

Active Travel to School and Physical Activity Levels of Irish Primary Schoolchildren

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The purpose of this study was to (1) determine the physical activity levels of 9–11 year old children, and (2) compare the activity levels of children who commute to school by active and passive modes. 140 children aged 9–11 years (85 boys) were recruited from four urban Irish schools. Mode of commuting was assessed by questionnaire. Step counts were measured for 4 consecutive days. Mean daily step counts for the sample were 14386 ± 5634 . Boys were significantly more active than girls (15857 ± 5482 vs. 12113 ± 5127 steps). Eighty-seven children (62.1%) traveled by car, 51 children (36.4%) walked to school, one child traveled by bus and one child cycled. Children who walked or cycled to school had higher daily step counts than those who traveled by passive modes (16118 ± 5757 vs. 13363 ± 5332 steps). Active commuting to school may therefore represent a worthwhile strategy for improving children's physical activity levels.

Physically active children have higher levels of cardiorespiratory and muscular fitness, lower body fatness, stronger bones, and may have reduced symptoms of anxiety and depression compared with their inactive counterparts (31). However high proportions of children in Ireland (18), other European countries (22) and the US (2) do not achieve the recommended level of physical activity. Strategies to improve the physical activity levels of children should therefore be seen as a public health priority. The journey to school is an ideal opportunity for increasing children's daily physical activity.

Rapid economic and demographic change in Ireland over the last decade has resulted in increased car ownership (5) and a concomitant rise in the percentage of journeys to work and school by car (3). Census figures demonstrate that the proportion of children in Ireland aged 5–12 years who engage in active school

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transport decreased from 50% in 1986 to 25% in 2006. This decline is mirrored by data from other countries (9,32) and has occurred in a period of rising levels of childhood overweight and obesity (19) and declining rates of children's physical activity. Active commuting initiatives may therefore represent a worthwhile strategy to address these interlinked trends. Examining the influence that mode of commuting to school has on overall activity levels will assist public health bodies in developing interventions suited to primary school aged children.

Studies to date on the physical activity habits of Irish children have been limited by the use of proxy and self-report measures and highlight the need for more objective measures. Pedometers provide a simple and affordable means of tracking daily physical activity volume and correlate well with that of different accelerometers (25). To the authors' knowledge there is only one published study which has assessed the step counts of Irish children (1). Belton et al. concluded that the sample of 6–9 year old children met the age- and sex- specific pedometer recommendations for healthy body composition of 12,000 steps per day for girls and 15,000 steps per day for boys (27). The commuting practice of these children was not measured however and therefore the contribution of active transport to meeting physical activity recommendations in this group is unknown.

The purpose of the current study was twofold: (1) to determine the physical activity levels of 7–9 year old children via pedometry (2) to compare the activity levels of children who commute by active and sedentary modes.

Methods

Subjects

140 children aged 9–11 years (9.9 ± 0.5 ; 85 male, 55 female) took part in the study. Children were recruited from four urban schools in Limerick City, Ireland. To provide a representative sample, schools designated as “disadvantaged” by the Department of Education & Science, where the catchment area would be predominantly lower social class and schools where the catchment area would be predominantly middle class were invited to participate. 27 children attended designated disadvantaged schools. Written informed consent was obtained from the parent/guardian of each child. The study was approved by the institutional review board and data were collected from March to May 2009.

Procedures

Steps counts were measured for 4 consecutive schooldays using a Yamax Digiwalker SW-200. Pedometers show acceptable accuracy, reliability and validity (29,30) and the Yamax has been designated as a ‘research grade’ instrument (28). Four days of monitoring is considered sufficient for determining habitual activity levels in children (34). Participants were given a brief overview of the study and were shown how to attach the pedometer to the waistband of their clothing (at the right hip, in line with the knee). Children were asked to wear the pedometer during all waking hours except when swimming or bathing. Each day children were required to record on a log-sheet the time of putting the pedometer on and off, and the total number of steps taken.

A once-off questionnaire was used to assess patterns of commuting to school. Children were asked how they usually traveled to and from school (car / motorcycle / bus / train / bicycle / walking) and how long the journey took (less than 5 min / 5–15 min / 15–30 min / 30 min to 1 hr / more than 1 hr).

Data Reduction and Analysis

Children who removed their pedometer for more than one hour of any day and those with daily step counts below 1,000 or above 30,000 had the steps on that day removed from the analysis (23). Furthermore subjects with more than one full day of missing data were excluded ($n = 11$). Data are presented for the 140 subjects whose data sets met the inclusion criteria.

Data from the child who cycled to school ($n = 1$) was pooled with data from children who walked to school ($n = 54$) and classified as 'active' commuting. Data from children who traveled to school by car or bus was pooled and classified as 'passive' commuting. Children who reported traveling to and from school by different modes were classified according to the mode of commuting to school (To school: 88 passive, 52 active; From school: 91 passive, 49 active).

Difference in mean daily steps counts of boys and girls, and steps counts of walkers and passive commuters were analyzed using independent t tests. A two-way ANOVA was used to examine gender X travel interactions for mean daily step counts. As all possible comparisons were planned, the multiple comparison problem was ignored and Fisher's Least-Significant Differences (LSD) post hoc (4) tests were used to identify significant differences between groups. Statistical significance was established at $p < .05$.

Results

Eighty-seven children (62.1%) traveled by car, 51 children (36.4%) walked to school, one child traveled by bus and one child cycled. Mean (SD) for step counts according to sex and mode of commuting to school are shown in Table 1. Children who walked to school had higher daily step counts than those who traveled by a passive mode ($16,118 \pm 5757$ vs. $13,363 \pm 5332$ steps; $p < .01$). The two-way

Table 1 Weekday Step Counts of Irish Primary School Children by Mode of Travel to School

	Active		Passive	
	(51 walk /1 bicycle)		(87 car/1 bus)	
	37 boys, 15 girls		48 boys, 40 girls	
	Mean	SD	Mean	SD
Boys	16675	5188	15227	5670
Girls	14743	6976	11127	3908
Total	16118	5757*	13363	5332*

*Significant difference between step counts of active and passive commuters $P < .01$

ANOVA did not reveal a significant gender x travel interaction for mean daily step counts.

Of those who traveled to school by car, 17.2% had a journey less than 5 min, 43.7% had a journey of 5–15 min and 39% traveled for more than 15 min. Eighty percent of journeys by foot were less than 15 min, and 35.3% less than 5 min.

Mean daily step counts for the sample were $14,386 \pm 5634$. Boys ($15,857 \pm 5,482$ steps) were significantly more active than girls ($12,113 \pm 5,127$ steps; $p < .01$). There were no significant differences in the step counts of children from disadvantaged schools and nondisadvantaged schools.

Discussion

This is the first study to investigate the influence of mode of commuting on objectively measured physical activity levels in Irish primary school children. Children who walked to school reported higher daily step counts than those who commuted by passive means.

Active vs. Passive Commuters

In agreement with previous research (12,33) children who walked to school demonstrated higher weekday step counts than those who commuted by a passive mode. The difference in total daily physical activity of approx 21% is similar to the magnitude of difference reported in a related study using accelerometer data (6). This finding is encouraging as active commuters demonstrate better cardiovascular fitness (8) and lower rates of obesity (13) compared with passive commuters. Our results suggest that active commuting initiatives, such as 'walking buses', may play an important role in school-based programs to increase physical activity. Of course whether this difference between active and passive commuters can be explained by the physical activity accumulated in the journey to school only is unknown. It has been previously shown that active travel to school is associated with higher levels of active travel to other neighborhood destinations (10) and suggests that the differences in physical activity by transport mode are not simply due to the fact that more active children choose active forms of transport to school (8).

Thirty six percent of children in the current study walked to school which is higher than national estimates but consistent with rates for the particular city studied (3), reflecting findings that urban form is an important factor that influences the likelihood of walking to school (16). Eighty percent of journeys by foot were less than 15 min indicating that proximity to school may be a key factor in determining choice to commute actively. A U.S. study found that living within a mile of school made it over three times more likely that a child would walk to school rather than be driven (16). Similarly a UK study demonstrated that children aged 9–10 years whose distance to school was less than 1km were more likely to walk to school (20), while an Irish study found that the further an adolescent lives from school, the less likely they are to walk or cycle (17). Of course there are other mediating factors that influence choice to actively commute as it is associated with environmental characteristics (e.g., higher land mix use, presence of street trees); which suggests that planners should consider these factors when locating schools to promote increased physical activity (15).

Gender Differences

As found previously boys were more active than girls (35). In fact boys accumulated approximately 30% more steps per day than girls. Previous estimates of the difference in physical activity levels of boys and girls are 15–25% (24). Tudor-Locke et al. (2004) established that for 6–12 year old children, girls taking < 12,000 steps per day and boys taking < 15,000 steps per day are more likely to be classified as overweight/obese (27). If these observations are applied to the current study then 48% of boys ($n = 41$) and 56% of girls ($n = 31$) did not accumulate the number of steps per day associated with a healthy weight. It is plausible that a proportion of children in this cohort is at risk for being classified as overweight/obese and warrant intervention, although in the absence of BMI measures this remains speculative. Of note is that girls who commuted to school by passive means accumulated < 12,000 steps per day ($11,127 \pm 3908$). This finding highlights the important role that active commuting may play in combating rising levels of physical inactivity and obesity in children.

Physical Activity Levels

Mean weekday step counts for the sample (14,386) are greater than that reported previously in an Irish sample (1). Belton et al. (2010) reported 10,948 steps per day for children aged 6–9 years. This difference between 6–9 year old children and those immediately older is consistent with the findings of a review of 31 studies (26). Combined these experimental studies provide valuable objective data on step counts and physical activity levels of primary school children in Ireland, adding to existing work using proxy and self-report measures (14).

The weekday step counts found in the current study are greater than that previously found in 8–11 year old children in England (13,827 steps/day; 11), and lower than that reported in children in school years 4–6 (approx age 8–10) in New Zealand (15,671 steps/day)(7) and 9–11 year old Swedish children (21). The disparity in findings may represent not only different age ranges but also differing social and environmental factors between countries, and highlights the needs for further research to establish country-, gender- and age-specific norms.

Limitations

Data collected in the current study is cross-sectional and information on health measures were not assessed therefore causal relationships between mode of commuting and health outcomes cannot be inferred. Also as the pedometers were not sealed there is potential that reactivity occurred. Results are representative of 9–11 year old Irish children living in an urban area, and should be interpreted as such when comparing with other populations. Children reported the length of their commute by recall and this data may therefore be influenced by subject bias. Influencing factors on commuting behavior, such as car ownership and distance to school, was not assessed. Finally, the sample was recruited from four schools and it should be noted that children from the same school are not independent as they are likely to be influenced by factors such as school ethos, schools facilities and the distance of school from residential areas.

In summary, the current study demonstrates that children aged 9–11 who walk to school accumulate more daily steps than those who commute by passive means. Active commuting initiatives may therefore represent a worthwhile element of school based health promotion strategies.

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