Socio-economic factors and active commuting to school in urban Spanish adolescents: the AVENA study

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Background: This study aimed: (i) to describe the patterns of commuting to school in urban Spanish adolescents; and (ii) to examine the associations between active commuting to school (ACS) and socio-economic factors.
Methods: From the AVENA Study, 2183 adolescents (1142 females) aged 13–18.5 years were gathered. Mode and time of transportation to school were self-reported by the adolescents. Parental education level (primary, secondary or university degree), parental professional level (managerial, skilled worker or unskilled worker/unemployed) and the type of school (public or private) were self-reported by the parents. The relationships between ACS and socio-economic factors were analysed by binary logistic regression.
Results: Nearly <65% of the adolescents reported ACS and 83% of them spent <15 min travelling to school. In male adolescents, maternal primary education level showed an odds ratio (OR) of 1.55 (95% confidence interval, 1.12–2.15), with respect to mothers with a university degree. In female adolescents, mothers with a primary education level showed an OR of 0.68 (0.50–0.92), with respect to mothers with a university degree. Low maternal professional level showed an OR of 1.70 (1.29–2.24), with respect to high maternal professional levels. Students attending public schools showed an OR of 3.47 (2.46–4.90), with respect to students from private schools.
Conclusion: Most of the adolescents actively commuted to school, yet the time spent commuting was low. Socio-economic level seems to be inversely related to the ACS in adolescents. Type of school and maternal educational level were the main predictors of ACS.

Keywords: active commuting, adolescence, physical activity, socio-economic factors.

Introduction

Active commuting to school (ACS) by walking or cycling is a potential source of daily physical activity for children.[1–8] Promoting daily routine activities, such as ACS, may have important health implications. Active commuting has been shown to be related to higher cardiorespiratory fitness levels,[4,9] which is known to be a powerful marker of health in children.[10,11] ACS patterns in relation to socio-economic factors have been examined in several countries.[6–8, 12–18] The majority of these studies have observed higher levels of ACS in children and adolescents with lower socio-economic status.[6,7,13,16–18] However, opposing findings have also been reported.[8] The reason for the discrepancies may be explained by differences in socio-cultural context, climate, urbanization and ethnicity. The way of assessing the socio-economic level (family incomes,[6,16,18] television,[6] motor vehicle ownership[6,13,17] or specific socio-economic indexes[7,12]) may have also contributed to the different associations. To the best of our knowledge, the association between ACS and socio-economic factors in adolescents from Spain has not yet been addressed.

The main aim of this study was to describe the patterns of commuting to school in a sample of Spanish adolescents and to examine the associations between ACS and several socio-economic factors, including parental education and professional level and the type of school the adolescents attended. The representativeness of the participants, in terms of socio-economic level, was also studied.

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Methods

Study sample and design

The present work used data from the AVENA study (Alimentación y Valoración del Estado Nutricional de los Adolescentes/Feeding and assessment of nutritional status of Spanish adolescents), a cross-sectional study designed to assess the nutritional status of a representative sample of Spanish adolescents. The complete methodology of the AVENA study has been described elsewhere.[19,20] Briefly, a multicenter study was performed involving a representative sample of Spanish adolescents aged from 13 to 18.5 years. The population was selected by multiple-step, simple random sampling—first taking into account location (Madrid, Murcia, Granada,

Santander and Zaragoza) and then by random assignment of the school within each city. The cities were chosen according to the population rate (more than 100 000 inhabitants), geographical location in the country (north–south gradient, in order to be representative) and taking into account a main practical issue, the presence of a qualified research group in the city. Sample size was stratified by age and sex. The socio-economic variable was considered to be associated to location within the city and type of school. As the selection of schools was done by random selection proportionally to the number of schools in each city district, guaranteeing the presence of almost one school per district, the socio-economic variable was also considered to be randomly assigned. After analysis of the data, this method has proven to be adequate, as the socio-economic status of our sample has a normal distribution according to the distribution in the Spanish society. To calculate the number of adolescents to be included in the AVENA study in order to guarantee a representative sample of the whole country, we selected the variable with the greatest variance for this age group from the data published in the literature at the time the study was planned; that was body mass index.[21] The sampling was determined for the distribution of this variable; the CI was established at 95% with an error ±0.25%. The minimum subject population was established at 1750. The sample was oversized in order to prevent later loss of information and because technically it was necessary to perform fieldwork in complete classrooms. The final number of subjects included in the AVENA Study was 2859 adolescents.

In the present work, only those individuals who had complete and valid data on self-reported commuting to school were included, i.e. 2183 adolescents (1041 males and 1142 females). These subjects were equally distributed by the five cities and proportionally by gender and age (13, 14, 15, 16 and 17–18.5 years). The study sample was considered urban, since all the subjects lived in cities. In order to examine any potential differences between the adolescents included in this study and the total AVENA sample, one-way analysis of variance (ANOVA) was performed for weight, height and body mass index (variables with the highest percentage of valid data in AVENA study). No differences were found between the adolescents included in this study and those excluded of it according to these variables.

Parents and school supervisors were informed by letter about the nature and purpose of the study and written informed consent was required. The study protocol was designed and followed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki (amended in Hong-Kong in 1989 and in Edinburgh in 2000), and was approved by the Review Committee for Research Involving Human Subjects of the Hospital Universitario Marqués de Valdecilla (Santander, Spain).

Active commuting to school

Mode and time of transportation to school were recorded by a self-report questionnaire.[22] The questions regarding transportation were: 'How do you usually travel to school?' and 'How long does it usually take you to travel from home to school?' Response options to the former question included car, walking, biking, bus/subway, motorcycle or other. Response options to the latter question included ≤15 min, 15–30 min, from 30 to 60 min or >60 min. The adolescents were classified to the ACS group if they travelled to school either by walking or biking; or to the non-ACS group if they commuted to school by car, bus/subway or motorcycle. In accordance with the majority of previous studies,[2–4,6,8,12,13]

the time spent commuting to school was not considered when grouping as ACS or non-ACS.

Socio-economic factors

Parental education level

Both parents were asked to fill in a questionnaire about their education level. One of three possible answers from: primary school, secondary school/technical training or university training, could be chosen. The minimum training period in the Spanish education system was 8 years for primary school, 4 years for secondary school/technical training and 3 years for university training.

Parental professional level

Both parents were asked to answer a series of questions concerning their current occupation. The questions were adapted from, and classified according to, the recommendations of the Spanish Society of Epidemiology.[23–25] Three categories of parental professional levels were established: managerial (I–II), skilled worker (III–IV) and unskilled worker/unemployed (V). These three categories shall be referred to as high, medium and low professional level, respectively.

Type of school

The schools were classified into two groups. Public schools were defined as those funded by the national government; whereas private schools were defined as not being funded by the national government.

Comparison between the sampled families and national data, according to socio-economic status

The representativeness of the participants in the AVENA study, in terms of socio-economic status, was examined by comparing three socio-economic factors (parental education level, parental professional level and type of school) collected in AVENA to national data obtained from the Spanish National Institute of Statistics;[26,27] both sets of data were collected in 2000–2002. Since 99.6% of fathers and 99.9% of mothers from AVENA study belonged to the 30–64 age group, only 30- to 64-year olds were selected from the national population data set.

Statistical analysis

Gender and age differences on the socio-economic factors were analysed by Chi-squared tests.

Associations of ACS with gender, age and socio-economic factors (parental education level, parental profession level and type of school) were studied using binary logistic regression analysis. ACS was entered into the models as the dependent variable and age, sex and one of the socio-economic variables as independent variables. The socio-economic variables were analysed separately in all the models in order to avoid multicollinearity. Previously, interactions between ACS and socio-economic variables with age and gender were studied. A significant interaction between gender and maternal educational level was found; therefore, the analysis involving this variable was separately performed for males and females. The other two socio-economic factors were analysed for the entire sample and controlled by gender and age. The reference groups were the university level for parental education, the high level (managerial, social class I–II) for parental profession, and the private school for type of school.
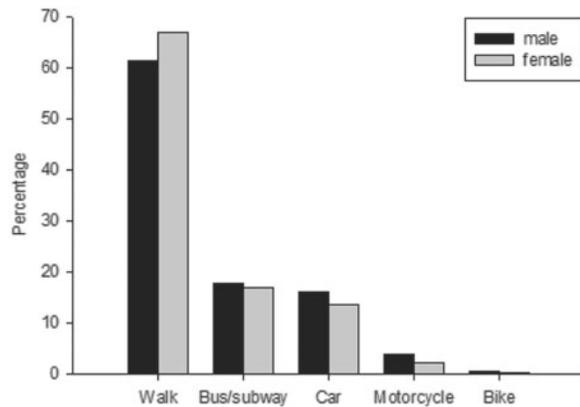
Figure 1 Commuting modes to school by gender
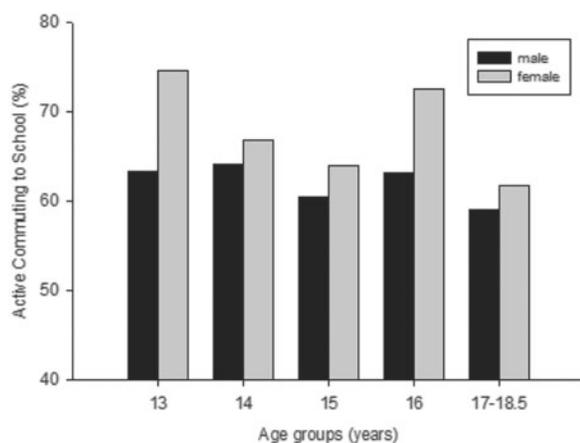
Figure 2 ACS (includes walking and biking) by age groups and gender

The significance level was 5% and all calculations were performed using SPSS v.15.0 software for Windows.

Results

Commuting to school patterns

Descriptive data on the patterns of commuting to school patterns are shown in Figures 1 and 2. The majority of the adolescents reported walking to school [64.3%, confidence interval (CI): 62.3–66.3] and the minority reported biking to school (0.5%, CI: 0.2–0.8). In terms of the non-active means of transport to school 17.3% (CI: 15.7–18.9) of the adolescents travelled by bus or subway, 14.7% (CI: 13.3–16-3) travelled by car and 3.1% (CI: 2.4–3.9) travelled by motorcycle. Of the adolescents classified as ACS, 83.3% (CI: 81.3–85.2) spent <15 min actively travelling to their school.

Associations between ACS and socio-economic factors

Odds ratios (ORs) and 95% CI for ACS according to gender, age and socio-economic factors are shown in Table 1. The odds of being classified as ACS was higher among the females compared with the males (OR: 1.28, 95% CI: 1.05–1.53). Setting the 13-year old age group as the reference group, the odds of being classified as ACS tended to decrease with increasing age. Specifically, significant differences were found

Table 1 ORs for ACS according to gender, age and socio-economic factors (parental educational and professional levels and type of school)

	ACS		
	OR	**95% CI**	*P*
Gender			
Male	1	Reference	
Female	1.28	1.05–1.53	**0.006**
Age (years)			
13	1	Reference	
14	0.85	0.63–1.15	0.308
15	0.73	0.55–0.97	**0.034**
16	0.94	0.69–1.28	0.723
17–18.5	0.67	0.48–0.92	**0.015**
Educational level			
Maternal[a]			
University	1	Reference	
Secondary	1.41/0.94	0.96–2.09/0.64–1.39	0.080/0.775
Primary	1.55/0.68	1.12–2.15/0.50–0.92	**0.008/0.014**
Paternal			
University	1	Reference	
Secondary	0.95	0.72–1.25	0.734
Primary	1.04	0.83–1.31	0.677
Professional level			
Maternal			
Managers (I, II)	1	Reference	
Skilled workers (III, IV)	1.65	1.22–2.23	**0.001**
Unskilled workers, unemployed (V)	1.70	1.29–2.24	**<0.001**
Paternal			
Managers (I, II)	1	Reference	
Skilled workers (III, IV)	1.25	1.00–1.58	**0.049**
Unskilled workers, unemployed (V)	0.96	0.56–1.64	0.901
Type of school			
Private	1	Reference	
Public	3.47	2.46–4.90	**<0.001**

All the analyses involving socio-economic factors were controlled for gender and age

a: An interaction by gender was found. Data were analysed separately for males/females

for the 15-year old (OR: 0.73, 95% CI: 0.55–0.97) and the 17- to 18.5-year old (OR: 0.67, 95% CI: 0.48–0.92) age groups.

Parental educational level

No significant associations were found between ACS and maternal educational level in the whole sample. Upon stratifying by gender, however, male adolescents whose mothers achieved a primary educational level had increased odds of being classified as ACS compared with males born to mothers who achieved a university degree (OR: 1.55, 95% CI: 1.12–2.15). In contrast, female adolescents whose mothers achieved a primary educational level had decreased odds of being classified as ACS compared with females born to mothers who achieved a university degree (OR: 0.68, 95% CI: 0.50–0.92). No significant differences were found with regard to the paternal education level.

Parental professional level

Adolescents whose mothers belonged to the low and medium professional levels showed 1.70 (95% CI: 1.29–2.24) and 1.65 (95% CI: 1.22–2.23) times increased odds for ACS, respectively, than adolescents whose mothers belonged to the highest professional level. A weak positive association was observed between medium paternal professional level and

Table 2 Socio-economic factors of the AVENA participants: an analysis with National data

Socio-economic factors		Males N (%)	Females N (%)	AVENA data N (%)	National data[a] N (%)
Educational level					
Maternal	University	443 (46.2)	531 (45.5)	974 (45.8)	1 499 313 (18.1)
	Secondary	185 (19.3)	205 (17.6)	390 (18.4)	1 732 194 (20.9)
	Primary	331 (34.5)	430 (36.9)	761 (35.8)	5 069 797 (61.1)
Paternal	University	479 (50.7)	584 (51.5)	1063 (51.1)	1 470 587 (17.5)
	Secondary	174 (18.4)	208 (18.3)	382 (18.4)	2 041 448 (24.3)
	Primary	292 (30.9)	342 (30.2)	634 (30.5)	4 899 128 (58.2)
Professional level					
Maternal	Managers (I, II)	165 (18.6)	164 (14.9)	329 (16.5)	642 192 (6.8)
	Skilled workers (III, IV)	273 (30.8)	341 (30.9)	614 (30.9)	3 535 837 (37.4)
	Unskilled workers, unemployed (V)	448 (50.6)	597 (54.2)	1045 (52.6)	5 268 918 (55.8)
Paternal	Managers (I, II)	275 (33.6)	301 (32.1)	576 (32.8)	1 711 041 (18.4)
	Skilled workers (III, IV)	507 (61.9)	595 (63.5)	1102 (62.8)	5 344 370 (57.4)
	Unskilled workers, unemployed (V)	37 (4.5)	41 (4.4)	78 (4.4)	2 254 053 (24.2)
Type of school					
	Private	128 (9.5)	75 (5)	203 (7.1)	141 451 (4.6)[b]
	Public	1218 (90.5)	1419 (95)	2637 (92.9)	2 912 960 (95.3)[b]

a: INE (National Institute of Statistics), year 2001, 30–64 age group, Census of population and housing, $N = 40\,670\,710$ (inhabitants), Census

b: INE (National Institute of Statistics), Academic year 2001/02, Statistical yearbook of Spain 2007, $N = 3\,054\,411$ students (13–18.5 age group—Avena data). Information from Ministry of Education and Science

high paternal professional level (OR: 1.25, 95% CI: 1.00–1.58). Since a significant interaction was found between maternal professional level and type of school, the analysis was repeated for private and public schools separately. In both analyses maternal professional level showed an inverse significant association with ACS (data not shown).

Type of school

The adolescents attending public schools had significantly increased odds of being classified as ACS, compared with the adolescents attending private schools (OR: 3.47, 95% CI: 2.46–4.90). This association remained, even after controlling for parental education and professional levels (data not shown).

Additional analysis

When the analyses were adjusted for biological age (Tanner Stage), instead of chronological age, the results remain unchanged. In order to account for the ACS time, a dichotomous variable of commuting time from house to school (≤15 and >15 min) was included in the analyses. Since no significant differences were observed, it was excluded from the final model.

Comparison between the sampled families and national data, according to socio-economic status

Data on parental educational, parental professional level and type of school attended were collected during AVENA and from the national population are shown in Table 2. With respect to the parental education level, a much higher percent of parents from AVENA attained a university degree compared with national data. Regarding the professional level, a higher percent of the adolescent's mothers and fathers from AVENA were classified in the highest professional level compared with national data. In addition, a smaller percent of the adolescent's fathers from AVENA were classified in the lowest professional level compared with national data. Parental education and professional levels from the AVENA study showed higher socio-economic values than those from national data. The public/private school attendance data were similar between the AVENA study and the national figures from the 2001/2002 academic year.

Discussion

ACS patterns

Approximately two thirds of Spanish adolescents used active means to travel to school. Walking was the most common commuting mode to school, and the typical daily journey time was <15 min. Similar ACS prevalence has been reported elsewhere; 69% of Swiss adolescents (13–14 years) reported ACS[17] and 47% and 36% of Asian adolescent males and females (14–16 years), respectively, walked to school.[6] Lower commuting rates were reported by North American adolescents.[16,28] Only 15% and 13% of Canadian adolescents (13 and 16 years) walked to school;[16] and only 8% of US adolescents (14–17 years) from North Carolina reported ACS at least 1 day/week.[28] In contrast, a much higher percentage of Danish adolescents aged 15- to 16-year olds reported ACS (85%).[2,4] The percentage of individuals who biked to school was much higher in these Danish adolescents, compared with adolescents from other countries.[3,5,6,8,12,17,28] This is likely to be due to the fact that cycling is a very common form of travel in Denmark, not only in young people, but in the general population.

The results of the present study showed that ACS levels were higher among the Spanish females compared with their male peers. Similar findings have also been reported in European children[2,3] and adolescents,[17] American children[5] and Asian adolescents.[6] However, the opposite pattern has been shown in Australian children[12] and Danish adolescents,[4] where a greater proportion of boys cycled to school compared with girls. This suggests that gender differences in ACS may depend on the means of transport.

Our data concur with findings from other studies in that younger adolescents tend to have higher levels of ACS than older adolescents. In a sample of Canadian adolescents ACS levels were compared across three age groups (9, 13 and

16 years old); it was concluded that ACS decreases with increasing age.[16] Considering the type of ACS, Danish adolescents showed a higher ACS by cycling, whereas Danish Children showed a lower ACS on foot.[4] The different age groups considered in the mentioned studies, as well as the differences in the means of ACS, make accurate comparisons difficult.

ACS and socio-economic factors

The results obtained in this study showed that adolescents from high socio-economic families had lower levels of ACS, compared with their peers from low socio-economic families. However, the results differed slightly depending on the socio-economic factor studied. Among the socio-economic factors analysed, the type of school and maternal professional level were the main factors associated with ACS in Spanish adolescents.

Adolescents attending public schools had three and half times higher odds for ACS than their peers attending private schools. The same finding was observed in Australian children[13] and Canadian adolescents.[29] Sending children to public or private schools is a deliberate decision of parents; therefore the type of school could reflect specific characteristics of the parents and/or their professional or education level. Our data showed that attending private schools was associated with a higher family socio-economic level, as measured by parental professional and education levels ($P \leq 0.001$). However, attending public schools was associated with higher ACS, compared with those attending private schools; even after controlling for educational and professional factors. This suggests that other factors, in addition to parental education or professional level may influence ACS. The distance from house to school is a socio-environmental factor that could also explain the low ACS in adolescents attending private schools, which has been previously suggested.[12,30,31] Most of Spanish schools are public and strategically located around neighbourhoods, thus making it amenable to walk to school. In contrast, private schools are a minority and usually located in the peripheries of cities. Moreover, the impact of the school to house distance on ACS is stronger when adolescents choose walking instead of cycling to school, as was the case in Spanish adolescents. This suggests that differences in ACS between public and private schools could highly be explained by the school to house distance factor. Further research is needed to confirm this hypothesis.

Maternal professional level was significantly associated with ACS. Adolescents whose mothers belonged to lowest professional level were more likely to show a higher ACS than those belonged to higher professional levels. This association remained significant after controlling for the type of school. Our results showed that maternal socio-economic factors (both professional and educational levels) are associated with ACS of their offspring, while weaker associations were found for paternal socio-economic factors. Accordingly, there is growing evidence indicating that the characteristics of the mothers have a higher influence than those of the fathers on several behaviours.[32,33] Data from the Swedish part of the European Youth Heart Study showed that maternal overweight was associated with a higher risk of being overweight and having higher levels of abdominal adiposity in children and adolescents, to a greater extent than paternal overweight.[34] In the current study sample, ~50% of the mothers were unemployed, compared with only 4% of the fathers. Consequently, mothers spend more time at home with their offspring and therefore could have a greater influence on their child's attitudes and behaviours.

Parental professional level was more influential on the adolescents' ACS than the parental educational level of both the mothers and fathers. Similar findings have been reported in Australian children.[13] Families of high socio-economic status may have more cars to drive their offspring to school, and more resources to support motorized transport to school. Collectively this environment may discourage adolescents to be active, and thus be more dependent on their parents.

Comparison between the sampled families and national data, according to socio-economic status

A higher percent of mothers and fathers from the AVENA study belonged to higher education and professional levels compared with the national population. This finding is in accordance with previous studies[35–37] and suggests that individuals who participate in research studies tend to have a higher socio-economic background than non-participants. In addition, all the AVENA participants lived in capital cities and the national population belonged to both rural and urban areas. It has been reported that populations from urban areas show higher education[36] and professional levels[38] than people from rural areas. This information helps explain the extent of the prevalence of higher socio-econimic status families in the AVENA study.

On the other hand, the public/private school attendance from the AVENA study was very similar to the national figures. This suggests that the findings related to type of school may have a higher representativeness than those drawn for parental educational and professional levels.

Some limitations and strengths need to be considered in this study. The distance from house to school was not registered in the AVENA study. The house to school distance has been shown to be the most common barrier to ACS[17,18,39] and it could explain the difference in the ACS between adolescents attending public and private schools. Future studies comparing patterns of ACS between public and private schools should examine the role of the distance from house to the schools. ACS seems to depend on the socio-economic factor studied; further research into this matter should include as many socio-economic factors as possible, such as family income. Differences of ACS between urban and rural Spanish adolescents cannot be analysed in the current study, since the AVENA participants were sampled from Spanish cities. This is an interesting topic that should be addressed in the future. Moreover, the strength of the association observed for educational and professional factors were rather weak, which suggest than other factors beside those studied in the present study may also determine ACS. Further studies are needed to better understand the associations of parental educational and professional levels with regard to ACS. Finally, most studies have included only a single socio-economic factor and they did not analyse paternal and maternal factor separately. In this regard, the three socio-economic factors included in this study, along with paternal and maternal data, can be viewed as a notable strength. Moreover, the substantial number of subjects and the wide age range are additional strengths of this study.

In conclusion, although most of the Spanish adolescents commuted actively to school, the time spent in this activity was low. High socio-economic levels seem to be related to passive modes of commuting to school. The type of school and maternal professional level seem to be the main socio-economic factors associated with the ACS in Spanish adolescents. More studies examining the influence of personal, family, social and environmental factors on the ACS behaviour should be carried out.

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Funding

Key points

- Nearly 65% of Spanish adolescents used active ways of travel to school.
- A high socio-economic level was associated with a low ACS.
- Adolescents attending public schools showed higher levels of ACS than their peers attending private schools.
- More studies examining the influence of personal, family, social and environmental factors on the ACS behaviour should be carried out.

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