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How can schools help youth increase physical activity? An economic analysis comparing school-based programs

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ABSTRACT

Objective. For optimal health, physical activity should be an integral and routine part of daily life. Youth spend a significant amount of time at school yet rarely achieve the recommended 60 min of moderate and vigorous physical activity in physical education (PE) classes or recess. This study assessed the following types of school-based opportunities to improve physical activity for youth: after-school programs, before-school programs, PE classes, extended-day PE, and short physical activity breaks during the school day.

Method. An economic analysis conducted in 2013 compared school-based approaches to increasing physical activity. Analysis factors included costs, reach, effects on physical activity gains, cost-effectiveness, and other potentially augmenting benefits.

Results. Two programs were significantly superior in terms of reach and cost per student: (1) extending the school day with mandatory PE participation and (2) offering short (10-minute) physical activity breaks during regular classroom hours. After-school program costs per student are high and the programs have a smaller reach, but they offer benefits (such as childcare) that may justify their higher costs. Before-school programs did not appear feasible.

Conclusion. Incorporating short physical activity breaks into the existing school day would be a cost-effective way to increase school-based activity. This type of program is inexpensive and has broad reach. Inserting activity breaks throughout the day is appropriate, especially when youth are otherwise largely sedentary.

Introduction

The Institute of Medicine (IOM) recommends that everyone make physical activity a routine part of life in order to reduce obesity, promote health and fitness, and reduce the risk for chronic health conditions (IOM, 2012). The *Physical Activity Guidelines for Americans* recommends that youth engage in at least 60 min of daily physical activity (U.S. Department of Health and Human Services, 2008). In addition to the well-documented health benefits of physical activity, research also suggests that school-based physical activity is positively associated with academic benefits including better academic achievement, better performance in math, reading and English, and improved attention and concentration (Centers for Disease Control and Prevention, 2010; Nelson and Gordon-Larsen, 2006; Castelli et al., 2007; Chomitz et al., 2009). Importantly, no studies have reported evidence that time spent in school-based physical activity adversely impacted academic performance (Centers for Disease Control and Prevention, 2010; Active Living Research, 2009). Regular physical activity in childhood also influences health outcomes in adulthood. Physically active youth are more likely to become physically active adults (Telama et al., 2005) and have reduced risk for various chronic illnesses, such as obesity, diabetes, high blood pressure, high cholesterol, asthma, arthritis, and poor health status (IOM, 2005).

Despite these benefits, few youth meet physical activity recommendations. According to the 2006 National Health and Nutrition Examination Survey (NHANES), which measured physical activity with accelerometers, fewer than 9% of adolescents and 42% of children met physical activity guidelines (Troiano et al., 2008). Many other studies have also documented low rates of moderate and vigorous physical activity (MVPA) among youth, and the rates tend to decline as youth mature (Brownson et al., 2005; Kimm et al., 2000). Youth spend a significant amount of time at school, making schools a good venue for opportunities to increase physical activity. Research suggests that school-based physical activity programs can increase physical activity among youth (Kriemler et al., 2011). Information about the cost-effectiveness of different options for school-based physical activity can guide decisions about utilization of limited school resources.

We reviewed four types of school-based approaches to increasing youth physical activity and estimated their costs and cost-effectiveness:

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after-school programs, before-school programs, extending the school day to provide 60 min of PE, and short (10-minute) in-class physical activity breaks. These four broad types of programs were selected to represent the general types of school-based programs that are commonly found in schools and have been examined previously in intervention research. In addition, we included before school programs because of a planned intervention on this topic (Tompkins et al., 2012).

School-based approaches to increasing physical activity

After-school programs

After-school programs traditionally have provided a means to supervise youth who might otherwise not have age-appropriate adult supervision (Beets, 2012; Tebes et al., 2007; Vandell and Corasaniti, 1988; Posner and Vandell, 1994). They can include a variety of activities that vary with the age of participants including arts and crafts, recreational opportunities, field trips, computer labs, homework assistance, informal sports, interscholastic sports, and clubs. After-school programs have been found to contribute to modest amounts of physical activity. One study found that out of 102 min of after-school time, students participated in, on average, 40.8 min of light, 13.4 min of moderate, and 6.9 min of vigorous physical activity, yielding a total of 20.3 min of MVPA (Trost et al., 2008). This is one third of the recommended children's daily physical activity level. Given that after-school programs typically last 3 h per day, they offer a significant opportunity to increase children's physical activity.

Before-school programs

Theoretically, physical activity among youth could be increased by providing opportunities for exercise before school begins each day, similar to after-school programs that incorporate recreation and informal sports. We have found no published research that examines before-school physical activity programs, but there is one planned study (Tompkins et al., 2012).

PE classes and extended-day PE

PE classes offer another opportunity for youth to engage in physical activity. Approximately 75% of the states require that schools teach PE in elementary through high school, and the majority of states require schools or districts to follow guidelines based on the National Standards for Physical Education (Lee et al., 2007). However, many students accumulate only a few, if any, minutes of MVPA during PE. For each hour of PE class, standardized curricula typically include only half an hour of MVPA; and research suggests that most classes seldom achieve even this 50% benchmark (Levin et al., 2001). Extending the school day to offer additional PE time using evidence-based PE curricula that optimize MVPA (Sallis et al., 1997; McKenzie et al., 1996; Luepker et al., 1996) could provide a meaningful physical activity opportunity.

In-class physical activity breaks

Another potential approach is to provide structured physical activity breaks during regular school hours (Salmon, 2010). Examples include Instant Recess® and Take 10!®. Research suggests that these physical activity breaks can provide significant increases in physical activity, are associated with improvements in weight status, and can also lead to increased physical fitness, improved attention in class, and improved academic performance (Barr-Anderson et al., 2011; Mark and Janssen, 2009; Spiegel and Foulk, 2006; Whitt-Glover et al., 2011; Katz et al., 2010; Donnelly et al., 2009; Mahar, 2011; Kibbe et al., 2011). Although physical activity breaks provide a short duration of physical activity, the evidence suggests that sporadic bursts of physical activity can be beneficial to health (Glazer et al., 2013; Holman et al., 2011).

Methods

To assess the value and impact of school-based programs and interventions to increase physical activity for school-age children, we compared costs, reach (including minorities and low-income families), effects on physical activity gains, and cost-effectiveness for the following four types of program options:

1. After-school program, typically from 3 to 6 PM. The option includes programs that are either fee-based or subsidized and either on-site or off-site.
2. Extended school day (40 to 60 min longer) with increased time for PE class, mandatory for all students. This option would require a trained PE teacher competent in implementing evidence-based curricula.
3. In-class activity consisting of two 10-minute breaks of structured physical activities, implemented by playing exercise videos (such as Instant Recess® or Take10!®). This option does not require extra personnel such as PE teachers. These types of activity breaks could be incorporated into the existing school day, or the school day could be lengthened slightly (by 20 min) to allow the breaks to be incorporated without displacing other planned classroom activities.
4. Before-school activity program, with volunteer or professional supervision available 30 min before school during regular school days for students to participate in physical activities, informal sports, or interscholastic sports.

Because active commuting programs and the factors that influence them vary widely, we did not attempt to include an active commuting program in this economic analysis.

Estimates of program costs and costs for students

For this analysis, program costs considered the total annual cost per participating child to operate the program on an on-going basis, regardless of sources of funds. All costs are reported in 2012 dollars. The cost figures were estimated from published cost analyses, when available, or imputed based upon resource utilization (Haddix et al., 2003), including program personnel costs, supplies and materials, equipment, program overhead costs such as facilities costs (30% of direct costs), and, when applicable (such as for off-site after-school programs), transportation costs. Teacher and program personnel wages were based on the median national wage rate from Bureau of Labor Statistics (2012a, 2012b) data (hourly rate = $24.06) (Bureau of Labor Statistics, 2012b). This hourly rate was multiplied by 30% fringe and benefit and 40% overhead to arrive at estimated hourly personnel costs (i.e., $44/h). To determine cost per year per child, we assumed a school year length of 180 school days and an average of 30 students per class. Nationally, the average school year is 179 days and the average class size is 21 for elementary schools and 27 for secondary schools (National Center for Education Statistics, 2013). Equipment costs related to physical activity breaks included $15 per DVD and $100 for a DVD player.

Cost estimates for after school programs are based on costs reported by the Afterschool Alliance. In 2009 the alliance reported that the average cost of after-school care, including summer programming, is $3190 per child (2009 dollars, or $3345 in 2012 dollars adjusted by average Consumer Price Index-Urban Consumers, CPI-U (Bureau of Labor Statistics, 2012a)), with parents paying an average of $2400 of this (2009 dollars, or $2517 in 2012 dollars); the balance of the costs is subsidized by the school district or other sources (Earle and Afterschool Alliance, 2009). After-school programs costs were prorated for 180 school days from 210 days including summer programs (National Center for Education Statistics, 2013).

The program operating cost excludes costs incurred for the development of the program, research purposes, participant-specific cost (e.g., purchase of sneakers), or other intangible societal cost (e.g., loss of productivity due to volunteering). We did not include potential effects on health care costs (such as injuries, improved health, and reduced health care utilizations) or costs related to productivity and welfare (such as increased future earnings, or economic benefits related to reduced pregnancy and crimes). Costs for students were the out-of-pocket costs paid by students and their families to attend a program but did not include activity-specific supplies that the students have to purchase, such as special shoes and helmets.

Program reach

Values for program reach for after-school programs were drawn from Afterschool Alliance research (After School Alliance, 2009), which reports that only 15% of all students participate. Several factors affect participation. Off-site