




Article

Barriers and Determinants of Active Commuting to School in Slovenia

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Abstract: There is a growing body of literature reporting the health benefits of active commuting to school. This study investigated barriers and determinants of active commuting in children in Slovenia living within walking or cycling distance to school, i.e., 3 km. The sample consisted of 339 children (163 girls) aged 11–14 years who reported their mode of commuting, as well as their parents who described the socioeconomic environment of the family. Every third child in this study traveled to school exclusively by car/public transport, while every fifth participant used a passive means of transport when returning home from school. Potential household poverty, education of the mother and parental encouragement for physical activity were not associated with the commuting mode. In addition, conformist family barriers dominated among reasons for not choosing active commuting. A distance to school that was perceived to be too long was the most frequently cited barrier (72% of participants who passively commuted in both directions), followed by concern about being late for school (38% of participants who passively commute in one direction). Parents from all social strata who drive their children to school in either one or both directions while living in a walking or cycling range are a promising target population for active commuting interventions.

Keywords: passive commuting; traveling; driving; reasons; correlates



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1. Introduction

Physical inactivity has become a worldwide health problem, especially in children and youths [1–3]. Based on objectively measured physical activity and sedentary time, less than 10% of children and adolescents meet the recommended minimum of 60 min of daily moderate-to-vigorous physical activity (MVPA) [4]. Slovenian children are among the most physically active, since 88% of 11-year-olds and 66% of 14-year-olds meet these recommendations [5]. The COVID-19 pandemic facilitated a trend of physical inactivity as several measures designed to limit the spread of the virus were introduced. Due to authorities' strict advocacy of the "stayhome" policy and remote schooling, which have detained young people in their homes, the amount and intensity of their physical activity has lowered, and screen time has dramatically increased [6,7]. Since physical activity is favorably associated with numerous physical, psychological and cognitive health indicators [8–10], severe negative consequences are already visible [11].

Young people spend a major part of their time in schools. Therefore, schools will remain an important environment in the promotion of healthy movement behaviors, despite COVID-19 confinement measures in other settings. Compared to other settings (e.g., organized sports), school is also the only environment where all children from the same generation meet. Moreover, schools are very well connected with the local community

with regards to physical activity infrastructure, i.e., playgrounds, safe paths, green areas, urban sports facilities and sport clubs. Accordingly, schools should advocate physical activity even more than before the pandemic. One of the actions that should be on the radar of school authorities is physically active commuting to school. Namely, in a world of very low physical activity in children, this kind of activity can contribute to children's total daily physical activity [12–17] as well as their energy expenditure [15,18], both directly and indirectly. Specifically, besides physical activity related to walking or cycling to school or home, physically active commuters might engage in more spontaneous physical activities (e.g., running and jumping while playing outside) as well as becoming more familiar with physical activity infrastructure in their local environment and using it more frequently in their leisure time.

Consequently, several systematic reviews [16,19] reported positive associations between physically active commuting to school and cardiorespiratory fitness in youth, which is known to be an essential health marker in young people [20]. Interestingly, this association was significant for cycling, but not for walking to school. A very recent study of this problem [21] showed that when studying the effects of physically active commuting to school, the distance from home to school can have a moderating effect and should thus be considered. Children who actively commute typically live in close proximity to schools [22–26]. Similarly, children who walk to school do not live too far away, which could be the reason why improvements in physical fitness are not seen in those who have a physically active commute to school [15]. The close proximity to school means that the duration and the intensity of physical activity are low, even if the walk is daily. In contrast, living too far from the school is one of the most important barriers to a physically active commute to school. The largest acceptable distance for physically active commuting to school seems to be related to individual, family and environmental characteristics [22,27]. For example, a study from rural and urban areas of the UK showed that the threshold distance that best discriminated 14-year-old walkers from passive commuters was 3.1 km [28]. Another study in Belgium showed that this distance was 1.5 km in schoolchildren from urban areas [29], while findings from urban areas of the USA, Spain and Australia indicate that children who live farther than cca. 800 m from their school are less likely to make a physically active journey to school [24,30,31]. Another study from Australia reported that the likelihood of a physically active commute to school decreases with distance in a non-linear fashion [32]. It was found that 90% of trips will be active if the destination is 0.25 km away, 75% at 0.4 km, 50% at 0.9 km, 25% at 2.0 km and 10% at 3.2 km. Furthermore, Oliver et al. [33] reported that New Zealand children living farther than 2 km from school were significantly less likely to make active trips than those living less than 700 m away.

Besides distance, there are several other important barriers to physically active commuting to school. The systematic review of perceived barriers to children's physically active commuting to school conducted by Lu et al. [34] found several groups of barriers. *Personal barriers* were parents' lack of time, ease of dropping a child off on their way to work, a child's heavy backpack and a child's preference to be driven to school. The most common *physical environmental barriers* were traffic safety and distance to school, while *social environmental barriers* mostly addressed neighborhood safety. A recent systematic review [35] specifically addressed parental barriers and found that walkability was the most reported barrier (22 studies), followed by a high amount of traffic (14 studies), crime-related safety (15 studies) and distance (15 studies), which was the barrier with the strongest association with a physically active commute to school. Additionally, studies show that socioeconomic status is also an important predictor of a physically active commute to school. Several studies have recognized that children with a lower socioeconomic status are more likely to make active trips to school [36,37], while some studies show that the opposite is true [32].

Based on described findings, we wanted to consider the distance to school when examining the determinants of a passive commute to school. Therefore, the purpose of the present study was to gain an understanding of the choice to passively commute to school in Slovenia for children who live within walking or cycling distance to their school,

especially since Slovenian schools generally have good conditions for physically active commuting to school (e.g., school walkability, very low prevalence of crime).

2. Materials and Methods

2.1. Study Sample and Design

The participants included in this study were part of a decennial study on children's biological, psychological and social development: The Analysis of Children's Development in Slovenia (ACD.Si). The design and procedures of the ACD.Si were described in detail elsewhere [38]. The study was approved by the Commission of the Republic of Slovenia for Medical Ethics (No. 138/05/13). Parents or legal guardians provided informed consent for participation for both their underaged children and themselves.

We included children attending grades 6–9 (ages 11–14) from 11 randomly selected Slovenian primary schools. Data collection took place in September and October 2013. The initial sample size was 1437 (767 boys, 670 girls), but due to invalid or missing data, only 339 children were included in the analyses (176 boys and 163 girls; see Figure 1). Note that we only included adolescents living within 3 km from school, because it has been shown that the threshold distance that best discriminates walkers and passive commuters is 3 km for adolescents [28].

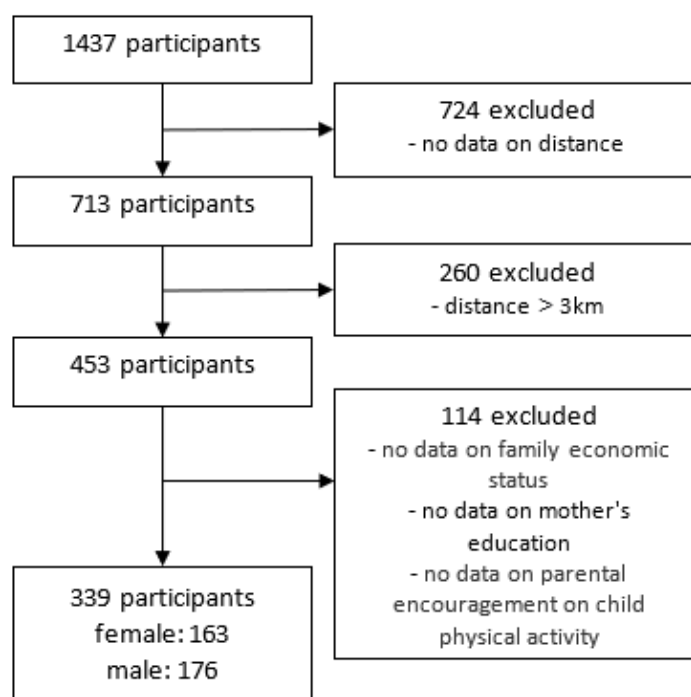


Figure 1. Participant flow diagram.

2.2. Measurements

2.2.1. School Commuting and Barriers for Active Commuting

The children completed the computerized SHAPES questionnaire on physical activity, supplemented with 2 questions regarding school commuting (Figure 2). The used questionnaire was piloted beforehand [38].

The children who chose a passive mode of commuting on the previous question (i.e., by car, by bus or by train) also answered the multiple-choice question regarding barriers to a physically active commute to school, with 8 given answers and one open answer (Figure 2).

School Commuting

In what way did you usually commute to and from school in the last seven days? If you have used two or more commuting modes, choose the one for which you spent the most time.

	By car	By bus or train	By walking	By bicycle	By skateboard, roller skates, or kick scooter
to school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
from school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Barriers for Active Commuting

What are the reasons for your passive commuting to or from school?

- ☐ School is too far from home.
- ☐ None of my friends are going to school by themselves.
- ☐ The school coincides with parent's work schedule.
- ☐ I do not want to walk or cycle to school.
- ☐ The school path is not traffic safe.
- ☐ I do not want to be late for school.
- ☐ School path is not safe, due to high crime rates.
- ☐ Because of my after-curriculum activities.
- ☐ Other:

Parents Encouragement for Children's Physical Activity

Do parents encourage to be physically active

- ☐ Parents encourage me.
- ☐ Parents neither encourage or discourage me.
- ☐ Parents discourage me.

Socioeconomic Environment

What is mother's educational attainment?

- ☐ Primary school.
- ☐ Secondary vocational school (2–3 years).
- ☐ Secondary school (4 years).
- ☐ Higher vocational education.
- ☐ Bachelor's degree.
- ☐ Master's degree or PhD.

How does your monthly income satisfy your family needs?

- ☐ We can easily meet ends with our monthly income (we can afford some more expensive things or exotic holidays...).
- ☐ We can meet ends with our monthly income, but we cannot afford more expensive things.
- ☐ It is difficult to meet ends with our monthly income, so we have to control our monthly spending.
- ☐ It is very difficult to meet ends with our monthly income, so we regularly give up everything except basic goods
- ☐ We are not able to meet ends with our monthly income, we regularly give up everything and ask for help.

Figure 2. Questions relating to school commuting, barriers to active commuting, parental encouragement for children's physical activity and socioeconomic environment.

2.2.2. Assessment of Distance from Home to School

The children's home address and the school's geographical coordinates were used to determine the actual (street) distance between them. We used the web application Here.com to calculate the distances, considering the mode of commuting. The only exception was commuting by public transport, where the actual distances were not known, and car distances were used.

2.2.3. Parental Encouragement for Children's Physical Activity

Children assessed how their parents encourage them in physical activity by one of three given answers (Figure 2).

2.2.4. Socioeconomic Environment

Parents were asked to describe the specifics of their socioeconomic environment with several questions, of which two were included in our analyses (Figure 2). To gather their answers, we used the pen & paper method. At the end of the first day of data collection, children were handed a questionnaire for their parents with the instruction to return them on the following day (detailed study design is available elsewhere [38]).

The mother's highest educational attainment was determined by one of six given answers, and potential risk of household poverty was investigated with the adapted question

of the EU-SILC questionnaire [39], describing the difficulties with making ends meet (parents were instructed to pick the one of five answers that best describes their situation).

2.3. Statistical Analysis

All statistical analyses were performed using the IBM SPSS Statistics 25. Descriptive statistics were presented as frequencies and percentages, means and standard deviations, and medians and interquartile ranges, as appropriate. The difference between genders in terms of active commuting to and from school was determined using the chi-square test. In addition, the differences in terms of mother's education, family economic status and parental encouragement in physical activity between the different commuting groups were determined using the Likelihood Ratio chi-square test. Here, the threshold for statistical significance was set at $p \leq 0.003$ due to the Bonferroni correction. Logistic regression was used to examine the associations between family economic status, the mother's education, and parental encouragement in physical activity with the commuting mode choice. Note that the reference value for calculating the logistic regression was the lowest value in the above variables.

3. Results

Table 1 shows that 32% and 20% of our participants reported commuting passively to and from school, respectively. The chi-square test showed a difference between genders in terms of preferred mode of commuting to school ($p = 0.005$). Boys were more likely to choose wheels (i.e., bicycle, skateboard, roller skates, or kick scooter) as a commuting mode ($p = 0.044$), while girls more often walked ($p = 0.25$). In terms of commuting from school, boys and girls were equally likely to choose a physically active commute to school ($p = 0.082$). Differences among genders are presented in supplement in Tables S1 and S2. Logistic regression showed no significant effects of the mother's education (p -values ranged 0.207–0.948), the economic status of the family (p -values 0.120–0.999) and parental encouragement of the child in physical activity (p -values 0.763–0.950) on commuting mode choice. In addition, the chi-square test showed no significant differences in terms of the mother's education, the economic status of the family and parental encouragement of the child's physical activity among the different commuting groups (Table 2). On the other hand, the distance to school was much greater in the passive commuting group in both boys and girls. Among passive commuters, the median distance (IQR) to school was 1956.5 (1853.3) and 2030.0 (1658.8) m for boys and girls, respectively, and among active commuters 818.0 (647) and 766.0 (763.5) m, respectively.

Table 1. Frequency of different modes of commuting to school and from school back home.

		Commuting from School				
		Car	Bus, train	Walk	Bicycle	Skateboard, Roller Skates, Kick Scooter
Commuting to School	Car	20 (5.9%)	7 (2.1%)	31 (9.1%)	0	0
	Bus, train	0	39 (11.5%)	13 (3.8%)	0	0
	Walk	2 (0.6%)	1 (0.3%)	210 (61.9%)	0	0
	Bicycle	0	0	3 (0.9%)	11 (3.2%)	0
	Skateboard, Roller Skates, Kick Scooter	0	0	0	0	2 (0.6%)
	Total	22 (6.5%)	47 (13.9%)	257 (75.8%)	11 (3.2%)	2 (0.6%)
		Total				
		22 (6.5%)	47 (13.9%)	257 (75.8%)	11 (3.2%)	2 (0.6%)

Most participants who lived within 3 km of their school and commuted passively to and from school marked "School is too far" as the main reason for their passive commuting (72% of them, Table 3). Interestingly, most of the participants from the mixed group who passively commuted in one direction chose "Do not want to be late" as their main reason

(38% of them). There was a small gender difference among the reasons mentioned. Girls expressed more often that the reason for their passive commuting is that school coincides with their parents' work schedule ($p = 0.037$) and that the school path is not traffic safe ($p = 0.021$). Differences among genders in reasons for passive commuting are presented in supplement in Table S3.

Associated with distance perception, of those who chose the reason "School is too far", 80% commute passively in both directions and live on average 1860 ± 940 m from their school, while the remaining 20% commute passively in one direction and live 1640 ± 797 m from their school. Among those who live less than 1 km from their school, 57% state that reason for their passive commuting is that school is too far and 40% they do not want to be late. Note that the children who have a physically active commute to school live 926 ± 516 m from the school.

Table 2. Descriptive statistics on children's encouragement by parents, mother's education, and economic status stratified by commuting mode.

		Type of Commuting to/from School							
		Boys				Girls			
		Passive in both directions $n = 36$	Passive in one direction $n = 27$	Active in both directions $n = 113$	χ^2 p -value	Passive in both directions $n = 30$	Passive in one direction $n = 20$	Active in both directions $n = 113$	χ^2 p -value
Age	Mean (SD)	13.5 (± 0.8)	13.7 (± 0.8)	13.4 (± 0.9)		13.4 (± 1.0)	13.4 (± 0.7)	13.4 (± 0.9)	
Mother's education	Median (IQR)	3 (2)	4 (2)	3 (3)	0.531	3 (2)	3.5 (2)	3 (3)	0.317
Economic status	Median (IQR)	3 (1)	2 (1)	2 (1.5)	0.017	2 (1)	2 (1)	2 (1)	0.679
Parental encouragement	Median (IQR)	2 (1)	2 (1)	2 (1)	0.093	2 (1)	2 (1)	2	0.942
Distance (m)	Median (IQR)	1956.5 (1853.3)	1552.0 (1097.5)	818.0 (647)	0.000	2030.0 (1658.8)	1066.0 (886.0)	766.0 (763.5)	0.000

SD—standard deviation; IQR—interquartile range; n —numerus; χ^2 —chi-square.

Table 3. Proportion of children who live within 3 km distance of their school and use passive or mixed commuting to school across different reasons for not actively commuting to school.

Reasons for not Actively Commuting to School	Commuting to/from School		
	Passive in both directions $n = 66$	Passive in one direction $n = 47$	Total $n = 113$
School is too far from home.	48 (72.2%)	12 (25.5%)	60 (53.1%)
I do not want to be late for school.	19 (28.9%)	18 (38.3%)	37 (32.7%)
The school coincides with parents' work schedule.	9 (13.6%)	9 (19.1%)	18 (15.9%)
Because of my after-curriculum activities.	10 (15.2%)	5 (10.6%)	15 (13.3%)
I do not want to walk or cycle to school.	7 (10.6%)	4 (8.5%)	11 (9.7%)
The school path is not traffic safe.	7 (10.6%)	1 (2.1%)	8 (7.1%)
None of my friends are going to school by themselves.	4 (6.1%)	4 (8.5%)	8 (7.1%)
School path is not safe, due to high crime rates.	1 (1.5%)	0	1 (0.9%)

4. Discussion

This study investigated the barriers to physically active commuting to school for children in Slovenia who live within a walking or cycling distance of their school (i.e., 3 km). The main finding is that potential household poverty, the mother's education and parental encouragement of children's physical activity do not determine passive commuting to school. The second important finding is that conformist family barriers dominate among reasons for not choosing a physically active commute to school. Perceived long distance to school was the most frequently cited barrier, followed by worrying about being late for school.

Commuting to school is a complex phenomenon, since commuting patterns depend on social and physical environmental factors such as traffic safety and distance to school, school characteristics such as school policies on daily school commuting and school districts and personal and family factors such as both the parents' and child's perception of distance and safety [22,34]. In this study, around 2/3 of children reported physically active commuting to school in both directions, while almost 80% participants chose an active way to get back from school. A similar trend of different commuting modes to and from school for certain groups of children was also noticed in previous studies from Spain [40], the United States [41–43], Iran [44] and Canada [45]. This indicates that passive commuting in the morning might be linked to the convenience for the parents of dropping a child at school on the way to work, and not necessarily to reservations about active commuting [46,47] or other determinants such as gender, family social status or education of parents.

Interestingly, our study did not show many gender differences in active commuting to school. A recent study reported that girls are more likely to use motorized transport than boys [48], although we did not find such a difference. However, we found that boys were more likely to use wheeled modes of commuting (e.g., bicycle, skateboard) and girls were more likely to walk. Accordingly, the main finding of our study is that family potential household poverty, the mother's education and parental support for children's physical activity did not determine a physically active commute to school. The lack of association between the different indicators of socioeconomic status and physically active commuting to school is not surprising because, according to a systematic review by Aranda-Balboa et al. [35], the main parental barriers to their children's physically active commuting to school are more related to the built environment, distance, traffic safety, crime-related safety and social support. On the other hand, these factors are likely to have some indirect influence on how children commute to school because, depending on the environment and parental education, some parents saw traffic volume as a greater threat than other barriers such as sidewalk maintenance [49]. Our findings imply that in high-income countries similar to Slovenia, interventions designed to promote active commuting should be delivered to parents from all social strata equally.

Reasons for not choosing physically active commuting to school reported in this study suggest that there is a meaningful proportion of children who use passive commuting to school for the wrong reasons. Specifically, 32.4% of students who lived within walking or cycling distance of their school commuted to school passively (by car, by public transport). The first three most frequently perceived barriers in this study (school is too far, fear of being late, school coincides with parents' work schedule) mark conformist family behavior related to the beginning of school, which is in line with findings from earlier studies [46,47]. Specifically, for the children included in this study, school starts between 7.30 and 8.20 a.m., which closely corresponds to parents' departure for work and results in parents driving their children to school on their way to work. Hence, a later school start could be accompanied by an increase in physically active commuting to school. Notably, it has been shown that a later school start is also related to longer sleep duration [50,51], improved academic performance [51] and decreased risk of motor vehicle crashes [50]. To this end, results from this and previous studies offer a powerful incentive for school administrations and national educational authorities to start school later in order to gain all these benefits.

The next important group of barriers identified in this study was related to perceived conditions for physically active commuting to school (none of my friends are going to school by themselves, I do not want to walk or cycle to school, school path is not traffic safe). These barriers fall into the category of social support and are in line with some previous studies. For example, in the study by Salmon et al. [52], 48.5% of 717 parents reported that there were no other children with whom their child could walk to school. In addition, 48.3% of them reported that their children preferred to be driven to school by car, and 69.2% of parents were concerned that their children might be injured in a road accident walking to school. Therefore, initiatives focused on addressing these problems

are called for. In cooperation with parents, schools should implement active commuting interventions, known in many countries as the walking bus and bicycle train forms of transport for schoolchildren, who, chaperoned by adults, walk or cycle to school along a set route, in much the same way a school bus would drive them to school. Besides increasing physical activity levels, these kinds of interventions can contribute towards an improvement of physical fitness in certain groups of children. Namely, our previous study showed that boys who walked or used wheels for commuting (e.g., bicycle, skateboard) to school had about 4 ml/min/kg higher predicted cardiorespiratory fitness compared to their peers who were driven to school [21]. Maximum benefits of active commuting for physical fitness are likely to be gained by children who live a little farther from their school, especially if they cycle to school. A recent study from Denmark reported that children who cycled to school had higher aerobic power (by 4.6–5.9%), isometric muscle endurance (by 10–16%), dynamic muscle endurance in the abdominal muscles (by 10%) and flexibility (by 6%) than either children who walked to school or passive commuters [53]. Moreover, a longitudinal study of Danish children [54] showed that switching from passive commuting to cycling to school was associated with 9% higher cardiorespiratory fitness at follow-up. Taken together, this suggests that initiatives that promote physically active commuting to school should prioritize cycling whenever the traffic infrastructure allows.

Additionally, together with the local community, schools should provide infrastructural support, such as safe routes to schools with playgrounds as stopovers, slower traffic in the school district, and storage for bicycles or other wheeled equipment at schools. In addition to the promotion of such commuting infrastructure, this could also affect perceptions regarding the distance to school, which is perceived as a barrier to a physically active commute to school.

Strengths and Limitations of the Study

The strengths of this study include an accurate and consistent measurement protocol, consideration of commuting distance between school and home when examining determinants and barriers for passive commuting and information on different commuting modes to school and home. However, there are several limitations worth highlighting as well. First, we used a subjective method (questionnaire) with specific types of questions to obtain information about the mode of commuting (7-day recall), which is frequently subject to bias and may not reflect the participants' typical commuting modes. Second, the commuting modes during the period of this study may have also been influenced by other factors (e.g., weather conditions) not observed in our study. To that end, it is worth noting that data for this study were collected in late summer and early autumn, when the weather in Slovenia is usually mild. Thus, whether the conclusions of this study would also be valid for winter remains to be determined. Third, we assessed family socioeconomic environment in our survey based on subjective perception of potential household deprivation, which we did not validate with a direct question on income. We did not use a direct question on monthly household income based on our previous experience in order to avoid the risk of increased drop-out due to the sensitivity of the information. Using a different direct or proxy indicator of socioeconomic status could result in different outcomes.

5. Conclusions

This study demonstrated that passive commuting to school in children living in a 3 km radius is not determined by family economic status, the mother's education or parental encouragement of children's physical activity. Additionally, it showed that barriers to a physically active commute to school are frequently associated with convenience, which are in turn linked with habitual daily family dynamics. This provides a good opportunity for active commuting interventions initiated by schools and implemented jointly with families and local communities, where the parents who live in a walking or cycling range and drive their children to school should be prioritised. In addition, local communities should promote physically active commuting to school among students

and should implement evidence-based programs, such as walking bus and bicycle train. Competent authorities should also consider a later start of school in the morning to allow more time for transport. Such approaches can guarantee the sustainability of the practice of a physically active commute to school as an important contributor to a healthy lifestyle, while at the same time reducing CO₂ emissions. Namely, children who actively commute receive more opportunities to master their built environment (e.g., crossing roads) and learn to be physically active in different weather conditions (e.g., walking in the rain). Moreover, these children also get more opportunities to develop their motor skills because the route from home to school is not necessarily direct, and children tend to engage in spontaneous activities along the way, such as climbing rocks or throwing snowballs. Therefore, children who actively commute gain more motor skills in their free time than their non-actively commuting peers. Finally, it should be noted that active commuting policies in school settings can easily reach children from all socioeconomic strata, and as such should be high on the policymaker's agenda. Still, in order to direct future policies on active transport, further research on children's and parents' perception of the adequate distance for a physically active commute to school is needed, as well as research on parents' reasons for choosing passive commuting.

Supplementary Materials: The following are available online at <https://www.mdpi.com/article/10.3390/su132413808/s1>, Table S1: Frequency of different modes of commuting to school and from school back home for boys, Table S2: Frequency of different modes of commuting to school and from school back home for girls, Table S3: Proportion of children who live within 3 km distance to school and use passive or mixed commuting to school across different reasons for not actively commuting to school, separated by gender.

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