

II. PHYSICAL ACTIVITY: MEASUREMENT AND BEHAVIORAL PATTERNS IN CHILDREN AND YOUTH

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ABSTRACT With physical activity levels among children and adolescents at an all-time low, there is a critical need for scientists and public health officials alike to further examine the physical activity behaviors of this population. Accordingly, this chapter will act as an entrée to the rest of the monograph by providing a general overview of the epidemiology of physical activity among youth in the United States. In so doing, we discuss the following: public health guidelines for youth-based physical activity, current rates and trends of physical activity participation in youth, issues related to physical education rates in school systems, lifestyle practices that encourage sedentary behaviors and attendant disease states, a synopsis of the health-related benefits of a physically active lifestyle, promotion of and opportunities for increased engagement, and comparisons of objective and subjective methods of measuring physical activity.

The health-related literature suggests that physical activity levels among children and adolescents have witnessed significant declines over the last several decades (Salmon & Timperio, 2007). Support for such a claim, however, is equivocal; due primarily to a lack of longitudinal evidence, coupled with relatively poor and changing methods of assessment. Nevertheless, it appears that physical activity levels in youth as a whole are significantly lower than the nationally recommended guidelines for health-related outcomes. In particular, escalating engagement in sedentary behaviors (Brownson, Boehmer, & Luke, 2005; Pate, Mitchell, Byun, & Dowda, 2011) combined with lower rates of active transport, cuts to and elimination of physical education programs, and various societal trends (Dollman, Norton, & Norton, 2005) provide sufficient reason to believe that more effective means of education and intervention for youth-based physical activity are necessary, particularly to prevent and/or minimize the wide range of negative health-related consequences associated with physical inactivity. Accordingly, this chapter provides an overview of

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Support from the National Institute on Aging (Grant # AG 5 R01 AG020118-08) facilitated the writing of this chapter.

physical activity guidelines for youth, insight into their current rates, trends, and patterns of physical activity participation, highlights of health-related benefits, a summary of commonly identified youth-based correlates and determinants of physical activity behavior, and a synopsis of measurement-related issues and concerns. The chapter concludes with a discussion on directions for future research and suggestions for increasing opportunities for regular physical activity engagement in the youth demographic.

PHYSICAL ACTIVITY GUIDELINES

In light of the worldwide obesity epidemic and high prevalence of non-communicable diseases (e.g., cardiovascular disease, chronic respiratory diseases, type 2 diabetes; WHO, 2011), most developed countries, in partnership with national and global health organizations, have developed specific guidelines for physical activity participation among various segments of the population (Janssen, 2007). The importance of encouraging regular physical activity participation in youth is primarily based on the following health-related concerns: (1) to positively augment growth and development, to enhance physical fitness and health, and to improve general well-being; (2) to nurture and create active lifestyles that lead into adulthood; and (3) to minimize the risk of developing chronic diseases (Biddle, Sallis, & Cavill, 1998). With these goals in mind, physical activity recommendations for children and adolescents indicate that at least 60 min of primarily aerobic physical activities of moderate-to-vigorous intensities should be accumulated on a daily basis to attain fitness- and health-related benefits (Janssen & LeBlanc, 2010; USDHHS, 2008). Additionally, age-appropriate muscle- and bone-strengthening activities should be incorporated into physical activity routines at least three times per week (Janssen & LeBlanc, 2010; USDHHS, 2008). It is important to note that youth engagement in physical activity does not need to be continuous in nature, as children and adolescents often exhibit rather short and sporadic bouts of activity in natural settings (Bailey et al., 1995). Thus, youth are encouraged to accumulate at least 60 min of intermittent physical activity each day, rather than meet this guideline with a single 60-min bout of exercise. Furthermore, providing youth with options that are enjoyable and include opportunities for increased socialization are critical for boosting regular physical activity participation in this demographic (USDHHS, 2008; Welk, 1999).

PHYSICAL ACTIVITY TRENDS

Technological advances, labor saving devices, and enhanced transportation systems have proliferated at an unprecedented rate resulting in

reduction in activity across the societal landscape (Brownson et al., 2005). Secular trends suggest that declines in physical activity among children and adolescents may in part be due to decreases in the frequency of active transportation and physical education and increases in sedentary behaviors (Salmon & Timperio, 2007; Dollman et al., 2005; Pate et al., 2011). The rate of decline in physical activity is also exacerbated as they progress from infancy through adolescence and onto adulthood (Craggs, Corder, van Sluijs, & Griffin, 2011). Thus, it is vital to accurately determine current physical activity rates among youth to effectively determine which environments are most amenable to intervention by researchers and health practitioners, and thereby reverse these declines. The following section details the current rates of physical activity participation in youth and highlights various areas that have contributed to these declines.

Current Rates

According to data from the 2011 Youth Risk Behavior Surveillance survey, more than 70% of American youth did not meet the national physical activity guidelines of accumulating at least 60 min of moderate-vigorous aerobic activity on a daily basis (CDC, 2012). Further, data indicate that only 18.5% of females meet the physical activity guidelines compared to 38.3% of their male counterparts. Approximately half of those surveyed did not adequately engage in physical activities over a 5-day period and 14% did not participate in *any* type of substantial physical activities during any day of the week. In terms of muscle-strengthening activities, approximately 45% of youths surveyed did not meet the recommendation of engaging in such activities (e.g., weightlifting, push-ups, pull-ups) on at least three or more days over a 7-day period (CDC, 2012). Whereas the failure of youth, as a whole, to meet health-related physical activity guidelines could certainly be attributable to unique individual factors (e.g., behavioral control, self-efficacy), it is more likely that relatively recent and rapidly increasing social and environmental changes have greatly contributed to lower rates of participation.

Physical Education

Physical education classes that focus on improving and maintaining physical fitness and health can provide youth with an arsenal of knowledge, skills, strategies, and mastery experiences to assist with leading a healthy and active lifestyle. Unfortunately, opportunities for children and adolescents to regularly engage in physical activities throughout the school day are becoming increasingly limited, and, in some cases, are being abandoned altogether (Hillman et al., 2009; IOM 2013). Recent data indicate that roughly 30% of American youth are offered physical education classes on a

daily basis, whereas the majority (nearly 50%), do not engage in any form of physical education during the school week (CDC, 2012). Such results are not entirely surprising, however, as federal law does not require schools to offer physical education to students. As a result, state governments set varying guidelines and requirements for physical education among school children within each state. The ultimate implementation of these programs is often left to independent school districts; however, due to a lack of oversight and accountability, many schools do not meet state-based expectations for providing “adequate” amounts of physical activity to students (NASPE & AHA, 2012). These poor rates of engagement throughout the school day are often the result of a lack of resources due to underfunded programs (NASPE & AHA, 2012). Furthermore, increases in classroom time for the purpose of improving academic achievement, especially performance on standardized testing, has resulted in cutbacks to and the elimination of physical education (Castelli, Hillman, Buck, & Erwin, 2007). However, the rationale for decreasing or eliminating physical education classes to enhance academic performance is unsubstantiated with no empirical evidence to support the position that replacing time dedicated for physical activity with additional classroom-based academic pursuits will result in improved academic achievement (Sallis, 2010; see Chapter 7 for a more detailed discussion). Even if academic performance did not improve as a function of regular physical education, such a null relationship would be beneficial, because the increase in physical activity would not harm academic performance while resulting in an array of health benefits. Regardless, a growing literature base suggests that incorporating bouts of physical activity into the school day is associated with greater attention and improved learning (Coe, Pivarnik, Womack, Reeves, & Malina, 2006). Schools are ideal settings to promote physical activity participation in children and adolescents, primarily because a majority of their daily lives are spent within the confines of school walls. Whether it be via daily physical education classes or regularly scheduled activity breaks, schools can provide today’s youth with the opportunity to meet or, at the very least, adequately approach recommended levels of physical activity for health- and fitness-related benefits (Cale & Harris, 2005).

Unstructured Play

Most physical activities undertaken by youth, particularly in children, are reflected in forms of unstructured play (Epstein, Saelens, & O’Brien, 1995; Tomporowski, 2003), in contrast to engagement in traditionally structured exercise programs, which are more common and appropriate for the adult population. Unfortunately, evidence suggests that the amount of time spent participating in self-selected physical activities during discretionary time has been on the considerable decline over the last three decades (Burdette &

Whitaker, 2005; Hofferth, 2007; Hofferth & Sandberg, 2001). These declines may be attributed to factors such as parental employment, concerns about environmental/community safety, and increased engagement of sedentary behaviors. Additionally, the decline of sport participation, as a result of both age and its highly organized and competitive nature, further contributes to the concern over the lack of physical activity engagement during free time (Stubbe, Boomsma, & de Geus, 2005; Johnston, Delva, & O'Malley, 2007). It has been suggested, however, that encouraging play in this demographic may be a more successful way of promoting physical activity, rather than focusing on the importance of health-specific outcomes. Children tend to choose active play for a variety of reasons, including increased social involvement and a sense of affiliation, perceptions of choice and/or control, desire for achievement, improved self-esteem, and fun (Burdette & Whitaker, 2005). Time for play, however, seems to be diminishing among today's youth. According to the American Academy of Pediatrics Committee on Sports Medicine and Fitness (2001), this may be due to today's increased demands on a young person's time, reductions in physical activity requirements at school, and numerous competing options for the way in which "free" or leisure time is spent. It has therefore been suggested that reinforcing a reduction in sedentary behaviors can provide youth with the opportunity to choose how to allocate newly available time, and as a result, this new opportunity to choose among alternatives can be reinforcing (Epstein et al., 1995). Thus, further promotion and examination of unstructured play (especially outdoors; Cleland et al., 2008) as a form of accumulating physical activity for health and fitness is warranted.

Active Transport

The frequency of active transport (e.g., walking, biking, skating) among youth also appears to be on the decline (Chillón, Evenson, Vaughn, & Ward, 2011; Faulkner, Buliung, Flora, & Fusco, 2009; Tudor-Locke, Ainsworth, & Popkin, 2001). For example, McDonald (2007) reported that active transportation for school-aged children has decreased from roughly 40% in 1969 to nearly 10% in 2001. Although it is unclear as to the underlying reasons for this dramatic decline, it has been speculated that this proactive avoidance of potentially (real or perceived) hazardous environments and the overall safety of youth may play a role (Salmon & Timperio, 2007).

Technology and Sedentary Behaviors

Across the demographic and socioeconomic landscape, our society has become permeated with technological advances that are readily accessible and often considered indispensable for everyday use and functioning (Jeffery

& Utter, 2003). Such widespread use of technology has been associated with or, in some cases, directly resulted in poor behavioral trends (e.g., physical inactivity) and negative health outcomes (e.g., obesity). Ever increasing options for and accessibility of technology-based activities (e.g., video games, Internet use, television) during one's leisure-time has been identified as one of the primary contributing factors to increased sedentary behavior among children and adolescents (CDC, 2012; Tremblay et al., 2011). A growing evidence base suggests that, on average, children and youth spend up to 8 hr per day engaged in sedentary activities (Matthews et al., 2008; Whitt-Glover et al., 2009). This represents a grave public health concern, as sedentary behaviors have been associated with an array of preventable health-related consequences in youth, including, but not limited to, increased body mass index, greater risk for cardiovascular disease, and reduced well-being (Tremblay et al., 2011).

HEALTH-RELATED BENEFITS OF PHYSICAL ACTIVITY

Many health organizations (e.g., National Institutes of Health; Centers for Disease Control and Prevention; Institute of Medicine; Robert Wood Johnson Foundation; World Health Organization) and scientific communities (e.g., American College of Sports Medicine; American Alliance for Health, Physical Education, Recreation, and Dance; Society of Behavioral Medicine; International Society for Physical Activity and Health) have made considerable efforts to delineate the benefits of physical activity for youth, highlighting the importance of—and need for—increased involvement.

Physical Health Benefits

The physical benefits associated with regular participation in physical activities have been well documented in children and adolescents (Janssen & LeBlanc, 2010; Lobstein, Baur, & Uauy, 2004). Specifically, an abundance of scientific evidence strongly supports the positive effects of physical activity on cardiovascular disease risk profiles, musculoskeletal health, and adiposity levels of overweight and obese youth, while moderate support exists for the advantageous effects on “normal weight” individuals, including improvements in blood pressure, levels of cholesterol, weight maintenance, and decreases in cardiovascular risk factors (Strong et al., 2005). Additional benefits include optimal growth, development, and function, improvements in cardiorespiratory fitness and pulmonary function, as well as a reduction in risks factors for chronic diseases (e.g., type 2 diabetes). Moreover, many observational studies have supported a dose–response relationship, whereby higher levels of activity are commonly associated with greater physical health

outcomes, and a number of experimental studies have indicated that even modest amounts of physical activity can lead to significant improvements in the physical health of children and adolescents (Janssen & LeBlanc, 2010). In terms of mode, aerobic activities of moderate to vigorous intensity appear to be the most effective way to attain a majority of these physical benefits, with the exception of improved bone health, which typically requires high-impact, weight-bearing activities (Janssen & LeBlanc, 2010).

Psychological Health Benefits

Research examining the influence of physical activity on the psychological health of children and adolescents is somewhat limited (Whitelaw, Teuton, Swift, & Scobie, 2010) with the majority focused on the relationships of physical activity on self-esteem, depression, and anxiety (Biddle & Asare, 2011). Of these three constructs, self-esteem has received the greatest attention. According to a meta-analysis of youth-based randomized controlled trials, exercise interventions typically produced modest positive effects on global self-esteem when compared to no-intervention controls (Ekeland, Heian, Hagen, Abbott, & Nordheim, 2004). Evidence detailing the influence of physical activity on depression and anxiety of youth is limited in terms of high-quality longitudinal studies and randomized controlled trials (Biddle & Asare, 2011; Brown, Pearson, Braithwaite, Brown, & Biddle, 2013; Kremer et al., 2013). However, there is some evidence that suggests that physical activity provides a small yet statistically significant effect in reducing symptoms of depression and anxiety in children and adolescents (Larun, Nordheim, Ekeland, Hagen, & Heian, 2006).

Cognitive Health Benefits

An ever-growing evidence base supports the role that physical activity plays on the cognitive function of children and adolescents (Biddle & Asare, 2011; Chaddock, Pontifex, Hillman, & Kramer, 2011; Hillman, Erickson, & Kramer, 2008; Tomporowski, Davis, Miller, & Naglieri, 2008; see Chapters 3, 5, and 7). Indeed, research suggests that integrating physical activity throughout the school day may enhance learning via enhanced attention span and concentration (Maeda & Murata, 2004; Pellegrini & Bjorklund, 1996; Shephard, 1997). Such suggestions are primarily based on the positive effects of physical activity on academic achievement. For example, higher levels of participation in vigorous physical activities have been shown to be associated with better grades in youth (Coe et al., 2006), and acute bouts of aerobically based physical activity in particular have revealed improved performance on academic achievement tests (Hillman et al., 2009; IOM, 2013). Whereas this specific area of research is still relatively new

within the fields of health, kinesiology, and neuroscience, research continues to produce small yet significant results in favor of physical activity on academic achievement (Sibley & Etnier, 2003).

CORRELATES AND DETERMINANTS OF PHYSICAL ACTIVITY BEHAVIORS

A plethora of research regarding the correlates of physical activity behaviors in children and adolescents exists. Well-established correlates include: fixed or relatively stable demographic factors and physical traits, such as age, sex, and socioeconomic status, as well as body composition; psychosocial variables, such as self-efficacy to maintain physical activity and to overcome barriers to participation, and social support from parents, siblings, and peers; perceptions of the physical environment (i.e., safety, accessibility, and structure); and behavioral variables such as screen time, sport participation, and poor diet (Sallis, Prochaska, & Taylor, 2000). Longitudinal research examining potentially influential variables of this demographic is still fairly limited and has been equivocal. As a result, a recent systematic review of the literature (Craggs et al., 2011) identified the following as consistent determinants of physical activity: maturation, self-efficacy, behavioral control, parental and social support, and socioeconomic status. These determinants of change can be used to not only reduce rates of decline in physical activity participation, but may lead to improvements and/or maintenance, as well.

Barriers and Facilitators

Children and adolescents face many barriers to regular physical activity participation, some of which are relatively stable and difficult to change, while others are fairly dynamic and readily targetable. Common barriers include: poor physical condition and function; a lack of athletic competence; concern with physical appearance and body image; antipathy toward highly structured and overly competitive activities organized by adults; conflicting interests and schedules, such as attending school; participating in extracurricular activities; and regularly utilizing technology-based entertainment (Bragg, Tucker, Kaye, & Desmond, 2009; Rees et al., 2006). Although many of these barriers are also common among adults, several are unique to children and adolescents. Consequently, many of these youth-specific barriers can be difficult to overcome, as various parental, sociocultural, and environmental constraints can limit their ability to take personal action and responsibility to become more physically active.

Despite these common restrictions and potential limitations to being physically active, there are several important facilitators of regular physical

activity participation for youth. For example, there is a general agreement that children and adolescents are more likely to be active if they are provided with opportunities for fun and socialization with their peers (Allender, Cowburn, & Foster, 2006). Moreover, perceptions of autonomy and choice tend to lead to greater levels of activity, especially when trying to avoid general boredom (Hagger, Chatzisarantis, & Biddle, 2002). Additional facilitators that are common among youth include positive affect and well-being, weight control, and social support from family and friends (Bragg et al., 2009; Rees et al., 2006). Interventions and programmatic approaches to increasing and maintaining physical activity among children and adolescents are likely to meet with greater success if the above determinants are integrated into program content.

PHYSICAL ACTIVITY MEASUREMENT

An array of methods exists for measuring physical activity in children and adolescents. As such, there are several issues that must be taken into consideration when attempting to conduct behavioral assessments in this population. Mode, frequency, intensity, duration, sample size, and available resources (e.g., funds, equipment, trained staff, time) are all critical to the type of assessment chosen. Accurate and detailed measurement is essential for: monitoring individual- and group-based progress; identifying and understanding patterns and trends; and assessing the effectiveness of various interventions, programs, and campaigns aimed at improving physical activity behaviors in youth. As such, this section is provided to articulate the strengths and weaknesses of the various measurement techniques, in an effort to include the necessary information to better evaluate the work that is described throughout the monograph.

Subjective Methods

Subjective techniques for measuring physical activity in youth primarily include self-report methods, such as diaries, logs, and various forms of questionnaires. Diaries provide researchers with the ability to capture and evaluate detailed information regarding one's engagement in physical activities throughout the day either as they occur or as they are retrospectively reflected upon (Sirard & Pate, 2001). Activity logs, on the other hand, are more structured and typically completed during or immediately after a predetermined bout or session of physical activity (e.g., exercise). Both methods provide a high degree of specificity and can offer insight to the affective responses associated with such behaviors. However, diaries and logs have several limitations including difficulties with data reduction and scoring,

participant burden, and concerns regarding validity due to the monotonous nature of both methods.

Other subjective options for youth-based physical activity assessment include questionnaires, often in the form of self- or interviewer-administered recalls and surveys (Sallis & Saelens, 2000). While these instruments can offer a great amount of detail (both quantitative and qualitative) in a highly structured and analyzable form, they vary in the type (i.e., school-, household-, occupational-, transportation-, leisure-, and sport-based activities) and components of physical activity being assessed (i.e., mode, time frame, frequency, and intensity). These methods are attractive to researchers, primarily due to practicality and convenience. Despite these benefits, however, questionnaires designed for the youth demographic consistently demonstrate low-to-moderate correlations with objective measures, have the potential of providing responses based on social desirability, and are prone to over/underestimation and misinterpretation—all of which contribute to reliability and validity concerns (Welk, Corbin, & Dale, 2000). Although such issues are not particularly unique to children and adolescents alone, they may be amplified to a certain extent by varying levels of education, cognitive development, and physical maturation.

Objective Methods

Common objective techniques used for quantifying physical activity in children and adolescents include heart rate monitors, pedometers, and accelerometers (Eston, Rowlands, & Ingledew, 1998). Heart rate monitors can be used to provide an indirect estimate of energy expenditure and these noninvasive devices are frequently utilized in exercise-related research to provide accurate intensity data in both laboratory and field settings (Janz, Golden, Hansen, & Mahoney, 1992). Despite their accuracy and practicality, heart rate monitors are best used to assess the intensity of aerobic activities during relatively short periods of time. Another popular method of objectively tracking and assessing physical activity patterns is pedometry, which has proven to be a valid and reliable form of assessment in a variety of populations and is commonly used in research with children and adolescents (McNamara, Hudson, & Taylor, 2010). These monitors, which are explicitly designed to record steps over short or long periods of time, are attractive assessment tools due to their low cost, ease of use and distribution, and ability to provide instant feedback. Nevertheless, pedometers have several major disadvantages including being limited to ambulatory movement, inability to record frequency, intensity, and duration data, the potential for reactivity, issues regarding proper placement, and ease of manipulation.

Finally, accelerometers are highly sophisticated motion sensors that are becoming the “gold standard” of objective physical activity assessments, due

to their ability to assess acceleration in multiple dimensions, which results in activity counts that are directly related to the quantity, duration, and intensity of physical activity. These advanced activity-monitoring devices provide accurate data and valuable insight to the daily physical activity patterns of youth (Freedson, Pober, & Janz, 2005). Unlike pedometers, accelerometers have time-sampling capabilities, which allow researchers to thoroughly analyze the components of physical activity captured during the instructed wear-time of the device. However, due to the unique developmental and behavioral physical activity patterns of the youth population, caution should be practiced when determining which data should be included for (or excluded from) possible analysis. For example, as a result of the intermittent nature of activity behaviors in children, the use of predetermined cut points for determining youth-based intensity levels could underestimate engagement in daily physical activities (Welk, Blair, Wood, Jones, & Thompson, 2000). In this case, it has been recommended that shorter time-sampling intervals (e.g., 30 s) should be used to better capture the spontaneous and changing movement of this population and avoid the potential misclassification of time spent being inactive (Trost, Pate, Freedson, Sallis, & Taylor, 2000; Welk, Blair, et al., 2000). Despite these analytic hurdles, accelerometers are still among the best tools available for objectively quantifying physical activity in youth, although issues relative to cost, body placement, and the need for device-specific computer software to access, extract, and score the data reflect limitations in this approach.

Criterion Standards

The major criterion standards (i.e., “gold standards”) of physical activity-related measurement in children and adolescents include the use of doubly labeled water, indirect calorimetry (see “Aerobic Fitness Assessment” in Chapter 5 for detailed methodology of indirect calorimetry), and direct observation. Both doubly labeled water and indirect calorimetry are exceptional methods for accurately assessing energy expenditure associated with physical activity engagement. Specifically, the doubly labeled water method requires individuals to drink water containing stable isotopes of hydrogen and oxygen that, in turn, allows researchers to assess participants’ carbon dioxide production via urine samples (Dishman, Washburn, & Schoeller, 2001). Although the use of doubly labeled water provides researchers with a true representation of daily energy expenditure (i.e., metabolic rate) in free-living conditions, it is not always practical for research purposes because of high participant burden and cost, and the difficulty associated with obtaining stable isotopes and proper tools for assessment (Ekelund et al., 2001). The use of indirect calorimetry, where short- or

long-term energy expenditure can be assessed via an analysis of respiratory gasses, can pose even greater difficulties for large-scale research, as it is typically restricted to highly controlled laboratory settings with expensive, non-portable equipment required for analysis (Rodriguez, Moreno, Sarria, Fleta, & Bueno, 2000). Additionally, this method is not practical for the assessment of energy expenditure in natural settings (e.g., parks, schools, homes). It is important to recognize that neither of the techniques described above can accurately assess patterns or changes in physical activity, nor can either provide insight into the mode of activities chosen (Sirard & Pate, 2001).

The method of direct observation, on the other hand, is not subject to the inherent limitations of the techniques described above. Direct observation has been argued to be the best method for identifying and quantifying physical activity in children and adolescents, particularly because it allows researchers to effectively capture short-term patterns and frequent changes. Moreover, direct observation provides the greatest opportunity to adequately assess information relative to the mode, frequency, intensity, social structure, place, and time associated with physical activity participation. As a result, several standardized direct observation measures exist for child and adolescent populations (e.g., CARS, *see* Puhl, Greaves, Hoyt, & Baranowski, 1990; BEACHES, *see* McKenzie, Sallis, Nader, & Patterson, 1991; LETO, *see* Bailey et al., 1995; and SOPLAY, *see* McKenzie, Marshall, Sallis, & Conway, 2000). These measures of direct observation still have their own inherent limitations, including high experimenter burden, difficulties in choosing and accessing various locations for assessment, and discrepancies in the recommended length of time needed to accurately quantify typical daily activity patterns in youth.

CONCLUSION

Despite the proven health-related benefits associated with engagement in physical activities (Janssen & LeBlanc, 2010; Livingstone, Robson, Wallace, & McKinley, 2003; Strong et al., 2005; Tomporowski, Lambourne, & Okumura, 2011), the vast majority of adolescents do not meet recommended guidelines (CDC, 2012). The apparent decline in participation rates among this demographic, coupled with increases in sedentary behaviors, has become a grave public health concern, particularly with the high prevalence of arguably preventable chronic diseases and conditions associated with physical inactivity (Beaglehole et al., 2011). As a result, federal guidelines for youth-based physical activity have been created and publicized for the attainment and maintenance of health (USDHHS, 2008). Whereas these guidelines were vital in increasing societal awareness of the importance of systematic physical activity, acceptance and implementation of these recommendations still

remain a challenge. Many social and environmental factors contribute to this challenge, including cuts to physical education programs and competing interests and behaviors during times of leisure. However, given the benefits of physical activity on the physical, psychological, and cognitive development of children, it is imperative for public health officials to continue to bring attention to this issue and, based on empirical evidence, to further identify strategies to reliably increase rates of physical activity participation.

In an effort to promote active lifestyles in youth and to counteract the many negative health-related consequences of physical inactivity, researchers should consider designing interventions that focus on and attempt to manipulate the known determinants of physical activity in youth, such as self-efficacy and social support. Furthermore, these behavioral programs should highlight and target facilitators of physical activity in youth, while simultaneously identifying strategies to overcome common barriers to participation. Researchers should also be aware and consider the appropriateness of various assessment techniques. Whereas such decisions are largely dependent on study design (e.g., epidemiological vs. randomized controlled trial) and the mode of activity being examined (e.g., aerobic vs. weight-loading activities), it is recommended that multiple measurement techniques be used when possible to better understand the physical activity patterns of children and adolescents.

To change physical activity trends among youth at the societal level, it is essential to evaluate the generalizability and effectiveness of successful clinical trials in real-world settings. A great deal of evidence indicates that traditional, face-to-face physical activity interventions have been shown to be effective in improving health and behavioral outcomes in youth; however, due to the rigidity and control of clinical trials, it is often difficult to translate these programs outside of the laboratory setting. Barriers to effective translation often include lack of accessibility and inadequate resources to successfully implement such programs at the community, state, or national level. Partnering with school systems, investing in environmental and structural improvements, and manipulating technology (e.g., mobile phones, social media) may be promising ways to promote physical activity on a large scale. Further application and evaluation of strategies aimed at improving child and adolescent health via physical activity are warranted, as this will provide greater insight to both the problem of and potential solution to physical inactivity among this demographic.

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