Physical activity plays an important role in children’s cardiovascular health, musculoskeletal health, mental and behavioral health, and physical, social, and cognitive development. Despite the importance in children’s lives, pediatricians are unfamiliar with assessment and guidance regarding physical activity in children. With the release of the 2018 Physical Activity Guidelines by the US Department of Health and Human Services, pediatricians play a critical role in encouraging physical activity in children through assessing physical activity and physical literacy; providing guidance toward meeting recommendations by children and their families; advocating for opportunities for physical activity for all children in schools, communities, and hospitals; setting an example and remaining physically active personally; advocating for the use of assessment tools and insurance coverage of physical activity and physical literacy screening; and incorporating physical activity assessment and prescription in medical school curricula.

INTRODUCTION AND RATIONALE FOR PHYSICAL ACTIVITY ASSESSMENT AND COUNSELING

The 2017 Youth Risk Behavior Survey (YRBS) revealed that only 26.1% of American adolescents reported levels of activity consistent with current guidelines, and 15.4% of students reported not being physically active for at least 1 hour on a single day in the previous week. With the exception of increased sports participation among high school female students, overall youth physical activity levels have decreased. The lowest rates of physical activity occur among adolescent girls, children and youth with special health care needs (CYSHCN), and youth of minority status; rates of inactivity increased with age. Although only approximately one-fourth of children report meeting physical activity guidelines, objective measurement of activity by accelerometer reveals that less than half of children and 8% of adolescents were meeting the 2008 Physical Activity Guidelines from the US Department of Health and Human Services of 60 minutes daily of moderate-to-vigorous physical activity (MVPA) as...
recently as 2016.\textsuperscript{1,4,5} With rates of obesity rising over the last decades, annual relative increases of 4.8\% in the incidence of type 2 diabetes mellitus,\textsuperscript{6} and declines in estimated life expectancy at time of birth since 1993, the role of physical activity on child, and later adult, health remains an important component of preventive care and disease treatment.\textsuperscript{7,8}

In 2006, the American Academy of Pediatrics (AAP) published the policy statement "Active Healthy Living: Prevention of Childhood Obesity through Increased Physical Activity."\textsuperscript{9} That statement addressed not only the role of physical activity in obesity but also identification of individuals at risk for decreased physical activity, age-appropriate activity recommendations, and the role of schools in promoting activity.\textsuperscript{9} Since that time, the AAP and other organizations have published statements on the assessment, prevention, and treatment of pediatric obesity that include recommendations to promote improved nutrition and sleep, decreased sedentary time, and increased physical activity, although details regarding how to achieve physical activity recommendations are limited.\textsuperscript{10–13} Unfortunately, 5 years after the 2008 Physical Activity Guidelines were released, only 23\% of family physicians and 33\% of pediatricians were able to correctly identify current physical activity guidelines for children 6 to 18 years of age.\textsuperscript{14,15} Physical activity is a "priority topic" in Bright Futures: Guidelines for Health Supervision of Infants, Children and Adolescents, Fourth Edition, for every health supervision visit starting at 18 months of age, with inclusion of recommending meeting the Physical Activity Guidelines beginning at 5 years of age.\textsuperscript{16} The 2018 Physical Activity Guidelines outline the recommended physical activity levels for children and adolescents, provide guidelines for children younger than 6 years, and support the role of physical activity on not just physical health but also in development, mental health, and school performance (Table 1).\textsuperscript{17} As such, this clinical report replaces the previous statement on active healthy living, augments existing statements, highlights the role of physical activity in all children's health, and provides guidance for physicians to better assist families in increasing physical activity.

**PHYSICAL ACTIVITY AND HEALTH OUTCOMES IN CHILDREN AND YOUTH**

The relationships between physical activity, cardiovascular health, and body composition have been well established. Morris et al\textsuperscript{18} demonstrated decreased rates of adult coronary heart disease in active versus sedentary employees of the London Transport Executive in 1953. In the absence of longitudinal studies assessing the impact of childhood physical activity on adult mortality, studies have confirmed the benefit of physical activity on children's cardiorespiratory fitness, lipid profiles, insulin sensitivity, and serum glucose concentrations in individuals with obesity as well as associations with more optimal cardiovascular profiles in the most physically active children.\textsuperscript{19–24} Importantly, for the developing child, aerobic activity and strength training result in increased muscle mass and decreased fat mass.\textsuperscript{21,22,25} Physical activity also increases bone density and improves balance, protecting against falls and injury both in childhood and later in life.\textsuperscript{26–30} Overall, strong evidence supports that MVPA improves cardiovascular and muscular fitness, bone health, weight status, and cardiometabolic risk factor status in children and adolescents, as outlined by the 2018 Physical Activity Guidelines Advisory Committee.\textsuperscript{31}

Less widely appreciated, physical activity benefits behavioral, cognitive, and social aspects of child health. Increased physical activity has also been shown to be associated with decreased rates of smoking and fewer symptoms of depression, and increased rates of inactivity and sedentary activity can predict future alcohol and drug use in adolescents.\textsuperscript{32–34} Both randomized controlled trials and systematic reviews support the effect of physical activity on academic performance, possibly even in a dose-response relationship.\textsuperscript{35–41} Children who are provided opportunities to be physically active during school focus and behave better, including children with attention-deficit/hyperactivity disorder.\textsuperscript{42–44} Benefits may be even greater in children with autism spectrum disorder who show decreased perseverative behavior and easier redirection after a bout of physical activity.\textsuperscript{45,46} The 2018 Physical Activity Guidelines Advisory Committee concluded that in children ages 5 to 13 years, acute bouts of physical activity and regular MVPA

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|}
\hline
Age & Activity Amount & Intensity \\
\hline
3–5 y & 3+ h/d & Light, moderate, vigorous \\
6–17 y & \begin{tabular}{c}
\geq 60 min/d  \\
\end{tabular} & \begin{tabular}{c}
Moderate or vigorous aerobic activity daily  \\
 Vigorous at least 3 d/wk  \\
 Muscle-strengthening activities at least 3 d/wk  \\
 Bone-strengthening activities at least 3 d per wk  \\
\end{tabular} \\
\hline
Children not meeting guidelines & Gradually increase activity in ways the child enjoys & Moderate-vigorous; increase time per d and No. days per wk; use multiple, smaller time increments in activity that are additive throughout the day \\
\hline
\end{tabular}
\caption{2018 Physical Activity Guidelines Applicable to Children}
\end{table}

improve cognition, including memory, processing speed, attention, and academic performance.\textsuperscript{31}

Even more concerning than the rates of inactivity among children overall is the low rate of physical activity among CYSHCN.\textsuperscript{3} CYSHCN represent a wide range of children with chronic physical, developmental, behavioral, or emotional conditions.\textsuperscript{47} The benefits of physical activity for CYSHCN are substantial. Physical activity plays a vital role in strength, endurance, and bone health for all children and especially for children with neuromotor disorders such as spina bifida, muscular dystrophy and other myopathies, Prader-Willi syndrome, and cerebral palsy.\textsuperscript{48–54} Beyond musculoskeletal benefits, activity may play a role in speech and fine motor development, possibly through opportunities for social interaction, postural control and positioning, and use of orofacial muscles required for breathing during physical activity.\textsuperscript{55–60} Despite its pronounced benefits, rates of physical activity in CYSHCN are much lower than in health-normative peers.\textsuperscript{3,61} Any successful effort to increase physical activity requires approaches tailored to an individual’s unique needs.\textsuperscript{62}

Physical activity may also create unexpected benefits in children with other chronic health conditions. Children with a history of cancer experience increased rates of cardiovascular events, and physical activity has been shown to improve cardiovascular risk factors in this population.\textsuperscript{63–65} Physical activity also improves immune function, which may decrease pulmonary infection, and improves weight gain in children with cystic fibrosis.\textsuperscript{66–69} Physical activity benefits cardiorespiratory function in, and may be engaged in safely by, children with congenital heart disease under properly advised and supervised programs.\textsuperscript{70–72}

**CURRENT PHYSICAL ACTIVITY GUIDELINES IN YOUTH**

The 2018 Physical Activity Guidelines Advisory Committee reaffirmed the 2008 Physical Activity Guidelines, which recommend children and adolescents (6–17 years of age) engage in at least 60 minutes of physical activity every day, including vigorous-intensity as well as muscle- and bone-strengthening activities, at least 3 days per week (Table 1). The AAP has advised that physical activity should also include a muscle-strengthening program that targets all major muscle groups, starts with no load and incrementally may add load once exercise technique is mastered, involves 2 to 3 sets of 8 to 15 repetitions, and is performed 2 to 3 days per week for at least 8 weeks.\textsuperscript{73}

The 2018 Physical Activity Guidelines Advisory Committee concluded there is strong evidence that a greater volume of physical activity among children ages 3 to 5 years of age is associated with a decreased risk of excessive weight gain and improved bone health.\textsuperscript{31} The committee concluded these children should aim to achieve at least the median level of physical activity of children this age, which is 3 hours or more of physical activity per day.\textsuperscript{31} This is consistent with other guidelines that suggest that adults should provide opportunities for free play and unstructured physical activity for children 3 to 5 years of age,\textsuperscript{15,74} including at least 180 minutes of physical activity throughout the day (approximately 15 minutes every hour while awake) that helps to develop movement skills in a variety of activities and in a variety of environments. The higher volume of activity recommendation for children 3 to 5 years of age is based on the nature of their activity being intermittent and typically of lower intensity than older children.\textsuperscript{75} Infants should be physically active several times per day, mostly through interactive floor-based play.\textsuperscript{75} The AAP clinical report “The Power of Play: A Pediatric Role in Enhancing Development in Young Children” offers guidance on appropriate approaches for young children.\textsuperscript{76} Caring for Our Children: National Health and Safety Performance Standards; Guidelines for Early Care and Education Programs is another AAP publication providing guidance for child care settings.\textsuperscript{77}

For all children and adolescents, it is important that activities are appropriate to a child’s age, enjoyable, and varied.\textsuperscript{75} Examples of child and youth physical activities as well as recommendations based on the principles of frequency, intensity, time, and type of activity are included in Tables 2 and 3.

**THE IMPORTANCE OF PHYSICAL LITERACY IN SHAPING PHYSICAL ACTIVITY PARTICIPATION**

Attention to physical literacy, defined by the Aspen Institute as “the ability, confidence, and desire to be physically active for life” may provide an opportunity to increase and sustain physical activity across childhood and adolescence.\textsuperscript{80} Ability includes competence in fundamental movement skills including throwing, catching, jumping, striking, running, kicking, agility, balance, and coordination. Fundamental movement skills emerge starting with gross motor skill development in infancy and early childhood, progress throughout early and midchildhood, and are honed in preadolescence and adolescence (see Table 4).\textsuperscript{85} Competency in fundamental movement skills is a strong predictor of both current and future physical activity levels, cardiovascular fitness, BMI, and risk of overweight and obesity.\textsuperscript{86–88} Confidence, or self-efficacy in one’s ability to play sports or enjoy physical activity, develops from early positive experiences with physical play and a variety of sports that are inclusive and welcoming of...
Desire encompasses the interest and enjoyment in physical activity and movement.85 Teenagers report the strongest facilitators of physical activity include a favorable attitude toward physical activity; motivation; perception of competence and body image; fun; influence of friends, family, and physical education teachers; and environmental physical activity opportunities.91 Higher physical literacy is associated with higher physical activity levels and cardiorespiratory fitness in children and adolescents.92,93 On the other hand, children who do not develop fundamental movement skills are unlikely to develop the confidence and desire to be active and are at increased risk for sedentary lifestyle and its associated risks, as demonstrated by children with developmental coordination disorder who experience increased rates of obesity.94,95

Children who do not engage in regular physical activity miss out on important benefits such as improved self-esteem, leadership and team building skills, decreased stress and anxiety, decreased depression, and fun, as well as improved physical and brain health.74 Because physical activity is essential to normal pediatric development and health, the term “exercise deficit disorder” has been proposed to identify children who, for a variety of reasons, do not engage in sufficient physical activity to promote overall health.96

Many groups experience barriers to being physically active and developing fundamental movement skills, such as girls, children of minority status, children from low-income households (rural and urban), and CYSHCN.85 If these skills do not develop, the likelihood of being physically inactive later in life increases, creating an integral role for the pediatrician in screening for physical literacy, physical activity opportunities, and exercise deficit disorder97 and referring to a youth fitness specialist, physical education teacher, or physical and/or occupational therapist because structured programming improves fitness, strength, and functional movement skills.98,99 National standards outline physical literacy as the primary purpose of physical education classes in schools.100

The role of early physical activity and literacy on later adult health may play a role in fracture risk beyond effects of impact activities on bone density and geometry.101 Multidirectional ball sports earlier in life appear to protect against stress fractures in adolescent runners.102 Physical function or, rather, dysfunction has been found to be a contributor to adult “fragility.”

### TABLE 2 Examples of Types of Physical Activity

<table>
<thead>
<tr>
<th>MET</th>
<th>Physical Symptoms</th>
<th>Examples of Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Light</td>
<td>1</td>
<td>Easily able to converse</td>
</tr>
<tr>
<td></td>
<td>&lt;3</td>
<td>Household chores</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Walking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Playing catch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No sweating or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>shortness of breath</td>
</tr>
<tr>
<td>Moderate</td>
<td>3–6</td>
<td>Some difficulty talking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Feeling warm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Light sweating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slight shortness of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>breath</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unable to talk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Short of breath</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Face red</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sweating</td>
</tr>
<tr>
<td>Vigorous</td>
<td>&gt;6</td>
<td>Unable to talk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Short of breath</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Face red</td>
</tr>
<tr>
<td>Wheelchair use or use of assistive devices (crutches or ankle-foot orthoses)</td>
<td>Comparable METs expended for comparable examples noted above (eg, wheeling on a smooth surface = light; wheeling fast or up an incline or as part of ball sports = moderate; wheelchair racing or sit-skiing = vigorous) (use of crutches or ankle-foot orthoses involves higher METs but usually not enough to increase the level of PA, eg, from light to moderate)</td>
<td></td>
</tr>
<tr>
<td>Muscle strengthening</td>
<td>—</td>
<td>Pushing and/or pulling one’s body or an object</td>
</tr>
<tr>
<td>Bone strengthening</td>
<td>—</td>
<td>Increased impact</td>
</tr>
</tbody>
</table>

Data are from references 78–82. MET, metabolic equivalent of task; PA, physical activity; —, not applicable.
Because osteopenia only explains part of fracture risk, the role of sarcopenia, the loss of muscle, especially with aging, has been proposed as an important risk factor. Similar to exercise deficiency disorder, the term "dysmobility syndrome" has been coined for adults, both resulting from dynapenia, the loss of muscle.

INACTIVITY AND SEDENTARY TIME

The typical preschooler spends more than 6 hours per day in sedentary activity and just under 15 minutes per day in MVPA. More than 20% of children watch 3 or more hours of television per day on school days, and the average 8- to 18-year-old spends more than 7 hours per day in front of a screen.

The health effects of a sedentary lifestyle are an area of intense research and emerging concern. For adults, physical inactivity is associated with increased all-cause mortality, cardiovascular disease, cancer incidence and mortality, and diabetes incidence. Among other harmful health consequences, the 2018 Physical Activity Guidelines Advisory Committee concluded that there is limited available scientific evidence linking sedentary behavior to health outcomes; however, given the high prevalence of physical inactivity in youth, especially CSHCN, replacing some sedentary time with MVPA could improve health, given the strong association. More research is needed to better understand the effects of time spent sitting and in light-intensity physical activity among children and adolescents.

Although the advent of exergaming, or active video games, pose an attractive option to promote physical activity in children drawn to electronic media and video games and averse to traditional physical activity, exergaming primarily

### TABLE 3 Age-Appropriate Recommendations for Increased Physical Activity

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Intensity</th>
<th>Time</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant (0–1 y)</td>
<td>Daily</td>
<td>Any</td>
<td>Interactive floor-based play and at least 30 min of tummy time spread throughout the day while awake</td>
</tr>
<tr>
<td>Toddler (1–3 y)</td>
<td>Daily</td>
<td>Any</td>
<td>Activities that develop gross motor skills; examples include walking in the neighborhood, unorganized free play outdoors, walking through a park or zoo, or playing on a playground for toddlers</td>
</tr>
<tr>
<td>Preschool (3–5 y)</td>
<td>Daily</td>
<td>Any, including some moderate to vigorous</td>
<td>Activities that develop gross motor skills; unorganized free play in a safe environment; activities include walking, running, swimming, tumbling, throwing, and catching</td>
</tr>
<tr>
<td>Elementary (5–10 y)</td>
<td>Daily</td>
<td>Moderate to vigorous</td>
<td>Aerobic daily; vigorous activity, muscle, and bone-strengthening at least 3 d/wk; include free play with opportunities for fundamental movement skill development through walk, dance, jump rope. Introduce organized sports with flexible rules and short instruction time with a focus on enjoyment rather than competition</td>
</tr>
<tr>
<td>Middle School (11–14 y)</td>
<td>Daily</td>
<td>Moderate to vigorous</td>
<td>Aerobic daily; vigorous activity, muscle, and bone-strengthening at least 3 d/wk; incorporate activities that are enjoyable and encourage socialization; avoid sport specialization</td>
</tr>
<tr>
<td>Adolescence (15–18 y)</td>
<td>Daily</td>
<td>Moderate to vigorous</td>
<td>Aerobic daily; vigorous activity, muscle, and bone-strengthening at least 3 d/wk; incorporate activities that are enjoyable and encourage socialization and competition, when appropriate</td>
</tr>
</tbody>
</table>

Data are from references 9, 15, 73, 75, 83, and 84.
TABLE 4  Supporting Physical Literacy

<table>
<thead>
<tr>
<th>Toddler or preschool age: support development of fundamental skills</th>
<th>Infancy: supporting rudimentary motor skill development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encourage fun and socialization, incorporating activities preferred by the child, family walks, and chores (picking up, retrieving items, helping clean)</td>
<td>Grasping (3–4 mo)</td>
</tr>
<tr>
<td>Running (by 2 y)</td>
<td>Offer toys to support hand-eye coordination</td>
</tr>
<tr>
<td>Throwing (2 y)</td>
<td>Roll over (4–6 mo)</td>
</tr>
<tr>
<td>Catching (2+ y)</td>
<td>Tummy time to build core strength</td>
</tr>
<tr>
<td>Kicking (2 y)</td>
<td>Sitting (6 mo)</td>
</tr>
<tr>
<td>Play soccer with light, foam balls</td>
<td>Crawling (7–10 mo)</td>
</tr>
<tr>
<td>Swimming (1–4 y)</td>
<td>Place toys to help build strength and balance</td>
</tr>
<tr>
<td>Enroll in swimming lessons</td>
<td>Cruising (8 mo)</td>
</tr>
<tr>
<td>Skating (4 y)</td>
<td>Offer a safe environment to explore which increases strength and balance</td>
</tr>
<tr>
<td>Elementary school age: improve fundamental skills and develop self-efficacy</td>
<td>Walking (12 mo)</td>
</tr>
<tr>
<td>Encourage fun and socialization, incorporating fitness preferences (such as dance, yoga, running, hiking, sports), active transportation (walking, cycling to school and activities), and chores (walking the dog)</td>
<td>Create a safe environment to explore which improves balance and coordination</td>
</tr>
<tr>
<td>Running</td>
<td>Avoid sports specialization until mid-to-late teenaged years</td>
</tr>
<tr>
<td>Build fitness and skills with tag, introduce sports like soccer by age 6</td>
<td>Data are from references 16, 76, 83–85, 89, and 90.</td>
</tr>
</tbody>
</table>

Promotes only light physical activity, with few games demonstrating effectiveness in increasing activity to moderate or vigorous levels. Although MVPA occurs with specific games in structured settings, applicability to home settings and the ability to achieve sustained, or cumulative, durations necessary to meet physical activity guidelines has not been demonstrated.

The AAP advises that parents develop a family media use plan to help children limit screen time activities to ensure they do not replace adequate sleep, physical activity, and other behaviors essential to health. Likewise, Bright Futures: Guidelines for Health Supervision of Infants, Children and Adolescents, Fourth Edition, recommends physical activity and play as alternatives to screen time, as well as a way to promote family routine and social interaction, in addition to benefiting normal growth and development.

EVIDENCE IN SUPPORT OF PHYSICAL ACTIVITY PROMOTION IN PEDIATRIC CARE SETTINGS

Among adults, substantial international evidence supports the use of multiprong physical activity counseling and referral strategies, particularly those linking health care and community-based resources, to improve physical activity levels. Meta-analyses and systematic reviews have shown that physician counseling (odds ratio, 1.42; 95% confidence interval, 1.17–1.73) and exercise referral systems (relative risk, 1.20; 95% confidence interval, 1.06–1.35) promote improvements in adult patients’ physical activity for up to 12 months, with evidence supporting the notion that physical activity counseling can be successfully implemented in routine clinical practice and that protocols are acceptable among health care providers. Integration of physical activity counseling and referral strategies into adult primary care settings.
care settings has also been found to be cost-effective,\textsuperscript{124–126} provide early return on investment because of lower health care use and costs,\textsuperscript{129,130} and have been successfully scaled to national levels with adequate sustainability.\textsuperscript{128}

Although the experience from adult medicine shows that multicomponent intervention approaches can be effectively implemented within established primary care practices making use of existing resources and personnel, evidence on the effectiveness of physical activity promotion in pediatric settings is more limited.\textsuperscript{131} To date, most interventions have been centered on multiple health behaviors including sedentary time and healthy diet in the context of weight management. For example, the Patient-Centered Assessment and Counseling for Exercise Plus Nutrition (PACE+) intervention showed that computer-assisted, individually tailored counseling for physical activity in children 11 to 15 years of age can be effective in reducing sedentary time and improving compliance with physical activity guidelines at 12 months, particular among boys.\textsuperscript{132}

The Physical Activity Guidelines for Americans Midcourse Report assessed evidence-based recommendations to increase youth physical activity across multiple sectors.\textsuperscript{31} In this report, the authors found insufficient evidence to support specific strategies for physical activity promotion in the clinical setting.\textsuperscript{31} The 2018 Physical Activity Guidelines Advisory Committee remarked that this could be improved with more robust and standardized strategies incorporating additional team members and tools such as motivational interviewing and a specific exercise prescription.\textsuperscript{31} The committee also noted that individually focused interventions delivered in a variety of settings can successfully increase youth physical activity, especially when families and schools are incorporated into the interventions.\textsuperscript{31}

The Healthcare Effectiveness Data and Information Set measure on Weight Assessment and Counseling for Nutrition and Physical Activity for Children/Adolescents assesses the percentage of patients 2 to 17 years of age who had an outpatient visit with a primary care provider and who had evidence of BMI percentile documentation, counseling for nutrition, and counseling for physical activity during the measurement year.\textsuperscript{133} Depending on insurance type, 60% or fewer pediatric visits contained documentation of counseling for physical activity or referral for physical activity on the basis of administrative data or medical record review that included a note indicating the date and at least one of the following activities: (1) discussion of current physical activity behaviors (eg, exercise routine, participation in sports activities, examination for sports participation); (2) checklist indicating physical activity was addressed; (3) counseling or referral for physical activity; (4) member received educational materials on physical activity; or (5) anticipatory guidance for physical activity. Examples of notations that do not count toward this requirement include “notation of ‘cleared for gym class’ alone without any documentation of a discussion” or “notation of ‘health education’ or ‘anticipatory guidance’ without any specific mention of physical activity.”\textsuperscript{133}

The US Preventive Services Task Force recommends that clinicians screen children 6 years and older for obesity and offer them or refer them to comprehensive, intensive behavioral intervention that includes physical activity and nutritional counseling to promote improvement in weight status. Rated as a “B” recommendation, this strategy must be included in health plans under the Affordable Care Act’s Prevention and Health Promotion activities.\textsuperscript{134} Similarly, the AAP clinical report on obesity prevention also underscores the importance of physical activity promotion by pediatricians and other health care providers.\textsuperscript{10} Given the critical importance of play in childhood, of which physical play is one type, the AAP recommends that clinicians write a “prescription for play” at well-child visits in the first 2 years of life.\textsuperscript{76} Bright Futures: Guidelines for Health Supervision of Infants, Children and Adolescents, Fourth Edition, encourages play as a way to decrease screen time starting at 18 months of age, promoting behavioral management and social development starting at 2 years of age, and advancing to promotion of physical activity guidelines at 5 years of age for growth and development.\textsuperscript{16} As such, physical activity is a component of the Bright Futures health supervision priorities of social and emotional well-being, school readiness and performance, and risk-behavior reduction.\textsuperscript{16}

**ROLE OF PARENTS IN PHYSICAL ACTIVITY FOR CHILDREN**

Early in life, opportunities for the development of physical literacy occur at home. Parents are integral, not only in role-modeling movement, but also in playing with their children to allow for acquisition of necessary skills.\textsuperscript{76} The role of parents is even more important in CYHSCN given the complexity of needs and barriers to participation that children with disabilities face.\textsuperscript{135} Free-play is the primary exposure of necessity.\textsuperscript{76} Playing catch, climbing structures and natural elements, such as boulders and trees, and tag address skills in travel, hand-eye coordination, and balance and strength through natural exploration and fun play. Organized sports are unnecessary at early ages but are beneficial for more specific skill development once a child is ready on the basis of physical,
cognitive, and behavioral readiness.136 Children who engage in a variety of different activities and sports, especially those that help build fundamental movement skills such as gymnastics, swimming, and track will be more likely to develop physical literacy as well as enjoyment of physical activity and attain recommended levels of MVPA.85

Sport specialization, as outlined in the AAP statement “Sports Specialization and Intensive Training in Young Athletes,” is discouraged before puberty because there is no evidence that young children will benefit from early sport specialization in the majority of sports, and some data suggest that early specialization leads to higher rates of overuse injury and burnout from concentrated activity.83,137,138 Exposure to nature has also been shown to have its own benefits on health; thus, opportunities for play and movement outdoors, even in the smallest of green spaces, are important and create an increased appreciation of movement and nature.139,140

ROLE OF SCHOOLS IN PROMOTING PHYSICAL ACTIVITY IN YOUTH

In many areas, school provides the primary opportunity for physical activity and acquisition of physical literacy. In fact, the 2018 Physical Activity Guidelines Advisory Committee found strong evidence that interventions that affect multiple components of schools are effective for increasing youth physical activity, particularly among those at highest risk of physical inactivity, such as adolescent girls and children with limited access to safe and affordable activity opportunities outside of school.81 The American Heart Association calls for schools to become the central element in a community system that ensures that students participate in enough physical activity to develop healthy lifestyles.141 Developing physical education curricula that promotes enjoyment of movement and skill development is important, especially including CYSHCN, as is providing opportunities for movement before, during, and after school.142 National standards outline the role of physical education classes in physical literacy.100 It is important to recognize that in physical education classes at school, a number of factors have been shown to result in children spending less than 50% of class time engaged in MVPA.143,144 Opportunities for additional movement throughout the day through active classrooms benefit not only the child through increased physical activity but also the learning environment as a result of improved behavior.36,42,145 Recess and physical education during school that maximize movement and minimize sedentary and/or standing time and encourage social interaction are critical.146,147 Schools also provide a safe place for physical activity before and after school that many children do not have at home, especially outside, increasing the time spent in MVPA.148–150 SHAPE America, the Society of Health and Physical Educators, discourages the use and withholding of physical activity as punishment in schools.100

TOOLS FOR ASSESSING PHYSICAL ACTIVITY IN PEDIATRIC CLINICAL SETTINGS

In a nationally representative sample (N = 811) of US primary care physicians caring for children and adolescents (pediatrics and family medicine), most physicians reported assessing physical activity in youth using general questions about the amount of physical activity (98%).14 However, a lower proportion (66%) asked specific questions about duration, intensity, and type of physical activity, and only a minority reported using a standardized questionnaire (7%) or other written physical activity assessments (6%).14 In comparison, 98% of physicians reported regularly measuring weight objectively on a scale in the office setting.14 That the majority of pediatric primary care physicians report somehow assessing physical activity levels in their clinical practice is encouraging, but the study by Huang et al14 that revealed fewer than one-third of pediatricians could correctly identify guidelines calls into question the degree to which providers are correctly screening for insufficient physical activity or adequately counseling adolescents and their families on the recommended “dose” of physical activity for health.

Several methods have been used to assess physical activity in children and adolescents including questionnaires, activity logs, pedometers, and research-grade and consumer-oriented accelerometers. Practicality, validity, and reliability are important considerations when deciding appropriate methods to assess physical activity levels in clinical settings.120 Although physical activity is important, assessment of physical literacy (Table 4) is first necessary to quantify current activity, create appropriate goals for improvement, and allow for dose-response relationships to changes in other health parameters (and subsequent studies to demonstrate benefit or lack thereof) (Table 5). In the absence of opportunities to directly assess movement, quantification of physical activity may serve as a surrogate measure for younger children in representing opportunities for development of physical literacy. Simply asking children about their enjoyment of movement may provide insight into their physical literacy.105

In the adult population, systematic assessment of physical activity levels in clinical settings has been established through the integration of a self-reported physical activity vital sign (PAVS) into electronic health records (EHRs).151 The PAVIS has
Assessment of physical activity levels in youth via self-report is a more complex undertaking because youth are less likely to make accurate self-report assessments than adults because of developmental differences, especially in the ability to perform detailed recall and understand concepts regarding physical activity duration and intensity.\textsuperscript{161,162} In addition, youth have an activity pattern that is more variable and intermittent compared with adults.\textsuperscript{163} Furthermore, sports practices involve MVPA for only a fraction of the time, and the amount of time varies greatly by sport.\textsuperscript{164} A thorough review of physical activity assessment tools is included in the Supplemental Information.

### STRATEGIES TO OVERCOME BARRIERS TO PHYSICAL ACTIVITY ASSESSMENT, COUNSELING, AND REFERRAL IN CLINICAL PRACTICE

Physicians face many barriers to implementing physical activity assessment, counseling, and referral in clinical practice.\textsuperscript{151} Clinical visit times are short, and the list of preventive guidance to incorporate into well-child checks is long.\textsuperscript{151} Solutions will likely require interprofessional approaches and engagement with community organizations in development of tools to provide interventions and track physical activity, integration of measurements of activity into the EHR, and identification of associations with health outcomes.\textsuperscript{151} Regardless, physical activity assessment, counseling, and promotion follows the same approach as used in other areas of lifestyle change for chronic disease, yet it is applicable to all patients (Table 5).\textsuperscript{165}

Pediatricians will need efficient workflows to incorporate physical activity assessment, counseling, and referral into the clinical visit. This could be accomplished through a PAVS in the medical record, previsit questionnaires, or screening performed by support staff.\textsuperscript{151} EHR companies and health care institutions are encouraged to include tools to measure, document, report, and investigate physical activity measures and association with other health outcomes, including assessing for physical literacy. For example, the Intermountain Healthcare system developed and integrated into their EHR system a pediatric PAVS for use at preventive care visits for children ages 6 to 18 years.\textsuperscript{151} This tool combines the PACE+ validated item with the addition of questions to assess activity participation on specific settings and domains (physical education, recreation, sports, transportation, home, after school, sedentary or screen time) in an effort to facilitate compliance assessment and guide goal-setting and domain-specific counseling.\textsuperscript{151} Since 2011, the Kaiser Permanente Health System integrated the pediatric exercise vital sign, modeled after the YRBS questions, for youth 5 to 18 years (Fig 1).\textsuperscript{166} Although not yet formally validated in children, implementing the PAVS as a part of the health visit and within the EHR represents a starting point in initiating the conversation around physical activity in primary care and assessing the potential to predict future disease risk\textsuperscript{150} as well as determining the validity of the PAVS in pediatric practice.\textsuperscript{167} Brief tools for assessing physical activity are included in Table 6 (see the Supplemental Information for a full discussion regarding the tools and methodology used to identify advantages and disadvantages of each).

Similar to adult-based approaches, once the current physical activity level of the child is understood, providers can offer more specific, developmentally tailored physical activity advice or set an appropriate incremental goal for increase in activity and can include further guidance and referral resources in the after-visit summary.\textsuperscript{129} For children identified as needing further intervention, a brief follow-up visit could be scheduled, or the patient could be referred to a community

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**TABLE 5 Steps Toward Integrating Physical Activity Assessment and Counseling Into Clinical Practice**

1. Ask about current physical activity frequency and duration and enjoyment of movement.
2. If it is an acute or subspecialty visit, connect benefit of physical activity to current health condition and advise on restrictions in physical activity (if applicable).
3. If it is a health supervision visit, assess physical literacy and any gap between current and recommended activity level. Assess the patient and family interest in discussing promotion of physical activity.
   a. If not interested, provide information on the benefit of physical activity to current health, if the patient has any chronic issues, and/or future health (including athletic performance).
   b. If interested, discuss the reason for interest and potential area of change and establish a specific, attainable incremental goal to progress toward physical activity guidelines. Connect patient and/or family to resources to support achievement of goal, such as a physical education teacher, exercise specialist, physical or occupational therapist, or coach.
4. Recommend scheduling an appointment to discuss achievement toward goal, identify obstacles to change and establish new goals.
resource (such as a teacher or community center). In addition, support staff could receive appropriate training to elaborate on a provider’s physical activity prescription and connect patients with community and technology resources to fill the prescription. Special emphasis on addressing barriers for CYSHCN may be needed to assist patients and families with underlying mobility issues. Further guidance for CYSHCN may be found in the AAP clinical report “Promoting the Participation of Children With Disabilities in Sports, Recreation, and Physical Activities.”

Institutional support of pediatric physical therapists, occupational therapists, athletic trainers, exercise specialists, social workers, and other professionals is necessary to assist in addressing the needs of the children most at risk for inactivity, such as CYSHCN; children of minority, rural, and urban status who experience insufficient access or resources to physical activity; and adolescent girls. Ideal partnerships result in access to programs that are safe, close to home, financially feasible, fun, and culturally appropriate and offer adaptive experiences and intellectually appropriate programming (eg, Special Olympics) so that children facing barriers receive the same opportunities as their peers (Table 6).

Insurance companies can play a role by providing coverage for necessary services and reducing reasons for payment denials because improved physical literacy and physical activity, even for nonambulatory individuals, result in later health benefit and savings in health care expenditures.

**ROLE OF PHYSICIANS IN PROMOTING PEDIATRIC PHYSICAL ACTIVITY OUTSIDE OF DIRECT PATIENT CARE**

Many patients, families, and community organizations look to pediatricians to provide physical activity recommendations for sports participation, modifications for children with special needs or an acute or chronic injury, and increasingly for management of many physical and behavioral conditions such as prediabetes and attention-deficit/hyperactivity disorder. Yet many pediatricians may feel they do not have the experience or training needed to guide their patients toward meeting physical activity recommendations. In medical school, they likely received little to no training in exercise prescription. Most did not fare any better in residency, with only 26% of pediatric residency programs reported having a curriculum in physical activity counseling, with the greatest barrier being the lack of faculty with training in physical activity counseling, limiting provider knowledge and self-efficacy. Encouragingly, training pediatric residents in physical activity counseling has been shown to improve the physical activity of...
Implementing curricula and providing education is an effective first step (Table 7), which could be expanded to continuing medical education for practicing clinicians. Clinicians have a responsibility to model physical activity for their patients and families through their own physical activity and community engagement. Several studies have shown that physicians’ personal physical activity behaviors are an important correlate of their attitudes and clinical practice regarding physical activity.177,179 Interestingly, the greatest predictor of asking about physical activity by pediatricians is being personally “fit and healthy” themselves.180 In addition, physical activity is integral to personal well-being for the health care professional, improving quality of life and work-life balance and decreasing burnout.181-184 The AAP has published a clinical report on the subject.185

RECOMMENDATIONS

Pediatricians are encouraged to promote physical literacy and activity in children and progress toward recommended physical activity guidelines in one or more of the following ways.

1. Assess and document gross motor skills and physical activity as appropriate at health care visits (Table 5, Fig 1).
   a. Assess gross motor skill development, physical literacy, and physical activity levels at all health supervision visits, with early referral to assess and treat identified delays or deficits (Table 4). A PAVS tool may be a useful screening tool to guide specific counseling (Fig 1).
   b. For CYSHCN, discuss physical activity prescription and any physical activity limitations with subspecialists who are sharing in a patient’s care.
2. Discuss the role and benefits of physical activity on physical and social growth and development and management of other health conditions as well as in mental health, school performance, behavioral management, and risk-behavior reduction specifically related to the patient.
3. Encourage parents to not only “do as I say” but also “do as I do” because children who grow up in families with active parents are much more likely to be active themselves.
4. Provide specific tools and resources to help families build skills. Assist families in overcoming barriers to physical activity by referring families to community advocates and community-based activity programs and other places to be active, such as sports clubs, recreation centers, parks, walking and biking trails, skate parks, and playgrounds.
5. Advocate with health care organizations, insurance providers, schools, and community organizations to increase opportunities for physical activity for all children.
   a. Encourage healthy child care centers and preschools to provide ample opportunities for children to move in ways

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**TABLE 6** Resources for Pediatricians on Physical Activity Assessment and Counseling

<table>
<thead>
<tr>
<th>Resource</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institute for Healthy Childhood Weight</td>
<td><a href="http://ihcw.aap.org">http://ihcw.aap.org</a></td>
</tr>
<tr>
<td>Exercise is Medicine</td>
<td><a href="http://www.exerciseismedicine.org">www.exerciseismedicine.org</a></td>
</tr>
<tr>
<td>National Physical Activity Plan</td>
<td><a href="http://www.physicalactivityplan.org">http://www.physicalactivityplan.org</a></td>
</tr>
<tr>
<td>National Association of Physical Literacy</td>
<td><a href="http://napusa.org">http://napusa.org</a></td>
</tr>
<tr>
<td>SHAPE America: 2016 Shape of the Nation</td>
<td><a href="https://www.shapeamerica.org/advocacy/son/default.aspx">https://www.shapeamerica.org/advocacy/son/default.aspx</a></td>
</tr>
<tr>
<td>Prescription for Activity</td>
<td><a href="https://www.prescriptionforactivity.org/">https://www.prescriptionforactivity.org/</a></td>
</tr>
<tr>
<td>Lifestyle Medicine Education Collaborative</td>
<td><a href="http://lifestylemedicineeducation.org/">http://lifestylemedicineeducation.org/</a></td>
</tr>
<tr>
<td>National Association for the Education of Young Children: including Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth through Age 8, Third Edition, as a resource for schools</td>
<td><a href="https://www.naeyc.org/">https://www.naeyc.org/</a></td>
</tr>
</tbody>
</table>

SHAPE, Society of Health and Physical Educators.

**TABLE 7** Recommendations for Promoting Physical Activity Assessment and Counseling in Medical Education

1. Demonstrate assessment and counseling in practice for learners.
   a. Primary care pediatricians and health care providers: general physical activity assessment and screening, counseling and goal-setting, and activity or exercise prescription and referral to community partners and resources.
   b. Subspecialists: guidance on physical activity benefits and restrictions as related to relevant medical condition to patient, family, and other physicians involved in the patient’s care.
2. Advocate for the inclusion of education regarding physical activity guidelines within medical school and residency training.
3. Advocate for the inclusion of education regarding physical activity counseling and exercise prescription as part of longitudinal curricula within medical school and residency training.

Clearly document a patient’s individual physical activity prescription so that other providers, therapists, caretakers, and parents can help a child implement the prescription.
that they were designed to move, that is, in frequent, short bursts.

b. Support education policies that engineer physical education and literacy back into the school day and shared use policies that allow for safe, accessible, affordable access to recreational space.

c. Support the development of programs that provide resources for physical activity of children who are hospitalized (and their siblings) and for children needing additional resources to be physically active, such as CYSHCN and those who experience socioeconomic barriers.

6. Identify opportunities for physical activity assessment and prescription for children facing barriers to activity. Those most at risk for inactivity include children of minority, urban, and rural status, adolescent girls, and CYSHCN. In many cases, school-based physical activity interventions are the most promising approach to increase physical activity.186

7. Advocate for the inclusion of physical activity assessments within EHRs and use the assessments to provide patient-specific physical activity recommendations for pediatric patients.

a. Advocate for payment from public and private payers for administration of validated physical activity assessment instruments.

b. Investigate the type and effects of physical activity on health outcomes of pediatric patients.

8. Work with medical schools, residency programs, and health care institutions to develop curricula in exercise prescription and methods for physical activity assessment and prescription that include the recommended frequency, intensity, duration, and type of activity, taking into consideration the child’s current health, fitness, and preferences (Table 7).

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ABBREVIATIONS
AAP: American Academy of Pediatrics
CYSHCN: children and youth with special health care needs
EHR: electronic health record
MVPA: moderate-to-vigorous physical activity
PACE: Patient-centered Assessment and Counseling for Exercise plus Nutrition
PAVS: physical activity vital sign
YRBS: Youth Risk Behavior Survey

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REFERENCES


58. Oudgenoeg-Paz O, Volman MC, Leseman PP. First steps into language? Examining the specific longitudinal relations between walking, exploration and linguistic skills. Front Psychol. 2016;7:1458


104. Binkley N, Krueger D, Buhring B. What’s in a name revisited: should osteoporosis and sarcopenia be considered components of “dysmobility syndrome”? Osteoporos Int. 2013;24(12):2955–2959


111. Biddiss E, Irwin J. Active video games to promote physical activity in children


141. Pate RR, Davis MG, Robinson TN, Stone EJ, McKenzie TL, Young JC; American Heart Association Council on Nutrition, Physical Activity, and Metabolism (Physical Activity Committee); Council on Cardiovascular Disease in the Young; Council on Cardiovascular Nursing. Promoting physical activity in children and youth: a leadership role for schools: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism (Physical Activity Committee) in collaboration with the Councils on Cardiovascular Disease in the Young and Cardiovascular Nursing. Circulation. 2006;114(11):1214–1224


196. Brener ND, Collins JL, Kann L, Warren CW, Williams BL. Reliability of the Youth


200. Paridon SM, Alpert BS, Boas SR, et al; American Heart Association Council on Cardiovascular Disease in the Young, Committee on Atherosclerosis, Hypertension, and Obesity in Youth. Clinical stress testing in the pediatric age group: a statement from the American Heart Association Council on Cardiovascular Disease in the Young, Committee on Atherosclerosis, Hypertension, and Obesity in Youth. Circulation. 2006;113(15):1905–1920


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