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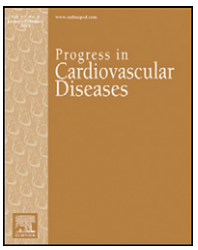

Supporting Public Health Priorities: Recommendations for Physical Education and Physical Activity Promotion in Schools

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ABSTRACT

Physical activity (PA) provides numerous physiological and psychosocial benefits. However, lifestyle changes, including reduced PA opportunities in multiple settings, have resulted in an escalation of overweight and obesity and related health problems. Poor physical and mental health, including metabolic and cardiovascular problems is seen in progressively younger ages, and the systematic decline in school PA has contributed to this trend. Of note, the crowded school curriculum with an intense focus on academic achievement, lack of school leadership support, funding and resources, plus poor quality teaching are barriers to PA promotion in schools. The school setting and physical educators in particular, must embrace their role in public health by adopting a comprehensive school PA program. We provide an overview of key issues and challenges in the area plus best bets and recommendations for physical education and PA promotion in the school system moving forward.

Physical activity and healthy growth and development

Health benefits of physical activity (PA) are well documented and include improved body composition and the prevention of overweight and obesity; and improved skeletal,[1] metabolic,[2] and cardiovascular health.[3,4] Benefits not only are limited to the biological, but also include numerous psychosocial advantages such as a reduction in the symptoms of depression, stress, anxiety, and improvements in self-confidence and self-esteem.[5,6] The collective benefits of participation in regular PA are important at all ages but critical in the formative years for healthy growth and development,[7,8] optimizing cardiometabolic function,[8] and preventing chronic disease.[9]

In recent decades, significant changes in lifestyle practices and reduced opportunities for PA mean that too many children and adolescents are not sufficiently active to realize health benefits. Declines in PA and corresponding increases in sedentary behaviors have resulted in an escalation of overweight and obesity and related health problems.[10–12] Outcomes are poor physical and mental health at progressively younger

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Abbreviations and Acronyms

CSPAP = comprehensive school physical activity program

CVD = cardiovascular disease

CRF = cardiorespiratory fitness

HOPE = health-optimizing physical education

VO_{2max} = maximal oxygen consumption

MVPA = moderate-to-vigorous physical activity

NASPE = National Association for Sport and Physical Education (NASPE)

PA = physical activity

PE = physical education

SCORES = Supporting Children's Outcomes using Rewards, Exercise and Skills

US = United States

ages such that children and adolescents present with metabolic and cardiovascular problems previously limited to adults (i.e., type 2 diabetes mellitus, atherosclerosis, etc.).

Health and motor-related components of fitness are markers of health status and influenced by physical growth and maturation during childhood and adolescence. Accordingly, it is challenging to separate the impact of regular participation in PA from growth and development *per se*. Growth and maturation continues despite limited physical activity, whereas sound nutritional practices (ideally in combination with PA), are essential to optimize growth and development. Therefore, when nutrition and PA is optimal, growth and development of an individual is more likely to match their genetic potential. Sadly, the opportunities for many youngsters to be PA are seriously limited[13] and this has resulted in significant declines in cardio-respiratory fitness (CRF).[14]

Current rates of physical activity

Many children and adolescents engage in low levels of PA and in many developed countries only a small proportion meet daily PA recommendations.[11,15,16] A concomitant trend is for sedentary behaviors to increase[17] such that physical inactivity is responsible for 6% of deaths globally (the fourth leading risk factor for mortality) and has been described as one of the greatest public health challenges of our time.[18]

Certainly PA guidelines have been developed based on empirical evidence and detail the minimum targets to maintain health at different ages.[17] These PA guidelines were originally developed for adults but have become progressively detailed for children of different ages. Such guidelines incorporate reference to intensity, duration and frequency of PA; however a primary question remains—how much PA is needed to provide a health benefit such as protection against metabolic and cardiovascular diseases (CVDs)? Clearly, PA guidelines must be used as indicators or desirable goals *above* habitual levels of PA. This is consistent with evidence from reviews of the literature that suggest that for positive health benefits from school-based interventions, exposure needs to be substantial, 60-min per day or higher.[4]

Start early to establish sound activity practices

Consistent with the notion of a link between early-life experiences and later health outcomes, greater attention is being given to the importance of exposure to PA opportunities during infancy and childhood. If health behaviors established during early life are more likely to persist or 'track' from childhood to adulthood, greater efforts should be made to capitalize on key opportunities, including in the school setting. Activity opportunities should not be considered solely in relation to physical education (PE) but also before and after school, during school breaks and where possible, an active curriculum.

Common sense suggests that individuals will be motivated to participate in and benefit more from engaging in PA they enjoy. Unfortunately, evidence suggests that we have engineered PA out of the daily lives of children and also often impose adult restrictions on activity time and movement opportunities.

Early, enjoyable activity experiences and 'tracking' of behaviors

Investment in PE has traditionally been predicated on the notion that physical skills developed during the elementary school years and consolidated during high school, would provide the foundation for engagement in PA in adulthood. In parallel with development of motor skills, is the expectation that PE is beneficial for the health of the developing child and that persistence or 'tracking' of PA into and across the adult years will provide ongoing health benefits.[19] However, very few longitudinal studies have addressed the long-term effect of PE as a child on physical activity as an adult and long-term general health and CVD benefits.[20]

Actual and perceived physical competences are important determinants of PA in young people, both of which contribute to an individual's success in physical endeavors and subsequent enjoyment.[21,22] Indeed, a recent systematic review and meta-analysis found a medium effect size for the relationship between affective judgment of PA (i.e., overall pleasure/displeasure, enjoyment, and feeling states) and actual behavior in young people, which is larger than other meta-analytic correlates in youth.[23] Logic suggests that enjoyment of PA as a youngster will increase the likelihood of the tracking of the PA habit across the lifespan.

Limitations of study design, including the widespread use of self-report *vs.* objective measures of PA, along with modest timeframes, have influenced our ability to be definitive regarding the tracking of PA[24] and the related impact of PE. From both a participation and health perspective, the nature of the activity experience, including stability over time requires further study to explore the tracking of different levels of PA. However, the rationale for commencing the PA experience from a young age, or intervening early in the case of inactive and overweight or obese children, is based on some degree of tracking of PA behavior or health parameter(s).[24] Telama et al.[19] have undertaken one of the most comprehensive analyses of tracking of multiple cohorts

from 6 to 27 years of age and confirmed that a physically active lifestyle commenced during the childhood years persists with moderate to high stability of PA from youth to adulthood.

Rationale for using schools for physical activity promotion

The foundations of PA behaviors are set early in life and influenced by a number of sectors in our society, including families, schools, community organizations, health care providers, faith-based institutions, government agencies, and the media. Based on the significant amount of time children spend at school, this sector has a great influence on promoting and improving PA in our youth.[25] The normal school day is usually 8–9 hours long and in most cases, a considerable proportion of this time is composed of sedentary activities.[25] In addition to the hours spent in school, in most countries children spend almost half of each calendar year in school. Therefore, schools are responsible for a large amount of contact time and have the potential to assist children in meeting their daily PA needs.[25]

A multi-component comprehensive school PA program (CSPAP) is needed to ensure that children get the opportunity to meet the PA guidelines of 60 minutes of moderate-to-vigorous physical activity (MVPA) each day.[26] The Centers for Disease Control and Prevention[26] suggest that a CSPAP should involve coordination across the following five components: 1) quality PE; 2) PA during the school day; 3) PA before and after school; 4) staff involvement; and 5) family and community involvement. Table 1 summarizes CSPAP recommendations.

Worldwide, PE is by far the most common method of promoting PA during the school day and a majority of countries have legal requirements for school PE for at least some part of the compulsory schooling years. Even in countries where PE may not be mandated by law, the subject is still offered. An estimated 5% of countries world-wide do not offer PE or only offer it to boys.[27] In regards to volume of PE, the National Association for Sport and Physical Education (NASPE) recommend that elementary and secondary schools provide 150 minutes and 225 minutes of PE each week, respectively.[28] In addition, PE should be enjoyable and keep students active for at least 50% of lesson time, as noted in the Healthy People 2010 objectives.[25] Although activity levels in both elementary and secondary school PE are often well below this guideline,[29] teachers can learn to increase the levels of MVPA in lessons by: 1) reducing the transition time between PA; 2) maximizing students' opportunities to be active; and 3) integrating fitness activities into more sedentary activities. Indeed, a recent systematic review and meta-analysis[30] found that interventions can increase MVPA in PE lessons by 24%.

Activity levels in PE are one measure of lesson quality, but young people also need to develop movement and behavioral skills that will enable them to be active within and beyond the school setting. Elementary school represents the ideal time for young people to acquire competency in locomotor (e.g., running and jumping) and object control (e.g., throwing and kicking) fundamental movement skills, that may provide the foundation for a lifetime of PA.[22] A recent review of the long-term effects of school-based interventions to increase PA, fitness and movement skills, found that the maintenance of effects was strongest for movement skills,[20] suggesting greater permanency compared to PA, which tracks at a low to moderate level from childhood into adolescence.[31] It has been suggested that school and PE focused on competitive team sports may contribute to the decline in PA observed during in adolescence.[32] Consequently, secondary schools are encouraged to provide adolescents with greater choice and expose them to a range of lifelong PA (e.g., health-related fitness activities) that may be easily carried into adulthood. In addition, PE should enhance young people's physical fitness, knowledge and behavioral skills (e.g., goal setting and self-monitoring).

Lunch and recess breaks represent valuable opportunities for young people to participate in a range of organized and unorganized PA. Just 5 to 10 years ago, 40% of school districts in the United States (US) were reducing or eliminating recess to devote more time to teaching and learning.[33] However, with rising concern over childhood obesity there has been a shift in trying to help children become more physically active. In 2006, nearly all elementary schools (96.8%) in the US provided regularly scheduled recess for students in at least one grade and 74% of elementary schools provided regularly scheduled recess for students in all grades.[34] It has been suggested that young people should be active for at least 40% of recess and lunch-time,[35] yet reviews have demonstrated that many young people, especially girls, spend the majority of break-time sedentary.[36] Evidence suggests that supportive school policies and the provision of playground markings and changes to the school physical environment can increase the PA of school children during recess in the short to medium term.[37]

School-based intramural activities also provide another opportunity to promote PA and encompass a variety of choices including sports (e.g., volleyball, tennis), individual lifelong PA (e.g., resistance training, walking, jogging) and classes or lessons (e.g., karate, dance).[38,39] They can be offered before or after school in both competitive and non-competitive environments and are often offered in all levels of education. In 2006, 49.5% of elementary schools, 48.5% of middle schools and 44.8% of high schools offered intramural activates or PA clubs to students.[34] Although interscholastic sports involve a high level of PA and are highly exclusionary, they play an important part in most secondary schools. In addition, interscholastic sports often play an integral part of most communities in promoting athletics. In 2006, 77% of middle schools and 91.3% of high schools in the US offered students opportunities to participate in at least one interscholastic sport.[34]

Participation in regular PA breaks during the school day is another way to promote PA and is more common among middle schools than elementary and high schools. Such strategies include the use of energizers (i.e., short physical activity breaks conducted in the classroom)[40] and integrating PA to assist learning in other curriculum areas (e.g., maths and science).[41] There is a growing body of evidence indicating a positive association (and perhaps causal relationship) between PA and executive functioning, concentration and on-task

Table 1 – Comprehensive school physical activity program recommendations.

Component	Description and Recommendations
Physical education	• Provide 150 minutes/week of PE for elementary schools • Provide 225 minutes/week of PE for secondary schools • Students are physically active for at least 50% of PE lesson time • Provide quality PE that is enjoyable and teaches students movement and behavioral skills in PE
Physical activity during school	• Provide students with opportunities to be active during recess and lunch-time • Provide playground markings, access to equipment and organized activities during break-times • Integrate physical activity into the classroom to assist learning in other curriculum areas (e.g., mathematics and science) and to break up sitting time (e.g., energizers)
Physical activity before and after school	• Offer a variety of intramural activities before and after school that are both competitive and non-competitive in nature • Promote active transportation to school (i.e., walking and riding to school)
Staff involvement	• Provide appropriate and on-going professional learning in physical activity instruction for staff members • Provide wellness programs for staff members that encourage them to role model physical activity • Encourage staff members to be active with students in PE and school sport
Family and community engagement	• Involve family members and guardians as volunteers in PE and school sport • Involve family members and guardians in evening and weekend special events • Establish joint-use and shared-use agreements with community organizations to encourage use of school facilities before and after school

behavior in young people,[42] which provides further justification for schools to explore novel opportunities to integrate PA into the classroom. In 2006, 43.6% of US elementary schools, 66.8% of middle schools, and 22.2% of high schools had students participate in regular PA breaks during the school day. In addition, 44.3% of all US schools supported or promoted walking or biking to and from school.[34]

School employees have an important role to play in the promotion of PA in the school setting.[26] In particular, both primary and secondary physical education teachers are role models for students and school wellness programs can contribute to the overall culture for PA at a school. In addition a CSPAP should include family and community engagement. Family members and guardians can facilitate a CSPAP by participating in special events and volunteering for PA and school sport activities. Finally, community involvement promotes the maximum use of school and community facilities within and beyond the school day.[26]

Clearly, schools play an important role in both promoting PA participation and educating children in the importance of PA. Despite wide variability in facilities and equipment from location to location, many schools are also well outfitted to promote PA to school-aged children and the wider community.

Evidence-based physical education and physical activity promotion in schools

Schools are widely recognized as important institutions for the promotion of PA and fitness in children and adolescents.[26,43–46] Indeed, a recent Cochrane review of school-based PA interventions reported improvements in MVPA ranging from five to 45 min/day and increases in maximal oxygen consumption (VO_{2max}) of 1.6 to 3.7 $mL \bullet kg^{-1} \bullet min^{-1}$.[47] Evidence suggests that CSPAPs[26] that include quality PE can improve the health of children and adolescents. Yet there are those who have questioned the role of schools and more specifically PE in supporting public health objectives.

In their seminal paper, Sallis and McKenzie[48] outlined the potential of school-based PE to improve child health and encouraged physical educators to collaborate with public health professionals to develop and evaluate evidence-based PE programs. The authors argued for health-related PE and the pursuit of public health goals,[48] partly because PE had embraced too many objectives and possessed a 'muddled mission.'[49] According to Sallis and McKenzie, the main objectives of health-related PE are to: 1) prepare youth for a lifetime of PA; and 2) provide them with PA during PE classes. Although many have embraced the role of schools and PE in achieving public health outcomes, others have argued the limitations of health-oriented PE.[50,51] More specifically, some have suggested the approach presents PA as an obligation or duty, with benefits that are extrinsic from the PA itself.[51] These individuals have argued for joy-oriented PE, where movement is considered a 'delightful distraction' driven by intrinsic satisfactions related to 'moving competently and creatively'. However, this argument is based on the flawed assumption that PE lessons involving high levels of MVPA cannot also be enjoyable for students.

On the 20th anniversary of their 1991 paper, Sallis and colleagues[52] published a follow-up paper describing the progress of PE in public health and made explicit the multi-dimensional nature of health-related PE. The authors described a comprehensive, but physically active approach that involves "teaching social, cognitive and physical skills, and achieving other goals through movement". Over the past 30 years a proliferation of studies have evaluated the effects of PE

programs designed to achieve multiple goals (e.g., knowledge, fitness and movement skills), while ensuring that students engage in high levels of MVPA.[53–55] The Sports, Play and Active Recreation for Kids[53] and the Child and Adolescent Trial for Cardiovascular Health[54,55] provided early evidence for the benefits of this approach for child health.

More recently, Kriemler and colleagues[46] demonstrated the utility of increasing the volume and intensity of PE lessons on body fat, fitness and overall PA in a sample of children attending Swiss elementary schools. Similarly, the Supporting Children's Outcomes using Rewards, Exercise and Skills (SCORES)[56] intervention adopted a socio-ecological approach that focused on providing professional learning for Australian elementary school teachers. SCORES was designed to provide teachers with the necessary training to increase levels of MVPA in PE, while promoting student enjoyment and the development of fundamental movement skills. The 12-month intervention resulted in significant improvements in PA, CRF and movement skills.[45] By contrast, interventions evaluated in the secondary school setting have produced more modest results.[57,58]

School-based interventions have demonstrated that health-oriented PE programs, now referred to as health-optimizing PE (HOPE), can involve high levels of PA, yet still achieve positive outcomes across a variety of domains. But the question remains whether or not the benefits of HOPE are sustained over time, as few studies have examined the long-term effects of school-based interventions.[44] Researchers rarely report the sustained impact of their intervention once the support from the research team has been removed. Furthermore, there is little evidence to suggest that evidence-based HOPE programs are being adopted and implemented in the US[52] and throughout the world.

Barriers to physical activity promotion in schools

There are a number of commonly cited barriers to PA promotion in the school setting. These may be broadly categorized as institutional (concerning school policies, facilities and administrative support), teacher-related (arising from the teachers' beliefs and skills) or student-related (relating to the student population).[59] Barriers often differ by school level (i.e., elementary *vs.* secondary) and level of experience (i.e., specialist versus non-specialist),[60] yet there is consistency in the types of barriers reported across the globe.

Poor access to facilities and equipment, low subject status and the crowded school curriculum (generally manifested in lack of time allocated to PE) have been identified as barriers to PA promotion in both elementary and secondary schools in Australia, the U.S. and the United Kingdom.[59–64] In a survey of 115 Australian secondary school PE teachers, the crowded school curriculum and lack of facilities were the two most commonly cited barriers to student participation in PE and PA.[60] Similarly, a survey of elementary school teachers from the US revealed that institutional barriers, including the number of PE specialists, lack of financial resources and the crowded school curriculum were the most frequently identified barriers.[63] School facilities, time allocated to PE and other reported institutional barriers to PA are controlled by the principal and other school administrators, which may explain why teachers and principals often report different barriers.[63] Nevertheless, these findings reinforce the importance of engaging key stakeholders in the design and evaluation of CSPAPs.

Teacher-related barriers differ by school level, with non-specialist elementary school teachers often reporting a lack of confidence in their ability to teach PE.[59] Lack of interest, poor attitudes to PE and inadequate expertise and qualifications have also been described in previous studies with non-specialist elementary school teachers.[59,65] Alternatively, fewer teacher-related barriers have been reported in secondary school studies,[60,64] but difficulty engaging students and the low levels of students' interest in PE and PA were noted in a recent Australian study.[60] Participation in PE[34] and PA[66] decline during adolescence, with smaller declines observed among youth with higher levels of motivation,[67] perceived behavioral control, social support for PA, and self-efficacy.[68]

Schools may assist in preventing PA decline, but many non-specialist elementary and secondary school teachers do not possess the necessary skills and knowledge to engage adolescents in HOPE. The declining levels of motivation observed among adolescents combined with the low levels of MVPA typically observed within PE lessons,[29] highlight the need for professional learning opportunities for both non-specialist and PE specialist elementary and secondary school teachers. Although schools are well positioned to provide all students with opportunities to be physically active, it is clear that many schools are not achieving their potential. Indeed, the importance of schools to provide and promote PA is more important now than during previous decades when young people accrued considerable amounts of PA as part of their daily living.[69]

Recommendations

The foundations of PA behaviors are set early in life and schools have an important role to play in shaping young people's activity behaviors. A CSPAP should consist of PE and other PA opportunities such as recess, intramurals, interscholastic sports, classroom PA breaks and walk and bicycle to school initiatives.[34]

Due to the relationship schools have with their communities, both local and national governments need to be involved in developing CSPAPs. Governments can provide leadership by requiring schools to provide daily PE and other PA opportunities before, during, and after school and by enabling schools to establish health-promoting environments that support PA. For example, governments can mandate the amount of time allotted for PA during the school day/week. A number of organizations have advocated for PE instructional periods totaling 150 min/week for elementary students and 225 min/week for middle and secondary school students.[28,70] In addition, PE needs to focus more on giving students the knowledge and skills to participate in a lifetime of PA.

Schools could also promote PA in schools outside PE classes by incorporating at least 20 minutes of recess per day.[71] Again, governments could mandate the time allowed

for recess, and PA breaks should also be built into the classroom, for example, walks outside as part of a science class, etc. Schools should also offer PA opportunities before, during or after school as part of intramurals and interscholastic sports programming, and schools should participate in International Walk to School Week and support ongoing walk and bike to school programs by creating safe routes to school, and providing access to secure bike racks.[25]

Finally, physical educators must be key drivers of physical and health literacy and behavior change to optimize the PA of children and adolescents. For parents, physical educators need to provide information regarding the benefits of PA via messages sent home and different school activities. In addition, physical educators need to encourage families to become involved in school-based PA and events. Since non-specialist classroom teachers and staff often serve as role models for children, physical educators need to encourage school staff to be more physically active.

Statement of Conflict of Interest

The authors report no conflicts of interest.

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