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Increased commuting to school time reduces sleep duration in adolescents

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Active travel to school has been referred to as one way of increasing the level of daily physical exercise, but the actual impacts on student's general health are not clear. Recently, a possible association between active travel to school and the duration of sleep was suggested. Thus, the aim was of this study to investigate the associations between the type of transportation and travel time to school, the time in bed and sleepiness in the classroom of high school students. Information on sleeping habits and travel to school of 1126 high school students were analyzed, where 55.1% were girls with an average age of 16.24 (1.39) years old, in Santa Maria Municipality, Rio Grande do Sul, Brazil. Multiple linear regression and adjusted prevalence rates analyses were carried out. The frequency of active travel found was 61.8%. Associations between time in bed, sleepiness in the classroom and the type of transportation (active or passive) were not identified. Nevertheless, the time in bed was inversely associated with the travel time ($p = 0.036$) and with a phase delay. In the adjusted analysis, active travel was more incident for the students of schools in the suburbs (PR: 1.68; CI: 1.40–2.01) in comparison with the students of schools in the center. Therefore, longer trips were associated with a reduction of sleep duration of morning and night groups. Interventions concerning active travel to school must be carried out cautiously in order not to cause a reduction of the sleeping time.

Keywords: Adolescent, health promotion, motor activity, school health, sleep

INTRODUCTION

Proposals for promotion of healthy behavior in sleep during adolescence have been investigated due to the several associations of short sleeping times and excessive daily sleepiness with health and learning problems. The sleep phase delay common in adolescence, characterized by later sleeping and waking up times, is related to the maturational process and can be observed up to the end of puberty in the human species (Carskadon et al., 2004; Gibson et al., 2006). This delay, as discussed by Hagenauer et al. (2009) is common in mammals, but it seems to be more extended in humans than in other species, and a longer delay is observed in the final stages of gonadal development.

Roenneberg et al. (2004) has proposed, from an analysis carried out with ~25 000 subjects that the phase delay would begin right after childhood and remain until ~19.5 years old for females and 20.9 years old for males. This coincides with important endocrine changes, for instance, with the delay of ~1 h of the maximum concentration of the growth hormone and the minimum concentration of cortisol in comparison with the elderly.

The biological phase delay may be influenced by social and environmental issues and, therefore, intervention measures such as sleep education and exposure to light programs have been proposed (Carskadon et al., 2004; Sousa et al., 2007). Factors such as long exposures to artificial light, the longer lasting maturation of the central nervous system and different hormonal levels in different stages of development are pointed out as factors that could possibly explain the phase delay characteristics in human beings (Hagenauer et al., 2009).

Active commuting to school could be thought of as an alternative to change the sleep–wake cycle in adolescents and reduce sleepiness in the classroom due to a possibly higher exposure of the adolescent to the morning light, which would act in the circadian timing system. However, the literature lacks analyses of this association (Pereira et al., 2010b). Considering the high prevalence of insufficient levels of physical activities, active commuting to school (defined as the use of active

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means, such as walking and bicycling to and from school) has been indicated as a possible intervention to promote health in adolescents (Chillón et al., 2011).

Nevertheless, the actual effects of active commuting on several aspects of adolescents' health still need to be better clarified. Davison et al. (2008), in a wide review of studies about this subject, pointed to inconclusive results. The authors found more frequent associations between active commuting and higher levels of physical activity and, consequently, a better cardiorespiratory level, but not with other health indicators, such as the nutritional state.

The results observed in the study carried out by Hallal et al. (2006), which analyzed 4452 Brazilian adolescents, are in accordance with the analyses of Davison et al. (2008). In the study conducted by Hallal et al. (2006), active commuting was considered a significant variable for the increase of the daily physical activity level. However, after correction for confounding variables, the socioeconomic status seemed to be more associated with the variable and other health indicators.

Recently, an association between active commuting and longer sleep duration in adolescents was suggested. In the study carried out by Martínes-Gómez et al. (2011) with 2029 Spanish adolescents between 13 and 17 years old, the factors associated with active commuting to school were analyzed and, after correction for confounding factors, especially in terms of socioeconomic status, the authors verified that the only variables that remained associated with active commuting were the habit of having breakfast and the sleep duration. Active commuting by Spanish adolescents was more frequent in cases where the sleep duration was >8 h (OR: 1.39; CI: 1.06–1.57). Sleepiness in the classroom and the commuting time were not analyzed in that research, and the literature is limited in studies with these associations.

In light of this situation, the objective of this study was to investigate the associations between the type of transportation and commuting time to school with the time spent in bed and the sleepiness in the classroom from a sample of high school students. We suppose that a higher commuting time would be associated to earlier wake up times and, consequently, to shorter sleep duration.

METHODS

General procedures and selection of the sample

The sample of the study consists of 1126 high school students (55.1% female students), between 13 and 21 years old, with an average age of 16.24 (1.39), going to public schools in Santa Maria municipality, RS, Brazil. Data collection was performed between April and August 2009.

In Santa Maria, 97.9% of youngsters between 10 and 14 years old are at school, while the municipality presents an urbanization rate of ~95% (IBGE, 2007).

The number of subjects needed for the study sample was calculated from the number of students enrolled in public schools, which corresponds to ~80% of all municipality's high school students according the National Institute for Educational Studies and Research (INEP, 2007). The minimum sample size needed was calculated according to the proposal by Luiz & Magnanini (2000) considering a sampling error of three percentage points, which indicated the need to assess ~900 students. For stratification purposes, the municipality was divided into five regions (center, west, north, east and rural) and the sample was proportionally divided according to the region. Students from six schools (total of 18 schools) were investigated (one school in each suburb region and two in the center). Schools and students were randomly selected.

The data were gathered in the classroom with the approval of teachers, and the research project had been previously approved by the Human Research Ethics Committee of the Federal University of Paraná (reference number 032/08) and the students or legal representatives signed the Statement of Awareness and Consent. Moreover, the protocol conformed to international ethical standards for human research (Portaluppi et al., 2010).

Inclusion and exclusion criteria

The final sample of the analysis was made of the students up to 21 years old who were present in the classroom at the time of gathering and gave their consent and answered the questionnaires properly. The adolescents diagnosed with sleeping disorders and under medication that could influence the expression of the sleep–wake cycle were excluded from the sample.

Assessments

The behaviors related to sleep were gathered by means of a questionnaire (Louzada & Menna-Barreto, 2004) that included questions about the presence of health problems and the occurrence of a possible sleeping disorder, sleeping habits and the school schedule (morning, afternoon or evening). The sleep duration was referred to as the time spent in bed, considering the times of falling asleep and waking up during school nights. Additionally, the questionnaire included general, social and demographic data, such as the home address.

For purposes of categorization, adolescents with <8 h sleep were considered to have short sleep duration (Perez-Chada et al., 2007). The sleepiness in the classroom was assessed by means of the question: ''Considering the days you come to school, how many times do you feel very sleepy in the classroom?'', to which students could choose the alternatives: always, often, sometimes or never. The students who chose the alternatives ''always'' and ''often'' were classified as being sleepy in the classroom (Gaina et al., 2007). The chronotype was assessed by means of the questionnaire developed by Horne & Östberg (HO) (1976), which

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classifies students into morning people (morning and moderately morning), intermediate or evening people (evening and moderately evening).

The students were asked about how they commuted to school and back home and how long those journeys take. The students who claimed to commute on foot, by bicycle or roller skates on their way to and back from school were classified as active commuting; the ones who commuted by bus, car or motorcycle were classified as passive commuting. The commuting time considered the sum of the time spent to go to and come back from school in minutes, and was analyzed in minutes and categorized in tertiles according to the frequency distribution observed in the sample: 1–9, 10–19 and 20–90 min.

The socioeconomic class was assessed according to the recommendations proposed by the Brazilian Association of Research Companies (ABEP) (ABEP, 2008), which considered the property ownership and the educational level of the head of the family, classifying adolescents into classes A1, A2, B1, B2, C, D and E. This study considered the higher class (A1, A2, B1 and B2), the middle class (C) and the lower class (D and E). The level of physical activity was assessed by means of the instrument used by Hallal et al. (2006), considering 300 min a week as the cutoff point, besides physical education classes at school, to define insufficiently active youngsters. Aiming at defining an indication of the subjective perception of adolescents' mental health, the following question on stress was asked: ''How would you describe the level of stress in your life?'' The answer alternatives were: hardly ever stressed (living very well); sometimes stressed (living reasonably well); often stressed (facing problems with attendance) and excessively stressed (facing difficulties in living everyday life).

Statistical analysis

The analyses of differences between averages and proportions were carried out by means of the chi-squared and Kruskal–Wallis test, complemented by Dunn's multiple comparisons test. The analysis of homogeneity of sleep and commuting data variance between girls and boys was carried out by means of the Levene test. The correlations between sleep duration and time in bed and commuting time were performed by mean of Spearman's test. In order to analyze the association between the time spent in bed with the type of transportation and commuting time, multiple linear regression models were calculated using the time in bed (h) and the mid-sleep phase (h) – midpoint, represented in time, of the night sleep – as dependent variables and the type of transportation (active or passive) and the commuting time (in min) as independent variables. The active/passive commute variable was fitted to this model by dummy type variables. Aiming at analyzing the variables associated with the active journey, while controlling for possible confounding factors, the Poisson regression (Barros & Hirakata, 2003) was used, and for the adjusted model, variables were those with $p<0.25$ (Hosmer & Leneshow, 1989). All of the statistical analyses adopted a probability level of significance of 5%.

Statistical analysis were performed with SPSS® 20.0 software.

RESULTS

Descriptive statistics for variables analyzed in the study are presented in Table 1. The average age of the subjects was 16.24 (1.39) years old, and it was not different between girls and boys ($p=0.055$). A low percentage of adolescents were classified as belonging to the lower socioeconomic class (5.6%) and most of the sample demonstrated the habit of actively commuting to school (61.8%). It was found that 44% of adolescents living in the suburbs commuted to the schools in the center. The age and sleep duration showed a negative correlation ($r=0.159$; $p<0.001$), which confirms a reduction in sleeping hours throughout adolescence.

The variables related to sleep and the commuting time were similar for girls and boys, although the 29.9% prevalence of sleepiness in the classroom of girls was larger than the 23.7% sleepiness observed

TABLE 1. Characteristics of the sample.

Variable	Indexes*
Age, years	16.24 (1.39)
Male, %	44.9
Age (years), %	
13–14	9.1
15–16	51.0
17–18	34.4
19–21	5.6
School region, %	
Center	50.4
Suburbs	49.6
Home/school address	
Center/center	10.8
Suburbs/suburbs	50.0
Suburbs/center	39.2
School schedule, %	
Morning (starting time: 7:30 am)	54.2
Afternoon (starting time: 1:30 pm)	25.5
Evening (starting time: 7 pm)	20.3
Social class, %	
Lower	5.6
Middle	42.4
Higher	52.1
Active commuting to school, %	61.8
Home/school commuting time (active), min	13.96 (9.71)
Home/school commuting time (passive), min	16.45 (12.15)
With sleepiness in the classroom, %	27.1
Time in bed, h	8.27 (1.67)
Mid-sleep phase, h	3.54 (1.29)
Time in bed (up to 8 h), %	53.6
Insufficiently active, %	54.8
Perception of stress, %	
Hardly ever	29.1
Sometimes	51.8
Often	16.2
Excessive	2.9

*The values are expressed in average (SD) or percentage.

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in boys ($p = 0.020$). The girls also had a shorter average time in bed of ~30 min in comparison to boys ($p = 0.001$). Active commuting was more frequent within the male group ($p = 0.011$) – while 58.4% of the girls presented active commuting, the percentage was 65.9% in the male group. However, the commuting time, either passive ($p = 0.552$) or active ($p = 0.719$) was not different between the genders.

Considering the group as a whole, no differences were found in the time in bed between students with active and passive commuting in the male group ($p = 0.255$) and the female group ($p = 0.342$). The same is true for sleepiness in the classroom, in which parameter differences were not found in the sleepiness prevalence for the male ($p = 0.133$) and female ($p = 0.316$) group between active and passive commuting groups. The number of youngsters insufficiently active was significantly higher in the female group ($p < 0.001$). While 35.2% of the boys were classified as insufficiently active, 70.7% of girls were given this classification. In terms of the prevalence of perception of stress, boys presented higher percentages in the ''never'' and ''sometimes'' categories and lower percentages in the ''often'' and ''excessively'' categories, which indicates a higher incidence of stress in the female group ($p < 0.001$) in general.

Relating the time in bed to the type of transportation and commuting time, significant and inversely proportional associations were found between the time in bed and the commuting time ($p = 0.036$) according to the data presented in Table 2. The correlation between the sleep duration and the commuting time was $r = -0.092$ ($p = 0.025$). Considering the associations between the commuting time and the mid-sleep phase, negative associations were identified ($p < 0.001$) indicating that, the longer the journey to school, is earlier the mid-sleep phase (Table 3). In the analysis of the sleepiness in the classroom, no significant differences were found between the incidences of sleepiness or its absence and the commuting time regardless the school schedule, gender or type of transportation.

TABLE 2. Multiple linear regression analysis correlating the time in bed and the type of transportation and commuting time.

Variables	Time in bed	
	β	p Value
Type of transportation	0.138	0.217
Commuting time	−0.005	0.036

TABLE 3. Multiple linear regression analysis relating the mid-sleep phase with the type of transportation and commuting.

Variables	Mid-sleep phase	
	β	p Value
Type of transportation	0.167	0.005
Commuting time	−0.005	<0.001

The delay in the times to wake up and the mid-sleep phase observed in the morning schedule according to the commuting time is illustrated in Figure 1, which shows significant differences of the mid-sleep phase and the time to wake up according to the home/school commuting time tertiles. The length of time in bed according to the commuting time tertiles for the morning schedule were 7.85; 7.45 and 7.38 h, for the first, second and third tertiles, respectively, while significant differences were observed between the first and second tertiles and the first and third tertiles ($p < 0.05$).

Thus, despite the mid-sleep phase advance for the longer journeys, there was also a reduction of the sleep duration due to the proportional lack of advance at sleeping times. The analysis of the commuting time to school identified significant differences ($p < 0.001$) considering schools in the center and the suburbs in all schedules (Figure 2). Similarly to what occurred with the sleep, the perception about stress was not associated with the type of transportation ($p = 0.184$). However, the commuting time was longer considering more prevalence of stress ($p = 0.014$) (Figure 3). This tendency was confirmed in the male ($p = 0.030$) and female ($p = 0.022$) group.

Table 4 presents the results of the analysis of factors associated with active commuting. The non-adjusted analysis identified associations between the active commuting and the age ($p < 0.001$); gender ($p = 0.010$); school region ($p < 0.001$); school schedule ($p < 0.001$) and social class ($p = 0.012$). In this analysis, the active commuting was not associated with the sleep duration ($p = 0.454$) and sleepiness in the classroom ($p = 0.816$). In the adjusted model, the variables that remained associated with active commuting were the school region ($p < 0.001$) and the home address in relation to the school region ($p < 0.001$). The students of schools in the suburbs presented a prevalence of active commuting 1.68 (CI: 1.40–2.01) times higher than those going to schools in the municipality's center, and >90% of the adolescents living and studying in the suburbs engaged in active commuting, which indicates that the distance between their home and the school is possibly one of the factors associated with active commuting.

DISCUSSION

The data analyzed in the present study indicated that the type of transportation was not related with the time in bed, but longer journeys to school were associated with an earlier wake up time and delay at the mid-sleep phase, especially in the morning schedule adolescents, which led to a significant reduction of time in bed.

It is known that the sleep regulation processes can present changes throughout adolescence. In terms of the homeostatic regulation process (process S), there seems to be more evidences of a slower accumulation of sleep according to the maturational process, although

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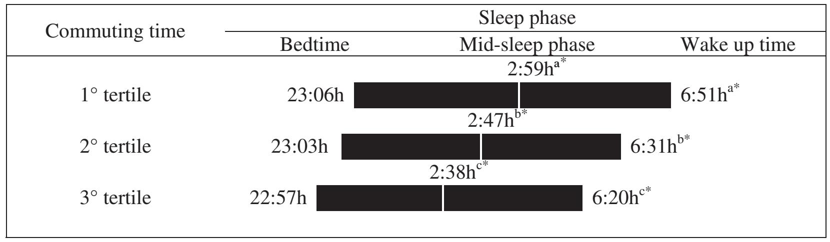
FIGURE 1. Illustration of the delay for wake up time and the mid-sleep phase according to the home/school commuting time for the morning schedule.



Kruskal–wallis test considering the sleep duration ($p = 0.002$); bedtime ($p = 0.433$); wake up time ($p < 0.001$) and mid-sleep phase ($p < 0.001$). *Different superscripted letters refer to different values ($p < 0.05$). Time in bed: 1° tertile=7.75 h; 2° tertile=7.47 h; 3° tertile=7.38 h.

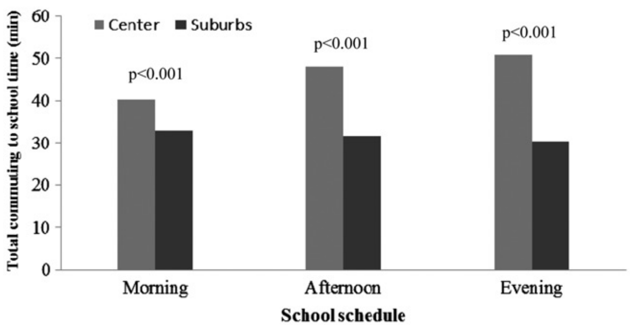


FIGURE 2. Differences in duration of commuting according to the school location.

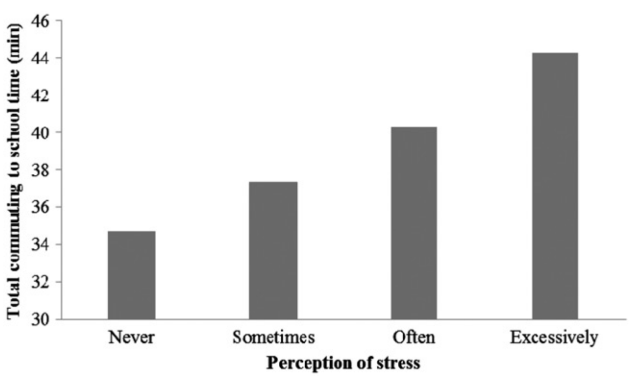


FIGURE 3. Increase of the perception of stress according to the increase in the commuting time to school.

the dissipation of this pressure during sleep seems to be stable during this stage (Tarokh et al., 2010).

On the other hand, considering the circadian regulation process (process C), the actual changes that occur in the human maturation are not as clear, but it is believed that the circadian system in adolescence may alter the sensitivity to light and a longer subjective night in comparison with adults and, thus, a longer exposure to light in the morning would produce an advance and, at night, a delay in the sleep phase (Crowley et al., 2007). This could also take place in relation to a possible non-photic synchronization of the aerobics exercise (Back et al., 2007).

Experiments on exposure to light in adults showed clearer results than the ones carried out with adolescents. In the study carried out by Hansen et al. (2005), the authors did not observe changes in sleep patterns in adolescents exposed to 1800 lux artificial light in the early morning. Individual differences and the light intensity used may have influenced this result.

Intervention such as the 30-min delay in the beginning of classes in the morning, carried out by Owens et al. (2010) at a North American school, led to a significant increase in the sleep duration in adolescents, besides the decrease of sleepiness and fatigue.

The conjugated analysis of the results found by Hansen et al. (2005) and Owens et al. (2010) can contribute to the understanding of the results observed in present study, in which a shorter commuting time to school led to an association similar to the one observed after the delay of the beginning of classes. Moreover, it is necessary that future studies investigate the amount of light which students are exposed in the different types of transportation and commuting times to school.

The results found in present study confirm the studies carried out by Davison et al. (2008); Dollman & Lewis (2007) and Timperio et al. (2006), which point out the existence of a tendency of boys to commute actively more often than girls. The relations between active commuting, gender and sleep are also relevant, since the girls tend to show more sleepiness and shorter sleep duration than boys (Bernardo et al., 2009). Overall, the frequency of active commuting identified in present the study (61.9%) was similar to the ones observed in samples with Brazilian youngsters, such as in Pelotas (72.8%) (Hallal et al., 2006) and João Pessoa (70%) (Silva & Lopes, 2008). The prevalence of a short sleeping time of 53.6% identified in the young population of this present study seems larger than the one observed in the young population of São Paulo, 39% (Bernardo et al., 2009), and more similar to the one observed in Argentinian adolescents – 49% (Perez-Chada et al., 2007). Additionally, girls showed shorter time in bed, higher sleepiness and were less active when compared to boys. Previous studies showed that girls have shorter sleep duration and feel sleepy more often (Pereira et al., 2011) and are less involved in physical activities in school (Hallal et al., 2006). These findings must be more closely examined, since a general tendency of reducing the hours of sleep in the population in general has been observed.

The data presented by Martínes-Gómez et al. (2011) have not been confirmed in the young population of this present study, where active commuting was not found

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TABLE 4. Adjusted and unadjusted analyses of the association between the incidence of active commuting to school, sleep variables and adjustment factors.

		Unadjusted analysis*		Adjusted analysis**	
Variable	Prevalence (%)	PR (95% IC)	*p* Value	PR (95% IC)	*p* Value
Age (years)					
13–14	49.0	1	<0.001	1	0.775
15–16	59.5	1.21(0.98–1.50)		1.16(0.84–1.59)	
17–18	65.4	1.33(1.08–1.65)		1.17(0.83–1.62)	
19–21	80.3	1.64(1.29–2.08)		1.09(0.70–1.68)	
Gender					
Male	65.9	1.13(1.03–1.24)	0.010	1.11(0.95–1.30)	0.162
Female	58.4	1		1	
School region			<0.001		<0.001
Center	40.0	1		1	
Suburbs	84.1	2.10(1.89–2.34)		1.68(1.40–2.01)	
Home/school location					
Center/center	25.65	1	<0.001	1	<0.001
Suburbs/center	84.47	3.29(2.79–3.89)		3.17(2.68–4.32)	
Suburbs/suburbs	92.11	3.59(3.02–4.26)		3.64(3.06–4.32)	
School schedule			<0.001		0.351
Morning	57.8	1.07(0.94–1.21)		1.05(0.86–1.28)	
Afternoon	54.1	1		1	
Evening	82.1	1.52(1.34–1.72)		1.12(0.88–1.43)	
Social class			0.012		0.317
Lower	69.5	1.19(1.01–1.22)		0.96(0.81–1.13)	
Middle	65.1	1.11(1.01–1.42)		1.01(0.71–1.42)	
Higher	58.6	1		1	
Time in bed			0.454		
Up to 8 h	61.1	1		Excluded	–
>8 h	63.3	1.03(0.94–1.14)			
Sleepiness in the classroom			0.816		
No	61.8	1.01(0.91–1.13)		Excluded	–
Yes	61.1	1			
Chronotype			0.137		
Morning	55.2	1		1	0.661
Indifferent	62.1	1.12(0.95–1.33)		1.04(0.80–1.34)	
Evening	63.9	1.16(0.97–1.39)		1.07(0.80–1.42)	
Physical activity			0.378		
Active	61.3	1		Excluded	
Insufficiently active	63.9	1.04(0.95–1.15)			
Perception of stress			0.184		
Never	67.4	1.26(0.88–1.79)			
Sometimes	60.9	1.14(0.80–1.62)			
Often	65.1	1.21(0.84–1.74)			
Excessively	53.6	1			

*Unadjusted *p* value (chi-square *p*).
**Adjusted tendency *p* value.

to be associated with a longer sleep duration, considering the same cutting point in hours of sleep for the analysis. The lack of control of the commuting time to school and the school schedule in the study with Spanish youngsters may constitute possible reasons for the divergence in the results, since the sleep duration tends to be reduced in students that attend school mainly in the morning.

Still considering the data presented by Martínes-Gómes et al. (2011), it is possible that factors such as the home/school distance, quality of urban paths and public transportation and safety justify the differences observed with the Brazilian data. The question discussed by the authors, that adolescents with shorter sleep duration may show more fatigue, and thus prefer the passive commuting, was also not confirmed in the students of this present study. Additionally, the studies in general point out that the type of transportation seems to be more related to social and environmental factors than to the students' freedom of choice, as observed in the studies carried out by Davison et al. (2008); Dollman & Lewis (2007); Robertson-Wilson et al. (2008); and Timperio et al. (2006). These findings must be considered in studies and public policies focused on encouraging active commuting.

Another study was analyzed in terms of the association between sleep and commuting. However, it presented results within a very different context considering only the commuting time (Tagaya et al., 2004). Tagaya et al. (2004) investigated factors associated

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with the short sleep duration in student adolescents and also identified an inverse association between the commuting time and the sleep duration. Nevertheless, the study with Japanese youngsters did not analyze the type of transportation (active or passive) and used a 2-h interval as the cutting point to define a short or long commuting time from home to school and six daily hours as a short sleep duration – which is considered a very short time for adolescents (Pereira et al., 2010a,b). In spite of this, the data found by Tagaya et al. (2004) confirm the inverse association between the sleep duration and the commuting time as observed in present study, besides indicating that the sociocultural and economic context is relevant when analyzing such associations.

The socioeconomic class seems to be a relevant factor both for the analysis of sleep patterns and the types of transportation to school. Bernardo et al. (2009) presented data relating to the adolescents in São Paulo which indicated that those belonging to higher socioeconomic classes showed more prevalence of short durations of sleep, in opposition to the results found in studies with North American samples. The studies of Hallal et al. (2006) and Silva & Lopes (2008) are also important in this sense for indicating a tendency of lower income youngsters that go to public schools to have a higher frequency of active commuting.

The relationship between the type of transportation and the socioeconomic *status* must be more closely examined, since, as seen in present study, the social class lost the power of association when the analysis was adjusted by other factors similarly to the findings identified in the studies carried out by McMillan (2007) and Sirard et al. (2005), both with North American samples, when compared to demographic factors. Furthermore, factors such as demographic density in the school's region, the safety perceived by parents and the safety of the traffic, the conditions of public streets, transportation options and even socio/cultural rules of each place were discussed by these authors as essential factors to increase active commuting. Other specific issues such as the lack of bicycle parking at schools, for instance, are also important barriers to this activity (Davison et al., 2008).

The main limitations pointed out in this study that impede the statement of some inferences, especially in relation to sleep regulation processes, are the lack of control of the light exposure of the adolescents during the journey to school and the intensity of physical activity performed during this journey using. Additionally, follow-up studies may be useful to investigate more impacted caused by the time of type of transportation to school on students' health, and studies with direct measures, such as actigraphy, Multiple Sleep Latency Test and reaction time in classroom.

CONCLUSIONS

The time in bed and sleepiness in the classroom were not associated with the type of commuting. However, longer journeys were associated with the decrease of time in bed in the morning and evening schedule groups and with an advance in the wake up time, not compensated by advances in the bedtime, in the morning schedule. Active commuting was more closely related to a shorter distance between home and school when analyzed with socioeconomic factors. Thus, interventions for the promotion of active commuting to school must be cautiously undertaken, and factors such as the distance between home and school, location of the school, school schedule, among others, must be considered so that they do not engender a decrease in the sleep duration. Considering the morning schedule in particular, active commuting seems to be indicated only when the commuting time does not generate significant additions in the duration of the journey.

DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article. This work was supported by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

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