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# Tracking of physical activity during adolescence: the 1993 Pelotas Birth Cohort, Brazil

## Atividade física ao longo da adolescência: Coorte de Nascimentos de Pelotas de 1993

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### ABSTRACT

**OBJECTIVE:** To analyze physical activity during adolescence in participants of the 1993 Pelotas Birth Cohort Study, Brazil.

**METHODS:** Data on leisure time physical activity at 11, 15, and 18 years of age were analyzed. At each visit, a cut-off point of 300 min/week was used to classify adolescents as active or inactive. A total of 3,736 participants provided data on physical activity at each of the three age points.

**RESULTS:** A significant decline in the proportion of active adolescents was observed from 11 to 18 years of age, particularly among girls (from 32.9% to 21.7%). The proportions of girls and boys who were active at all three age points were 28.0% and 55.1%, respectively. After adjustment for sex, economic status, and skin color, participants who were active at 11 and 15 years of age were 58.0% more likely to be active at 18 years of age compared with those who were inactive at 11 and 15 years of age.

**CONCLUSIONS:** Physical activity declined during adolescence and inactivity tended to track over time. Our findings reinforce the need to promote physical activity at early stages of life, because active behavior established early tends to be maintained over time.

**DESCRIPTORS:** Adolescent. Motor Activity. Exercise. Sedentary Lifestyle. Cohort Studies.

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## RESUMO

**OBJETIVO:** Analisar a participação em atividade física ao longo da adolescência na coorte de 1993 de Pelotas.

**MÉTODOS:** Estudo de coorte composta pelas crianças nascidas em Pelotas, RS, em 1993. Foram analisadas as informações sobre a prática de atividades físicas no lazer aos 11, 15 e 18 anos de idade. O ponto de corte de 300 min foi usado para classificar os adolescentes como ativos em cada período. Um total de 3.736 indivíduos forneceu dados sobre atividades físicas realizadas nos três momentos estudados.

**RESULTADOS:** Declínio significativo na proporção de adolescentes ativos foi observado entre 11 e 18 anos, especialmente entre as meninas (32,9% para 21,7%). A proporção de meninas e meninos ativos nos três momentos foi de 28,0% e 55,1%, respectivamente. Após ajuste por sexo, nível econômico e cor da pele, os indivíduos ativos aos 11 e 15 anos, quando comparados àqueles inativos nessa faixa etária, foram 58,0% mais prováveis de serem ativos aos 18 anos.

**CONCLUSÕES:** A prática de atividade física diminuiu entre os 11 e 18 anos de idade e o comportamento inativo tendeu a se manter ao longo do período. Os resultados obtidos reforçam a importância de promover a atividade física nos estágios iniciais da adolescência, pois esse comportamento tende a ser mantido ao longo do tempo.

**DESCRIPTORIOS:** Adolescente. Atividade Motora. Exercício. Estilo de Vida Sedentário. Estudos de Coortes.

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## INTRODUCTION

High rates of global physical inactivity are negatively impacting population health.<sup>10,13</sup> Understanding the factors associated with physical activity practice is an essential step for planning interventions aimed at reducing the high rates of physical inactivity observed worldwide.<sup>4</sup> Personal, environmental, physical, and social factors are recognized as important variables associated with physical activity practice.<sup>4</sup>

The Brazilian National Adolescent School-Based Health Survey (PeNSE) showed that 43.1% of students from the 9<sup>th</sup> grade achieved the recommended levels of physical activity for youth.<sup>9</sup> However, recent reviews reinforce the importance of intervention during adolescence, particularly through school programs,<sup>11,19</sup> because of the positive impact of being active on physical, social, and mental health<sup>5</sup> and the increased chances of keeping active during adulthood.<sup>1,12,15,20,21</sup> Evidence on the tracking of active behavior, particularly during adolescence, suggests moderate stability of physical activity, although most of these studies have been conducted in high-income countries.<sup>14</sup>

The aim of the present study was to analyze physical activity during adolescence in participants of the 1993 Pelotas Birth Cohort Study, Brazil.

## METHODS

In 1993, all maternity hospitals in Pelotas, RS, Southern Brazil, were visited daily and 5,265 newborns whose family lived in the urban area of the city were identified. A total of 5,249 mothers agreed to enroll their infants in the study.<sup>22</sup> All participants were followed-up at 11, 15, and 18 years of age. Table 1 presents details of the participants at enrolment and at the 18-year follow-up. Further details on the study methodology have been published elsewhere.<sup>2,22</sup>

Similar data were collected in 2004 and 2008 when the participants were, on average, 11 and 15 years of age. In both surveys, trained interviewers collected data during face-to-face home interviews. For quality control, 30.0% of the interviews were repeated (10.0% in person and 20.0% by phone call) using a short version of the questionnaire. The last set of data collection was performed in 2011 when the participants were 18 years of age. Different from the previous follow-up visits, in 2011, the participants were invited to our research center for interviews and measurements.

Leisure-time physical activity was self-reported in all interviews. At 11 and 15 years of age, adolescents were

prompted to recall the duration and frequency of practicing a list of different activities during the past week. The list was constructed on the basis of a pilot study that identified the most frequent activities practiced at each age. The instrument showed moderate reliability ( $\rho = 0.62$ ) and concurrent validity ( $\kappa = 0.58$ ) in a validation study.<sup>3</sup> The time spent on leisure-time physical activity was estimated from the weekly frequency and duration of each activity. Participants were considered active if they performed  $\geq 300$  min/week of moderate-to-vigorous physical activity.<sup>23</sup> At 18 years of age, the participants answered the leisure-time section of the International Physical Activity Questionnaire (IPAQ), long version.<sup>7</sup> The same cut-off point was used.

In data analyses, we determined the levels of physical activity and other independent variables. The Chi-square test was used to compare physical activity levels according to sex at each age point. Changes in physical activity levels over time were tested using the Chi-square test for linear trend.

Poisson regression was used to analyze the associations between physical activity levels at 11 and/or 15 years of age and the levels at 18 years of age after adjusting for confounding factors. To reproduce physical activity guidelines, we used categorical physical activity variables in the periods studied. Therefore, the use of Poisson regression provided us with the likelihood of being active at any age according to activity levels at the previous age point.

Analyses were stratified by sex and the significance level was set at 5%. Data on skin color were collected at 11 years of age. The household socioeconomic index was calculated using principal component analysis of a list of household assets (TV, car, radio, computer, DVD, internet, refrigerator, freezer, vacuum cleaner, and washing machine). The continuous score of the first component was divided into quintiles. The confounding factors included in the adjusted analyses were sex, skin color, and socioeconomic index.

The study was approved by the *Comitê de Ética em Pesquisa da Faculdade de Medicina da Universidade Federal de Pelotas* (Process 05/2011 – 2/22/2011). All adolescents and their parents signed an informed consent form.

## RESULTS

At 18 years of age, a total of 4,092 adolescents (78.0% of the original sample) were interviewed and provided data on physical activity (Table 1). All categories based on sex and family income showed participation rates higher than 75.0%. Table 2 details the types of physical activities reported at 18 years of age. The mean walking time was about 1 h/week for both sexes. More than 50.0% of females were physically inactive (Table 2). A total of 3,736 participants provided data on physical activity at each of the three age points.

Figure 1 shows physical activity levels according to age. The analysis demonstrates that regardless of the study period, boys were more active than girls ( $p < 0.001$ ), and there was a significant decrease in physical activity as age increased across the sample ( $p < 0.001$ ).

Table 3 shows the prevalence ratios for being active during leisure time at 18 years of age according to physical activity levels at 11 and 15 years of age. In the adjusted analysis, participants who were active at 11 and 15 years of age were 58.0% (95%CI 1.39;1.80) more likely to achieve  $\geq 300$  min/week of physical activity

**Table 1.** Details of the original cohort and the participants followed-up at 18 years of age. The 1993 Pelotas Birth Cohort, Brazil.

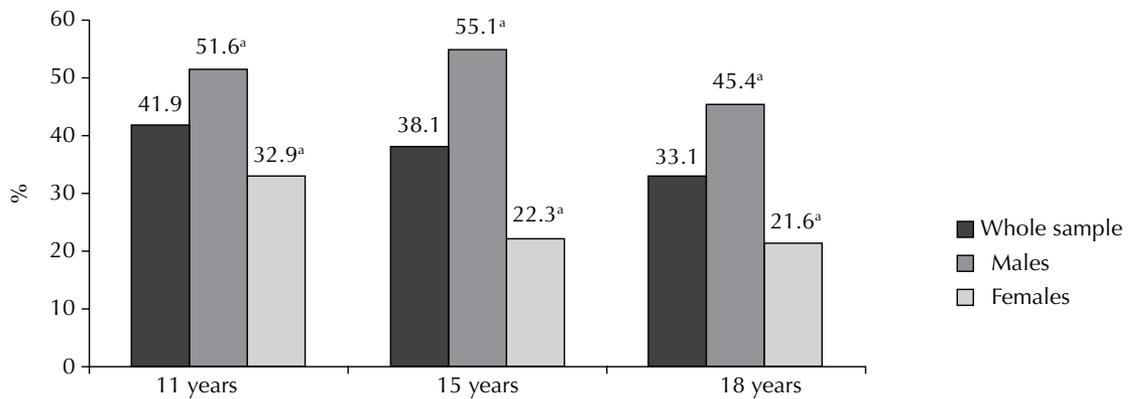
Variable	Original cohort in 1993		Visit at 18 years	
	n	n <sup>a</sup>	n <sup>a</sup>	%
Sex				
Male	2,580	2,006		77.8
Female	2,667	2,086		78.2
Family income				
1 (poorest)	967	731		75.6
2	2,260	1,766		78.1
3	1,204	985		81.8
4	433	331		76.4
5 (richest)	385	293		76.1

<sup>a</sup> Participants who provided data on leisure-time physical activity.

**Table 2.** Leisure-time physical activity patterns at 18 years of age. The 1993 Pelotas Birth Cohort, Brazil.

Leisure time physical activity	Whole sample			Males			Females		
	Average	SD	Median	Average	SD	Median	Average	SD	Median
Walking (min/week)	58	149	0	57	160	0	59	136	0
Moderate-intensity activities <sup>a</sup> (min/week)	81	177	0	125	221	60	38	103	0
Vigorous-intensity activities (min/week)	123	228	0	186	273	60	63	151	0

<sup>a</sup> Excluding walking.



<sup>a</sup> Males were significantly more active than females at all age points ( $p < 0.001$ ).

**Figure 1.** Physical activity level ( $\geq 300$  min/week) according to sex at 11, 15, and 18 years of age. The 1993 Pelotas Birth Cohort, Brazil.

at 18 years of age compared with those who were inactive at 11 and 15 years of age.

Figure 2 shows the maintenance of physical activity across the three age points. Considering all active participants at 11 years of age, 32.0% and 8.0% of males and females, respectively, remained active at 15 and 18 years of age. Analysis of all participants who were inactive at 11 years of age (Figure 3) showed that the

proportion of participants who were consistently inactive was higher among females (66.0%) than males (31.0%).

## DISCUSSION

The findings of the present study support the results of previous research that has identified declining levels of physical activity during adolescence. Furthermore, the results indicate that individuals active in early

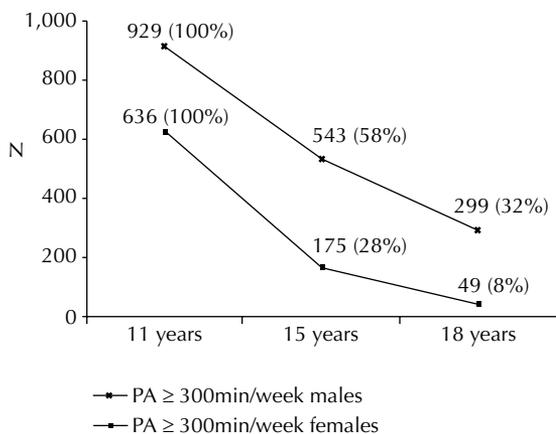
**Table 3.** Prevalence ratios for the association between physical activity levels at 11, 15, and 18 years of age. The 1993 Pelotas Birth Cohort, Brazil.

Physical activity at 11 and 15 years ( $\geq 300$ min/week)	Physical activity at 18 years ( $\geq 300$ min/week)						
	Crude				Adjusted		
	%	PR	95%CI	p	PR	95%CI	p
Whole sample				< 0.001			< 0.001 <sup>a</sup>
11(-) 15(-)	23.2	1.00	–		1.00	–	
11(+) 15(-)	31.6	1.36	1.19;1.56		1.22	1.07;1.41	
11(-) 15(+)	39.5	1.70	1.49;1.94		1.35	1.18;1.55	
11(+) 15(+)	48.5	2.09	1.85;2.35		1.58	1.39;1.80	
Males				< 0.001			< 0.001 <sup>b</sup>
11(-) 15(-)	35.8	1.00	–		1.00	–	
11(+) 15(-)	39.9	1.11	0.93;1.33		1.10	0.92;1.31	
11(-) 15(+)	47.3	1.32	1.13;1.55		1.29	1.10;1.52	
11(+) 15(+)	55.1	1.54	1.33;1.79		1.49	1.28;1.73	
Females				< 0.001			0.001 <sup>b</sup>
11(-) 15(-)	18.1	1.00	–		1.00	–	
11(+) 15(-)	24.7	1.36	1.11;1.68		1.40	1.13;1.73	
11(-) 15(+)	25.8	1.42	1.11;1.81		1.38	1.08;1.78	
11(+) 15(+)	28.0	1.55	1.18;2.02		1.67	1.28;2.19	

<sup>a</sup> Adjusted for sex, socioeconomic status, and skin color.

<sup>b</sup> Adjusted for socioeconomic status, and skin color.

(-) Did not reach the physical activity cut-off point. (+) Reached the physical activity cut-off point.



PA: Physical activity

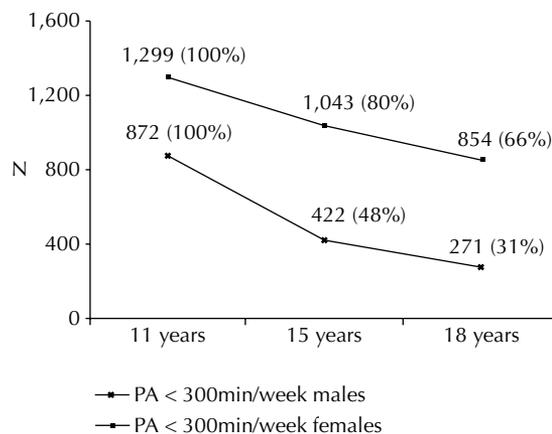
**Figure 2.** Tracking of physical activity (≥ 300 min/week). Only participants classified as active at 11 years of age were considered in this analysis. The 1993 Pelotas Birth Cohort Study, Brazil.

adolescence have a higher likelihood of being active in early adulthood. There is a strong stability of physical inactivity across adolescence, suggesting that interventions should start as early in life as possible.

The high proportion of participants who were followed-up at each age point reduces the likelihood of selection bias. Furthermore, data on confounders such as socioeconomic status were prospectively collected, minimizing the possibility of residual confounding or other biases.

Although there are limitations of using self-reported physical activity, both instruments used in this study have been validated prior to use in our cohort. The IPAQ has been used in several countries, enabling comparison with other contexts.<sup>8</sup> The positive validity indicators for both instruments suggest that physical activity levels reflect the reality, minimizing the likelihood of bias resulting from the use of different instruments. Although physical activity guidelines for adults recommend half the time suggested for adolescents,<sup>23</sup> we used the same cut-off point (≥ 300 min/week) throughout the study to allow comparison at different ages.

The finding that physical activity levels decline during adolescence is consistent with the results of previous studies.<sup>6,16-18</sup> Besides showing lower levels of physical activity at the beginning of adolescence, girls display a greater decrease in activity over time.<sup>20</sup> The present study shows that practicing physical activity according to the recommendations (≥ 300 min/week) at 11 and 15 years of age is associated with a 58.0% increased likelihood of achieving the physical activity recommendations at 18 years of age. Studies from the 1982 Pelotas Birth Cohort Study, which tracked physical activity at 15, 18, and 23 years of age, showed similar results.<sup>1</sup>



PA: Physical activity

**Figure 3.** Tracking of physical activity below the recommended level (< 300 min/week). Only participants classified as inactive at 11 years of age were considered in this analysis. The 1993 Pelotas Birth Cohort Study, Brazil.

It is relevant, but worrying, that tracking of inactive behavior is stronger than that of physical activity, particularly among girls. At 11 years of age, a large number of girls did not accomplish the physical activity recommendations, and they tended to continue being inactive throughout adolescence. Physical activity practice during adolescence is related to different determinants, including personal, social, cultural, and behavioral factors.<sup>17,18</sup> Several demographic variables linked to physical activity, such as sex, age, skin color, and socioeconomic status, were included in the present study as possible confounders. However, other determinants that can affect physical activity, such as competence perception, parental support, and availability of facilities, were not included in this study.

In Latin America, some initiatives have produced positive results.<sup>11</sup> The school is an important place to target investments to increase physical activity among students, and physical education classes play an important role.<sup>11</sup> Brazil needs to strengthen commitment and contributions to physical education at school using policies on physical activity and sports promotion.

Findings from the present study reinforce the evidence that promoting physical activity at early stages of life is an important public health priority, given the tendency of inactive behavior to track over time. Considering the high rates of physical inactivity at the beginning of adolescence, particularly among girls, and the evidence that physical activity during adolescence can predict future active or sedentary lifestyle, it is necessary to increase efforts and interventions to promote physical activity and health during childhood.

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