Rev Saúde Pública 2010;44(3):457-67

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Prevalence and correlates of physical activity among adolescents from Southern Brazil

Prevalência de atividade física em adolescentes e fatores associados

ABSTRACT

OBJECTIVE: To estimate the prevalence and identify correlates of physical activity among adolescents.

METHODS: Cross-sectional study nested within a cohort of 4,325 subjects from the city of Pelotas, Southern Brazil, aged 14-15 years in 2008. Physical activity was analyzed using three different approaches: (1) prevalence of any leisure-time physical activity; (2) prevalence of any active commuting to school; and (3) prevalence of engaging in at least 300 minutes per week of both (1) and (2) combined. Independent variables included sociodemographic, behavioral, social, and biological characteristics, and number of different leisure-time physical activites practiced. Statistical analyses were carried out using Poisson regression.

RESULTS: The proportion of adolescents involved in any type of leisure-time physical activity was 75.6%, while 73.4% displayed some form of active commuting to school. Prevalence of total physical activity score (≥ 300 min/week) was 48.2%, being greater among boys (62.6%) than among girls (34.5%). Furthermore, prevalence increased along with the number of physical activity modalities practiced ($p<0.001$). Factors associated with greater physical activity (leisure + commuting) at the recommended levels were: nonwhite skin color, having failed at school, and playing videogames. Lower socioeconomic status, more time spent on the computer, and parental physical activity were associated with the outcome only among girls.

CONCLUSIONS: Less than half the adolescents reached recommended levels of physical activity, and this proportion tended to decrease among subjects with higher socioeconomic level. Associated factors were different for leisure-time and commuting. Engaging in a wide variety of physical activities should be encouraged already during childhood.

DESCRIPTORS: Adolescent. Exercise. Activities of Daily Living. Leisure Activities. Socioeconomic Factors. Cross-Sectional Studies.

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Received: 9/13/2009
Approved: 12/7/2010

Article available in Portuguese and English at:
www.scielo.br/rsp

RESUMO

OBJETIVO: Estimar a prevalência de atividade física entre adolescentes e identificar fatores associados.

MÉTODOS: Estudo transversal aninhado em uma coorte com 4.325 indivíduos de 14-15 anos em Pelotas, RS, em 2008. A atividade física foi analisada por meio de três diferentes abordagens: 1) prevalência de alguma atividade física de lazer; 2) prevalência de algum deslocamento ativo para a escola; 3) prevalência de engajamento em pelo menos 300 minutos por semana da combinação de ambos (1 e 2). Variáveis independentes incluíram características demográficas, socioeconômicas, comportamentais, sociais e biológicas e número de atividades físicas praticadas no tempo de lazer. As análises estatísticas foram feitas pela regressão de Poisson.

RESULTADOS: A proporção de adolescentes envolvidos em alguma atividade física de lazer foi 75,6%, enquanto 73,4% apresentou alguma forma de deslocamento ativo para a escola. A prevalência de atividade física total (escore ≥ 300 min/sem) foi 48,2%, sendo maior para os meninos (62,6%) do que para as meninas (34,5%). Além disso, a prevalência aumentou de acordo com o número de atividades físicas praticadas ($p < 0,001$). Os fatores associados à maior prática de atividade física (lazer + deslocamento) nos níveis recomendados foram: cor de pele não-branca, ter repetido de ano na escola e jogar videogame. As variáveis menor nível socioeconômico, maior tempo de uso de computador e atividade física dos pais estiveram associadas ao desfecho apenas entre as meninas.

CONCLUSÕES: Menos da metade dos adolescentes atingiu as recomendações para a prática de atividade física, e essa proporção tende a diminuir entre os sujeitos de maior nível socioeconômico. Os fatores associados diferiram entre lazer e deslocamento. Engajamento em uma ampla variedade de atividades físicas deve ser encorajado desde a infância.

DESCRITORES: Adolescente. Exercício. Atividades Cotidianas. Atividades de Lazer. Fatores Socioeconômicos. Estudos Transversais.

INTRODUCTION

The 2002 World Health Report ranked physical inactivity among the ten major causes of mortality and disability in the developed world.[24] The World Health Organization (WHO) estimates that nearly 2 million deaths worldwide can be attributed to physical inactivity.[a] Benefits of physical activity on health are widely recognized in the recent literature, which also suggests that promotion of physical activity should begin already in early life.[12] Among children and adolescents, there is strong evidence that regular physical activity improves body composition, cardio-respiratory and muscular fitness, bone health, and levels of metabolic health biomarkers.[21]

The Physical Activity Guidelines for Americans states that children and adolescents should perform at least 60 minutes per day of moderate-to-vigorous physical activity to obtain health benefits.[21] A recent survey of 9th to 12th graders carried out by the US Youth Risk Behavioral Surveillance System showed that only 35% of subjects reached the recommended levels of physical activity, this proportion being higher among boys (44%) than among girls (26%).[8] In spite of the large number of sources of data on physical activity prevalence of children and adolescents worldwide, correlates of physical activity have not been fully established. A review including studies published between 1999 and 2005 showed that only a few (male sex, motivation and social support), of the many variables studied showed consistent association with physical activity.[22] However, correlates may change with time (e.g. maturation and/or period effects)[16] and may also differ according to the level of development of the study settings.

[a] World Health Organization. Global strategy on diet, physical activity and health. Fifty-Seventh World Health Assembly. Geneva; 2004. (WHA 57.17).

Physical activity is multidimensional, and can be influenced by physiological, developmental, environmental, psychological, social, and demographic factors.

Thus, the objective of the present study was to estimate the prevalence of physical activity and identify its correlates among adolescents from Southern Brazil.

METHODS

The subjects included in the present study were members of a birth cohort carried out in the municipality of Pelotas, Southern Brazil, a city of approximately 340,000 inhabitants. Briefly, this cohort included all newborns delivered in 1993 in Pelotas hospitals (over 99% of all births). Several visits were subsequently conducted on subsets of the 5,249 children enrolled in the cohort.[23] During the last visit, in 2008, when subjects were aged 14-15 years old, an attempt was made to trace all cohort members. A total of 4,384 subjects were traced. Of these, 55 refused to be interviewed and four were unable to participate in the study. By adding the 147 subjects known to be deceased to the total number of subjects interviewed (N=4,325), the follow-up rate of the present study was 85.2%.

Fieldwork lasted for eight months, from January to August 2008. Data were collected by trained interviewers during face-to-face home interviews. All instruments were previously tested and standardized. One questionnaire was administered to mothers (or guardians) and another to the adolescent. Interviews typically lasted for about one hour and were carried out only after consent was obtained from both mother and adolescent. For data quality control purposes, 30% of participants were re-interviewed (10% in person and 20% by phone), using a short questionnaire. Additionally, all questionnaires were checked by study supervisors upon completion.

The outcome of interest was adolescent physical activity. This variable was measured using a questionnaire that included the two main domains of physical activity at this age: leisure-time activities and commuting to school. A very similar version of this instrument (with nine of the 13 physical activities investigated in the present study) was shown to be both reliable (rho=0.62) and valid (kappa=0.58) when compared to pedometer measurements.[3]

To measure leisure-time physical activity, each adolescent was asked whether he or she had engaged in any physical activity (from a list with 13 types read by the interviewer) in the week preceding the interview. The instrument included the following activities: outdoor soccer, indoor soccer, athletics, basketball, dance, gymnastics, martial arts, swimming, volleyball, tennis, walking, weight lifting, and fitness training. Other activities (not listed) could also be reported by the adolescent and were further coded (the most commonly cited activities were cycling and running). Physical education classes and labor activities were not considered. In case the adolescent had engaged in some type of leisure-time physical activity, information on frequency (days per week) and duration (hours and/or minutes per day) of this activity were collected. A score of leisure-time physical activity was then calculated by multiplying frequency (d/wk) by duration (min/d).

The adolescent was considered as actively commuting to school when reporting going to and/or returning from school on foot or by bicycle. A commuting-to-school physical activity score was calculated by multiplying time (in minutes) spent walking/cycling to and/or from school by five (number of schooldays in a week). A total score (min/wk) of physical activity was then generated by adding leisure-time and commuting scores. This score was dichotomized using a cut-off point of 300 min/wk, as recommended by the Physical Activity Guidelines for Children and Adolescents.[21]

Independent variables investigated included self-referred skin color (white, black, or mixed); socioeconomic level, measured in quintiles of an assets index obtained by principal component analysis,[2] which considered 19 household assets and other features of economic level; schooling of head of household (0-4, 5-8, 9-11, 12 or more years); schooling of the adolescent (up to 5th grade, 6-7th, 8-9th grade); weekly time spent watching television (in tertiles); weekly time on the computer (in tertiles); use of videogame (yes or no); body mass index (BMI), objectively measured and categorized into normal, overweight, or obese according to the WHO growth reference for school-aged children and adolescents;[7] and self-reported duration of parental (maternal or paternal) leisure-time physical activity, classified as active or inactive according to a cut-off of 150 min/wk.[21] The number of different physical activities performed was also investigated, but was not considered in the multivariable model due to being one of the components of the outcome.

Data were entered twice by different persons using Epi-Info 6.04 software. The "validate" tool was used to identify any discrepancies between entries. Data were then transferred to Stata, version 9.2, statistical package, in which we carried out range and consistency checks as well as all analyses. First, unadjusted and adjusted prevalence of any physical activity during leisure time or while commuting to school were analyzed according to independent variables. Then correlates of physical activity were analyzed for adolescents considered as active (at least 300 min activity/wk), in the two domains of physical activity (leisure time and commuting). Both unadjusted and adjusted prevalence ratios (PR) were obtained using Poisson regression with robust variance.

Multivariable analysis followed a conceptual hierarchical model that determined the order of entry of variables into the model to control for potential confounding factors. The first level included demographic and socioeconomic variables (skin color, assets index and schooling of head of household); the second level included the adolescent's schooling and the three variables related to sedentary behavior (watching television, using a computer and playing videogames); BMI status and parental physical activity were included in the third level. Variables were adjusted for those in the same or higher levels; those presenting a p-value ≤ 0.20 were kept in the final model. All analyses were stratified by sex and the significance level was set at 5% for two-tailed tests.

The study protocol was approved by the Research Ethics Committee of the *Universidade Federal de Pelotas*.

RESULTS

Of the 4,325 adolescents interviewed, 82% were 14 years old, 51% were female, 64% were white, 64% had failed at school at least once, 99% watched television, 71% used a computer, 38% played videogames, 28% were overweight and 15% had mother or father who were physically active. Only one subject failed to provide complete information on physical activity.

The proportion of adolescents engaging in any leisure-time physical activity was 75.6% (87.2% of boys and 64.5% of girls). The most common activity was outdoor soccer, reported by 62% of boys, and walking, reported by 36% of girls. As for commuting to school, 73.4% of subjects reported actively commuting (77.2% of boys and 69.8% of girls). Overall, 92.4% (95%CI: 91.6;93.2) performed some type of physical activity (96.7% of boys and 88.2% of girls). Average duration of total physical activity (comprising the two physical activity domains) was 445 min/wk (SD=508) with a median of 280 min/wk. There was a weak relationship between scores (min/wk) for leisure-time and commuting activity (Spearman's correlation = 0.06). Prevalence of reaching the recommended level of activity of at least 300 min/wk was 48.2% (95%CI: 46.7;49.7), being higher for boys (62.6%; 95%CI: 60.5;64.6) than girls (34.5%; 95%CI: 32.5;36.5).

The Figure illustrates the prevalence of total physical activity at the recommended levels according to the number of leisure-time physical activities performed. The proportion of active individuals increased linearly (p<0.001) with number of physical activities, reaching more than 90% among adolescents engaging in three or more types of leisure-time physical activity.

Factors associated with engagement in any leisure-time physical activity are presented in Table 1.

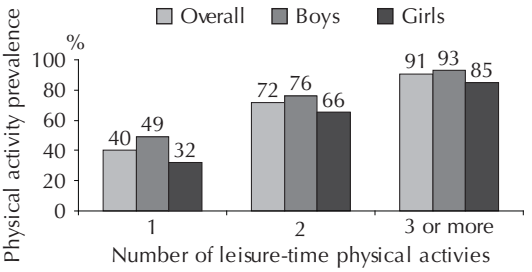

Figure. Proportion of adolescents performing at least 300 min/wk of physical activity (leisure-time plus commuting to school), according to the number of physical activities. Municipality of Pelotas, Southern Brazil, 2008. (N=4,325)

Prevalence was higher in the following groups: lower and intermediate tertiles of time watching television, intermediate tertile of computer use, adolescents who played videogames, and those whose parents were active (p<0.001). Non-obese boys were more likely to perform leisure-time physical activity in crude analysis (p=0.01). After adjustment, prevalence was higher among girls with mixed skin color than among those with white skin (p=0.04), and the assets index showed a direct association with leisure-time physical activity (p-value for linear trend=0.04).

Variables associated with active commuting to school are shown in Table 2. Prevalence of commuting to school on foot or by bicycle was higher among subjects who were non-white, had lower socioeconomic status, had failed at school, were in the lower tertile of computer use, and whose parents were active. Normal-weight boys were more likely to actively commute to school than their peers. After adjustment for potential confounders, computer use and parental physical activity (for both sexes) and skin color (only among boys) lost their association with active commuting to school.

Tables 3 and 4 show the associations between each independent variable and prevalence of total physical activity (at least 300 min/wk) among boys and girls, respectively. After adjusted analysis, correlates of physical activity (for both sexes) were: black or mixed skin color (when compared to white skin color), having failed at school, and playing videogames. Among girls, physical activity correlates included the assets index (negative association), computer use (positive association), and parental physical activity. After adjustment, assets index, computer use and BMI status (for boys) and schooling of the head of household (for girls) lost association with the outcome. Moreover, a negative confounding effect was observed for computer use among girls; this variable was associated to the outcome only after multivariable analysis.

If only leisure-time physical activity was considered, overall prevalence of reaching the recommended

Table 1. Prevalence of engagement in any leisure-time physical activity among adolescents, stratified by sex.[a] Municipality of Pelotas, Southern Brazil, 2008.

Variable	n	Unadjusted		Adjusted	
		Boys	Girls	Boys	Girls
Skin Color		*0.371*	*0.084*	*0.329*	*0.044*
White	2769	86.6	63.2	86.7	62.8
Mixed	784	88.5	69.1	88.4	69.6
Black	611	89.1	64.2	89.5	65.1
Assets index (quintiles)		*0.940*	*0.394*	*0.962*	*0.221*
1st (poorest)	866	87.0	60.7	87.3	60.0
2nd	856	87.7	65.1	87.8	64.7
3rd	860	86.7	65.8	86.8	65.7
4th	865	88.1	65.0	88.1	65.5
5th (wealthiest)	857	86.3	66.6	86.5	67.5
Schooling of family's head (years)		*0.058*	*0.538*	*0.058*	*0.484*
0 to 4	1124	84.6	65.2	84.6	66.2
5 to 8	1820	89.3	64.9	89.3	65.1
9 to 11	941	86.1	62.3	86.1	61.8
≥ 12	419	87.9	67.7	87.9	66.3
Schooling of the adolescent (grade)		*0.098*	*0.317*	*0.121*	*0.409*
Up to 5th	1345	85.5	63.0	86.3	64.2
6th to 7th	1410	89.3	63.4	89.8	63.3
8th to 9th	1569	87.1	66.3	87.5	66.5
Television viewing (tertiles)		*0.043*	*0.073*	*0.027*	*0.050*
1st (less time)	1537	87.1	65.6	88.1	66.3
2nd	1351	89.6	66.8	89.9	66.9
3rd	1437	85.1	61.4	85.1	61.3
Computer use (tertiles)		*0.003*	*<0.001*	*0.010*	*0.001*
1st (less time)	1506	84.8	59.4	85.7	59.7
2nd	1381	90.9	69.1	90.9	69.0
3rd	1438	86.5	65.2	86.9	65.6
Videogame playing		*<0.001*	*<0.001*	*0.001*	*<0.001*
No	2668	84.0	62.6	84.7	62.8
Yes	1656	89.5	72.7	89.7	72.9
BMI status[b]		*0.036*	*0.368*	*0.039*	*0.464*
Eutrophic	2969	87.9	65.8	88.7	66.0
Overweight	776	88.7	62.8	88.9	63.8
Obese	355	81.9	61.6	82.2	61.7
Parents leisure-time physical activity		*0.015*	*<0.001*	*0.027*	*<0.001*
< 150 min/wk	3663	86.5	62.9	87.4	63.3
≥ 150 min/wk	651	91.4	73.6	91.8	73.8
Total	4325	87.2	64.5	88.1	65.0

[a] Italic numbers correspond to p-values comparing the variables categories within each sex.
[b] Variable with 5% of missing data (remaining variables presented less than 1%).
BMI – Body Mass Index

Table 2. Prevalence of active commuting to school (walking or bicycle) among adolescents, stratified by sex.[a] Municipality of Pelotas, Southern Brazil, 2008.

Variable	n	Unadjusted		Adjusted	
		Boys	Girls	Boys	Girls
Skin color		*<0.001*	*<0.001*	*0.112*	*<0.001*
White	2769	73.4	63.6	77.7	68.1
Mixed	784	82.7	80.4	81.0	77.8
Black	611	85.9	81.4	83.0	78.5
Assets index (quintiles)		*<0.001*	*<0.001*	*<0.001*	*<0.001*
1st (poorest)	866	89.4	86.4	87.7	83.2
2nd	856	87.4	79.9	86.0	77.5
3rd	860	84.6	72.6	84.0	71.9
4th	865	73.8	65.8	75.0	69.3
5th (wealthiest)	857	52.3	42.5	58.8	52.3
Schooling of family's head (years)		*<0.001*	*<0.001*	*<0.001*	*<0.001*
0 to 4	1124	85.7	81.4	82.4	77.6
5 to 8	1820	81.8	76.8	81.3	75.9
9 to 11	941	70.2	56.4	76.6	62.1
≥ 12	419	47.4	41.9	64.3	57.9
Schooling of the adolescent (grade)		*<0.001*	*<0.001*	*<0.001*	*<0.001*
Up to 5th	1345	88.0	87.2	84.1	81.8
6th to 7th	1410	80.7	76.5	81.7	75.9
8th to 9th	1569	59.3	54.9	70.0	63.4
Television viewing (tertiles)		*0.887*	*0.177*	*0.930*	*0.878*
1st (less time)	1537	77.7	67.5	79.4	73.0
2nd	1351	76.6	70.0	80.1	72.7
3rd	1437	77.1	71.9	79.4	71.8
Computer use (tertiles)		*<0.001*	*<0.001*	*0.338*	*0.052*
1st (less time)	1506	86.8	79.7	81.3	72.1
2nd	1381	79.0	73.9	79.9	75.6
3rd	1438	65.7	54.8	77.6	69.5
Videogame playing		*0.791*	*0.334*	*0.817*	*0.102*
No	2668	77.5	69.4	79.9	71.7
Yes	1656	77.0	71.8	79.4	75.7
BMI status[b]		*<0.001*	*0.331*	*0.028*	*0.763*
Eutrophic	2969	80.3	69.7	81.3	72.8
Overweight	776	71.7	70.5	77.7	72.8
Obese	355	68.1	75.5	73.7	75.7
Parents leisure-time physical activity		*0.011*	*0.017*	*0.371*	*0.808*
< 150 min/wk	3663	78.2	70.9	79.7	72.9
≥ 150 min/wk	651	71.7	64.4	82.0	73.6
Total	4325	77.2	69.8	80.0	72.5

[a] Italic numbers correspond to p-values comparing the variables categories within each sex.
[b] Variable with 5% of missing data (remaining variables presented less than 1%).

levels (at least 300 min/wk) would be 38.2% (95%CI: 36.7;39.6). Correlates of this outcome were very similar (data not shown) to those observed for total physical activity (commuting and leisure time). A few exceptions were the lack of association with the outcome of schooling among boys and skin color and assets index among girls. All other correlates were kept in the final model.

In a simulated analysis involving the most active groups, adolescents who were male, black, enrolled in the 6th or 7th grades and who played videogames had 85% chance of being active (66% if only leisure-time activity is considered). In the same way, if female adolescents of low or middle socioeconomic level and with physically active parents had a 52% chance of being active (33% considering only leisure-time activity).

DISCUSSION

Certain methodological aspects of this study should be considered. As this study was cross-sectional, some of the associations detected may be subject to reverse causality, particularly BMI status and variables related to sedentary behavior (television, computer and videogame use). Physical education classes were not considered in the physical activity score due to their low intensity.[10] Furthermore, simulations including physical education classes in the final score have been published in a previous study, which found that this would lead to an increase in prevalence of physical activity of only 3.3 percentage points.[3] Physical activity at work or while commuting to work was not considered given the small number of working adolescents were working. Moreover, the vast majority of respondents (98%) was studying or had studied in the year prior to the interview. Another limitation is related to the lack of an intensity-related physical activity variable, although the majority of physical activity modalities included in the questionnaire can be regarded as of vigorous intensity.

Prevalence of any physical activity in leisure time or commuting to school in our cohort (92.4%) was very similar to that of another study conducted in schools of Rio de Janeiro, Southeastern Brazil. This study reported 90.3% prevalence (95% among boys and 88% among girls) of physical activity among students aged 15 years old on average.[5] When examining only leisure-time physical activity (which had a prevalence of 76% in the current study), our results are consistent with those of another study carried out in a representative sample of adolescents (12-18 years) from Taiwan, which reported a prevalence of 78%.[6] However, prevalence in our cohort was higher that reported by a Brazilian study with adolescents aged ten to 19 years (52% prevalence).[3] This same study found that 69% of adolescents were active commuters,[3] versus 73% in the present study. A nationally representative study with North-American subjects aged 9-15 years estimated that, among those living within a mile from school, prevalence of active commuters was 48%.[13]

The proportion of adolescents meeting the activity criterion (at least 300 min/wk) was slightly higher than that found in another Brazilian study investigating the same age group (48% versus 40%), but which included only public school students.[5] Compared to international data, a study conducted in 35 countries from Europe and North America found a mean prevalence of physical activity of 35.3% (ranging from 22.6% in Italy to 57.1% in the United States) among boys and 22.3% (ranging from 11.2% in France to 41.8% in the United States) among girls.[25] A study carried out in the 100 largest cities in the United States, in 2005, with adolescents aged 14 to 17 years, found 48% adolescents to be active (57% of boys and 40% of girls),[4] a prevalence similar to that found in the present study.

Regarding correlates of physical activity (considering the threshold of 300 min/wk), non-white boys and girls were, respectively, 16% (95%CI: 8;24) and 21% (95%CI: 7;37) more likely to be active than white adolescents, even after adjustment for socioeconomic level. When considering only leisure time, skin color was not associated with physical activity among girls, but remained associated with the outcome among boys. Other studies have evaluated the effect of this variable on physical activity levels, but results are contradictory.[22] There is a tendency for Euro-Americans to be more active when compared to other races.[16] However, the manner in which this variable is measured and classified also varies across studies. In addition, not all of these studies were controlled for the confounding effect of socioeconomic status.[11]

Socioeconomic status, as measured by the assets index, showed an inverse association with physical activity among girls (p=0.04), but not among boys (p=0.2). This variable affected primarily commuting to school, poorer subjects being more more active in this domain, as observed in a prior study.[13] A Brazilian investigation of students aged 15-18 years also detected a negative association between socioeconomic level and total physical activity (estimated by daily energy demand) among girls.[9] Unlike other studies,[4,15,17] socioeconomic status was not associated with leisure-time physical activity. Although a literature review showed a positive association between physical activity with parental schooling,[22] such an association was not detected in the present study. Two other studies carried out in China and Brazil also failed to detect an association between parental schooling and adolescent physical activity.[3,18]

Adolescents in the 8th or 9th grades (the expected grade for this age group), were less likely to be active in comparison to those in earlier grades. There is cross-sectional evidence that physical activity levels tend to decrease throughout adolescence.[16,17] While adolescents in the 8th or 9th grades have colleagues of the same age or older – who are known to be less active – the colleagues of adolescents in earlier grades are younger – and therefore more active. Thus, social support rather than cognitive performance could be the underlying explanation for the association observed between physical activity and adolescent schooling. However, further studies

Table 3. Unadjusted and adjusted analysis among boys of total physical activity prevalence (leisure-time plus commuting to school), according to the criterion of 300 min/wk for each category of the investigated variables. Municipality of Pelotas, Southern Brazil, 2008. (N=2,111)

Variable	% of actives	Unadjusted analysis		Adjusted analysis	
		PR (95%CI)	p-value	PR (95%CI)	p-value
Skin color			<0.001		<0.001
White	59.2	1		1	
Mixed	68.4	1.15 (1.06;1.26)		1.14 (1.05;1.24)	
Black	70.4	1.19 (1.09;1.30)		1.18 (1.08;1.28)	
Assets index (quintiles)			0.018[b]		0.186[b]
1st (poorest)	64.2	1.14 (1.02;1.27)		1.09 (0.97;1.21)	
2nd	64.3	1.14 (1.02;1.28)		1.10 (0.99;1.23)	
3rd	65.4	1.17 (1.05;1.30)		1.14 (1.02;1.27)	
4th	62.6	1.11 (1.00;1.24)		1.09 (0.98;1.22)	
5º (wealthiest)	56.3	1		1	
Schooling of family's head (years)			0.138[b]		0.959[b]
0 to 4	63.1	1.10 (0.96;1.26)		1.01 (0.87;1.18)	
5 to 8	64.3	1.12 (0.98;1.28)		1.04 (0.90;1.20)	
9 to 11	60.1	1.06 (0.92;1.22)		1.02 (0.88;1.18)	
≥ 12	57.4	1		1	
Schooling of the adolescent (grade)			0.001		0.008
Up to 5th	62.7	1.10 (1.01;1.19)		1.01 (0.91;1.12)	
6th to 7th	67.4	1.18 (1.08;1.28)		1.12 (1.03;1.23)	
8th to 9th	57.2	1		1	
Television viewing (tertiles)			0.629		0.297
1st (less time)	63.1	1.03 (0.95;1.12)		1.06 (0.98;1.15)	
2nd	63.5	1.04 (0.96;1.13)		1.06 (0.97;1.15)	
3rd	61.1	1		1	
Computer use (tertiles)			0.015		0.070
1st (less time)	61.4	1.03 (0.95;1.11)		0.95 (0.87;1.04)	
2nd	67.0	1.11 (1.03;1.21)		1.05 (0.96;1.14)	
3rd	59.9	1		1	
Videogame playing			<0.001		<0.001
No	57.0	1		1	
Yes	66.6	1.17 (1.09;1.25)		1.16 (1.08;1.24)	
BMI status[a]			0.044[b]		0.069[b]
Eutrophic	63.7	1		1	
Overweight	61.7	0.97 (0.89;1.06)		0.98 (0.89;1.07)	
Obese	55.9	0.88 (0.77;1)		0.89 (0.78;1.01)	
Parents leisure-time physical activity (min/wk)			0.163		0.075
< 150	61.9	1		1	
≥ 150	65.9	1.06 (0.98;1.16)		1.09 (0.99;1.19)	

[a] Variable with 5% of missing data (remaining variables presented less than 1%).
[b] Wald's test for linear trend.
BMI – Body Mass Index

combining qualitative and quantitative methodologies will be necessary to explain this association.

Watching television, using the computer, and playing videogames were explored as indicators of sedentary behavior. These variables were analyzed separately due to their different associations with prevalence of physical activity. Whereas watching television was not associated with physical activity, adolescents who played videogames (boys and girls, respectively) were

Table 4. Unadjusted and adjusted analysis among girls of total physical activity prevalence (leisure-time plus commuting to school), according to the criterion of 300 min/wk for each category of the investigated variables. Municipality of Pelotas, Southern Brazil, 2008. (N=2214)

Variable	% of actives	Unadjusted analysis		Adjusted analysis	
		PR (95%CI)	p-value	PR (95%CI)	p-value
Skin color			0.001		0.009
White	31.3	1		1	
Mixed	39.5	1.26 (1.10; 1.45)		1.21 (1.05; 1.40)	
Black	39.7	1.27 (1.08; 1.29)		1.21 (1.03; 1.42)	
Assets index (quintiles)			0.002[b]		0.036[b]
1st (poorest)	37.3	1.30 (1.08; 1.58)		1.21 (0.99; 1.47)	
2nd	37.3	1.30 (1.08; 1.58)		1.22 (1.01; 1.49)	
3rd	37.2	1.30 (1.07; 1.58)		1.24 (1.02; 1.51)	
4th	32.0	1.12 (0.91; 1.37)		1.10 (0.89; 1.35)	
5º (wealthiest)	28.6	1		1	
Schooling of family's head (years)			0.014[b]		0.394[b]
0 to 4	38.2	1.20 (0.96; 1.04)		1.01 (0.79; 1.29)	
5 to 8	35.2	1.03 (0.90; 1.36)		0.95 (0.75; 1.19)	
9 to 11	30.5	0.96 (0.76; 1.31)		0.88 (0.69; 1.12)	
≥ 12	31.9	1		1	
Schooling of the adolescent (grade)			<0.001		0.009
Up to 5th	41.0	1.34 (1.16; 1.54)		1.27 (1.08; 1.49)	
6th to 7th	34.7	1.13 (0.98; 1.30)		1.06 (0.92; 1.22)	
8th to 9th	30.7	1		1	
Television viewing (tertiles)			0.362		0.433
1st (less time)	33.6	1.01 (0.87; 1.16)		1.05 (0.91; 1.21)	
2nd	36.6	1.10 (0.95; 1.26)		1.10 (0.95; 1.26)	
3rd	33.4	1		1	
Computer use (tertiles)			0.227		0.001
1st (less time)	32.6	0.96 (0.83; 1.07)		0.74 (0.62; 0.88)	
2nd	36.8	1.08 (0.94; 1.24)		0.92 (0.80; 1.08)	
3rd	34.1	1		1	
Videogame playing			<0.001		<0.001
No	32.6	1		1	
Yes	42.4	1.30 (1.14; 1.98)		1.29 (1.14; 1.47)	
BMI status[a]			0.937[b]		0.811[b]
Eutrophic	35.1	1		1	
Overweight	34.1	0.97 (0.83; 1.13)		0.98 (0.84; 1.14)	
Obese	35.8	1.02 (0.81; 1.27)		0.99 (0.80; 1.22)	
Parents leisure-time physical activity (min/wk)			<0.001		<0.001
< 150	32.6	1		1	
≥ 150	45.4	1.39 (1.22; 1.59)		1.50 (1.31; 1.72)	

[a] Variable with 5% of missing data (remaining variables presented less than 1%).
[b] Wald's test for linear trend.
BMI – Body Mass Index

16% (95%CI: 8;24) and 29% (95%CI: 14;47) more active than their counterparts. Computer use was significantly associated with physical activity only among girls, whose physical activity prevalence was lower among the lower tertile (less time per week) than the upper tertile of this variable. Though computer use was directly related to socioeconomic status across all quintiles of the assets index, the most active girls were those who spent more time using computers. This seeming paradox can perhaps be explained by this group's greater awareness of the benefits of physical activity and larger social support from peers.

A study of adolescents from the United States did not find an association between time spent watching television or playing video or computer games and active commuting to school.[13] A study conducted with students aged 9-13 years from Canada found a positive relationship between time spent playing videogames and physical activity, both for boys and girls.[14] Another study with adolescents from Taiwan evaluated the daily time spent seated, finding that those spending less than eight hours seated were less engaged in physical activity than those spending over 12 hours.[6] Therefore, one can argue that physical activity and sedentary behavior are independent constructs, and not opposite factors at this age group.[19]

Prevalence of physical activity did not differ according to BMI status, though obese boys tended to be less active (adjusted PR=0.89; 95%CI: 0.78;1.01) than normal weight boys, as reported by another study using the same cut-off points.[14] However, lack of an association in this case should be viewed with caution due to the cross-sectional design and the possibility of reversed causality. In other words, overweight adolescents may engage in more physical activity as a consequence of their BMI condition. It is worth mentioning that, although physical activity and BMI show an inverse relationship in most studies, this association is not well established.[16,22]

Parental physical activity showed the strongest association with physical activity among girls, even after controlling for confounding factors. Girls with active parents (mother and/or father) were 50% (95%CI: 31;72) more likely to be active compared to those with inactive parents. Among boys, this association approached the significance level (p=0.075). A recent review of the literature supports the notion that parental physical activity has a positive role on physical activity among adolescents.[17] However, this finding is not consistently reported in the literature.[11,22] Also, parental activity may have a stronger effect on girls than on boys, especially if only maternal physical activity is considered.[14] Nevertheless, even when paternal and maternal physical activity is analyzed separately (data not shown), the results are still consistent to those presented in the Results section.

Finally, as expected, prevalence of physical activity increased as a function of the number of physical activities performed during leisure-time. A longitudinal study verified that the decline in prevalence of physical activity throughout adolescence was primarily due to a decrease in the number of reported physical activities rather than in the time spent in such activities.[1] Thus, engagement in a variety of leisure-time physical activities needs to be encouraged among children and adolescents. In addition, it is important to highlight that physical activity during youth may be a predictor of activity in adult age.[20]

In conclusion, the present study found that less than half the adolescents studied reached the recommended cut-off point of 300 min/wk of physical activity. Correlates of physical activity differed according to the domain being investigated (i.e. leisure-time or transport). For example, active commuting to school was inversely related to socioeconomic level, whereas leisure-time physical activity was mostly influenced by parental physical activity. The components of sedentary behavior, that is, time spent watching television, using the computer, and playing videogames showed divergent associations with physical activity; thus, we suggest that these factors be analyzed separately. Also, physical activity prevalence increased linearly with the number of physical activities performed. Therefore, engagement in a variety of leisure-time physical activities needs to be encouraged already in childhood. Longitudinal analyses are required to investigate change in physical activity and its predictors throughout adolescence and between adolescence and young adulthood.

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Dumith SC was supported by Conselho Nacional de Pesquisa e Desenvolvimento Científico e Tecnológico (CNPq – Process nº 142187/2007-0; doctoral scholarship) and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES – Process nº 4273/08-7; doctoral scholarship).
Article based on the doctoral thesis of SC Dumith, presented to the Programa de Pós-Graduação em Epidemiologia, Universidade Federal de Pelotas, in 2010.
The authors declare that there are no conflicts of interest.