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# Children's activity-transportation lifestyles, physical activity levels and social-ecological correlates in Toronto, Canada

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## ABSTRACT

Recent years have seen the emergence of a literature focused on physical activity outcomes among children, in relation to their transportation and bodily movement. As this literature grows, the importance of an integrated approach to understand a child's movement/ mobility behaviour is beginning to be recognized in policy and practice. Few studies examine patterns in children's daily activities and transportation together. In particular, an important research gap exists at the intersection of activity-transportation lifestyles and objective measures of physical activity. Using data gathered from 700 students attending grades 5 and 6, in 16 public elementary schools in Toronto, Canada, this research identifies patterns in activity-transportation participation among children, and their associations with various measures of physical activity. A two-step cluster analysis identified four distinct activity-transportation lifestyles, namely- *Artists*, *Readers*, *Homebound* and *Athletes*. *Athletes* accumulated the most daily physical activity. In contrast, the *homebound* group had the highest screen time. Further analysis using logistic regression models identified that lifestyle group membership can be explained by gender, ethno-cultural diversity, neighbourhood-level income and residential location (i.e., inner-urban versus suburban). Findings from this study may inform future programming and interventions to address emerging guidelines focused on children's 24-hour movement.

## 1. Introduction

Western countries have seen a systematic change in children's activity participation behaviour in recent decades (Tremblay et al., 2014). Increased reliance on inactive forms of transportation (e.g., being driven to/from school and elsewhere), at least since the mid-1980s, has also been reported internationally (Fyrhi et al., 2011; McDonald et al., 2007; Mitra et al., 2016; van der Ploeg et al., 2008). Researchers and professionals have taken notice of this trend as a missed opportunity to accumulate moderate-to-vigorous intensity physical activity (MVPA). For example, walking or bicycling, along with other means of human-powered conveyance, can be a regular source of MVPA among children and youth (Cooper et al., 2003; Goodman et al., 2011; Larouche et al., 2014). Recent research has also associated children's MVPA outcomes with higher amounts of active play (Faulkner et al., 2015) and organized sports (Goodman et al., 2011). On the contrary, worse outcomes have been observed in children with greater sedentary time, which is most often associated with screen time in the form of television, video games or computer use (Carson et al., 2016).

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A child may engage in daily activities in different environments (e.g., at home, at school, on the way to school) and contexts (e.g., transportation, play, sport). MVPA only accounts for a small proportion (< 5%) of all activities that a child undertakes during a 24-hour day, even among active children and youth. On the other hand, sleep (~40%), sedentary behaviour- SB (~40%) and light physical activity- LPA (~15%) make up approximately 95% of the day for an average child (Chaput et al., 2014). Exploring one of these environments or contexts would provide only partial insight in relation to a child's daily physical activity (PA) outcomes. In contrast, a systematic analysis of the diverse daily activities simultaneously, and the identification of patterns or profiles of daily behaviour (also known as lifestyles) among children, could provide an improved understanding of the interplay among activities, in relation to their potential effects on children's health and well-being (Saunders et al., 2016; Tremblay et al., 2016).

The importance of an integrated approach to understand a child's movement/ mobility behaviour is beginning to be recognized in health-related policy and practice. Recently, Canadian researchers have produced the first-ever 24-Hour Movement Guideline for Children and Youth (Canadian Society for Exercise Psychology, 2016; ParticipACTION, 2016; Tremblay et al., 2016). The new guideline recommends that for optimum health benefit, a child or youth should engage in high levels of MVPA ( $\geq 60$  mins a day), several hours of unstructured and unrestricted LPA, low levels of SB (< 2 h of recreational screen time; limited sitting for extended periods) and sufficient sleep (8–11 hours with consistent bed and wake-up times). In this context, research that focuses on the relationship between overall daily movement and PA could offer a potentially useful approach for identifying groups of children and types of behaviour that could benefit from PA- focused interventions.

Previous research has explored children's daily time use in various types of activities and travel, and found that the majority of a child's time is spent being sedentary (Copperman and Bhat, 2010; Sener et al., 2008). Others have measured children's PA-levels using accelerometry, and compared these data to various activities/trips that they undertake throughout the day (Cooper et al., 2003; Goodman et al., 2011; Oliver et al., 2015; Riddoch et al., 2004). As discussed above, this existing literature is primarily focused on individual activities/travels and their MVPA-related outcomes.

Less research is available on complete patterns of daily activity-travel behaviour among children (Nelson et al., 2005; Seghers and Rutten, 2010; Voulgaris et al., 2016). Voulgaris et al. (2016) found that those who actively travelled to school spent less time studying, exercising and engaging in structured extracurricular activities. In other words, their results indicated that patterns of both physically active and inactive activities may co-exist in a group of children, a finding that is also supported by some other researchers (e.g., Nelson et al., 2005; Seghers and Rutten, 2010). Results from this limited research begin to provide much needed evidence related to the "ActivityStat" hypothesis of overall stable levels of PA over time (Gomershall et al., 2013; Goodman et al., 2011). Theoretical works have suggested that a high-level of PA in one activity during the day may be compensated by other activities that require relatively low PA-engagements. Empirical studies that have systematically explored children's PA compensation are particularly limited (Goodman et al., 2011).

Existing studies of children's activity patterns or lifestyles also do not connect the activity-transportation data with various objective measures of PA (such as MVPA, LPA and SB). Instead, current research has largely used estimated measures of PA based on self-reported hours of engagement in physical or sedentary activities, in order to explore their correlations with a child's/ adolescent's activity lifestyles (Nelson et al., 2005; Seghers and Rutten, 2010). Assessing PA through self-report is prone to measurement error due to challenges with recall (Dollman et al., 2009). Incidental activities that are sedentary or light in nature may be particularly difficult for many to recall. To our knowledge, the relationship between activity and/or transportation lifestyles and objectively measured PA levels has yet to be systematically examined, which is a key emphasis of this research.

In addition, a child's likelihood of undertaking a healthy behaviour can potentially be explained by social and ecological factors that may operate at multiple levels (Glanz et al., 2008). Recent research on children's active school transportation (Guliani et al., 2015; Larouche et al., 2014; Mitra et al., 2016), independent mobility (Mitra et al., 2014), play (Faulkner et al., 2015) and daily PA-levels (Riddoch et al., 2004; Stone et al., 2012) has emphasized this social-ecological approach to understand where and among whom these physically active behaviours are more or less prevalent. Limited research has explored the socio-demographic correlates of children's activity lifestyles, and reported that patterns of daily activity participation may vary by a child's gender, race/ethnicity, household composition and income. More specifically, boys were typically found to have more active lifestyles (Gorely et al., 2007; Seghers and Rutten, 2010; Voulgaris et al., 2016) and participation in organized activities and sports were more common among children from higher-income households (Nelson et al., 2005; Sener et al., 2008). Results relating to a child's age, household composition or ethnic background remain mixed. Recent research has also reported correlations between inner-urban mixed use neighbourhoods and higher levels of PA or greater prevalence of physically active behaviours such as active school transportation (Mitra, 2013; Stone et al., 2012). The role of the neighbourhood environment on a child's activity-transportation lifestyle remains less understood.

This research addresses three research questions using data collected from elementary school-aged children living in Toronto, Canada. First, do distinct patterns in daily activity-transportation behaviour, i.e., activity lifestyles, exist among children? Second, are these daily activity-transportation lifestyles associated with children's PA levels? And third, are children's activity-transportation lifestyles different across socio-demographic groups and geographic locations? The findings emphasize the importance of taking a holistic approach to understanding children's daily activity and travel behaviour, and may inform an emerging body of policy (e.g., the Canadian 24-Hour Movement Guideline for Children and Youth) and related programming focused on planning for children's transportation, PA and health.

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