with larger heads (eg, mutations in the phosphatase and tensin homolog

gene and Fragile X syndrome) that may be associated with increased BMI at younger ages.<sup>73</sup> Overgrowth syndromes may be associated with I/DD, including ASD. History and examination are important in determining if additional workup is indicated. The AAP recommends consideration of genetic causes of ASD independent of obesity.

#### **Recommendation 4: Include an Assessment of Health Conditions and Risk Factors That Are Associated With Both ASD and Obesity, Including Eating and Physical Activity Patterns**

ASD is associated with a number of health conditions that have independent associations with obesity. Ongoing monitoring of and intervention for these conditions is called for and is important for obesity prevention (Table 2).

#### **Sleep Disorders**

Sleep problems are associated with obesity in the general population of children. Inadequate sleep increases the risk of insulin resistance, a sedentary lifestyle, and poor dietary patterns, including late-night snacking.<sup>75</sup> Obesity also increases the risk of sleep apnea. Difficulties falling and staying asleep may be seen in >70% of children with ASD.<sup>76</sup> The cause of delayed sleep onset in ASD may be similar to the causes in other children: lack of bedtime routines, caffeinated beverages, inability to fall asleep without a parent, a mismatch between parental bedtime expectations and age, and playing video games at bedtime. Night waking may be associated with snoring and/or obstructive sleep apnea, habitual waking induced and/or reinforced by feeding at bedtime, and parasomnias such as sleep walking. Children with ASD may have additional reasons for sleep problems, including sensory overresponsiveness, abnormalities in melatonin metabolism, and less time in rapid eye movement sleep.<sup>77</sup> Neurotransmitters implicated in the etiology of ASD, such as

γ-aminobutyric acid and serotonin, are also involved in sleep onset and maintenance.<sup>77</sup> Sleep problems may be associated with medications used for other symptoms; for example, selective serotonin reuptake inhibitors may lead to sleep fragmentation. Children with ASD are more likely than other children to have surgery for sleep-disordered breathing. It has been reported that social communication, attention, and repetitive behavior may improve after tonsillectomy.<sup>78</sup>

#### **Gastrointestinal Problems**

Children with ASD can have lactose intolerance, gastroesophageal reflux disease, and functional constipation resulting in gastrointestinal symptoms similar to other children. Many hypotheses exist as to why individuals with ASD might have an increased prevalence of gastrointestinal symptoms, including bacterial dysbiosis, altered reactivity to stress,<sup>79</sup> altered intestinal barrier function, impaired disaccharidase activity, and inflammation of the gut. Evaluation of children with ASD with gastrointestinal symptoms reveals similar findings to those of children without ASD.<sup>80</sup>

The data regarding an association between constipation and obesity are conflicting.<sup>81</sup> Children with ASD have less opportunity for physical activity, which may contribute to slower colonic transit time. Food selectivity in children with ASD has been shown to be associated with less fruit and vegetable consumption,<sup>15</sup> which may result in lower-than-recommended fiber consumption.<sup>82,83</sup> However, the association between fiber intake and stool frequency and consistency remains unclear.

#### **Neurologic Disorders**

Neurologic disorders are common in children with ASD. The prevalence of seizures in ASD ranges between 6% and 27% and varies according to age, sex, and the presence of an

intellectual disability.<sup>84–86</sup> Many anticonvulsant medications are associated with obesity,<sup>87</sup> which may be a side effect and/or result of medication-induced psychomotor slowing causing lower energy expenditure.

#### **Psychiatric and/or Behavioral Health Disorders and Psychotropic Medications**

Children with ASD should be screened for attention-deficit/hyperactivity disorder (ADHD), anxiety, and depression, and many resources now exist for providers to conduct such assessments.<sup>74,88,89</sup> ADHD is seen in 41% to 78% of children with ASD,<sup>74</sup> and anxiety is reported in up to 40% of children with ASD.<sup>88</sup> ADHD<sup>90</sup> and anxiety<sup>88</sup> are associated with sleep problems, functional gastrointestinal problems, learning challenges, and obesity.<sup>91–93</sup>

By adolescence, almost half of youth with ASD are prescribed one or more psychotropic medication. Stimulants used for ADHD may decrease appetite, whereas α-adrenergic agents may result in sedation and decreased activity. The use of selective serotonin reuptake inhibitors for anxiety and depression may result in weight gain, although evidence remains equivocal.<sup>94,95</sup> The SGA agents risperidone and aripiprazole are effective in treating irritability in children with ASD but also induce significant rapid weight gain,<sup>96</sup> which may be mostly associated with metabolic syndrome.<sup>97</sup> The presence of disruptive behavior itself also appears to be related to obesity.<sup>98</sup>

Given the effectiveness of SGAs for irritability with aggression, disruptive behaviors, and self-injury in youth with ASD, the risk of side effects (including weight gain) is often accepted by clinicians and families. A well-designed clinical trial demonstrated weight loss by 8 weeks of treatment by using metformin hydrochloride in children and youth

**TABLE 2** Medical Conditions Associated With ASD and Obesity and Approaches to Medical Assessment and Intervention

Condition	Assessment and/or Intervention
Sleep disorders	<p>Include sleep in the review of systems.</p> <p>Consider the impact of sleep problems on abdominal pain, ADHD and/or anxiety, wandering, or elopement.</p> <p>Sleep hygiene and regular bedtime routines help children calm down from the day and provide cues for bedtime.<sup>54</sup></p> <p>Encourage the discontinuation of electronic media 60 min before bedtime.</p> <p>Melatonin is safe and effective for helping with sleep onset.</p>
Gastrointestinal problems and food selectivity	<p>Use the same approach for a gastrointestinal workup as for children without ASD.</p> <p>Take a careful dietary history; include an assessment of food selectivity. Children with ASD may have insufficient fiber and/or fluid in their diet with resultant constipation.</p> <p>Constipation management includes behavioral approaches, dietary fiber, exercise to increase peristalsis, adequate fluids, and medication (such as polyethylene glycol) to promote passage of a soft stool.<sup>55</sup></p> <p>The Autism Speaks Autism Treatment Network toilet training and constipation toolkits provide useful information for managing these issues in children with ASD (<a href="http://tinyurl.com/ATN-AIR-P-ToiletTraining">http://tinyurl.com/ATN-AIR-P-ToiletTraining</a> and <a href="http://tinyurl.com/ATN-AIR-P-Constipation">http://tinyurl.com/ATN-AIR-P-Constipation</a>)</p> <p>Consult a gastroenterologist and/or dietitian who is familiar with ASD for concerns about nutritional adequacy.</p> <p>Seek the support of a dietitian, occupational therapist, or speech and/or behavioral therapist with experience treating problematic food refusal.</p> <p>A child may resist foods that are associated with discomfort (ie, pairing food[s] with episodes nausea, reflux, or a bout of gastroenteritis)</p>
Neurologic disorders	<p>Monitor for sedation and psychomotor slowing as side effects of anticonvulsants.</p> <p>Encourage active leisure for children with seizures and coordination challenges.</p>
Psychiatric and/or behavioral health disorders	<p>Include a review of common behavioral symptoms, including ADHD-related behaviors, anxiety, mood changes, aggression, self-injury, and tantrums.</p> <p>Change(s) in behavior may indicate an underlying medical condition. The history can help determine a behavioral reason for symptoms.</p> <p>Medications used for management of ADHD and anxiety may be considered part of an overall behavioral plan.</p> <p>Metformin may be considered a means of minimizing wt gain in patients treated with SGAs.<sup>52,74</sup></p>

with ASD who experienced SGA-induced weight gain.<sup>52</sup> Children 6 to 9 years of age were titrated up to a dose of 500 mg twice daily, and those 10 to 17 years of age were titrated to a dose of 850 mg twice daily. Clinical experience suggests that metformin may stabilize weight for at least 2 years of SGA treatment even if weight loss does not occur.<sup>99</sup> Metformin is approved for managing type 2 diabetes, which increases sensitivity to insulin while decreasing both intestinal glucose absorption and hepatic glucose production. Studies have not evaluated the potential impact of starting metformin at the time that SGAs are initiated to prevent weight gain.

### Eating and Physical Activity Patterns

Providers should query parents and/or caregivers about whether the child exhibits high intake of sugar-sweetened beverages or foods that are high in fat and/or sugar and/or has low intake of entire food groups (eg, vegetables, meat, dairy, or grains). Depending on the child's

weight status and the intractability of their eating behaviors, counseling by the provider or referral to behavior and nutrition professionals may be warranted. If parents express a desire to use dietary interventions to address ASD-related symptoms, providers should discuss the extent to which those diets may influence energy balance and may elect to refer to a dietetic professional.

### Recommendation 5: Providers Should Follow the Staged Approach Outlined in the 2007 Expert Committee Recommendations on Childhood Obesity With Additional Support and Services From the Child's School and/or Other Health Professionals

As with effecting change in other areas of the lives of children with ASD, the approach to weight management must be highly structured. Behavioral patterns and habits are likely to be more entrenched in children with ASD than in TD children, and family stress is also likely higher because of the behavioral challenges and service

needs that this population experiences.<sup>100</sup> The primary care provider can be a tremendous source of support to children and their families by identifying weight-related concerns early on, initiating early obesity prevention strategies, referring to behavioral and other specialists when the children's eating and/or physical activity habits are problematic, and providing support to families to devise strategies that will work for their children. Table 3 outlines the AAP's 2007 recommendations<sup>37</sup> with parallel adaptations and modifications tailored to the needs of children with ASD.

Providers are encouraged to work in concert with developmental specialists (eg, DBPs and behavioral psychologists) to address weight-related concerns. Developmental specialists may have autism-related expertise that can assist primary care providers in addressing lifestyle factors for children with ASD. At the same time, primary care providers possess knowledge and expertise in

**TABLE 3** AAP Recommendations and ASD-Specific Modifications

	AAP Recommendations for General Pediatric Population <sup>57</sup>	ASD-Specific Recommendations
Assessment	<p>Primary care providers should assess all children's wt status on at least a yearly basis to include calculation of height, wt, and BMI for age and plot on standard growth charts.</p> <p>Assessing dietary patterns qualitatively should occur at each well-child visit. For children and youth with concerns about wt status, assessments should also include readiness to change and identify specific dietary practices that may be appropriate targets for change:</p> <ul style="list-style-type: none"> <li>• Frequency of eating fast food or at restaurants</li> <li>• Excessive consumption of sugar-sweetened beverages</li> <li>• Excessive portion sizes for age</li> </ul> <p>Additional dietary assessment elements can include:</p> <ul style="list-style-type: none"> <li>• Excessive consumption of 100% fruit juice</li> <li>• Frequency and/or quality of breakfast</li> <li>• High intake of energy-dense foods</li> <li>• Low consumption of fruits and vegetables</li> </ul>	<p>Measuring and/or weighing some children with ASD may be challenging. Be flexible with measurement, such as leaving shoes on or holding a favorite object to obtain the best possible height or wt.</p> <p>Parents can hold or stand on the scale with the child and then be weighed separately.</p> <p>If child is uncooperative on a stadiometer, have them stand against a wall and use a straight edge to mark the wall and measure height. Alternatively, allow the parent to obtain height or wt.</p> <p>Using spinning toys, which entertain or distract the child, may be useful for encouraging children to stand on scales and stadiometers.</p> <p>Segmental heights may be required for children who use a wheelchair or cannot stand long enough to obtain a height. Arm span or knee height can also be used to determine height.<sup>53</sup></p> <p>Complete vital signs (especially blood pressure) at the end of the visit after the child has calmed down or acclimated to the visit.</p> <p>Assess for food selectivity; simple screening questions:</p> <ul style="list-style-type: none"> <li>• Does your child eat from all food groups on a daily basis?</li> <li>• Is your child specific about brands or food presentation (eg, only eats a certain type of chip, flavor of yogurt, or type of fast food)?</li> <li>• What are your and your child's favorite foods?</li> </ul> <p>Patterns of concern to look for include:</p> <ul style="list-style-type: none"> <li>• Low or no consumption of entire food groups (fruits, vegetables, meat, dairy, or grains)</li> <li>• High consumption of sugar-sweetened beverages</li> <li>• High consumption of high-fat or high-sugar food items (eg, baked goods and candy)</li> <li>• Child sneaks food, binges on food, or has vomited from overeating</li> </ul>
Treatment recommendations	<p>Primary care providers should address wt management and/or lifestyle issues with all patients on at least a yearly basis irrespective of wt status.</p> <p>All children ages 2–18 y with BMI values between the fifth and 84th percentile should follow preventive recommendations (see below).</p> <p>A staged approach should be taken to treat children ages 2–19 y whose BMI is &gt;85th percentile on the basis of child age, BMI, related comorbidities, parental wt status, and progress in treatment. The child's primary caregivers and family should be involved in the process.</p>	<p>Do not assume that parents of children with ASD are unconcerned about their children's wt status.</p> <p>The staged approach per AAP guidance for prevention and intervention is also appropriate for children with ASD. Include school and other treatment personnel (eg, behavior specialists) to support behavior change.</p> <p>Consider including eating and/or physical activity goals in IEPs.</p>
Stage 1: prevention plus	<p>May be implemented by the primary care providers with some training in pediatric wt management or behavioral counseling.</p> <p>Goal: wt maintenance with growth resulting in decreasing BMI with increasing age.</p> <p>Monthly follow-up assessment recommended; after 3–6 mo, if no improvement in BMI and/or wt status is noted, stage 2 is indicated, which is a structured wt management protocol (see below).</p>	<p>May be implemented by the primary care providers with some training in pediatric wt management or behavioral counseling.</p> <p>Goal: wt maintenance with growth resulting in decreasing BMI with increasing age.</p> <p>Monthly follow-up assessments; after 6 mo, if no improvement in BMI and/or wt status has been noted, advance to stage 2, a structured wt management protocol (see below).</p>



TABLE 3 Continued

	AAP Recommendations for General Pediatric Population <sup>57</sup>	ASD-Specific Recommendations
	<p>Stage 1 recommendations include:</p> <ul style="list-style-type: none"> <li>• Consume &gt;5 servings of fruits and vegetables per day</li> <li>• Minimize and/or eliminate sugar-sweetened beverages</li> <li>• Limit screen time to ≤2 h per d</li> <li>• No television in the room where the child sleeps</li> <li>• Engage in &gt;1 h of daily physical activity</li> <li>• The child and family should be counseled to adopt the following eating behaviors</li> <li>• Eating breakfast on a daily basis</li> <li>• Limiting meals eaten outside the home</li> <li>• Eating family meals at least 5–6 times per wk</li> <li>• Allowing the child to self-regulate his or her meals and avoiding overly restrictive behaviors</li> </ul> <p>Providers should acknowledge cultural differences and assist families in making appropriate adaptations to the recommendations.</p>	<p>Involving the parent(s) is essential; providers should work with the family and recommend:</p> <ul style="list-style-type: none"> <li>• Targeting gradual reduction (ideally elimination) of sugared drinks and juices, including 100% fruit juices</li> <li>• Developing viable strategies to manage portions and/or access to energy-dense foods (eg, removing temptation by eliminating certain energy-dense foods from the home or storing them out of sight)</li> <li>• Serving fruits and/or vegetables that the child likes at each meal</li> <li>• See additional suggestions for working with families and schools around healthy eating and physical activity</li> </ul> <p>Providers and family members should work together to set only 1–2 realistic and obtainable goals to work on each month.</p>
Stage 2: structured wt management protocol	<p>May be implemented by primary care providers highly trained in wt management.</p> <p>Goal: wt maintenance that results in decreasing BMI as age and/or height increase.</p> <p>Wt loss should not exceed 1 lb per mo for children 2–11 y of age or an average of 2 lb per wk for older overweight or obese children and adolescents.</p> <p>If there is no improvement in BMI and/or wt status after 3–6 mo, then stage 3 is recommended (see below).</p> <p>Stage 2 recommendations include:</p> <ul style="list-style-type: none"> <li>• Consumption of a balanced macronutrient diet with small amounts of energy-dense foods</li> <li>• Provision of structured daily meals and snacks (breakfast, lunch, dinner, and 1–2 snacks per d)</li> <li>• Supervised active play of &gt;60 min per d</li> <li>• No more than 1 h per d of screen time</li> <li>• Increased monitoring of target behaviors (eg, screen time, physical activity, dietary intake, and restaurant logs) by provider, patient, and/or family</li> <li>• Reinforcement for achieving targeted behavior goals (not wt goals)</li> </ul>	<p>May be implemented by primary care providers highly trained in wt management.</p> <p>Goal: wt maintenance that results in decreasing BMI as age and/or height increase.</p> <p>Wt loss should not exceed 1 lb per mo for children 2–11 y of age or an average of 2 lb per wk for older children and adolescents with overweight or obesity</p> <p>If there is no improvement in BMI or wt status after 6 mo, stage 3 is recommended (see below).</p> <p>Stage 2 recommendations include:</p> <ul style="list-style-type: none"> <li>• All of stage 1 for children with ASD recommendations and stage 2 recommendations from the AAP are also appropriate</li> <li>• Add the services of professionals who can work as a team <ul style="list-style-type: none"> <li>◦ Occupational or speech therapist to address sensory issues associated with extreme food selectivity if applicable</li> <li>◦ Behavioral specialist for resistance to making behavioral changes</li> <li>◦ Dietitian for dietary counseling and/or support with limited food repertoire</li> </ul> </li> <li>• Use a posted meal and snack schedule (eg, pictorial schedule if appropriate for the child's age and ability level)</li> <li>• Use a snack box with preselected and/or preportioned snacks to manage and/or limit snacking</li> <li>• Implement a reward chart for completing physical activity, trying new fruits and vegetables, and drinking water</li> </ul>
Stage 3: comprehensive multidisciplinary intervention	<p>Patients whose BMI or wt status has not improved after 3–6 mo should be referred to a multidisciplinary team that specializes in obesity treatment.</p> <p>Goal: wt maintenance or gradual wt loss until BMI is &lt;85th percentile; as above, wt loss should not exceed 1 lb per mo for children 2–5 y of age or 2 lb per wk for older children and adolescents with obesity.</p>	<p>Patients whose BMI or wt status has not improved after 3–6 mo should be referred to a multidisciplinary team that specializes in obesity treatment.</p> <p>Goal: wt maintenance or gradual wt loss until BMI is &lt;85th percentile; as above, wt loss should not exceed 1 lb per mo for children 2–5 y of age or 2 lb per wk for older children and adolescents with obesity.</p>

**TABLE 3** Continued

	AAP Recommendations for General Pediatric Population <sup>57</sup>	ASD-Specific Recommendations
Stage 4: tertiary-care protocol	<p>Eating and activity goals are the same as in stage 2 and should include:</p> <ul style="list-style-type: none"> <li>• Planned negative energy balance achieved through structured diet and physical activity</li> <li>• A structured behavior modification program, including monitoring and development of short-term diet and physical activity goals</li> <li>• Involve primary caregivers and/or family members for behavioral modification for children &lt;12 y of age</li> <li>• Training families to improve the home environment</li> <li>• Frequent office visits, weekly visits for a minimum of 8–12 wk, and subsequent monthly visits on a monthly basis to aid in maintaining new behaviors</li> <li>• Systematic evaluation of body measurements, dietary intake, and physical activity should be conducted at baseline and specific intervals throughout the program</li> </ul>	<p>Recommendations are the same as in stage 2 and the AAP's stage 3 but may also include 1 or more of the following strategies, tailored to the individual child:</p> <ul style="list-style-type: none"> <li>• Use food lists and/or guides such as the Stoplight Approach with support from a dietitian to help select snacks and/or guide meals</li> <li>• Remove trigger foods such as sugared beverages, chips, sweets, and other high-energy–dense foods from the house</li> <li>• Plan for a favorite food to be consumed 1 time per wk to prevent deprivation but do not use as a reward</li> <li>• Consider having family track calorie intake using a Web-based application with assistance from the dietary team</li> <li>• Identify locations for accessible physical activity</li> </ul>
	<p>Recommended for children &gt;11 y of age with BMI &gt;95th percentile who also have significant comorbidities and have not been successful in stages 1–3 or for children with BMI of &gt;99th percentile who have shown no improvement in stage 3.</p> <p>Treatment should include continued diet and activity counseling and consideration of additions such as meal replacements, low-calorie diets, medication, and possibly surgery.</p>	<p>Recommended for children &gt;11 y of age with BMI &gt;95th percentile who also have significant comorbidities and have not been successful in stages 1–3 or for children with BMI of &gt;99th percentile who have shown no improvement in stage 3.</p> <p>Treatment should include continued diet and activity counseling and consideration of the following strategies overseen by a team specializing in wt management of children with experience in working with children and youth with ASD and their families:</p> <ul style="list-style-type: none"> <li>• Family tracking of calorie intake by using a paper- or Web-based application</li> <li>• Use of meal replacements if the child does not have strong food aversions</li> <li>• Medications to counteract the effects of SGAs if medically appropriate</li> </ul> <p>Consultation to evaluate candidacy for surgical intervention; guidance from the American Society for Metabolic and Bariatric Surgery indicates that ASD should not be a contraindication for bariatric surgery. Intervention should be considered on a case-by-case basis for the patient's needs and ability to engage in the dietary and/or lifestyle changes required before and after surgery.<sup>57</sup></p>

weight management that should be shared with other professionals working with the children. Pediatric practices that employ colocated behavioral health clinicians should connect them with patients with ASD who have weight-related concerns early on for guidance and support, identify resources, and make appropriate referrals.

Primary care providers are in a position to exert influence on other service systems, such as school systems, by advocating for services and supports to be included in

children's Individualized Education Programs (IEPs). Providers can advocate for eating and physical activity goals to be included in the children's IEP. Federal law requires that children receiving IEPs must receive physical education; providers can recommend adaptive physical education consultation and services if a child is experiencing difficulties in physical education programming at school (Table 1).<sup>53,62</sup>

In cases in which parents and/or caregivers experience behavioral challenges associated with making

dietary changes or reducing screen time, providers should refer to a behavioral specialist. Children with ASD can display disruptive behavior in response to changes in dietary routines (eg, the introduction of new foods), changes in eating schedules, and efforts to reduce screen time. These behaviors serve the function (for the child) of avoiding or escaping experiences they perceive as aversive. Understandably, when parents work on their own without training in how best to enact change, conflicts may ensue, and parents may end up capitulating to the children's

behavior. Behavioral specialists use systematic, reinforcement-based approaches for gradually introducing changes to a child's routine in ways that avoid or limit adverse behavioral reactions. They can also conduct systematic preference assessments to identify new sources of positive reinforcement that support dietary and physical activity-related behavior change. Such assessments can also include identifying nonfood or healthier-food alternatives for use as reinforcers<sup>69</sup> at home and school.

## CONCLUSIONS

Children with ASD are at increased risk of obesity for both behavioral and biological reasons. Little to no research exists on weight management for children with ASD in primary care settings. While we await the results of additional research on obesity and effective treatments for children with ASD, providers can adapt the interventions that are known to prevent and treat obesity in TD children for implementation by the family, school, and other relevant entities on behalf of children and youth with ASD.

This is the first ASD-specific resource on weight management for pediatric primary care providers. The recommendations contained herein are based on extant research and clinical consensus but have not been formally tested. As such, they represent an emerging area of clinical intervention. Future research is needed to identify the ways in which providers can be most successful and effective in supporting children with ASD and their families in obesity prevention and intervention efforts. Future recommendations and effective strategies will need to be informed by new evidence. Nevertheless, these recommendations can assist providers in addressing this important issue in clinical practice with children with ASD and their families.

## ABBREVIATIONS

AAP: American Academy of Pediatrics  
 ADHD: attention-deficit/hyperactivity disorder  
 ASD: autism spectrum disorder  
 DBP: developmental-behavioral pediatrician  
 HWRN: Healthy Weight Research Network  
 I/DD: intellectual and/or developmental disabilities  
 IEP: Individualized Education Program  
 SGA: second-generation antipsychotic  
 TD: typically developing

## REFERENCES

1. Curtin C, Bandini LG, Perrin EC, Tybor DJ, Must A. Prevalence of overweight in children and adolescents with attention deficit hyperactivity disorder and autism spectrum disorders: a chart review. *BMC Pediatr*. 2005;5(1): 48
2. Curtin C, Anderson SE, Must A, Bandini L. The prevalence of obesity in children with autism: a secondary data analysis using nationally representative data from the National Survey of Children's Health. *BMC Pediatr*. 2010;10:11
3. Hill AP, Zuckerman KE, Fombonne E. Obesity and autism. *Pediatrics*. 2015; 136(6):1051–1061
4. Egan AM, Dreyer ML, Odar CC, Beckwith M, Garrison CB. Obesity in young children with autism spectrum disorders: prevalence and associated factors. *Child Obes*. 2013;9(2):125–131
5. Must A, Eliasziw M, Phillips SM, et al. The effect of age on the prevalence of obesity among US youth with autism spectrum disorder. *Child Obes*. 2017; 13(1):25–35
6. Dreyer Gillette ML, Borner KB, Nadler CB, et al. Prevalence and health correlates of overweight and obesity in children with autism spectrum disorder. *J Dev Behav Pediatr*. 2015; 36(7):489–496

7. Broder-Fingert S, Brazauskas K, Lindgren K, Iannuzzi D, Van Cleave J. Prevalence of overweight and obesity in a large clinical sample of children with autism. *Acad Pediatr*. 2014;14(4): 408–414
8. Healy S, Aigner CJ, Haegele JA. Prevalence of overweight and obesity among US youth with autism spectrum disorder. *Autism*. 2019;23(4): 1046–1050
9. Zheng Z, Zhang L, Li S, et al. Association among obesity, overweight and autism spectrum disorder: a systematic review and meta-analysis. *Sci Rep*. 2017;7(1):11697
10. Zuckerman KE, Hill AP, Guion K, Voltolina L, Fombonne E. Overweight and obesity: prevalence and correlates in a large clinical sample of children with autism spectrum disorder. *J Autism Dev Disord*. 2014;44(7):1708–1719
11. Must A, Strauss RS. Risks and consequences of childhood and adolescent obesity. *Int J Obes Relat Metab Disord*. 1999;23(suppl 2):S2–S11
12. Croen LA, Zerbo O, Qian Y, et al. The health status of adults on the autism spectrum. *Autism*. 2015;19(7):814–823
13. Cashin A, Buckley T, Trollor JN, Lennox N. A scoping review of what is known of the physical health of adults with autism spectrum disorder. *J Intellect Disabil*. 2018;22(1):96–108
14. Ledford JR, Gast DL. Feeding problems in children with autism spectrum disorders A review. *Focus Autism Other Dev Disabl*. 2006;21(3):153–166
15. Sharp WG, Berry RC, McCracken C, et al. Feeding problems and nutrient intake in children with autism spectrum disorders: a meta-analysis and comprehensive review of the literature. *J Autism Dev Disord*. 2013;43(9): 2159–2173
16. Bandini LG, Curtin C, Phillips S, Anderson SE, Maslin M, Must A. Changes in food selectivity in children with autism spectrum disorder. *J Autism Dev Disord*. 2017;47(2): 439–446
17. Suarez MA, Nelson NW, Curtis AB. Longitudinal follow-up of factors associated with food selectivity in children with autism spectrum disorders. *Autism*. 2014;18(8):924–932

18. Brown CL, Vander Schaaf EB, Cohen GM, Irby MB, Skelton JA. Association of picky eating and food neophobia with weight: a systematic review. *Child Obes.* 2016; 12(4):247–262
19. Schreck KA, Williams K, Smith AF. A comparison of eating behaviors between children with and without autism. *J Autism Dev Disord.* 2004;34(4): 433–438
20. Pan C, Frey GC. Identifying physical activity determinants in youth with autistic spectrum disorders. *J Phys Act Health.* 2005;2(4):412–422
21. Pan CY. Motor proficiency and physical fitness in adolescent males with and without autism spectrum disorders. *Autism.* 2014;18(2):156–165
22. Macdonald M, Esposito P, Ulrich D. The physical activity patterns of children with autism. *BMC Res Notes.* 2011;4:422
23. Memari AH, Ghaheri B, Ziaee V, Kordi R, Hafizi S, Moshayedi P. Physical activity in children and adolescents with autism assessed by triaxial accelerometry. *Pediatr Obes.* 2013;8(2): 150–158
24. Dewey D, Cantell M, Crawford SG. Motor and gestural performance in children with autism spectrum disorders, developmental coordination disorder, and/or attention deficit hyperactivity disorder. *J Int Neuropsychol Soc.* 2007; 13(2):246–256
25. Molloy CA, Dietrich KN, Bhattacharya A. Postural stability in children with autism spectrum disorder. *J Autism Dev Disord.* 2003;33(6):643–652
26. Minshew NJ, Sung K, Jones BL, Furman JM. Underdevelopment of the postural control system in autism. *Neurology.* 2004;63(11):2056–2061
27. Must A, Phillips S, Curtin C, Bandini LG. Barriers to physical activity in children with autism spectrum disorders: relationship to physical activity and screen time. *J Phys Act Health.* 2015; 12(4):529–534
28. Must A, Phillips SM, Curtin C, et al. Comparison of sedentary behaviors between children with autism spectrum disorders and typically developing children. *Autism.* 2014;18(4):376–384
29. Mazurek MO, Shattuck PT, Wagner M, Cooper BP. Prevalence and correlates of screen-based media use among youths with autism spectrum disorders. *J Autism Dev Disord.* 2012;42(8): 1757–1767
30. Kuo MH, Orsmond GI, Coster WJ, Cohn ES. Media use among adolescents with autism spectrum disorder. *Autism.* 2014;18(8):914–923
31. Obrusnikova I, Cavalier AR. Perceived barriers and facilitators of participation in after-school physical activity by children with autism spectrum disorders. *J Dev Phys Disabil.* 2011;23(3):195–211
32. Yoon Y, Wink LK, Pedapati EV, Horn PS, Erickson CA. Weight gain effects of second-generation antipsychotic treatment in autism spectrum disorder. *J Child Adolesc Psychopharmacol.* 2016; 26(9):822–827
33. Galling B, Roldán A, Nielsen RE, et al. Type 2 diabetes mellitus in youth exposed to antipsychotics: a systematic review and meta-analysis. *JAMA Psychiatry.* 2016;73(3):247–259
34. Walls M, Broder-Fingert S, Feinberg E, Drainoni ML, Bair-Merritt M. Prevention and management of obesity in children with autism spectrum disorder among primary care pediatricians. *J Autism Dev Disord.* 2018;48(7):2408–2417
35. Walls M, Curtin C, Phillips S, et al. Developmental-behavioral pediatricians' diagnosis and coding of overweight and obesity in children with autism spectrum disorder [published online ahead of print February 7, 2020]. *J Dev Behav Pediatr.* 2020. doi:10.1097/DBP.0000000000000783
36. Healy S, Pacanowski CR, Williams E. Weight management interventions for youth with autism spectrum disorder: a systematic review. *Int J Obes.* 2019; 43(1):1–12
37. Barlow SE; Expert Committee. Expert Committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics.* 2007;120(suppl 4): S164–S192
38. Spear BA, Barlow SE, Ervin C, et al. Recommendations for treatment of child and adolescent overweight and obesity. *Pediatrics.* 2007;120(suppl 4): S254–S288
39. Whitlock EP, Williams SB, Gold R, Smith PR, Shipman SA. Screening and interventions for childhood overweight: a summary of evidence for the US Preventive Services Task Force. *Pediatrics.* 2005;116(1). Available at: [www.pediatrics.org/cgi/content/full/116/1/e125](http://www.pediatrics.org/cgi/content/full/116/1/e125)
40. Barlow SE, Dietz WH. Obesity evaluation and treatment: expert committee recommendations. The Maternal and Child Health Bureau, Health Resources and Services Administration and the Department of Health and Human Services. *Pediatrics.* 1998;102(3). Available at: [www.pediatrics.org/cgi/content/full/102/3/E29](http://www.pediatrics.org/cgi/content/full/102/3/E29)
41. Cote AT, Harris KC, Panagiotopoulos C, Sandor GG, Devlin AM. Childhood obesity and cardiovascular dysfunction. *J Am Coll Cardiol.* 2013;62(15): 1309–1319
42. Taveras EM, Rifas-Shiman SL, Sherry B, et al. Crossing growth percentiles in infancy and risk of obesity in childhood. *Arch Pediatr Adolesc Med.* 2011;165(11): 993–998
43. Kuczumski RJ, Ogden CL, Guo SS, et al. 2000 CDC Growth Charts for the United States: methods and development. *Vital Health Stat 11.* 2002;(246):1–190
44. Kelly AS, Barlow SE, Rao G, et al; American Heart Association Atherosclerosis, Hypertension, and Obesity in the Young Committee of the Council on Cardiovascular Disease in the Young, Council on Nutrition, Physical Activity and Metabolism, and Council on Clinical Cardiology. Severe obesity in children and adolescents: identification, associated health risks, and treatment approaches: a scientific statement from the American Heart Association. *Circulation.* 2013;128(15): 1689–1712
45. Tybor DJ, Eliasziw M, Kral TV, et al. Parental concern regarding obesity in children with autism spectrum disorder in the United States: National Survey of Children's Health 2016. *Disabil Health J.* 2019;12(1):126–130
46. Jachyra P, Anagnostou E, Knibbe TJ, et al. "Girls don't have big tummies": the experiences of weight-related discussions for children with autism spectrum disorders. *Autism.* 2019;23(5): 1096–1105

47. Armstrong MJ, Mottershead TA, Ronksley PE, Sigal RJ, Campbell TS, Hemmelgarn BR. Motivational interviewing to improve weight loss in overweight and/or obese patients: a systematic review and meta-analysis of randomized controlled trials. *Obes Rev*. 2011;12(9):709–723
48. VanBuskirk KA, Wetherell JL. Motivational interviewing with primary care populations: a systematic review and meta-analysis. *J Behav Med*. 2014; 37(4):768–780
49. Gayes LA, Steele RG. A meta-analysis of motivational interviewing interventions for pediatric health behavior change. *J Consult Clin Psychol*. 2014;82(3): 521–535
50. Frielink N, Embregts P. Modification of motivational interviewing for use with people with mild intellectual disability and challenging behaviour. *J Intellect Dev Disabil*. 2013;38(4):279–291
51. Matheson B, Drahota A, Boutelle KN. A pilot study investigating the feasibility and acceptability of a parent-only behavioral weight-loss treatment for children with autism spectrum disorder. *J Autism Dev Disord*. 2019; 49(11):4488–4497
52. Anagnostou E, Aman MG, Handen BL, et al. Metformin for treatment of overweight induced by atypical antipsychotic medication in young people with autism spectrum disorder: a randomized clinical trial. *JAMA Psychiatry*. 2016;73(9):928–937
53. Bittner M, Goudy L, Dillon SR, Mcnamara S, Adams D. Exercise identified as an evidence-based practice for students with autism spectrum disorder. *Palaestra*. 2018;32(1):15–20
54. Malow BA, Byars K, Johnson K, et al; Sleep Committee of the Autism Treatment Network. A practice pathway for the identification, evaluation, and management of insomnia in children and adolescents with autism spectrum disorders. *Pediatrics*. 2012;130(suppl 2):S106–S124
55. Furuta GT, Williams K, Kooros K, et al. Management of constipation in children and adolescents with autism spectrum disorders. *Pediatrics*. 2012;130(suppl 2):S98–S105
56. Romano C, Dipasquale V, Gottrand F, Sullivan PB. Gastrointestinal and nutritional issues in children with neurological disability. *Dev Med Child Neurol*. 2018;60(9):892–896
57. Pratt JSA, Browne A, Browne NT, et al. ASMBS pediatric metabolic and bariatric surgery guidelines, 2018. *Surg Obes Relat Dis*. 2018;14(7):882–901
58. Murphy NA, Carbone PS; American Academy of Pediatrics Council on Children With Disabilities. Promoting the participation of children with disabilities in sports, recreation, and physical activities. *Pediatrics*. 2008; 121(5):1057–1061
59. Mahar MT, Murphy SK, Rowe DA, Golden J, Shields AT, Raedeke TD. Effects of a classroom-based program on physical activity and on-task behavior. *Med Sci Sports Exerc*. 2006;38(12): 2086–2094
60. Society of Health and Physical Educators (SHAPE). Providing community-based PE services for students with disabilities in special education transition programs: guidance document. 2016. Available at: <https://www.shapeamerica.org/publications/resources/pa/upload/Providing-Community-Based-PE-Services-for-Students-With-Disabilities-in-Special-Education-Transition-Programs-2.pdf>. Accessed September 27, 2017
61. US Department of Education, Office of Special Education and Rehabilitative Services, Office of Special Education Programs. Creating equal opportunities for children and youth with disabilities to participate in physical education and extracurricular athletics. 2011. Available at: <https://files.eric.ed.gov/fulltext/ED524248.pdf>. Accessed March 26, 2016
62. Kubik MY, Lytle LA, Story M. Schoolwide food practices are associated with body mass index in middle school students. *Arch Pediatr Adolesc Med*. 2005;159(12): 1111–1114
63. Provvienza CF, Hartman LR, McPherson AC. Fostering positive weight-related conversations between health care professionals, children, and families: development of a knowledge translation casebook and evaluation protocol. *Child Care Health Dev*. 2019; 45(1):138–145
64. Cermak SA, Curtin C, Bandini LG. Food selectivity and sensory sensitivity in children with autism spectrum disorders. *J Am Diet Assoc*. 2010;110(2): 238–246
65. Puhl RM, Schwartz MB. If you are good you can have a cookie: how memories of childhood food rules link to adult eating behaviors. *Eat Behav*. 2003;4(3): 283–293
66. Murray R, Ramstetter C; Council on School Health; American Academy of Pediatrics. The crucial role of recess in school. *Pediatrics*. 2013;131(1):183–188
67. Autism Speaks. ATN/AIR-P guide to exploring feeding behavior in autism. Available at: <https://www.autismspeaks.org/tool-kit/atnair-p-guide-exploring-feeding-behavior-autism>. Accessed December 18, 2017
68. Chazin, KT, Ledford JR. Reinforcement on the playground. Evidence-based instructional practices for young children with autism and other disabilities. Available at: <http://vkc.mc.vanderbilt.edu/ebip/reinforcement-on-the-playground>. Accessed March 20, 2019
69. Heckert RN, Yu CT, Barca M. Preference for food and non-food items of known reinforcing values in people with developmental disabilities. *J Dev Phys Disabil*. 2019;31:541–553
70. Styne DM, Arslanian SA, Connor EL, et al. Pediatric obesity—assessment, treatment, and prevention: an endocrine society clinical practice guideline. *J Clin Endocrinol Metab*. 2017;102(3):709–757
71. Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents; National Heart, Lung, and Blood Institute. Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents: summary report. *Pediatrics*. 2011;128(suppl 5): S213–S256
72. Marathe PH, Gao HX, Close KL. American diabetes association standards of medical care in diabetes 2017. *J Diabetes*. 2017;9(4):320–324

73. de Vinck-Baroody O, Shui A, Macklin EA, Hyman SL, Leventhal JM, Weitzman C. Overweight and obesity in a sample of children with autism spectrum disorder. *Acad Pediatr*. 2015;15(4):396–404
74. Mahajan R, Bernal MP, Panzer R, et al; Autism Speaks Autism Treatment Network Psychopharmacology Committee. Clinical practice pathways for evaluation and medication choice for attention-deficit/hyperactivity disorder symptoms in autism spectrum disorders. *Pediatrics*. 2012;130(suppl 2):S125–S138
75. Chen X, Beydoun MA, Wang Y. Is sleep duration associated with childhood obesity? A systematic review and meta-analysis. *Obesity (Silver Spring)*. 2008;16(2):265–274
76. Malow BA, Katz T, Reynolds AM, et al. Sleep difficulties and medications in children with autism spectrum disorders: a registry study. *Pediatrics*. 2016;137(suppl 2):S98–S104
77. Veatch OJ, Maxwell-Horn AC, Malow BA. Sleep in autism spectrum disorders. *Curr Sleep Med Rep*. 2015;1(2):131–140
78. Malow BA, Marzec ML, McGrew SG, Wang L, Henderson LM, Stone WL. Characterizing sleep in children with autism spectrum disorders: a multidimensional approach. *Sleep*. 2006;29(12):1563–1571
79. Ferguson BJ, Marler S, Altstein LL, et al. Associations between cytokines, endocrine stress response, and gastrointestinal symptoms in autism spectrum disorder. *Brain Behav Immun*. 2016;58:57–62
80. Kushak RI, Buie TM, Murray KF, et al. Evaluation of intestinal function in children with autism and gastrointestinal symptoms. *J Pediatr Gastroenterol Nutr*. 2016;62(5):687–691
81. Koppen IJ, Velasco-Bentez CA, Benninga MA, Di Lorenzo C, Saps M. Is there an association between functional constipation and excessive bodyweight in children? *J Pediatr*. 2016;171:178–182.e1
82. Hyman SL, Stewart PA, Schmidt B, et al. Nutrient intake from food in children with autism. *Pediatrics*. 2012;130(suppl 2):S145–S153
83. Bandini LG, Anderson SE, Curtin C, et al. Food selectivity in children with autism spectrum disorders and typically developing children. *J Pediatr*. 2010;157(2):259–264
84. Viscidi EW, Triche EW, Pescosolido MF, et al. Clinical characteristics of children with autism spectrum disorder and co-occurring epilepsy. *PLoS One*. 2013;8(7):e67797
85. Jeste SS, Tuchman R. Autism spectrum disorder and epilepsy: two sides of the same coin? *J Child Neurol*. 2015;30(14):1963–1971
86. Amiet C, Gourfinkel-An I, Bouzamondo A, et al. Epilepsy in autism is associated with intellectual disability and gender: evidence from a meta-analysis. *Biol Psychiatry*. 2008;64(7):577–582
87. Hamed SA. Antiepileptic drugs influences on body weight in people with epilepsy. *Expert Rev Clin Pharmacol*. 2015;8(1):103–114
88. Vasa RA, Mazurek MO, Mahajan R, et al. Assessment and treatment of anxiety in youth with autism spectrum disorders. *Pediatrics*. 2016;137(suppl 2):S115–S123
89. Gordon-Lipkin E, Marvin AR, Law JK, Lipkin PH. Anxiety and mood disorder in children with autism spectrum disorder and ADHD. *Pediatrics*. 2018;141(4):e20171377
90. Muskens JB, Velders FP, Staal WG. Medical comorbidities in children and adolescents with autism spectrum disorders and attention deficit hyperactivity disorders: a systematic review. *Eur Child Adolesc Psychiatry*. 2017;26(9):1093–1103
91. Anderson SE, Cohen P, Naumova EN, Must A. Association of depression and anxiety disorders with weight change in a prospective community-based study of children followed up into adulthood. *Arch Pediatr Adolesc Med*. 2006;160(3):285–291
92. Waring ME, Lapane KL. Overweight in children and adolescents in relation to attention-deficit/hyperactivity disorder: results from a national sample. *Pediatrics*. 2008;122(1). Available at: [www.pediatrics.org/cgi/content/full/122/1/e1](http://www.pediatrics.org/cgi/content/full/122/1/e1)
93. Cortese S, Angriman M, Maffei C, et al. Attention-deficit/hyperactivity disorder (ADHD) and obesity: a systematic review of the literature. *Crit Rev Food Sci Nutr*. 2008;48(6):524–537
94. Reekie J, Hosking SP, Prakash C, Kao KT, Juonala M, Sabin MA. The effect of antidepressants and antipsychotics on weight gain in children and adolescents. *Obes Rev*. 2015;16(7):566–580
95. Shelton RC. Depression, antidepressants, and weight gain in children. *Obesity (Silver Spring)*. 2016;24(12):2450
96. Maayan L, Correll CU. Weight gain and metabolic risks associated with antipsychotic medications in children and adolescents. *J Child Adolesc Psychopharmacol*. 2011;21(6):517–535
97. Scahill L, Jeon S, Boorin SJ, et al. Weight gain and metabolic consequences of risperidone in young children with autism spectrum disorder. *J Am Acad Child Adolesc Psychiatry*. 2016;55(5):415–423
98. Criado KK, Sharp WG, McCracken CE, et al. Overweight and obese status in children with autism spectrum disorder and disruptive behavior. *Autism*. 2018;22(4):450–459
99. Wink LK, Adams R, Pedapati EV, et al. Brief report: metformin for antipsychotic-induced weight gain in youth with autism spectrum disorder. *J Autism Dev Disord*. 2017;47(7):2290–2294
100. Gabovitch EM, Curtin C. Family-centered care for children with autism spectrum disorders: a review. *Marriage Fam Rev*. 2009;45(5):469–498

## Weight Management in Primary Care for Children With Autism: Expert Recommendations

Carol Curtin, Susan L. Hyman, Diane D. Boas, Sandra Hassink, Sarabeth Broder-Fingert, Lauren T. Ptomey, Meredith Dreyer Gillette, Richard K. Fleming, Aviva Must and Linda G. Bandini

*Pediatrics* 2020;145;S126

DOI: 10.1542/peds.2019-1895P

### Updated Information & Services

including high resolution figures, can be found at:  
[http://pediatrics.aappublications.org/content/145/Supplement\\_1/S126](http://pediatrics.aappublications.org/content/145/Supplement_1/S126)

### References

This article cites 92 articles, 15 of which you can access for free at:  
[http://pediatrics.aappublications.org/content/145/Supplement\\_1/S126#BIBL](http://pediatrics.aappublications.org/content/145/Supplement_1/S126#BIBL)

### Permissions & Licensing

Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:  
<http://www.aappublications.org/site/misc/Permissions.xhtml>

### Reprints

Information about ordering reprints can be found online:  
<http://www.aappublications.org/site/misc/reprints.xhtml>

# American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN®



# PEDIATRICS<sup>®</sup>

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

## **Weight Management in Primary Care for Children With Autism: Expert Recommendations**

Carol Curtin, Susan L. Hyman, Diane D. Boas, Sandra Hassink, Sarabeth Broder-Fingert, Lauren T. Ptomey, Meredith Dreyer Gillette, Richard K. Fleming, Aviva Must and Linda G. Bandini

*Pediatrics* 2020;145;S126

DOI: 10.1542/peds.2019-1895P

The online version of this article, along with updated information and services, is located on the World Wide Web at:

[http://pediatrics.aappublications.org/content/145/Supplement\\_1/S126](http://pediatrics.aappublications.org/content/145/Supplement_1/S126)

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 345 Park Avenue, Itasca, Illinois, 60143. Copyright © 2020 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 1073-0397.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN<sup>®</sup>

