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Review

Physical activity temporal trends among children and adolescents

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ABSTRACT

Objectives: It is particularly important to measure trends in physical activity to identify specific contexts where physical activity may have declined and can be targeted for intervention. The aim of this review was to summarize overall physical activity trends based on objectively measured physical activity as well as trends in specific contexts (active transport, organized sport, school physical education and school play periods) using self- or proxy-reported physical activity.
Design: A comprehensive literature search was completed to identify articles on the specific contexts of physical activity for inclusion in this review.
Methods: Journal articles for inclusion in this narrative review were sourced from the various databases and reference lists. Most studies in this review employed self-report or proxy-report methodologies.
Results: There is limited research on temporal trends in children's and adolescents' physical activity.

The few studies that employ objective measures to assess trends in physical activity indicate little change has occurred in the last 20 years. Other studies that employed self-report methods indicate organized sport trends are somewhat inconsistent across countries, however most studies reported an increase in participation. Within the limited physical education trend studies, inconsistent trends were noted. There have been consistent declines in active transport, particularly cycling. Few studies have investigated trends in physical activity and sedentary behaviour during school play periods, highlighting a need for further research.
Conclusions: Mixed results and inconsistent magnitudes of change were identified when exploring trends in different contexts of physical activity for children and adolescents over the last few decades. Taken overall, there is little evidence for a decrease in children's and adolescents' physical activity, although consistent declines in active transport highlight this context as a suitable intervention target.

1. Introduction

Since physical activity (PA) contributes 18–29% of daily energy expenditure, it has become an important focus for research into unsatisfactorily high rates of child overweight and obesity.[1] As well as assessing the total PA that children undertake, it is particularly important to measure trends in PA to identify specific contexts where PA may have declined and can be targeted for intervention. This is an update of a previous review,[2] describing recent trends in the following distinct PA contexts: active transport (AT); organized sport; school physical education (PE) participation; and PA during school play periods.

2. Current physical activity levels

World Health Organization[3] guidelines recommend that children and adolescents between ages 5 and 17 years accumulate a minimum of 60 min of moderate to vigorous PA (MVPA) per day[3] to achieve health benefits. A 2008 Western Australian study involving 1827 participants used self-report to identify that 27% and 41% of primary age girls and boys, respectively, and 10% and 37% of secondary age girls and boys, respectively, met recommended guidelines.[4] In the same study, pedometer steps were compared with recommended step cut points established using BMI-referenced weight categories;[5] 44% and 32% of primary age girls and boys, respectively, and 38% and 42% of secondary age girls and boys, met these recommendations. Regardless of measurement approach, in this sample less than half of young people met the recommended PA levels for health.

Few developed countries report a high prevalence of children meeting the recommended daily MVPA. For example, self-report data show that only 19–38% of 12–17 year olds in the United

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States of America (USA)[6] and 15–33% of 9–15 year olds in England[7] participate in 60 min or more of daily MVPA. These nationally representative studies involved 7521 and 15,425 participants from USA and England, respectively. Further, self-report data on 11 year olds from various European countries show that 37% (Russia) to 80% (Ireland) of boys and 23% (Portugal) to 70% (Finland) of girls participated in 60 min of MVPA on at least 5 days per week.[8] Physical activity report cards from developing countries highlighted that 58.5% of South African children,[9,10] 35.2% in Mexico[11] and 72% in Kenya[12] participated in sufficient MVPA.

3. Methods

Journal articles for inclusion in this narrative review were sourced from the following databases: ERIC; MEDLINE; SportDiscus; Ovid; Cochrane Library; Google Scholar; Informit health databases; PubMed; ProQuest family health; and CINAHL database. Search terms used consisted of a combination of: child; adolescent; schoolchildren; physical activity; trend; sport; active transport; recess; lunch; physical education; PE; self-report; objective; pedometer; and accelerometer. Some studies were also sourced from reference lists. Most studies in this review employed self-report or proxy-report methodologies which are relatively convenient and therefore most prevalent in the literature. While most reports of trends rely on such studies, conclusions are limited by error occurring through poor recall, mis-interpretation of the question and social desirability bias.[13] Objective measures, including pedometers and accelerometers are becoming more prevalent in trend studies, however are limited by the lack of availability of consistent baseline data with which to compare current data and often have smaller sample sizes, thus limited generalizability, compared to self-report studies.

4. Trends in physical activity

There is limited research on temporal trends in children's and adolescents' PA, in part due to inadequate baseline data, methodological inconsistencies between studies and a lack of research into specific PA contexts. Two recent reviews of temporal trends in PA participation of children and adolescents have suggested that PA may be declining,[2,14] although results are mixed and inconsistent.[2,14,15] The aim of this review was to summarize overall PA trends based on objectively measured PA as well as trends in specific contexts (AT, organized sport, school PE and school play periods) using self- or proxy-reported PA (see Table 1 for a list of studies).

5. Trends in overall physical activity

Few studies have investigated trends in PA using objective measures, with only three studies from Sweden, Czech Republic and Denmark identified in this review. Two of these studies used pedometers to record steps per day[17,18] and the other used accelerometry.[16]

Swedish researchers[17] assessed steps per day using a sealed Yamax pedometer in 429 adolescents aged 13 and 14 over four consecutive school days in 2000 and 2008 (see Table 1 for sample size by time-point for each study). No differences were found for boys (15,623–15,174 steps d^{-1}) and girls (12,989–13,338 steps d^{-1}).[17] It was noted that during this time span, interventions were initiated within Swedish schools to provide children and adolescents with daily structured PA during school time, but it was apparent that these initiatives had little impact on daily steps.

Sigmundová et al.[18] used pedometers to measure steps d^{-1} in 902 adolescents aged 14–18 years between 1998 and 2010 in the Czech Republic, with measurements at each time point conducted over seven consecutive days. The study found a decline in the percentage of boys who met the Czech health-related criterion recommendations of 11,000 steps d^{-1}, from 68% to 55%, while no change was observed among girls (75%–74%).

A Danish study used accelerometers to measure overall PA, as average counts per minute, over 5 consecutive days between 1997–1998 and 2003–2004 among 797 children aged 8–10 years.[16] No change was seen among either boys or girls regardless of socioeconomic status. Together these few studies traversing relatively brief time periods indicate little change in objectively measured PA. Ongoing surveillance using objective measures is warranted to detect trends over a longer time span.

6. Trends in specific contexts of physical activity

6.1. Organised sport

Organized sport is often defined as participation in a club or school sport and the associated training sessions with the exclusion of physical education. One study in the USA revealed that this can account for 23% (26 min) of daily MVPA for boys[19] while an Australian study suggested that this might be as high as 45% (43 min) of daily MVPA among adolescents.[20] Another Australian study found that approximately one-third of the time girls' were participating in organized sport sessions was spent in MVPA.[21] Studies of organized sport trends included in this review were conducted in Belgium, Iceland, Hong Kong, United States and Australia (see Fig. 1). There was a range in the number and detail of questions used to quantify organized sport participation across the studies.

A Belgian study investigated club sport participation, defined as at least one hour per week over a year, among a total of 22,424 high school students, every 10 years from 1969 to 1999.[22] There was a statistically significant increase in the proportion of boys and girls who participated in club sport from 35% to 62%, and 30% to 51%, respectively, across the 30 years, representing a rate of change of 8% per decade for girls and boys. The authors also reported that family socio-economic status (SES) influenced trends in sport participation differently for boys and girls, with low SES boys' participation increasing from 52% to 64% and high SES boys' participation decreasing from 44% to 38%.[22] The proportion of high (35–51%) and low SES (56–73%) girls' participation increased similarly.

Over a similar time span (1977–2005), the Finnish Adolescent Health and Lifestyle Survey was administered every 2 years to 12, 15 and 18 year olds, with each wave consisting of between 2832 and 8390 participants. Rates of increase in sport participation (at least once per week) during the period 1991–2005 were similar in low and high family SES, with an increase from 40% to 48% among low SES boys and 47% to 58% among high SES boys. Girls' participation increased from 26% to 35% in low SES families and 38% to 50% in high SES families.

Self-reported sport participation defined as club participation four or more times per week was assessed as part of The Youth in Iceland National Survey.[24] An increase was observed from 17% to 37% among a total of 27,426 14–15 year olds between 1992 and 2006. Both boys and girls increased their participation by about +14 percentage points per decade. These three studies completed in four different European countries showed an increase in organized sport participation among children and adolescents, suggesting increases have occurred in northern and western Europe, with magnitudes of change ranging from +8 percentage points per decade in Belgium to +14 percentage points per decade in Iceland.

A study of 8624 students aged 13–18 year olds in Hong Kong reported that the prevalence of extracurricular sports participation