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Attitudes, social support and environmental perceptions as predictors of active commuting behaviour in school children

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Abstract

Background—Environmental perceptions appear to play a role in determining behaviour in children, although their influence on active commuting remains unclear. This study examines whether attitudes, social support and environmental perceptions are associated with active commuting behaviour in school children and whether these associations are moderated by the distance to school.

Methods—Data were collected as part of the SPEEDY study (Sport, Physical activity and Eating behaviour: Environmental Determinants in Young people), a cross-sectional study of 2012 children from schools in Norfolk, England. Data regarding the usual mode of travel to school, attitudes towards and social support for active commuting, perceptions of the neighbourhood and route to school were assessed using questionnaires completed by the children and their parents. Distance to school was estimated using a Geographic Information System and this was used to compare associations between personal and environmental factors and active travel, across different distance categories.

Results—40% of children reported usually walking to school, with 9% cycling and the remainder using motorised travel. Parental attitudes and safety concerns, the presence of social support from parents and friends, and parent reported neighbourhood walkability were all found to be predictors of active commuting, with children receiving peer and family support and living in supportive environments being more likely to walk or cycle. There was some evidence of a moderating effect of distance whereby attitudes were more important for short distances and safety concerns long.

Conclusion—Both attitudinal and environmental perceptions are associated with children's active commuting behaviours. Given the difficulty in modifying attitudes directly, the effect on them of interventions to provide more supportive environments should be evaluated.

Introduction

The health benefits of physical activity in children are widely known. Engagement in physical activity is important for the prevention of obesity,[1] the reduction in cardiovascular risk factors,[2] and for the development and maintenance of a physically active lifestyle in adulthood.[3] In addition, physical activity is associated with good mental health,[4] and may result in improved performance in school.[5] Research suggests that children who walk to school are more physically active than those who use motorised travel, engaging in greater volumes of overall physical activity and spending on average over 30

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more minutes in moderate to vigorous physical activity during the week [6]. Furthermore, there is some evidence that children who walk to school are more active even outside the walking period [7]. As a result, walking or cycling to school or 'active commuting' may be an important contributor to children's overall levels of physical activity. [8]

In addition to health, the social and environmental benefits of walking and cycling have recently received increasing attention. Growing concern about climate change and increasing fuel costs,[9] as well as improving road safety and access to services,[10] have prompted transport policies to shift towards encouraging these more sustainable travel modes. Yet in spite of these benefits, the prevalence of walking to school is low. Furthermore, evidence suggests that levels of walking to school in children in the UK have decreased from 62% in 1989 to 52% in 2006. [11] Similar declines are observed in the United States and in Australia, although in these countries the prevalence of walking to school is already much lower (10% in the US [12] and 26% in Australia [13]).

According to social-ecological theory, personal, environmental and social factors influence children's behaviour.[14] Personal factors previously examined include age, sex, and attitudes towards physical activity. In a recent review, Davison and colleagues reported that child and family characteristics are consistently associated with active commuting.[15] They concluded that boys and children whose parents actively commute to work and who value physical activity are more likely to actively commute to school, although associations varied by age.

Perceptions of the physical environment may also act as predictors of walking or cycling to school. Short distance to school and living in an urban area [15] as well as positive perceptions of the environment, such as high levels of social interaction,[16] are important correlates of active commuting behaviour. Data from qualitative studies suggest that parents of young children often cite traffic and personal safety as barriers to walking and cycling to school.[17] However, the existing literature has a number of limitations. It does not provide a good understanding of the manner in which such factors might operate. We are aware of only one study that has examined the varying influence of individual, social and environmental perceptions on children's active commuting across different journey distances.[18] This is limiting as conceptual frameworks for active travel in children [19] suggest that distance may have an important moderating effect. Furthermore, only a small number of studies have assessed the relative importance of perceptions of the environment amongst children and their parents.[20, 21] Finally, most of the relevant research evidence comes from the USA and Australia. Both countries are distinctive in the manner in which their urban areas are designed and used, with a particularly strong emphasis on car use. Understanding the role of environmental perceptions in different settings is important if appropriate interventions are to be designed, as their effectiveness may be very specific to the context in which they are deployed.

In this study, we aimed to address the limitations outlined above, as we quantify the associations between personal, social and environmental characteristics of the local neighbourhood and route to school and active commuting to school in a sample of British children living in both urban and rural areas. We also examine how these relationships vary according to distance from school.

Methods

Study design, sample & data collection

The methods of recruitment, sampling and overall sample representativeness of the SPEEDY study (Sport, Physical activity and Eating behaviour: Environmental Determinants

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in Young people) have been described in detail.[22] Briefly, children were sampled through schools in the county of Norfolk, South-East England which were selected based on urban-rural status. 157 schools were approached, 92 agreed to take part and all children aged 9-10 years and their parents and guardians were invited to participate. 32.6% of schools in the sample were located in urban areas, 39.1% were in towns and the remaining 28.3% were located in villages. A team of trained field workers visited each school to distribute questionnaires for both children and parents and undertook measurements of height and weight of each child according to standard operating procedures. Body mass index (BMI) was calculated in kg/m^2 and used to classify children into 'normal', 'overweight' and 'obese' categories based on the method of Cole and colleagues.[23]

Travel behaviour measures

Children reported their usual travel mode to school using the four response categories provided ("by car", "by bus or train", "on foot" and "by bike"). Responses were collapsed into three categories; 'motorised travel', 'by bicycle' and 'on foot'.

Socio-demographic information

Data on ethnicity, access to or ownership of a car, usual mode of travel to work and educational level were collected in the parent questionnaire. Based on the highest qualification reported, parents were assigned to one of three categories of educational level; low (high school or less), medium (vocational above high school) and high (university education or above).

Attitudinal and social support factors

The exact wording of attitudinal, social support and environmental questions used are shown in Table 1. Parents were asked about their agreement with two statements regarding their attitude towards their child's journey to school. Five response options were provided, using a Likert-type scale from "strongly disagree" to "strongly agree". For the purposes of analysis, parents who reported that they "strongly agreed" or "agreed" with an item were compared to those who reported that they "strongly disagreed", "disagreed" or "neither agreed nor disagreed". Children were also asked about social support from friends and parents (two items), using "yes" or "no" response categories. All questions were newly developed, but were tested for face validity and pre-tested in the pilot study, which used a sample of 44 children from two schools (one located in an urban area and one from a village location) undertaken in February 2007. No resultant modifications to the questions were made and hence the results from the pilot were included in the main sample.

Neighbourhood and route environments

Parental perceptions of the neighbourhood environment were assessed using several questions. Firstly, parents specified their agreement with seven statements regarding the level of social cohesion and trust in their neighbourhood, using a five level Likert-type response scale. These were compiled based on a previous measure which examined social community organisation.[24] The scores on this scale ranged from 7-35 and the internal reliability was high, having a Cronbach's Alpha of 0.90. Secondly, a shortened 24 item version of the ANEWS instrument [25] was used. This gathers perceptions of a wide range of factors including residential density, street connectivity and traffic safety. ANEWS contained some terms which would not be familiar in a British setting such as 'sidewalks' and 'trails' so minor modifications were made (for example reference to 'sidewalk' was replaced with 'pavement'). A composite score was produced whereby a high score indicated a more favourable walking environment. The Cronbach's Alpha for this scale was 0.74. If parents answered less than two-thirds of the questions comprising a composite score it was

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coded as missing. In other cases missing responses were conservatively imputed with the response that was least likely to be associated with active travel based on findings in the literature. [15] Parents also reported their agreement with four statements about the social and physical environment of the route to school, again using a Likert-type scale with five response options. For the purposes of analysis, parents who reported that they "strongly agreed" or "agreed" with an item were compared to those who reported that they "strongly disagreed", "disagreed" or "neither agreed nor disagreed".

Questions relating to child perceptions of the neighbourhood environment focussed on safety. These included four items on their own perceptions as well as how they perceived their parents views on the neighbourhood environment. Children were also asked their perception of how their parents view the route to school (one item) using yes or no response categories. Again, all questions were newly developed, but face validity and pilot tests were undertaken.

Objective physical environment

Objective measures of urban-rural status and journey distance to school were estimated using Geographic Information Systems. Children's home address details were provided by consenting parents which were geo-referenced using Address layer 2, a dataset that identifies precise locations for all registered addresses in Great Britain.[26] If parents did not provide a complete address, the closest valid address was used. To estimate the distance travelled from home to school for each child, the locations of school entrances were mapped by researchers who visited participating schools. Assuming children would use their nearest entrance, the shortest route via the street network between it and each child's home was then calculated for all participants using ArcGIS Network Analyst, version 9.2.

Urban rural status of the home location was defined using the Rural and Urban Classification 2004.[27] Here, we collapsed the available categories into three groups; Urban, Town and fringe and Village.

Data Analysis

Analyses were undertaken using SPSS, version 16, to compare the number of children reporting the use of different travel modes across personal and demographic groups. In order to account for non-independence of observations, where similar active commuting patterns may be clustered amongst children attending the same schools, multilevel statistical modelling [28] was used in MLWin version 2.10 [29] by employing a 2 level structure of children nested within schools. Multinomial outcome models were specified with a three category outcome of walking, cycling, or motorised travel. Variables were retained in the models based on the goodness of fit. A number of variables showed correlations with each other and therefore to avoid problems of multi-colinearity, just one was selected for multivariate analysis. Analysis was stratified by three categories, based on distance to school; less than 1km, 1-2km and greater than 2km. These cut-offs were chosen as they were hypothesised to be appropriate for detecting possible transitions between walking and cycling and to maximise numbers of children in each category.

For each of the three stratifications, two sets of models were created; one which examined the effects of the factors of interest independently, adjusting for the hypothesised confounding effect of age, gender, child BMI, household car access, modelled distance to school (kilometres) and maternal travel mode to work, and a second set of 'best fit' models which fully adjusted for all predictors included in the model. Although, analyses were stratified using the distance categories specified above, a continuous measure of distance was also included to detect differences within distance categories. Maternal, rather than

paternal, travel mode to work was chosen as no associations were found with the latter measure. Variables were included in the best-fit models if they were statistically significant in independent analysis at ($p<0.05$), and the direction of effect was as expected or unchanged when added to the best-fit model. As a formal test for the moderating effects of distance, interactions were fitted between the three distance categories and each predictor variable.

Results

From the population sample of 3619 children, 2064 participated in the study but 52 were excluded; 41 did not provide an address which could be geo-referenced and 11 gave no information on travel mode to school. This left 2012 participants for analysis, representing 97% of the study sample. No significant differences were noted between those participants excluded from analysis and the main sample. There were few missing responses to each question, with only 4% of responses missing overall.

Sample characteristics

We found similar levels of walking or cycling to school compared to the national average for primary school children in the Great Britain (54%) [11]. In our sample, 40% of children reported usually walking to school, with 9% cycling to school and the remainder reporting use of motorised transport.

Table 2 shows the characteristics of participants by usual travel mode to school. A greater proportion of boys compared to girls usually cycled to school, although girls were more likely to report walking to school (both $p<0.001$). Children whose distance to school was less than 1km long and whose mothers actively commuted to work were more likely to walk to school. Access to or ownership of a car was very high in the sample, although just over 85% of those children who did live in homes without a car reported usually walking or cycling to school. In the overall sample, no statistically significant differences were seen between age, parental education or weight status by travel mode, although there was some evidence that obese children were less likely to walk than the rest of the sample.

Attitudinal, social support and environmental factors

Table 1 presents the percentage agreements reported by parents and children with the attitudinal, social support and environmental statements. Although both children and parents perceived their neighbourhoods to be safe and conducive to walking and cycling, perceptions did vary by distance to school. Children and parents tended to have more negative perceptions of social support and route perceptions as the distance required to travel to school increased. However, neighbourhood perceptions did not vary by distance to school.

Associations with walking and cycling to school

Initial examination of the data showed that parental reports of a lack pavements and a lack of cyclepaths were strongly related ($X^2 = 293.0$, $p<0.001$). Children who reported having other children in the neighbourhood were also more likely to report that the neighbourhood was safe ($X^2 = 58.39$, $p<0.001$). As all four measures were associated with each other at $p<0.01$ or less, only child report of whether it was safe to play, the strongest predictor of active commuting, was carried forward into the analysis to avoid potential problems of multi-collinearity.

We found that individual characteristics such as gender and maternal travel mode were associated with active commuting. For distances to school of less than 1km, boys ($p=0.03$)

and children with a higher BMI (p=0.01) were less likely to walk than girls and normal weight children. Children whose mothers walked or cycled to work were more likely to walk or cycle to school across most distance categories, (all p<0.05, except for cycling trips between 1 and 2km). Within each distance category, children who had a longer route to school were also less likely to walk or cycle (p<0.05), as were those whose parents reported having access to a car (p<0.001). As a result, we adjusted for these factors in our multivariate analysis. Table 3 presents independent associations between child and parental perceptions and children's travel mode to school, stratified by distance, and adjusted for age, gender, child BMI, household car access, modelled distance and maternal travel mode to work.

In general, across all distances, attitudinal and social support factors were associated with walking or cycling to school. When interaction terms were fitted to test for the moderating effect of distance, the associations between attitudinal factors and cycling were found to vary according to distance travelled; both of the attitudinal factors had a stronger effect for shorter distances (p<0.03) although distance did not moderate the association between attitudes and walking behaviour. Associations between parental concern about dangerous traffic and cycling were also moderated by distance; with stronger associations seen for longer distances (p<0.01). No further moderating effects were found.

Table 4 presents best-fit models predicting the odds of walking or cycling for each of the three stratifications according to distance. In cases where a variable was excluded from one of the stratifications 'n.i' (not included) is shown in the table. The findings are broadly similar to those reported in Table 3. For shorter distances, children who reported having peer encouragement were four times more likely to cycle rather than use motorised transport. Similarly, for those distances over 2km, children whose parents had concerns about dangerous traffic en route were half as likely to walk.

Discussion

This is one of the first studies to examine the influence of personal, and perceived social and environmental factors on children's active commuting in the UK, and the first to consider the moderating effect of distance to school. In this study, children whose distances were less than 1km and children whose mothers walked or cycled to work were more likely to walk or cycle to school. We found evidence that attitudinal, social and environmental factors, such as convenience of the car, parental encouragement and parental concern about dangerous traffic were associated with children's active commuting behaviour. However, some of the associations between attitudinal and environmental factors and cycling behaviour were moderated by distance travelled.

Consistent with studies of Australian children, we found that attitudinal factors were important correlates of self-reported active commuting behaviour. Salmon and colleagues [18] found few differences in the association between active commuting behaviours and environmental perceptions when their sample of Australian children was stratified according to whether or not children lived within walking distance of school. We found distance to be a moderating effect for attitudes and cycling behaviours, although nothing else. The findings of Merom et al [30] that children's travel mode was influenced by their parents' travel mode to work, were replicated here. However, we found mothers', as opposed to fathers', travel mode to work to be particularly important. Similar levels of active commuting in parents were observed in both our study and that of Merom et al.,[30] although in that study the children and parents who took part in that work mostly lived in urban areas.

We found social support was associated with active commuting for both longer and shorter distances, as previously reported among Australian children.[18] The consistency of findings around parental encouragement across all distances confirms the importance of parental support in encouraging walking and cycling, and that this support is independent of the parents' own mode of travel. Even though other factors, such as environmental conditions showed some associations, our results highlight that for this age group, parents have a strong influence on walking and cycling behaviour. The additional apparent effects of neighbourhood social cohesion suggest that social support at both the parental and neighbourhood levels is important, and that this is also not dependent on distance travelled.

As we have previously suggested may be the case,[19] both neighbourhood and route environment factors were related to both walking and cycling to school in this study, although the distance to school did not generally moderate the associations found. In general, children whose parents were concerned about dangerous traffic and personal safety en route to school were less likely to walk or cycle. We also found that parental perceptions of neighbourhood walkability were positively associated with children's walking or cycling to school. Furthermore, we hypothesised that the strength of the association between attitudes, social support and environmental perceptions and active commuting may differ according to distance (i.e. that distance acts as a moderator between these factors and active commuting). Although we found that the association between concerns about dangerous traffic and cycling were moderated by distance, in general our findings suggest that, regardless of distance, social support and environmental perceptions were important for both longer and shorter distances. Taken together, these findings confirm the potential role of environmental factors as important influences on both walking and cycling behaviours in this age group.

Findings from this study may help to inform the development of interventions designed to increase rates of walking and cycling to school. Our findings and those of others [17] suggest that interventions to promote active commuting which focus on road safety as well as parental and peer support should be piloted and tested. These views are in line with recent recommendations developed to promote physical activity in children produced by the National Institute for Clinical Excellence (NICE). [31]. Nevertheless, although interventions to directly modify attitudes may seem intuitively attractive they are difficult to successfully achieve. Hence, although our findings suggest that changing parental perceptions may be an important intervention strategy, how this could be achieved is currently unknown. The provision of more supportive environments for active commuting might be particularly appropriate as this may itself result in changes in attitudes or perceptions. Clearly both sets of social and environment concerns require addressing. [32]

This study has a number of strengths and potential limitations. Our findings are based on the analysis of data from a large scale, population-based study with significant variation in environments. We were able to utilise this heterogeneity to investigate interactions between distance to school and perceptions. We also collected particularly complete data on both children's and parents' perceptions, as both have been shown to be important in other studies, and we used a Geographic Information System to stratify our analysis by trip length.

In terms of limitations, our data are cross-sectional in nature and hence there are limitations in ascribing causality to the relationships observed. We also used a modified version of the street network that did not contain cut-throughs, and hence does not represent a complete pedestrian network. The sample from which is analysis is constructed had a 57.0% recruitment rate (based on a sample of 3621 invited children) and contained a largely British white population, so we were not able to examine how our findings might be affected by ethnicity. Compared to the child population of Norfolk [33] and the UK in general, [34] girls

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are slightly over-represented and obese children are underrepresented in this study. Furthermore, the county of Norfolk is predominantly rural [27] and has slightly higher levels of deprivation than the national average [35] which may limit the generalisability of our findings to some other settings. In order to capture habitual behaviour, we used self-reported usual travel mode to school, which may have led to some over-reporting of active travel, although any associated error is unlikely to introduce bias with respect to the associations we have tested. In this analysis we also combined travel by public transport and car, although travel by public transport has been shown to involve more physical activity than car use. [36] We did not use objective measures of environmental components in this study, which may limit our understanding of how the physical environment relates to perceptions, however this work was undertaken to specifically address how commonly reported barriers were associated with active travel in a sample of British children.

In conclusion we found that a combination of attitudinal, social, and environmental factors was associated with children's active commuting behaviour, and only a few of these associations varied by distance from school. In terms of further work, the difficulty with which attitudes and perceptions may be directly modified means there is a need for controlled trials to examine the effects of environmental modifications on them as well as the associated travel behaviours. Future work using longitudinal designs is also recommended to examine how changes in the socio-demographic and environmental structure of areas are associated with longer term trends in active commuting patterns in children. The transition of pupils from primary to secondary school also offers an attractive opportunity to explore how changes in perceptions of route environments may relate to travel behaviour.

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Table 1

Self-reported attitudes and perceptions, overall and stratified by distance to school

	All children		Distance to school < 1km	Distance to school 1-2km	Distance to school >2km	Linear test for trend (p)
Characteristic	**% agreeing (n)**	**% complete responses (n)**	**% agreeing (n)**	**% agreeing (n)**	**% agreeing (n)**	
Attitudinal factors						
Its more convenient to take my child to school by car [a]	35.4 (640)	89.9 (1809)	12.2 (78)	26.7 (171)	61.1 (391)	0.009
I'm usually around to take my child to school [a]	76.7 (1393)	90.3 (1817)	36.5 (508)	25.8 (359)	37.8 (526)	0.001
Social support factors						
My friends encourage me to walk or cycle to school [b]	32.1 (643)	99.9 (2011)	41.4 (266)	31.4 (202)	27.2 (175)	0.001
My parents encourage me to walk or cycle to school [b]	52.2 (1045)	99.5 (2001)	47.9 (501)	31.8 (332)	20.3 (212)	0.001
Physical and social environmental factors						
Route perceptions						
My parents think it's not safe to walk or cycle to school [b]	20.3 (403)	98.8 (1987)	22.8 (92)	22.3 (90)	54.8 (221)	0.001
The traffic makes it too dangerous for my child to walk or cycle to school [a]	34.9 (629)	89.7 (1804)	14.5 (91)	21.6 (136)	63.9 (402)	0.001
There are no safe pavements en route to school [a]	32.9 (595)	90.0 (1811)	13.9 (83)	15.3 (91)	70.8 (421)	0.001
There are no safe cycle paths en route to school [a]	66.6 (1211)	90.3 (1817)	32.4 (392)	24.7 (299)	42.9 (520)	0.001
I am worried that something will happen to my child on the way to school [a]	48.3 (877)	90.3 (1817)	30.0 (263)	52.6 (251)	41.4 (363)	0.001
Neighbourhood perceptions						
I'm not allowed to play outside because my parents think it's not safe [b]	11.3 (227)	98.5 (1981)	42.3 (96)	25.6 (58)	32.2 (73)	n.s
It is safe to walk or play in my neighbourhood during the day [b]	78.3 (1551)	98.5 (1981)	40.6 (630)	26.6 (412)	32.8 (509)	0.001
It is difficult to walk or play near my house because I don't feel safe [b]	14.9 (299)	98.7 (1986)	37.7 (702)	26.4 (492)	35.8 (667)	n.s
There are other children near my home for me to go out and play with [b]	78.6 (1581)	98.6 (1984)	40.4 (638)	26.4 (417)	72.3 (526)	0.001
Neighbourhood sense of community score (score range 7-35) [c]	24.8 (5.08)	91.7 (1845)	24.7 (5.01)	24.4 (5.12)	25.2 (5.11)	n.s
Neighbourhood walkability score (score range 24- 96) [c]	66.03 (8.77)	91.5 (1840)	67.1 (8.05)	67.1 (8.39)	64.2 (9.44)	0.001

[a] Parent's perceptions,

[b] Child's perceptions,

[c] Composite score of parental perceptions, n.s not significant (p>0.05) Mean scores and standard deviations (SD) reported

Table 2

Personal and household factors stratified by child's usual travel mode to school

Characteristic	Travel by motorised mode Percentage (n)	Travel by bicycle Percentage (n)	Travel on foot Percentage (n)	Total sample Percentage (n)
Age Tertiles				
Lowest tertile (youngest)	49.0 (331)	10.4 (70)	40.7 (275)	33.3 (671)
Middle tertile	54.4 (362)	7.1 (47)	38.6 (257)	33.3 (670)
Highest tertile (eldest)	49.0 (328)	10.3 (69)	40.7 (273)	33.3 (671)
Gender				
Boys	52.1 (468) **	13.0 (117) **	34.9 (314) **	44.7 (899)
Girls	49.7 (553)	6.2 (69)	44.1 (491)	55.3(1113)
Parental Education				
Low	49.2 (353)	8.4 (60)	42.5 (305)	39.0 (718)
Mid	52.6 (399)	9.7 (74)	37.7 (286)	41.2 (759)
High	53.0 (193)	9.3 (34)	37.6 (137)	19.8 (364)
Access to or ownership of a car				
No car	14.7 (14) **	15.8 (15) *	69.5 (66) **	5.1 (95)
Car	53.3 (948)	8.5 (152)	38.2 (680)	94.9 (1780)
Child weight status				
Normal	50.4 (776)	9.0 (138)	40.7 (627)	77.0 (1541)
Overweight	49.9 (173)	10.1 (35)	40.1 (139)	17.4 (347)
Obese	58.0 (65)	10.7 (12)	31.2 (35)	5.6 (112)
Urban rural status of home location				
Urban	43.1 (342) **	7.4 (59) **	49.5 (393) **	39.5 (794)
Town and fringe	40.6 (232)	12.4 (71)	47.0 (269)	28.4 (572)
Village	69.2 (447)	8.7 (56)	22.1 (143)	32.1 (646)
Mothers Transport				
No travel	50.3 (228) **	9.9 (45) **	39.7 (180) **	26.0 (453)
Motorised to work	57.7 (610)	7.1 (75)	35.2 (372)	60.6 (1057)
Active commute to work	27.2 (64)	15.7 (37)	57.0 (134)	13.5 (235)
Route length				
Less than 1km	18.2 (138) **	11.7 (89) **	70.1 (533) **	37.8 (760)
1km to 2km	47.4 (249)	12.4 (65)	40.2 (211)	26.1 (525)
Over 2km	87.2 (634)	4.4(32)	8.4 (61)	36.1 (727)

* $p<0.05$,

** $p<0.01$

Table 3

Independent associations between child and parental perceptions and child's travel mode to school, stratified by distance from school

	Distance to school less than 1km n= 760		Distance to school 1-2km n= 525		Distance to school over 2km n= 727	
Characteristic	**Travel by bike OR (95% CI) n=89**	**Travel on foot OR (95% CI) n=533**	**Travel by bike OR (95% CI) n=65**	**Travel on foot OR (95% CI) n=211**	**Travel by bike OR (95% CI) n=32**	**Travel on foot OR (95% CI) n=61**
Attitudinal factors						
Its more convenient to take my child to school by car [a]	0.03 (0.01, 0.20) **	0.07 (0.03, 0.14) **	0.04 (0.01, 0.11) **	0.06 (0.03, 0.10)	0.39 (0.13, 0.92) *	0.37 (0.19, 0.75) **
I'm usually around to take my child to school [a]	0.16 (0.10, 0.54) **	0.17 (0.09, 0.39) **	0.39 (0.20, 0.75) **	0.28 (0.17, 0.45) **	1.02 (0.33, 3.11)	0.76 (0.59, 1.68)
Social support factors						
Friend encouragement [b]	2.66 (1.66,4.26) **	1.27 (0.88, 1.63)	1.95 (1.12, 3.31)	1.29 (0.76, 1.97)	0.41 (0.13, 0.45)	1.93 (1.01, 3.69)
Parental encouragement [b]	3.74 (2.16, 6.40) **	3.22 (2.22, 4.66) **	5.50 (2.67, 10.44) **	2.82 (1.83, 4.75) **	2.91 (1.89, 4.48) **	5.47 (2.93, 10.89) **
Physical & social environmental factors						
Route environment						
Concern about dangerous traffic en route to school [a]	0.31 (0.14, 0.73) **	0.24 (0.14, 0.40) **	0.04 (0.01, 0.15)	0.17 (0.10, 0.31) **	0.13 (0.04, 0.35) **	0.29 (0.15, 0.62) **
Concern about something happening to my child on the way to school [a]	0.30 (0.16, 0.52) **	0.37 (0.25, 0.57) **	0.21 (0.02, 0.37) **	0.27 (0.18, 0.42) **	0.86 (0.37, 1.99)	0.54 (0.26, 1.05)
Neighbourhood environment						
Not allowed to play outside because my parents think its not safe [b]	0.37 (0.15, 0.93)	0.61 (0.25, 2.79)	0.90 (0.36, 2.20)	0.60 (0.31, 1.17)	0.91 (0.21, 3.97)	0.76 (0.20, 2.23)
It is safe to walk or play in my neighbourhood during the day [b]	1.68 (0.88, 3.34)	1.89 (1.18, 2.94) **	0.85 (0.43, 1.65)	1.25 (0.74, 2.11)	1.24 (0.80, 4.19)	1.84 (0.47, 3.24)
It is difficult to walk or play near my house because I don't feel safe [b]	3.45 (0.87, 10.0)	1.10 (0.53, 2.28)	0.86 (0.25, 2.19)	0.88 (0.35, 2.20)	1.15 (0.43, 3.09)	0.66 (0.23, 1.87)
Neighbourhood walkability score [a]	1.04 (1.02, 1.06) *	1.05 (1.03, 1.06) **	1.09 (1.07, 1.11) **	1.06 (1.04, 1.07) **	1.01 (0.97, 1.04)	1.10 (1.08, 1.11) **
Neighbourhood sense of community score [a]	1.07 (0.99, 1.10) **	1.07 (1.05, 1.08) **	1.06 (1.02, 1.09) *	1.02 (0.98, 1.05)	1.0 (0.94, 1.05)	1.01 (0.95, 1.06)
Urban Rural Status						
Town and Fringe	2.45 (1.50, 5.10) **	0.99 (0.42, 1.55)	2.02 (0.85, 4.76)	1.25 (0.73, 2.19)	0.60 (0.12, 2.84)	0.93 (0.33, 2.60)
Village, hamlet, isolated dwelling	2.80 (1.30, 5.60) **	0.83 (0.24, 1.41)	3.03 (1.24, 7.25) *	0.64 (0.32, 1.22)	0.81 (0.44, 2.40)	0.39 (0.16, 0.97) *

* p<0.05

** p<0.01

[a] Parent's perceptions,

[b] Child's perceptions,

[c] Composite score of parental perceptions.

All analyses adjusted for age, gender, BMI, maternal active travel to work, car access and modelled distance to school. Travel by motorised mode is the reference outcome category in all models. The reference category is "disagree" for all predictor items except urban rural status, where the reference is "urban" and friend and parental encouragement where the reference category is "no".

Table 4

Fully adjusted models of the associations between child and parental perceptions and child's travel mode to school, stratified by distance from school

	Distance to school less than 1km n= 654		Distance to school 1-2km n=475		Distance to school over 2km n=617	
Characteristic	**Travel by bike OR (95% CI) n=89**	**Travel on foot OR (95% CI) n=533**	**Travel by bike OR (95% CI) n=65**	**Travel on foot OR (95% CI) n=211**	**Travel by bike OR (95% CI) n=32**	**Travel on foot OR (95% CI) n=61**
Attitudinal factors						
Its more convenient to take my child to school by car [a]	0.04 (0.02, 0.09) **	0.05 (0.02., 0.17) **	0.05 (0.02, 0.22) **	0.08 (0.04, 0.17) **	0.96 (0.36, 2.51)	0.57 (0.27, 1.21)
I'm usually around to take my child to school [a]	0.40 (0.23, 0.73) **	0.32 (0.19, 0.55) **	0.79 (0.58, 1.44)	0.53 (0.26, 1.29) *	n.i	n.i
Social support factors						
Friend encouragement [b]	4.48 (3.99, 4.97) **	1.70 (1.24, 2.15)	n.i	n.i	n.i	n.i
Parental encouragement [b]	4.63 (4.06, 5.19) **	4.01 (3.55, 4.46) **	2.85 (1.84, 5.01) **	1.91 (1.09, 1.28) **	3.22 (1.16, 8.92) **	3.18 (1.45, 6.85) **
Physical & social environmental factors						
Route environment						
Concern about dangerous traffic en route to school [a]	0.89 (0.37, 2.12)	0.61 (0.33, 1.15)	0.05 (0.01, 0.25) **	0.36 (0.01, 0.58) **	0.19 (0.06, 0.58) **	0.48 (0.22, 1.07)
Concern about something happening to my child on the way to school [a]	0.38 (0.23, 0.66) **	0.56 (0.36, 0.88) **	0.46 (0.25, 0.94) *	0.57 (0.40, 1.07) *	n.i.	n.i.
Neighbourhood environment						
Not allowed to play outside because my parents think its not safe [b]	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
It is safe to walk or play in my neighbourhood during the day [b]	2.5 (1.28, 4.88) **	1.84 (1.07, 3.20) **	n.i.	n.i.	n.i.	n.i.
It is difficult to walk or play near my house because I don't feel safe [b]	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Neighbourhood walkability score [c]	1.04 (1.02, 1.05) *	1.02 (1.00, 1.03) *	1.05 (1.03, 1.06) **	1.01 (0.99, 1.02)	1.00 (0.97, 1.04)	1.05 (1.02, 1.09) *
Neighbourhood sense of community score [c]	1.09 (1.05, 1.12)	1.08 (1.04, 1.11)	1.11 (1.05, 1.16) **	1.05 (1.01, 1.08) **	n.i.	n.i.
Urban Rural Status						
Town and Fringe	2.29 (1.46, 4.70) **	0.84 (0.51, 1.37)	1.34 (0.78, 3.08)	0.70 (0.40, 1.17)	0.57 (0.03, 2.35)	0.37 (0.08, 1.50)
Village, hamlet, isolated dwelling	7.38 (5.61, 10.04) **	1.83 (1.06, 3.10)	3.85 (2.01, 6.91) *	0.55 (0.30, 1.19)	1.49 (0.52, 4.75)	1.29 (0.55, 3.01)

n.i Not included in the model

* p<0.05

** p<0.01

[a] Parent's perceptions,

[b] Child's perceptions,

[c] Composite score of parental perceptions.

All analyses adjusted for age, gender, BMI, maternal active travel to work, car access and distance to school.

Travel by motorised mode is the reference outcome category in all models. The reference category is "disagree" for all predictor items except urban rural status, where the reference is "urban" and friend and parental encouragement where the reference category is "no".