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Original article

## Time Trends of Physical Activity Among Brazilian Adolescents Over a 7-Year Period

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 A B S T R A C T

**Purpose:** To evaluate time trends in physical activity among adolescents aged 10 to 19 years living in southern Brazil over a 7-year period.

**Methods:** Two population-based cross-sectional surveys with similar methodologies were carried out in the city of Pelotas, Brazil, in 2005 and 2012. Leisure-time and transport-related physical activity were measured using a validated questionnaire. A cut-off point of 300 minutes per week was used to classify adolescents as active or not. We also analyzed the two domains of physical activity (leisure time and transportation) separately.

**Results:** The prevalence of physical inactivity was 69.6% (95% CI 66.5–73.2) in 2005 and 69.9% (95% CI 66.5–72.7) in 2012. The percentage of active adolescents in leisure time also remained stable in the period (26.3% in 2005 [95% CI 23.3–29.2] vs. 28.1% in 2012 [95% CI 24.9–31.4]). Among boys, we observed an increase in the practice of some leisure-time activities—weight lifting (87%) and running (78%)—and a decline in others—volleyball (61%) and basketball (56%). Among girls, the only significant difference was an increase in the practice of weight lifting (271%). The prevalence of active commuting to and from school declined from 69% (95% CI 65.6–72.4) in 2005 to 56.5% (95% CI 52.5–60.2) in 2012.

**Conclusions:** There was a significant decline in active commuting to school among adolescents. Interventions promoting active commuting modes to school are urgently needed in Brazil.

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 IMPLICATIONS AND  
 CONTRIBUTION

The prevalence of physical inactivity remained stable, but there was a significant decline in active commuting to school over time. Furthermore, we observed changes in the preference of physical activities practiced during leisure time. These findings emphasize the importance of the analysis of physical activity in its different domains.

Information on time trends in health-risk behaviors is essential to guiding the planning of effective policies and programs. Physical inactivity is currently one of the major risk factors for chronic diseases, being responsible for 5.3 million deaths per year worldwide [1]. Given this scenario, surveillance of population physical activity levels has become a public health priority [2,3].

Changes in physical activity patterns over time are being studied increasingly in Europe, Australia, and the United States

[4]. Among adults, the literature has shown a trend of stability or slight increase in leisure time physical activity, with a concomitant decline in occupational activities [4]. Among youth, however, the studies are less frequent, and due to heterogeneous methods, it is difficult to reach a clear conclusion regarding the time trends worldwide. On one hand, a literature review concluded that the available evidence points to a stability of total physical activity and sports participation among adolescents in recent decades [5]. On the other hand, there seems to be a trend of declining physical activity during physical education classes [4] and declines in active commuting to school [6–10].

Although surveillance of physical activity has progressed substantially in recent years, most existing data comes from

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high-income countries. In low- and middle-income countries, studies of time trends are still scarce, especially with youth populations [2]. In Brazil, a surveillance of physical activity in adolescents aged 13 to 15 years was initiated by the National Survey of School Health in 2009 [11], but no data on time trends are available so far. This study evaluates trends in physical activity practice among adolescents living in southern Brazil, during a 7-year period.

## Methods

Data analyzed here are part of two similar cross-sectional population-based surveys performed in 2005 and 2012, in the city of Pelotas, Brazil. The first study was conducted between October and December 2005 (spring and early summer) [12] and the second from February to June 2012 (summer and fall). According to data provided by the Center for Weather Forecasts and Research of the Federal University of Pelotas, average temperatures during the period of data collection were 20.8°C in the first study and 20.3°C in the second study, and the average accumulated rainfall was 54.7 mm and 56.7 mm of rain, respectively.

The sampling processes of the two studies were virtually identical. First, all census tracts (delimited areas comprising approximately 300 households each) were systematically selected. Subsequently, a systematic selection of households was conducted in each sampled tract. The number of households selected in each census tract was proportional to their sizes. In each household sampled, all individuals aged 10 to 19 years were eligible to participate in the study, except those with physical or mental incapacity to respond to the questionnaire. The total number of households visited was 1,507 in 2005 and 1,723 in 2012, accounting for 873 and 786 eligible adolescents, respectively. Nonresponse rates (losses and refusals) were 1.8% in 2005 and 5.7% in 2012. Therefore, the final sample included 857 adolescents in 2005 and 743 adolescents in 2012.

Physical activity practice was measured using a questionnaire administered face-to-face to the adolescents in their homes, by previously trained interviewers. The instrument used in both studies was identical and contained seven questions concerning the mode of commute to school and work, and eleven questions addressing physical activities practiced during leisure time (both organized and nonorganized). For each leisure-time activity, the question structure was: "Over the past 7 days, excluding physical education classes, have you played \_\_\_\_\_?" If the answer was yes, participants were questioned regarding the number of days and the duration of the activity each day.

Reliability of the instrument was tested in a survey conducted in 2005 in a sample of 92 adolescents. The questionnaire was administered to the adolescents twice (2-week interval). The reliability of the instrument was good, the Spearman correlation coefficient comparing the visits was .62 ( $p < .001$ ) and 73% of adolescents were classified in the same groups in the first and second visits. The kappa coefficient was .58.

The total physical activity score was generated by the sum of minutes per week spent on leisure-time and commuting activities. Individuals with physical activity practice below 300 minutes per week were considered inactive, in accordance with the recommendations of physical activity for adolescents [13]. Physical activity was also analyzed separately by domain. The same 300 minutes per week criterion was used to estimate the

percentage of adolescents active in leisure time. In the transport domain, we simply divided adolescents into those using active transportation to school versus the others.

Independent variables used in the analysis were sex, age, and socioeconomic status (defined according to the criterion of the Brazilian Association of Research Companies, which takes into account the purchasing power of individuals as well as the education of household head, where A represents the richest and E represents the poorest families) [14]. For comparison purposes, the independent variables collected in 2012 were identical to those collected in 2005.

Data analyses included the description of the frequency of independent variables for both studies. Subsequently, a comparison of the prevalence of physical inactivity and active commuting to school according to the subgroups of the independent variables was made. In multivariable analysis, Poisson regression model was used and the effect of each variable was adjusted for other variables. In leisure time, the percentage of active adolescents and the prevalence of each activity practiced were compared between studies. For activities whose change was statically significant, analysis was performed stratified by sex. Finally, the prevalence of active and inactive commuting to school and work was also compared. Statistical significance was calculated using *Chi-square* tests for heterogeneity. All analyses were conducted using Stata version 12.0 (StatCorp LP, College Station, TX) and took into account the effect of the sample design, using the command group "svy".

The study was approved by the ethics committee of the medical school of the Federal University of Pelotas. The interviews were conducted only after written consent of the interviewee, and individuals were granted the right of refusal and the confidentiality of the data reported.

## Results

In both studies, 48% of adolescents were boys and the mean age was 14.4 years in 2005 and 14.6 years in 2012. In the first study, 36.3% of adolescents were part of the lowest socioeconomic status (D + E), and this percentage was only 11% in the second study. In 2005, 84% of adolescents were attending school or university and 15.4% worked. In 2012, these percentages were 89% and 14.8%, respectively.

The prevalence of physical inactivity remained stable in the period (69.6% [95% CI 66.5–73.2] in 2005 and 69.9% [95% CI 66.5–72.7] in 2012) and did not change in any of the subgroups analyzed. Using the cutoff point of 420 minutes per week (60 minutes, 7 days of the week), the prevalence of physical inactivity also remained stable: 76.6 (95% CI 73.8–79.5) in 2005 and 76.6 (95% CI 73.5–79.6) in 2012. Both in 2005 and 2012, physical inactivity was higher in girls and did not differ according to age groups. Regarding socioeconomic status, in 2005, adolescents from the lowest socioeconomic groups were more inactive compared with adolescents from the highest socioeconomic levels, but this difference was not observed in 2012 (Table 1). However, the proportion of adolescents who do not exercise (zero minutes in the total score) increased from 26.4% (95% CI 23.4–29.4) in 2005 to 31.5% (95% CI 28.1–34.8) in 2012.

The percentage of adolescents active during leisure time also did not change (26.3% [95% CI 23.3–29.2] in 2005 and 28.1% [95% CI 24.9–31.4] in 2012) (Table 2). Regarding the activities practiced in leisure time, there was an increase of 128% in the practice of weight lifting and a 55% increase in running. We also

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