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Examining individual, interpersonal, and environmental influences on children's physical activity levels

Piotr Wilk[a,b], Andrew F. Clark[b,c], Alana Maltby[d], Christine Smith[c], Patricia Tucker[e], Jason A. Gilliland[b,f,*]

[a] Department of Epidemiology & Biostatistics, & Department of Paediatrics, University of Western Ontario, 1151 Richmond St., London, Canada N6A 3K7
[b] Children's Health Research Institute, 800 Commissioners Road East, London, Canada N6C 2V5
[c] Human Environments Analysis Laboratory, & Department of Geography, University of Western Ontario, 1151 Richmond St., London, Canada N6A 3K7
[d] Department of Epidemiology & Biostatistics, University of Western Ontario, 1151 Richmond St., London, Canada N6A 3K7
[e] School of Occupational Therapy, University of Western Ontario, 1151 Richmond St., London, Canada N6A 3K7
[f] Human Environments Analysis Laboratory, Department of Geography, School of Health Studies, Department of Epidemiology & Biostatistics, & Department of Paediatrics, University of Western Ontario, 1151 Richmond St., London, Canada N6A 3K7

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ABSTRACT

The purpose of this study was to explore individual-level socio-demographic factors and interpersonal-level factors related to social support, as well as the potential role of neighborhood and school environments that may influence the physical activity (PA) levels of children (ages 9–11). Child and parent questionnaires included individual and interpersonal factors, and PA behaviour. Home postal codes were used to determine the neighbourhood the child resides within, as well as their geographic accessibility to recreation opportunities. The models were assessed using a series of cross-classified random-intercept multi-level regression models as children's PA may be affected by both the school they attend and the neighbourhood in which they live. In the unadjusted model, PA varied significantly across school environments (γ = 0.023; CI: 0.003–0.043), but not across neighbourhoods (γ = 0.007; CI: -0.008 to 0.021). Boys were found to be more active compared to girls (b = 0.183; CI: 0.092–0.275), while the level of PA was lower for children whose fathers achieved post-secondary education (b = - 0.197; CI: -0.376 to 0.018) than for those whose parents completed only high school. The addition of the individual-level correlates did not have a substantial effect on level 2 variances and the level 2 variance associated with school environment remained statistically significant. At the interpersonal level, children's perception of parental support (b = 0.117; CI: 0.091–0.143) and peer support (b = 0.111; CI: 0.079–0.142) were positively related to PA. The level 2 variance for the school environment became statistically non-significant when the interpersonal factors were added to the model. At the environmental level, geographic accessibility did not have a significant association with PA and they did not significantly affect level 1 or 2 variance. As many children do not accrue sufficient levels of PA, identifying modifiable determinants is necessary to develop effective strategies to increase PA.

1. Introduction

Physical activity (PA) is an integral component of health and well-being (Janssen & LeBlanc, 2010), yet many children do not accrue sufficient levels of activity. Results from the 2012 to 2013 Canadian Health Measures Survey revealed that the majority (91%) of children and youth (ages 5–17 years) did not meet Canada's recommended guideline of 60 minutes of moderate-to-vigorous PA (MVPA) daily (Statistics Canada, 2015). The high rate of inactivity is not unique to Canada, with four-fifths of adolescents (ages 13–15) worldwide not reaching public health guidelines for recommended levels of PA (Hallal et al., 2012). Given that PA habits developed at a young age tend to persist into adulthood, it is essential to establish active lifestyles early (Telama et al., 2014).

The determinants of PA are complex and wide-ranging (Biddle, Atkin, Cavill & Foster, 2011; Sallis, Prochaska & Taylor, 2000). Socio-ecological models propose that these factors may be at an individual (e.g., age, sex, ethnicity, and socio-economic status [SES]),

interpersonal (e.g., parental and peer support), or environmental level (e.g., neighbourhood and school characteristics) (Biddle et al., 2011; Sallis et al., 2000).

Several individual-level factors have been associated with PA among children and youth. Declines in PA levels with age are particularly notable in the literature, with decreases more apparent among females than males, especially during adolescence (Biddle et al., 2011; Colley et al., 2011; Sallis et al., 2000). Within Canada, boys tend to be more active than girls (Breslin et al., 2012; Colley et al., 2011; Koezuka et al., 2006); however, other studies have not found the same trend (Tucker et al., 2009). There are also growing disparities amongst subgroups of children, as certain ethnic groups and recent immigrants participate in less PA (Singh, Yu, Siahpush & Kogan, 2008; Tremblay, Bryan, Perez, Ardern, & Katzmarzyk, 2006). One Canadian study found only 32% of new immigrants participate in organized PA once a week compared to 55% for non-immigrants (Cragg, Cameron, Craig, & Russell, 1999). In a large sample of children in the United States (n = 68,288, ages 6–17), immigrant children were more likely to be inactive and participated in less sports than children born in the United States (Singh et al., 2008). The relationship between SES and PA among children and youth has been inconclusive (Sallis et al., 2000), yet SES indicators such as parental income and education have been found to be strongly related to participation in structured PA (i.e., those activities that are planned, including organized sports or physical education classes) (Estabrooks, Lee, & Gyurcsik, 2003; Lasheras, Aznar, Merion, & Lopez, 2001; Tandon et al., 2012).

In addition, interpersonal-level or social factors have been known to influence PA behaviour. Several studies suggest that support from parents is positively associated with children's PA (Beets, Vogel, Forlaw, Pitetti, & Cardinal, 2006; Biddle et al., 2011; Duncan, Duncan, & Strycker, 2005). Parental support for PA often comprises actions, such as providing encouragement, providing transportation to PA opportunities, watching children participate in activities, and actively engaging with children in activity (Beets et al., 2006; Duncan et al., 2005; Trost & Loprinzi, 2011). Furthermore, through modeling, parents' PA behaviours may also influence children's PA, although evidence of this relationship has not been consistent (Biddle et al., 2011; Trost & Loprinzi, 2011). In addition to support from parents, children who have supportive friends and peers have also been found to be more physically active (Fitzgerald, Fitzgerald, & Aherne, 2012), whereas those who experience negative peer interactions may become less physically active (Beets et al., 2006; Salvy, Haye, Bowker, & Hermans, 2012; Salvy et al., 2009).

In recent years, there has been a growing interest in the effects of physical environmental factors on PA among children (Ding, Sallis, Kerr, Lee, & Rosenberg, 2011; Tucker et al., 2009). Efforts to understand the influence of environmental factors have concentrated on the relationship between PA and the proximity and accessibility of recreational opportunities within a child's neighbourhood as these may permit or limit children from being active. Researchers have found that access to recreational facilities, parks, and playgrounds is related to higher levels of PA (Davison & Lawson, 2006; Ding et al., 2011; Estabrooks et al., 2003; Sallis et al., 2000; Slater et al., 2010; Tucker et al., 2009). In a recent study conducted in London, Canada, researchers found that children (aged 9–14, n = 435) from neighbourhoods with greater access to parks with sports fields and multi-use path space had significantly higher levels of MVPA when controlling for individual and neighbourhood socio-demographic factors (Mitchell, Clark, & Gilliland, 2016). Other neighbourhood environmental correlates of PA identified among children have included traffic speed/volume, mixed land use, residential density, walkability (Ding et al., 2011), and SES (Crawford et al., 2008). Previous research has also suggested that within-community differences in how individuals interact with the physical environment play an important role, as not all residents of the same neighbourhood have equal PA opportunities (Giles-Corti & Donovan, 2002; Slater et al., 2010).

Additionally, a number of studies have examined the variation in PA across school physical environments (Faulkner, Zeglen, Leatherdale, Manske, & Stone, 2014; Leatherdale, Manske, Faulkner, Arbour, & Bredin, 2010), and different school characteristics have been examined, such as availability of equipment, activity structures in school play areas, school size, facilities, number of teachers, programs, and policies related to PA (Davison & Lawson, 2006; Morton, Atkin, Corder, Suhrcke, & van Sluijs, 2016; Naiman, Leatherdale, Gotay, & Masse, 2015). However, findings on the influence of school environmental factors on PA have been mixed (Czerwinski, Finne, Kolip, & Bucksch, 2015; Gomes, dos Santos, Zhu, Eisenmann, & Maia, 2014; Naiman et al., 2015; van Sluijs et al., 2011); with some indicating that individual-level factors may be more influential on PA (Czerwinski et al., 2015; Pereira et al., 2016).

Thus, it is evident that PA behaviours among children may not only depend on individual factors but also on interpersonal factors. There is also some limited evidence that children's PA may be affected by the physical environments in which these behaviours take place, specifically, by neighbourhood and school environments. However, due to inconsistent results, further examination of potential variation in PA across neighbourhood and school environments is warranted. Thus, the purpose of this study was to explore the role of individual and interpersonal level factors, as well as the potential role of neighborhood and school environments that may influence the PA levels of grade 5 children (ages 9–11 years) in London, Canada. A better understanding of the effects of these factors may improve the design and characteristics of PA interventions, to reverse declining PA levels, and consequently improve the overall health of Canadian children.

2. Methods

2.1. Study design and research protocol

The data for this study were derived from the Grade 5 ACT-i-Pass (G5AP) community-based PA intervention conducted in London during the 2014–15 school year. The G5AP offered all grade 5 children who attend one of 99 London schools (i.e., 93 English-speaking, 5 French-speaking, and 1 private school) free access to various PA facilities (e.g., Boys & Girls Club, YMCA, pools, arenas) and programs (e.g., basketball, dance, floor hockey) for an entire school year. A full description of the longitudinal G5AP intervention evaluation study design can be found elsewhere; the present study uses only baseline data (Gilliland et al., 2015). Ethical approval for this study was obtained from the University's Non-Medical Research Ethics Board and the participating local school boards (2 English and 2 French boards).

2.1.1. Recruitment and participation rates

In May 2014, all 3677 children in grade 4 from elementary schools within London (n = 99) were invited to participate in the G5AP intervention. Over the next 12 months, these children had the opportunity to register for the intervention and use the recreational facilities and programs for free. In total, 1709 eligible children registered for the G5AP, for a recruitment rate of 46.5%, and were asked to participate in a baseline survey. In total, 1440 parents and 957 children completed the baseline survey for the response rates of 84.3% and 56.0%, respectively. Several significant differences were found related to the uptake of the G5AP intervention (Wilk et al., 2017). Those in neighbourhoods with higher average income and a higher proportion of recent immigrants and those who were actively recruited (i.e., by interactive school presentations) were significantly more likely to register than those who were passively recruited (i.e., given a brochure).

We used the following inclusion criteria to reach our final sample for this study: (1) child enrolled in the program by October 2014; (2) consent was provided to participate in the research study; (3) child lived in London; and (4) home location (postal code) was available in the data. After applying the inclusion criteria, the final sample available