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Test-retest reliability and convergent validity of measures of children's travel behaviours and independent mobility

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ABSTRACT

Introduction: Active transportation (AT) and independent mobility (IM) represent promising avenues for increasing children's physical activity and minimizing car use. However, there are limited data on the psychometric properties of measures of AT and IM.

Methods: 94 child and parent dyads living in Ottawa (Canada) consented to complete a questionnaire twice, approximately two weeks apart, in English or French language. They were questioned on children's travel to/from places (e.g., school, parks, shops) and on the extent of the child's IM. The weekly volume of AT to/from school was calculated by multiplying the number of active trips by the home-school distance. An IM index consisting of six "mobility licenses" (to travel home from school, travel to other places within walking distance, cross main roads, cycle on main roads, go out after dark, and travel on local buses without adult supervision) was computed. Test-retest reliability and convergent validity between children and parents were assessed with Cohen's kappa or intra-class correlation coefficients (ICC).

Results: The volume of AT to/from school showed high test-retest reliability and convergent validity in both languages (ICC range = 0.81–0.97). Similarly, test-retest reliability was also high for the number of active trips to/from all destinations (ICC range = 0.60–0.94) and the IM index (ICC range = 0.63–0.88). Convergent validity for trips to/from all destinations was fair in the English language subsample (ICC range = 0.22–0.25), but substantial in the French language subsample (ICC range = 0.60–0.82). The IM index showed substantial validity at both test and retest and in both languages (ICC range = 0.61–0.80). Coefficients were generally lower when examining single destinations or mobility licenses.

Conclusion: With minor modifications, the child and parent mobility questionnaires can provide valid and reliable estimates of AT to/from a broad range of destinations and IM among English and French speaking grade 4–6 children.

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1. Introduction

Physical inactivity is among the most important risk factors implicated in the development of non-communicable diseases (Bouchard et al., 2012; Lee et al., 2012). Even in children and youth, physical inactivity is associated with the development of cardiovascular disease risk factors (Ekelund et al., 2012), obesity (Jiménez-Pavón et al., 2010), poor motor skills (Lubans et al., 2010), and adverse mental health outcomes (Biddle and Asare, 2011). Yet, the majority of children and youth do not meet current physical activity (PA) guidelines (Colley et al., 2011; Hallal et al., 2012). The promotion of active transportation (AT; i.e., using non-motorized modes such as walking and cycling) is increasingly regarded as an important strategy to increase PA (British Medical Association, 2012; Larouche et al., 2014a). Furthermore, increasing AT may help mitigate climate change, reduce traffic congestion, and prevent cardiovascular diseases caused by exposure to particulate matter emitted by motor vehicles (Larouche, 2012).

Systematic reviews have concluded that children and youth who engage in AT to/from school are more active than their peers who are driven (Larouche et al., 2014a; Lubans et al., 2011). In studies using accelerometers, the difference in moderate-to-vigorous PA between active and inactive travellers ranged from 0 to 45 min per day (Larouche et al., 2014a). Nevertheless, previous studies may have underestimated the contribution of AT to PA because they typically considered only the trip to/from school. While many children may live too far away from their school to engage in active school travel, other destinations such as friends' and relatives' houses, parks and shops could represent alternative opportunities to incorporate AT (Larouche et al., 2013a). As a first step to examine the contribution of such trips to children's PA, it is important to develop valid and reliable measures of AT in order to reduce measurement error. According to a recent systematic review, limited data are available on the psychometric properties of instruments to assess AT for non-school trips (Larouche et al., 2014b).

In parallel, children's independent mobility (IM) is gaining increased attention as a potential enabler of AT, outdoor play, and overall PA (Hillman et al., 1990; Schoeppe et al., 2013). Following Hillman et al. (1990) seminal study, IM is broadly defined as children's freedom to move around in public space without adult supervision (Hillman et al., 1990). Recent studies have indeed shown that children who are granted more IM are more likely to engage in AT (Carver et al., 2014a; Page et al., 2010), spend more time outside (Mackett et al., 2007; Page et al., 2010) and are more physically active overall (Page et al., 2009; Schoeppe et al., 2013; Stone et al., 2014). However, according to a recent systematic review, few studies have examined the reliability of measures of IM and none has assessed their validity (Bates and Stone, 2015).

To address the methodological issues discussed above, we conducted a study to examine the test-retest reliability and convergent validity (between children and parent reports) of measures of AT and IM in a bilingual sample of parent-child dyads recruited in English and French schools within the City of Ottawa, Canada. Based on the results of the study, we suggest some modifications that, we believe, could improve the reliability and validity of the questionnaires.

2. Methods

2.1. Participants and setting

155 children in grades 4 to 6 were invited to participate in the study and 94 child-parent dyads provided consent (response rate = 60.6%). Test questionnaires were returned by 77 children and 78 parents whereas retest questionnaires were returned by 81 children and 73 parents. Participants were recruited in three suburban catholic public schools within the City of Ottawa (two English schools and one French school). Data collection was completed between January and March 2016. Following the approach proposed by Zou (2012), it was estimated *a priori* that 69 participants would be needed to have a power of 0.80 to detect intra-class correlation coefficients of 0.80 with 95% confidence intervals ranging from 0.70 to 0.90. Anticipating that approximately 75% of participants would provide valid AT and IM data, we aimed to recruit 90 parent-child dyads. Approval was obtained from the institutional Research Ethics Board and the participating school boards. Written consent and assent were obtained from all parents and children.

Ottawa is the capital of Canada and the fourth largest census metropolitan area in the country (Statistics Canada, 2012). While the majority of Ottawans speak English, the City includes a large French-speaking community. This presented an ideal setting to validate our questionnaires in both official languages of Canada. In a previous study, we observed that Ottawa children attending French schools were less likely to engage in AT than their counterparts attending English schools, but this difference was no longer significant after controlling for reported school travel time (Larouche et al., 2014c). Given that distance is the most consistent environmental correlate of AT (Wong et al., 2011), this finding may reflect the fact that French schools in Ottawa have larger catchment areas. This highlights the importance to sample both English and French schools to uphold external validity.

2.2. Protocol

Participants and one of their parents (or guardians) were asked to complete a mobility questionnaire in their own time. The data collection period lasted seven days. Test and retest questionnaires were distributed in schools between one and two weeks apart, at the schools' convenience. We asked the same parent to complete the test and retest questionnaires, although we cannot rule out the possibility that, in some cases, different parents completed the test and retest questionnaire.

2.2.1. Child questionnaire

English and French versions of the original child questionnaire for the study are provided online in the [Supplementary File](#). Children were asked to indicate how they traveled to/from school on each day of the week in tables similar to those proposed by Bere

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