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Review

Associations of children's independent mobility and active travel with physical activity, sedentary behaviour and weight status: A systematic review

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ABSTRACT

Health benefits from children's independent mobility and active travel beyond school travel are largely unexplored.
Objectives: This review synthesized the evidence for associations of independent mobility and active travel to various destinations with physical activity, sedentary behaviour and weight status.
Design: Systematic review.
Methods: A systematic search in six databases (PubMed, Scopus, CINAHL, SportDiscus, PsychInfo, TRIS) for papers published between January 1990 and March 2012 was undertaken, focussing on children aged 3–18 years. Study inclusion and methodological quality were independently assessed by two reviewers.
Results: 52 studies were included. Most studies focussed solely on active travel to and/or from school, and showed significant positive associations with physical activity. The same relationship was detected for active travel to leisure-related places and independent mobility with physical activity. An inverse relationship between active travel to school and weight status was evident but findings were inconsistent. Few studies examined correlations between active travel to school and self-reported screen-time or objectively measured sedentary behaviour, and findings were unclear.
Conclusions: Studies on independent mobility suggested that children who have the freedom to play outdoors and travel actively without adult supervision accumulate more physical activity than those who do not. Further investigation of children's active travel to leisure-related destinations, measurement of diverse sedentary behaviour beyond simply screen-based activities, and consistent thresholds for objectively measured sedentary behaviour in children will clarify the inconsistent evidence base on associations of active travel with sedentary behaviour and weight status.

1. Introduction

In developed countries, children's active travel such as walking and bicycling to school and leisure-related destinations has declined dramatically during the last three decades. Simultaneously, children's commuting by car has increased.[1–4] For example, US data showed that between 1969 and 2001 children's active commuting to school decreased from 41% to 13%, whilst driving to school by car increased from 17% to 55%.[4] Active travel without adult accompaniment corresponds to the concept of children's independent mobility which is defined as the freedom of those aged under 18 years to move around in public spaces without adult supervision.[5] Independent mobility comprises various unsupervised activities relating to active travel with the purpose of getting to places and play outside the home.[6,7] In 1990, a UK study showed that only 9% of children aged 7–8 years were allowed to travel to school on their own, whereas in 1971 this proportion was 80%.[5] Similar declines in independent mobility have been observed in other countries such as the US, Denmark, Finland, Norway and the Netherlands.[3,8,9] Reasons for the declines in independent mobility and active travel include parental concerns about road safety and stranger danger, inconvenience with families' daily schedules, and longer commute distances because of increasing urban sprawl.[10–13]

The decrease in independent mobility and active travel is concerning since both can contribute towards attaining the recommended daily 60 min of moderate-to-vigorous physical activity and maintaining a healthy weight in children.[7,14,15] In particular, children who do not attain sufficient physical activity through organized sport may benefit from engaging in active travel and

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independent mobility.[14] Moreover, the independent mobility can provide psychosocial benefits for children in the form of social interactions and connectedness with friends and other people in the neighbourhood.[16] Some reviews[17–20] have shown a positive association of active travel to and/or from school with children's overall physical activity, whereas findings in relation to healthy weight appear less robust.[17,19–22] However, none of these reviews have sought to establish how sedentary behaviour may be associated with active travel. Sedentary behaviour is an emerging independent health risk factor for children's metabolic health, and a behaviour that increases with motorized travel.[23,24] Moreover, previous reviews primarily focused on active travel to school; it remains unknown whether active travel to non-school destinations such as shops, parks, and friend's houses increase children's daily physical activity and reduce the risk of being sedentary and overweight. These are important questions given that the school is only one of several travel destinations for children, and often it is located too far away from home to be considered suitable for active travel.[4] Furthermore, children's independent mobility has rarely been examined for its potential to lower the risks of being insufficiently physically active, sedentary and overweight.

This systematic review aims to synthesize the evidence for associations of children's independent mobility and active travel to various destinations with physical activity, sedentary behaviour and weight status. To the authors' knowledge this is the first systematic review that addresses relationships between independent mobility and active travel to school and non-school destinations with these health factors. Hence, this research builds on previous reviews that have considered relationships solely in regard to active school travel.

2. Methods

Relevant peer-reviewed, English language literature published between January 1990 and March 2012 was searched across six databases (PubMed, Scopus, CINAHL, SportDiscus, PsychInfo, Transport Research International Documentation). Systematic search strategies were designed using a combination of thesaurus and free terms covering the following terms: child, adolescent, adolescence, youth, kids, independent mobility, active travel, active commuting, active transport, walk, cycle, cycling, physical activity, active, sedentary, sitting, weight, body composition, body mass index (BMI), overweight, obese, obesity, and adiposity. In addition, articles were identified via hand-searching and reviewing the reference lists of relevant papers.

Studies were included in the present review if they focused on children and adolescents aged 3–18 years, and examined associations of independent mobility or active travel with physical activity, sedentary behaviour or weight status. Independent mobility and active travel were defined as exposure variables, and physical activity, sedentary behaviour and weight status were the outcome variables. Studies were excluded from the review if: (1) the age of study population was outside the designated age range, (2) inappropriate study designs were utilized (i.e. case or intervention studies, studies on prevalence or trend data), (3) the publication was not a peer-reviewed primary study (i.e. letters, commentaries, conference proceedings, previews reviews, narrative articles), (4) associations examined were outside the scope of this review, and (5) the publication was not written in English. As an exception, intervention studies were included if a cross-sectional analysis of the associations of interest was reported. Initially, titles and abstracts were screened for the inclusion criteria by a single reviewer (SS). Subsequently, two reviewers (SS and MJD) independently reviewed the full text of potentially eligible papers. Disagreement between these reviewers for inclusion was resolved by discussion and consensus with a third reviewer (HB).

For all included studies, data were extracted for author, year, country, study design/duration, study population, independent mobility, active travel, physical activity, sedentary behaviour, weight status and main study results (Table 1 in the Supplementary material). The methodological quality of the included studies was appraised independently by two reviewers (SS and MJD) using 21-point quality criteria adapted from existing checklists for the reporting of observational studies (Table 1).[25–27] This modified checklist captures quality of reporting of studies as well as characteristics of actual study quality. Each criterion was rated as yes = 1, partial = 0.5 if the criterion was only partially fulfilled, no = 0, unclear = 0, or not applicable = 0. The not applicable criteria related to the absence of measurement of independent mobility, active travel, physical activity, sedentary behaviour or weight status. If studies did not measure some of these variables to examine associations, the rating 'not applicable' was applied and the criterion was discounted from the 'overall study quality score' (sum of points). Hence, the highest attainable study quality score could range between 18 and 21. Adapted from another systematic review[28] the obtained study quality score was divided by the highest attainable study quality score, and multiplied by 100 to give an 'overall study quality percentage'. Study quality percentages were then grouped into high (>66.7%), fair (50–66.6%) or low (<50%) study quality.[28] The quality assessment for each study is presented in Table 2 in the Supplementary material.

The strength of evidence measure was adapted from previously published scoring systems[20,29,30] and derived from the proportion and quality of studies showing significant associations in the expected direction. Positive associations were anticipated between independent mobility/active travel and physical activity, whereas an inverse relationship was expected between independent mobility/active travel and sedentary behaviour as well as weight status. When 0–33% of studies showed a significant association ($p \leq 0.05$) of independent mobility or active travel with physical activity, sedentary behaviour and/or weight status, the findings were classified as no association (0). When 34–59% of studies reported significant associations, the findings were categorized as being inconsistent (?). When 60–100% of studies demonstrated significant associations, the findings were rated as positive (+) or negative (−) associations, respective of the direction of the relationship. When less than four studies were available for positive or negative associations, the evidence was rated as limited. In addition, the study quality was incorporated in the assessment of the strength of evidence. When 60–100% of high quality studies showed a significant correlation, the findings were considered as strong evidence for a positive (++) or negative (−−) association.

3. Results

A total of 2699 potentially relevant, non-duplicate papers were identified and screened based on title and abstract. Of these, 140 studies were retrieved for detailed review. After exclusion of 88 non-eligible studies, 52 studies were included in this review (Fig. 1 in Supplementary material). General study characteristics are summarized in Table 2; more detailed study characteristics are presented in Table 1 in the Supplementary material. In the majority of studies,[31–59] the mean age of the sample population was between 10 and 13 years, i.e. the age group when children's independent mobility and active travel usually increase.[12,45] Fewer studies focused on younger children aged 3–9 years[23,60–64] or adolescents aged 14–18 years.[65–74] Almost all studies targeted both boys and girls but merely a third of the studies reported results disaggregated by gender.[32,38,41,42,45,48,49,51,55,59,64,67,72–76]