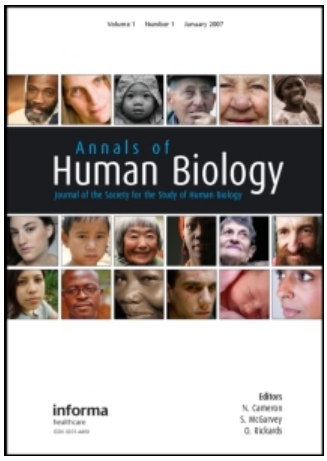


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**ORIGINAL ARTICLE**

# Active versus passive transportation to school – differences in screen time, socio-economic position and perceived environmental characteristics in adolescent girls

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**Abstract**

*Objective*: The aims of this study were (1) to assess the relationships between transport to and from school (active vs. passive), sedentary behaviours, measures of socio-economic position and perceived environmental variables, and (2) to determine which, if any, variables were predictors of active transportation.

*Methods*: The sample comprised 705 girls with mean age of 14.7 (SD = 1.6) years old. Questionnaires were used to describe travel mode to school and to estimate weekly television and computer use (screen time). Girls were assigned to active transportation (AT) or passive transportation (PT) groups depending on whether they walked or bicycled (AT) to and from school or travelled by car or bus (PT). Screen time was determined by the number of hours they reported watching television and using computers in the week preceding the examination, including weekends. Socio-economic position was established by parental occupation and educational level. A questionnaire assessed Perceived Neighbourhood Environments.

*Results*: No statistically significant differences were seen for screen time between travel groups. Occupational status of both mother ($r = -0.17$) and father ($r = -0.15$) and father's educational level ($r = -0.10$) were significantly and negatively associated with AT, while street connectivity ($r = 0.10$) was positively and significantly associated with AT. Logistic regression analysis showed that the likelihood of active commuting decreased by around 50% with increasing father's occupation (odds ratio (OR) = 0.51; $p \leq 0.05$) and father's education (OR = 0.52; $p \leq 0.05$) from low to middle socio-economic position groups. Further, the data showed that girls who agreed that 'there are many four-way intersections in my neighbourhood' were more likely to be active (OR = 1.63; $p \leq 0.05$).

*Conclusion*: The data of this study showed that lower socio-economic position is associated with active commuting to school and that street connectivity is a predictor of active transportation in adolescent girls.

**Keywords:** *Transport, girls, screen time, SES, perceived environment*

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## Introduction

Low levels of physical activity in childhood may increase the risk of developing obesity and diseases such as type 2 diabetes (Goran et al. 1999). Longitudinal studies have documented an age-related decline of 26–37% in total physical activity during adolescence (Hill and Peters 1998; Telama and Yang 2000). Of particular concern are adolescent girls, who have lower levels of activity than boys and who experience a steeper decline in activity with age (Riddoch et al. 2004; Sproston and Primatesta 2003). Therefore, the challenge is to understand the factors that influence the adoption of physical activity behaviours in youth, and how adolescents can be assisted to establish regular physical activity as a habit.

The journey to school might be a potentially important opportunity for establishing daily physical activity (Sleap and Warburton 1993; Tudor-Locke et al. 2001). Promoting active commuting to school not only reduces an inactive behaviour (passive commuting), but replaces it with a moderate intensity activity (Alexander et al. 2005). Recent studies have reported higher levels of physical activity in children (Cooper et al. 2003, 2005) or energy expenditure in adolescent girls (Tudor-Locke et al. 2003) associated with active travel to school, often greater than can be attributed to the journey itself.

Whilst the association between active commuting and higher physical activity has been established in a number of studies, little is known of the social, environmental or personal correlates of active travel to school. Social class and environmental perceptions have both been suggested to be determinants of active travel (Timperio et al. 2006) but the relationship of active commuting with sedentary behaviours such as television viewing and computer use have not been described. Active travel to and from school may provide greater opportunities for free play outside school, and it could be hypothesized that this may displace more sedentary activities.

To the best of our knowledge, no studies have addressed these questions in a Portuguese population. Hence, the aims of this study were (1) to assess the relationships between commuting to and from school (active vs. passive), sedentary behaviours, measures of socio-economic position and perceived environmental variables, and (2) to determine which, if any, variables were predictors of active transportation.

## Methods

### *Sample*

Eleven urban public secondary schools in Aveiro District, Portugal participated in this study. Schools were selected to encompass a wide range of social position. The potential sample included all the 841 girls from the 7th to 12th grades registered at the participating schools. The questionnaires were distributed and filled out during physical education classes in spring 2004. A response rate of 90% was obtained ($n = 757$). For the purpose of this study, girls ($n = 52$) who reported that they did not travel home in the same way that they travelled to school were excluded from analyses. After exclusions, 705 girls, mean age 17.7 (SD = 1.6) entered the analysis. Informed written consent was obtained from the participants and their parents or guardians before the subjects entered into the study.

### *Anthropometry*

Body height and body weight was determined by standard anthropometric methods. Height was measured to the nearest millimetre in bare or stockinged feet with girls standing upright

against a Holtain portable stadiometer. Weight was measured to the nearest 0.10 kg, with participants lightly dressed (underwear and T-shirt) using a portable digital beam scale (Tanita Inner Scan BC 532). Body mass index (BMI) was estimated from weight/height$^2$ (kg m$^{-2}$).

*Commuting to and from school*

Participants were asked if they walked, bicycled, went by car, or went by bus to and from school. Based on their answers, the respondents were categorized as using active (walking, bicycling) or passive (bus, riding in a private vehicle) commuting (Tudor-Locke et al. 2001).

*Television watching/computer use*

A questionnaire was used to ask participants how many hours they usually watched television and used a computer in the week preceding the examination, including weekends. Respondents were grouped as watching television and using computer on average less than 1 h day$^{-1}$, between 2 and 3 h day$^{-1}$ and more than 4 h day$^{-1}$ according to an established protocol (Eisenmann et al. 2000).

*Socio-economic position*

Socio-economic position was established using a questionnaire sent to the parents' home. The response rate was 82% from both parents. Two separate indices, occupation and educational level, were used in the analysis. Parents' occupations were classified according to the International Classification of Professions (CTIP-88). Occupational titles were regrouped in order to classify them as lower (LSC), middle (MSC) and upper (USC) social class as described in other studies (Raudsepp and Viira 2000). Parents' educational level was based on the Portuguese Educational system ((1) 9 years' education or less – sub-secondary level; (2) 10–12 years' education – secondary level and (3) higher education) and grouped into three categories (1 = Low (LE); 2 = Middle (ME) and 3 = High (HE) level of education). Similar procedures have previously been applied in the Portuguese context (Mota and Silva 1999).

*Environmental assessment*

A questionnaire using the Environmental Module (Perceived Neighbourhood Environments) of the International Physical Activity Prevalence Study was used. The questionnaire was designed to be a brief assessment of variables believed to be related to the activity-friendliness of neighbourhoods. Neighbourhood environmental variables assessed included (I) Access to destination (two questions); (II) Connectivity of the street network (one question); (III) Infrastructure for walking and cycling (one question); (IV) Neighbourhood safety (two questions); (V) Social environment (one question); (VI) Aesthetics (one question); and (VII) Recreation facilities (one question). These questions have previously been used in Portuguese adolescents, showing good reliability (Mota et al. 2005). A four-point scale assessed each question: strongly disagree, somewhat disagree, somewhat agree, strongly agree. However for statistical analysis a dichotomous

variable was constructed. Responses to the items were collapsed in two categories: (1) 'somewhat agree' and 'strongly agree', (2) 'strongly disagree' and 'somewhat disagree'.

*Statistical procedures*

For all analyses participants were assigned to one of two groups (active transportation (AT) or passive transportation (PT)) based on their self-reported mode of transportation to and from school. Differences in physical characteristics were tested by independent *t*-test. The chi-square ($\chi^2$) test was used to determine the differences in socio-economic status (SES), sedentary behaviours and perceived environmental variables between AT and PT groups. Bivariate associations between variables were investigated using Spearman correlation. The independent association of predictors with mode of transportation (active vs. passive) as the dependent variable was examined using logistic regression analysis. The variables entered in the model were selected for variables associating at a $p \leq 0.05$ in the correlations. All analyses were conducted using the Statistical Package for the Social Sciences (SPSS) v12.0. The level of significance was set at $p \leq 0.05$.

## Results

No statistically significant differences were found for physical characteristics between travel groups (Table I). Description of the participants travel patterns showed that 52.6% of the girls reported active in their way to and from school (walking = 27.3% and cycling = 25.3%), while 47.4% were driven to school by car (24.2%) or took the bus (23.2%).

The association between screen time and parental socio-economic position according to travel group are shown in Tables II and III. No statistically significant differences were seen for screen time between travel groups. Girls whose mother and father had lower occupational status reported travelling by active transportation significantly more ($p$ 0.05) than those with a higher status occupation. The same was found for the father's educational level ($p \leq 0.05$) but not for the mother's.

Table IV shows the differences in Perceived Neighbourhood Environments between girls in the AT and PT groups. Only street connectivity was significantly different ($p \leq 0.05$) between the travel groups, although neighbourhood safety was of borderline statistical significance ($p = 0.07$). No other statistically significant differences were found between travel groups.

Bivariate correlations showed that the occupational status of both mother and father, as well as the fathers educational level were significantly and negatively associated with AT, while street connectivity was positively and significantly associated with AT (Table V).

Table I. Physical characteristics according to transportation groups.

| | Passive ($n = 334$) | Active ($n = 371$) | $p$ |
|---|---|---|---|
| Age (years) | $14.5 \pm 1.8$ | $14.7 \pm 1.6$ | 0.07 |
| Body mass (kg) | $55.1 \pm 9.2$ | $54.9 \pm 9.3$ | 0.73 |
| Height (cm) | $160.5 \pm 0.8$ | $161.0 \pm 0.6$ | 0.39 |
| BMI ($kg\,m^{-2}$) | $21.5 \pm 3.9$ | $21.1 \pm 3.1$ | 0.22 |

No other statistically significant associations were found. Logistic regression analysis (Table VI) showed that the likelihood of active commuting decreased by around 50% with increasing fathers' occupation (odds ratio (OR) = 0.51; $p \leq 0.05$) and fathers' education (OR = 0.52; $p \leq 0.05$) from low to middle socio-economic position groups. Further, the data showed that girls who agreed that 'there are many four-way intersections in my neighbourhood' were more likely to be active travellers (OR = 1.63; $p \leq 0.05$).

## Discussion

The purpose of this study was to identify the associations between mode of transportation from and to school, sedentary activity (screen time), SES and several perceived physical environmental variables in a sample of adolescent girls. Previous research has consistently demonstrated that physical activity levels decline with increasing age and tend to be lower in girls than boys (Telama and Yang 2002; Van Mechelen et al. 2000). Thus, girls have long

Table II. Differences in screen time according to transportation groups: Active (AT) and passive transportation (PT).

| | AT (%) | PT (%) | *p* |
|---|---|---|---|
| *TV watching* | | | |
| ≤1 h | 11.3 | 12.0 | |
| 2–3 h | 49.6 | 51.5 | 0.78 |
| ≥4 h | 39.1 | 36.5 | |
| *Computer use* | | | |
| ≤1 h | 68.7 | 68.9 | |
| 2–3 h | 26.1 | 27.5 | 0.59 |
| ≥4 h | 5.1 | 3.6 | |

Table III. Differences in socio-economic background according transportation groups: Active (AT) and passive (PT).

| | AT (%) | PT (%) | *p* |
|---|---|---|---|
| *Father's occupation* | | | |
| Lower | 72.5 | 57.8 | 0.000 |
| Middle | 14.5 | 24.8 | |
| Upper | 12.8 | 17.4 | |
| *Mother's occupation* | | | |
| Lower | 73.6 | 57.1 | 0.000 |
| Middle | 17.0 | 28.4 | |
| Upper | 9.4 | 14.5 | |
| *Father's education* | | | |
| Lower | 78.9 | 69.8 | 0.007 |
| Middle | 14.4 | 23.8 | |
| Higher | 6.6 | 6.5 | |
| *Mother's education* | | | |
| Lower | 77.6 | 75.3 | 0.251 |
| Middle | 15.1 | 13.9 | |
| Higher | 7.3 | 10.8 | |

Table IV. Differences in Perceived Neighbourhood Environments domains according to transportation groups: Active (AT) and passive transportation (PT).

| Scale composition | Item | AT agree (%) | PT agree (%) | *p* |
|---|---|---|---|---|
| Access to destinations | Many stores are within easy walking distance of my home | 49.7 | 50.0 | 0.91 |
| | It is easy to walk to a transit stop (bus, trolley car) from my home | 62.8 | 61.0 | 0.68 |
| Connectivity of the street network | There are many four-way intersections in my neighbourhood | 56.0 | 46.1 | 0.02 |
| Infrastructure for walking and cycling | There are pavements on most of the streets in my neighbourhood | 54.5 | 48.7 | 0.19 |
| Neighbourhood safety | There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighbourhood | 27.9 | 27.7 | 0.97 |
| | The crime rate in my neighbourhood makes it unsafe or unpleasant to walk in my neighbourhood | 21.8 | 28.8 | 0.07 |
| Social environment | I see many people being physically active in my neighbourhood | 72.6 | 73.3 | 0.86 |
| Aesthetics | There are many interesting things to look at while walking in my neighbourhood | 36.8 | 42.2 | 0.21 |
| Recreation facilities | My neighbourhood has several public recreation facilities, such as parks, walking trails, bike paths, recreation centres, playgrounds, public swimming pools, etc. | 41.3 | 40.5 | 0.86 |

Table V. Spearman's correlation between transportation groups and independent variables.

| | Rho | *p* |
|---|---|---|
| Father's occupation | −0.15 | 0.000 |
| Mother's occupation | −0.17 | 0.000 |
| Father's education | −0.10 | 0.01 |
| Street connectivity | 0.10 | 0.002 |

Table VI. Logistic regression analysis with transportation groups as dependent variable.

| Variable | Item | OR | 95% CL | *p* |
|---|---|---|---|---|
| Father's occupation | Low | ref. | | |
| | Middle | 0.51 | 0.28–0.94 | 0.03 |
| | Upper | 0.48 | 0.15–1.52 | 0.21 |
| Father's education | Low | ref. | | |
| | Middle | 0.52 | 0.29–0.95 | 0.03 |
| | High | 0.91 | 0.20–4.01 | 0.89 |
| Connectivity of the street network | There are many four-way intersections in my neighbourhood | 1.63 | 1.08–2.45 | 0.02 |

OR, odds ratio; CLI, confidence limits.

been seen as an important target for campaigns and strategies to enhance physical activity. Active commuting (walking and bicycling), as part of the usual routine of everyday life has been understood as more likely to induce habitual physical activity than structured types of exercise (Moudon and Lee 2003).

In this study, 52.6% of the girls reported active travel to and from school, similar to other European countries (Cooper et al. 2003) but much higher than among American high school students, where as few as 4.9% have been reported to usually walk to school with 2.8% cycling (Evenson et al. 2003). No statistically significant differences were found for screen time between travel groups. The likely explanation for this observation is that watching television and using a computer are common and generalized activities in youth (Kerner et al. 2004). Although screen time has been described as a behavioural marker of sedentary children (Sallis et al. 2000), active or passive commuting was not associated with sedentary behaviours in other domains of daily life. This reinforces the suggestions that different sedentary behaviours such as computer use or television viewing are important in their own right (Eisenmann et al. 2000). Thus, other common sedentary behaviours such as passive transportation may also be important to analyse in the context of daily life. Conversely, socio-economic position differentiates both groups. Our data showed that girls with mothers and fathers in the lowest occupational group were significantly more likely to use active transportation than those in higher groups, and the association was similar for fathers educational level. Additionally, the data from logistic regression showed that change from the father's lower occupation status or low education level to middle occupation or education groups was a predictor of passive transportation. Higher socio-economic position has been associated with physical activity in previous studies, with increased availability of parents to drive children to and from sports facilities, with more positive attitudes towards the value of physical activity during leisure time

(Bois et al. 2005) and higher participation in organized sports activities (Santos et al. 2004). Moreover, our data also highlights that higher socio-economic position is associated with higher passive commuting, which might be related with more money availability and car ownership per household (Prentice and Jebb 1995). Indeed, it has been reported that higher parental education was associated with reduced odds of walking to school (Evenson et al. 2003). However, some barriers to active transportation might avoid those choices. Busy roads were reported as a negative correlate of active transportation (Timperio et al. 2006). Furthermore, distance to school was the most commonly cited barrier to walking to and from school (CDC 2002). In our study we did not analyse how far students commuted to school, which could bias the outcomes, since if they live too far away from the school to walk or cycle then they have no real transportation choice. Nevertheless our data clearly suggest that higher socio-economic position is associated with passive transport to school. The extent to which this affects overall physical activity was beyond of the scope of this study and should be further explored.

Different environmental factors within neighbourhoods may promote or inhibit physical activity. Indeed, commuting (active or passive) to school might be a matter of choice related to environmental characteristics (Tudor-Locke et al. 2001). Our study showed that street connectivity was the most important perceived environmental factor associated with active travel. Connectivity refers to the availability of direct routes and the provision of safe connections for pedestrians and bicyclists (Saelens et al. 2003), and this finding thus agrees with the suggestion that how neighbourhoods and communities are designed may be important in promoting or discouraging activity (Handy et al. 2002). Previous research has reported some other perceived measures of environment that were positively associated with time spent participating in transport-related physical activity (Troped et al. 2003). Traffic safety and fear of crime have been cited as reasons for not walking to school (Collins and Kearns 2001). Although safety is an important issue for youth transportation, it is also important to take into consideration the cultural context where youth lives, which might explain that the borderline significance ($p = 0.07$) that was found for safety issues. Nonetheless, this association agrees with previous studies that linked transportation and safety in youth (Staunton et al. 2003). However, our data stressed the importance of street connectivity and give additional support to other findings suggesting that improvements on road and pedestrian features in neighbourhoods and/or perceptions of road safety may be important components of strategies for increasing availability to walk and cycle (Timperio et al. 2004). Nevertheless, the relationship between the local neighbourhood and walking and cycling is a complex issue. For example, living in an urban environment has been associated with a greater number of pavements, which were a predictor of walking for exercise, but were also an area of high crime, which is a deterrent for walking (Collins and Kearns 2001). Thus it is possible that other characteristics of the environment are important when mode of transport is the aim rather than walking or cycling related to overall physical activity.

The strengths of this study include an important topic area, a large sample size, and parent assessment of socio-economic position. Additionally the study is based in Portugal and therefore provides information that can be contrasted with previous studies conducted elsewhere. Nevertheless, the limitations of the study should be recognized. The results of this study should be interpreted with the understanding that the data are cross-sectional and thus it may be difficult to assign causality, and prevents causal inferences being drawn. Further data are needed to replicate these findings using longitudinal designs.

## Conclusion

This study showed that social (lower socio-economic position) and environmental (street connectivity) factors are predictors of active transportation in adolescent girls. These influences should be taken into account when developing strategies for enhancing physical activity in young people.

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## References

Alexander LM, Inchley J, Todd J, Currie D, Cooper AR, Currie C. 2005. The broader impact of walking to school among adolescents: Seven day accelerometry based study. BMJ 33:1061–1062.

Bois JE, Sarazzin PG, Brustad RJ, Trouilloud DO, Curry F. 2005. Elementary school children's perceived competence and physical activity involvement: The influence of parents' role modelling behaviours and perceptions of their child's competence. Psychol Sport Exerc 6:381–397.

CDC. 2002. Barriers to children walking and biking to school – United States, 1999. MMVR 51:701–704.

Collins DCA, Kearns RA. 2001. The safe journeys of an enterprising school: Negotiating landscapes of opportunity and risk. Health Place 7:293–306.

Cooper AR, Page AS, Foster LJ, Qahwaji D. 2003. Commuting to school. Are children who walk more physically active? Am J Prev Med 25:273–276.

Cooper AR, Andersen LB, Wedderkopp N, Page AS, Froberg K. 2005. Physical activity levels of children who walk, cycle, or are driven to school. Am J Prev Med 29:179–184.

Eisenmann JC, Bartee RT, Wang MW. 2000. Physical activity, TV viewing, and weight in US youth: 1999 youth risk behaviour survey. Obes Res 10:379–385.

Evenson KR, Huston SL, McMillen BJ, Bors P, Ward DS. 2003. Statewide prevalence and correlates of walking and bicycling to school. Arch Pediatr Adolesc Med 157:887–892.

Goran MI, Reynolds KD, Lindquist CH. 1999. Role of physical activity in the prevention of obesity in children. Int J Obes 23:S18–SS33.

Handy SL, Boarnet MG, Ewing R, Killingsworth RE. 2002. How the built environment affects physical activity: Views from urban planning. Am J Prev Med 23(2 Suppl.):64–73.

Hill JO, Peters JC. 1998. Environmental contributions to the obesity epidemic. Science 280:1371–1374.

Kerner MS, Kurrant AB, Kallinski M. 2004. Relationship between leisure-time sedentary behaviors and physical activity, attitude to physical activity, and physical fitness of high school girls. Eur J Sport Sci 4:1–17.

Mota J, Silva G. 1999. Adolescent's physical activity: Association with socio-economic status and parental participation among a Portuguese sample. Sport Educ Soc 4:193–199.

Mota J, Almeida M, Santos P, Ribeiro JC. 2005. Perceived Neighborhood Environments and physical activity in adolescents. Prev Med 41:834–836.

Moudon AV, Lee C. 2003. Walking and bicycling: An evaluation of environmental audit instruments. Am J Health Promot 18:21–37.

Prentice AM, Jebb SA. 1995. Obesity in Britain: Gluttony or sloth? BMJ 311:437–439.

Raudsepp L, Viira R. 2000. Sociocultural correlates of physical activity in adolescents. Ped Exerc Sci 12:51–60.

Riddoch CJ, Andersen LB, Wedderkopp N, Harro M, Klasson-Heggebø L, Sardinha LB, Cooper AR, Ekelund U. 2004. Physical activity levels and patterns of 9 and 15 year old European children. Med Sci Sport Exerc 36:86–92.

Saelens BE, Sallis JF, Frank LD. 2003. Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. Ann Behav Med 25:80–91.

Sallis JF, Prochaska JJ, Taylor WC. 2000. A review of correlates of physical activity of children and adolescents. Med Sci Sports Exerc 32:963–975.

Santos MP, Esculcas C, Mota J. 2004. The relationship between socioeconomic and adolescents' organized and nonorganized physical activities. Ped Exerc Sci 16:210–218.

Sleap M, Warburton P. 1993. Are primary school children gaining heart health benefits from their journeys to school? Child Care Health Develop 19:99–108.

Sproston, K., Primatesta, P. (Eds.) (2003). Health Survey for England 2002: The health of children and young people. London: The Stationery Office.

Staunton CE, Hubsmith D, Kallins W. 2003. Promoting safe walking and biking to school: The marin county success story. Am J Public Health 93:1431–1434.

Telama R, Yang X. 2000. Decline of physical activity from youth to young adulthood in Finland. Med Sci Sports Exerc 32:1617–1622.

Timperio A, Crawford D, Telford A, Salmon J. 2004. Perceptions about the local neighbourhood and walking and cycling among children. Prev Med 38:39–47.

Timperio A, Ball K, Salmon J, Roberts R, Giles-Corti B, Simmons D, Baur LA, Crawford D. 2006. Personal, family, social, and environmental correlates of active commuting to school. Am J Prev Med 30:45–51.

Troped PJ, Saunders RP, Pate RR, Reininger B, Addy CL. 2003. Correlates of recreational and transportation physical activity among adults in a New England community. Prev Med 37:304–310.

Tudor-Locke C, Ainsworth BE, Popkin BM. 2001. Active commuting to school: An overlooked source of children's physical activity? Sports Med 31:309–313.

Tudor-Locke C, Ainsworth BE, Adair LS, Popkin BM. 2003. Objective physical activity of Filipino youth stratified for commuting mode to school. Med Sci Sports Exerc 35:465–471.

Van Mechelen W, Twisk JW, Post GB, Snel J, Kemper HC. 2000. Physical activity of young people: The Amsterdam Longitudinal Growth and Health Study. Med Sci Sports Exerc 32:1610–1616.