



## Do school-based physical activity interventions increase or reduce inequalities in health?



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### ABSTRACT

Little is known about the effectiveness of school-based health promotion on physical activity inequalities among children from low-income areas. This study compared the two-year change in physical activity among 10–11 year-old children attending schools with and without health promotion programs by activity level, body weight status, and socioeconomic backgrounds to assess whether health promotion programs reduce or exacerbate health inequalities. This was a quasi-experimental trial of a Comprehensive School Health (CSH) program implemented in schools located in socioeconomically disadvantaged neighbourhoods in Edmonton, Alberta, Canada. In the spring of 2009 and 2011, pedometer (7 full days) and demographic data were collected from cross-sectional samples of grade five children from 10 intervention and 20 comparison schools. Socioeconomic status was determined from parent self-report. Low-active, active, and high-active children were defined according to step-count tertiles. Multilevel linear regression methods adjusted for potential confounders were used to assess the relative inequity in physical activity and were compared between groups and over-time. In 2009, a greater proportion of students in the intervention schools were overweight (38% vs. 31%  $p = 0.03$ ) and were less active (10,827 vs. 12,265 steps/day  $p < 0.001$ ). Two years later, the relative difference in step-counts between intervention and comparison schools reduced from  $-15.5\%$  to  $0\%$  among low-active students, from  $-13.4\%$  to  $0\%$  among active students, and from  $-15.1\%$  to  $-2.7\%$  among high-active students. The relative difference between intervention and comparison schools reduced from  $-11.1\%$  to  $-1.6\%$  among normal weight students, from  $-16.8\%$  to  $-1.4\%$  among overweight students, and was balanced across socioeconomic subgroups. These findings demonstrate that CSH programs implemented in socioeconomically disadvantaged neighbourhoods reduced inequalities in physical activity. Investments in school-based health promotion are a viable, promising, and important approach to improve physical activity and prevent childhood obesity, and may also reduce inequalities in health.

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### 1. Introduction

Physical activity is associated with improved physical and mental health among children (Janssen and Leblanc, 2010). However, the majority of children do not meet the recommended

60 min of daily moderate to vigorous physical activity (Colley et al., 2011; Hallal et al., 2012). Similar to other health behaviours and outcomes (i.e. obesity, poor diet, smoking), the prevalence of physical inactivity is more common among socioeconomically disadvantaged children (Currie et al., 2008; Ferreira et al., 2007; Sallis et al., 2000; Seabra et al., 2008; Van Der Horst et al., 2007). This discrepancy in physical activity may contribute to the well-established and robust inequalities in health during both childhood (Chen et al., 2006; Marmot, 2005) and adulthood (Lynch et al., 1997; Poulton et al., 2002). Accordingly, interventions that reduce the inequity in physical activity

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among socioeconomically disadvantaged children may reduce health inequalities later in life.

Schools are an ideal setting to deliver health promotion programs to children (Pate et al., 2006), and various approaches to school-based health promotion have been studied. Programs are deemed successful if the average physical activity level increases. Rose demonstrated that even small increases in the average may shift the population distribution in a favourable direction, lowering the overall risk of disease (Rose, 2001). However, the concern has been raised that intervention effects may be more robust among the healthiest children, and less effective among high-risk children (Brown and Summerbell, 2009; Salmon et al., 2007). That is, even where school-based health promotion programs are successful at improving physical activity across the population of participating students, they have the potential to create new or perpetuate existing health disparities in the prevalence of physical activity among children (Lorenc et al., 2013; Maziak et al., 2008). This has been expressed in the literature as the “inequality paradox” (Frohlich and Potvin, 2008), or the “inverse care law” (Hart, 1971). Several studies have attempted to overcome this paradox and reduce inequities by implementing programs in schools located in disadvantaged communities (Breslin et al., 2012; Caballero et al., 2003; Heath and Coleman, 2002; Jago et al., 2011; Jurg et al., 2006), while others have used a targeted approach, tailoring interventions to the characteristics of specific groups at risk of poor health behaviours or outcomes (Lubans et al., 2010; Pate et al., 2005; Robbins et al., 2013; Webber et al., 2008). Some of these equity-based interventions have reported increases in children’s physical activity (Breslin et al., 2012; Heath and Coleman, 2002; Jurg et al., 2006; Pate et al., 2005; Webber et al., 2008). However, to our knowledge, no experimental studies exist assessing the effectiveness of a population-based intervention by comparing the change in children’s physical activity between intervention schools located in socioeconomically disadvantaged neighbourhoods and non-intervention schools located in middle-income neighbourhoods.

To overcome this limitation and determine if school-based health promotion programs exacerbate or reduce inequalities in health, the present study compared the two-year change in objectively measured physical activity among low-active, active, and high-active grade five students attending schools with and without health promotion programs. We also compared changes in physical activity among students by body weight status groups and socioeconomic backgrounds to examine whether health promotion is equally effective among those who would benefit the most.

## 2. Methods

### 2.1. Study design

This was a quasi-experimental pre-post design with a parallel non-equivalent comparison group. The Alberta Project Promoting active Living and healthy Eating in Schools (APPLE Schools) was a school-wide intervention that was launched in January 2008 and lasted through June 2011. Cross-sectional samples of grade five students were recruited for measurement each year in the spring term for the duration of the project. Grade five students were of interest because most are pre-pubescent. Pre-pubescent boys and girls have similar body compositions (Guo et al., 1997; Maynard et al., 2001), and have not experienced pubertal weight gain (Ahmed et al., 1998) or marked declines in physical activity (Aaron et al., 2002; Brodersen et al., 2007; Kimm et al., 2000).

The APPLE Schools intervention targeted schools “in need of health promotion”. Accordingly, schools were not randomly assigned to intervention and comparison groups. Schools were

considered to become an intervention school if they were located in socioeconomically disadvantaged neighbourhoods and the school principal was willing to support the intervention and research. Based on these criteria, an advisory panel representing five school jurisdictions identified 10 potential schools in the City of Edmonton, Alberta that would benefit from the intervention and therefore qualify for the study. All 10 schools invited elected to participate in the intervention. The comparison schools consisted of a sample of 20 schools also located in Edmonton drawn from a sample of randomly selected schools that participated in the 2008 “Raising healthy Eating and Active Living Kids” (REAL Kids) Alberta survey (Simen-Kapeu and Veugelers, 2010). The REAL Kids Alberta survey aims to assess current lifestyle behaviours (i.e., physical activity, nutrition, sleep) and obesity prevalence rates among a representative sample of children in Alberta, Canada. All 20 schools that were invited agreed to participate in the research. These schools had no prior involvement in health promotion.

### 2.2. Population

All grade five students within each school were invited to participate in the study. In 2009, among the 10 APPLE Schools, all 412 grade five students were provided with home surveys and consent forms for their parents to complete and return to school. A total of 358 parents completed surveys (completion rate = 86.9%) and provided their consent for their child to participate in the evaluation. All students with parent consent assented to participate and completed student surveys; 198 of these students also provided complete pedometer recordings and were included in analyses (completion rate = 48.1%). In 2011, only 339 students were enrolled in grade five within the APPLE Schools, however, the survey completion rates and the number of complete pedometer recordings were similar (57.8%). In 2009, 2011, 845 and 680 surveys, respectively were provided to grade five students within the 20 comparison schools. Completion rates of the survey and pedometer recordings were similar in comparison schools in 2009 (53.7%) and 2011 (45.4%). Comparison schools also had fewer grade five students in 2011 than in 2009.

### 2.3. APPLE schools: the intervention

APPLE Schools uses a Comprehensive School Health (CSH) approach “to make the healthy choice the easy choice”. CSH is described as, “an internationally recognized framework for supporting improvements in students’ educational outcomes while addressing school health in a planned, integrated, and holistic way” (Joint Consortium for School Health, 2008). The framework encompasses the whole school environment and addresses actions in four inter-related pillars, including: social and physical environments; teaching and learning; healthy school policy; and partnerships and services (Joint Consortium for School Health, 2008). In the United States, CSH is more commonly referred to as “Coordinated School Health”, while the synonymous term “Health Promoting Schools” is used in Australia and Europe (Veugelers and Schwartz, 2010). A key component of the APPLE Schools CSH intervention was the placement of a full-time School Health Facilitator (SHF) in each school. Their role was to facilitate the development and implementation of the project, to ensure that it met the schools’ unique needs for health promotion, and that it aligned with the core principles of CSH. The overall aim of the project was to create and sustain supportive physical and social environments that cultivate a healthy lifestyle with the involvement of key stakeholders i.e., parents, students, staff, and community.

To reach low-active children and those at high risk of inactivity, intervention schools offered a variety of non-competitive,

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