



Temporal trends (2006-2019) regarding physical activity among adolescents living in the city of Rio de Janeiro, Brazil

Tendencias temporales (2006-2019) de la actividad física en adolescentes residentes en la ciudad de Río de Janeiro, Brasil

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Abstract

Introduction: Continuous epidemiological monitoring is vital for health behavior analysis, yet remains deficient in low- and middle-income countries. Global instruments often lack local precision, necessitating context-specific, validated tools.

Objective: to estimate the prevalence and the factors associated with the practice of physical sports activities (PSA) among adolescents aged 14-15 years in the city of Rio de Janeiro in 2019, and investigate this temporal trend in 2006, 2014, and 2019.

Methodology: a cross-sectional study conducted with 1240 students in 2019. The questionnaire used to assess PSA was previously formulated and its reproducibility was validated in earlier studies between the years 2006 and 2014, enabling the assessment of temporal trends.

Results: PSA prevalence in 2019 was 47.2%, significantly associated with sex. While no overall difference was found between 2006 and 2019 ($p>0.05$), prevalence fluctuated significantly ($p<0.05$) across the period: increasing from 2006 (50.8%) to 2014 (56.6%), followed by a reduction in 2019 (47.2%).

Discussion: Findings reveal a non-linear trend, where PSA peaked in 2014 before declining. Sex remained a consistent correlate across all periods, whereas socioeconomic status was associated with PSA only in 2006 and 2014.

Conclusions: PSA prevalence has significantly declined, returning to levels from over a decade ago. This downward trend, driven by persistent sex and socioeconomic disparities, demands urgent and targeted public policies to safeguard adolescent health and reverse this regression.

Keywords

Temporal trends; exercise; social determinants of health; adolescents; Brazil.

Resumen

Introducción: El monitoreo epidemiológico continuo es vital para el análisis de las conductas de salud; sin embargo, sigue siendo deficiente en los países de ingresos bajos y medios. Los instrumentos globales a menudo carecen de precisión local, lo que exige herramientas validadas y específicas para cada contexto.

Objetivo: estimar la prevalencia y los factores asociados con la práctica de actividades físicas deportivas (AFD) en adolescentes de 14 a 15 años en la ciudad de Río de Janeiro en 2019, e investigar esta tendencia temporal en 2006, 2014 y 2019.

Metodología: estudio transversal realizado con 1240 estudiantes en 2019. El cuestionario utilizado para evaluar las AFD fue formulado previamente y su reproducibilidad fue validada en estudios anteriores entre los años 2006 y 2014, lo que permitió la evaluación de las tendencias temporales.

Resultados: la prevalencia de AFD en 2019 fue del 47.2%, asociada significativamente con el sexo. Aunque no se encontraron diferencias globales entre 2006 y 2019 ($p>0.05$), la prevalencia fluctuó significativamente ($p<0.05$) a lo largo del periodo: aumentó de 2006 (50.8%) a 2014 (56.6%), seguido de una reducción en 2019 (47.2%).

Discusión: Los hallazgos revelan una tendencia no lineal, donde las AFD alcanzaron su punto máximo en 2014 antes de disminuir. El sexo se mantuvo como un correlato constante en todos los periodos, mientras que el nivel socioeconómico se asoció con las AFD solo en 2006 y 2014.

Conclusiones: La prevalencia de AFD ha disminuido significativamente, regresando a los niveles de hace más de una década. Esta tendencia a la baja, impulsada por persistentes disparidades socioeconómicas y de sexo, exige políticas públicas urgentes y focalizadas para salvaguardar la salud de los adolescentes y revertir este retroceso.

Palabras clave

Tendencias temporales; ejercicio; determinación social de la salud; adolescentes; Brasil.



Introduction

Several health benefits resulting from regular physical activity have been supported by scientific literature, such as its use as a preventive strategy and non-drug intervention for cardiovascular diseases, type 2 diabetes, some types of cancer, anxiety, depression, sleep improvements, body-fat reductions, among others (Who, 2022; Blond et al., 2019; Warburton & Bredin, 2017; Rique; Soares; & Meirelles, 2002).

In the constant defense of the importance of regular physical activity, it seems paramount to engage children and adolescents from an early age, as these habits could contribute to the maintenance of this behavior throughout adulthood, contributing to the prevention of numerous chronic conditions associated with inactivity (Who, 2022; Kjønnsniksen; Fjørtoft; & Wold, 2009; Hallal et al., 2006).

According to the recommendations provided by the World Health Organization (WHO) published in 2022, children and adolescents between five and seventeen years of age should perform at least 60 minutes of predominantly aerobic moderate to vigorous activity daily, combined with muscle strengthening activities three times a week (Who, 2022).

From this perspective, further investigations involving the prevalence of physical activity in this population are needed, which, in addition to gathering data, also analyze the possible factors that could influence them, like socioeconomic and cultural status as well as the availability of safe public places that could stimulate the practice of physical activity (Hanifah, Nasrulloh, Sufyan, 2023). Furthermore, it would be interesting to periodically monitor epidemiological studies, aiming to enable a more systematic analysis, consisting of temporal and vigilant assessments of these events. However, this type of study is deficient, especially in least developed countries. Moreover, when available, data may have some important limitations due to the use of a global instrument to assess different countries and populations (Tremblay, 2020; Hallal et al., 2012; Hallal et al., 2006). Therefore, the temporal monitoring of physical activity seems to provide relevant information for planning and promoting local and global public policies that raise the population's activity levels (Guthold et al., 2020). Recent data indicates that global adolescent physical activity levels have not recovered to pre-pandemic standards, with structural inequalities becoming more pronounced in middle-income urban centers (Ludwig-Walz, 2025).

In Brazil, large-scale national data regarding the regular practice of physical activity among children and adolescents predominantly derive from the "National School Health Survey" (PeNSE), conducted by the Brazilian Institute of Geography and Statistics (IBGE) in 2009, 2012, 2015, and 2019. Although these national investigations offer critical macro-level prevalence rates, they inherently mask granular, city-specific trajectories and fail to explore how localized social determinants shape these behaviors over time. Consequently, a significant knowledge gap remains regarding how municipal realities and regional structural shifts impact adolescent physical activity, highlighting the need for localized, long-term temporal trend analyses that look beyond aggregate national percentages.

The city of Rio de Janeiro represents a unique economic and cultural micro-context for such an analysis, particularly due to the massive investments and structural modifications linked to hosting mega sporting events, such as the FIFA World Cup (2014) and the Olympic Games (2016). To date, only two local studies have verified the prevalence of physical-sports activities (PSA) among adolescents aged 14–15 years in public schools within this municipal territory. Pimenta (2006) observed a baseline active prevalence of 50.8%, which significantly increased to 56.8% when replicated by Lagreca (2014) during the peak of pre-mega-event investments. However, since this pre-Olympic period, local surveillance has ceased, leaving an empirical void regarding the long-term sustainability of these trends following the conclusion of these international events and the subsequent regional fiscal shifts.

Therefore, the aims of this study were twofold: to estimate the prevalence and factors associated with extracurricular PSA among adolescent students aged 14–15 years in Rio de Janeiro in 2019, and to analyze the 13-year localized temporal trend across 2006, 2014, and 2019, drawing direct comparisons with baseline methodologies.

Based on the empirical background of a post-mega-event economic slowdown, combined with the onset of severe national fiscal austerity (such as Constitutional Amendment 95/2016) and worsening local socioeconomic disparities, we hypothesize that the upward trend observed between 2006 and 2014 will reverse by 2019. We anticipate a decline in PSA prevalence, which may be interpreted as reflecting the cumulative effects of macroeconomic and structural constraints on adolescent health behaviors.



Method

Study Characterization

This study features a repeated cross-sectional design, integrated into a broader continuous monitoring project of behavioral and health parameters among adolescents in public schools within the municipality of Rio de Janeiro. Data collection for all three study waves was systematically carried out during the second half of the respective years: 2006, 2014, and 2019. By employing repeated cross-sectional surveys rather than a longitudinal follow-up, this design evaluates population-level shifts in physical-sports activities (PSA) over a 13-year span using independent, chronological samples of the same target age-group, thereby avoiding causal inferences while maintaining descriptive and trend validity within its methodological scope.

Participants

To ensure the representativeness of the local public school system, a multi-stage cluster sampling strategy was implemented. In the first stage, public schools were selected across the administrative regions of the municipality to mirror the geographic distribution established in the baseline investigations (2006 and 2014). In the second stage, intact classes corresponding to the targeted school year were randomly selected. The minimum required sample size was calculated a priori based on enrollment parameters provided by the Municipal Secretariat for Education, Sports, and Recreation of Rio de Janeiro (2019); adopting a 95% confidence interval, a 3% sampling error, and a conservative presumed prevalence of physical inactivity of 50%, the required sample was estimated at 1,040 students. The actual sample size achieved in 2019 was 1,240 students, exceeding the minimum logistical requirement, which provided sufficient statistical power to detect changes in PSA prevalence trends and perform adjustments while minimizing potential selection bias.

Students were selected from classes that had the largest number of adolescents in the age group of interest. The following inclusion criteria were adopted: (1) students enrolled in elementary school in the previous selected public schools, (2) students aged 14-15 years. Those who (1) did not reside in the city of Rio de Janeiro, (2) were pregnant, (3) had a disability, and (4) were unable to answer the research questions were excluded from the study.

Instruments

The instrument used for data collection was a previously validated questionnaire with open and closed questions, built in 2006 with the purpose of obtaining information regarding sociodemographic and socioeconomic variables, PSA engagement (including weekly time of practice, duration of practice and type of activity), motives associated with the practice and non-practice of PSA, participation or the lack of participation in school physical education classes, conditions for participation in school physical education classes, and the associated factors.

The reproducibility of this questionnaire was verified using test-retest procedures with 29 students from the same age group with a 10-day interval (Pimenta, 2006). To estimate the agreement between the two measurements, the Kappa index (k) was analyzed. All Kappa indices were statistically significant ($p < 0.05$).

During all time points (2006, 2014, and 2019), socioeconomic variables were investigated according to the Brazilian Association of Research Companies (ABEP). In this questionnaire, the sum of scores referring to the presence of material items found at an individual's home and their quantity, categorize adolescents into six social classes: A, B1, B2, C1, C2, D-E. However, in this study, social classes B and C were gathered, organizing the sample into four distinct social classes: A, B, C, and D/E.

The use of a key question identified the practice of PSA. Adolescents answered the following question: "In the last month, excluding school physical education classes, did you practice any other physical sports activity?". For instance, football, volleyball, dancing, cycling, wrestling, resistance training, surfing, and artistic gymnastics, among others, were considered physical-sports activities.



Additionally, weekly frequency and daily duration of activities were also investigated. After obtaining data, adolescents' activity levels were presented in four different categories according to their weekly practice: less than 90 minutes per week, 90 to 179 minutes per week, 180 to 300 minutes per week, and 300 minutes per week or more.

Ethical Procedures

The research was conducted under the following procedures: a) project submission for appraisal and approval by the Ethics Committee in Research with Human Beings of the Clementino Fraga Filho University Hospital (CEP/HUCFF) from the Federal University of Rio de Janeiro under the following number: 10123219.3.0000.5257; b) handover of the CEP's appraisal to the Municipal Secretariat for Education, Sports and Recreation for appreciation; c) with the authorization provided by the secretariat, each regional coordination was contacted; d) visit to schools upon presentation of the authorization letter to schedule for data collection; e) selection of school classes with the largest number of adolescents between 14 to 15 years of age; f) questionnaire application to the adolescents who were available at data collection. The adolescents' consent was obtained through a form after authorization from their legal guardians.

Statistical Analyses

The normality of data regarding the practice of physical activity was assessed using the Kolmogorov-Smirnov test ($p < 0.001$ for all years). Symmetry, kurtosis, histogram, and Q-Q plot analyses confirmed that the data distribution did not meet normality standards. Consequently, values for weekly practice time (minutes) and duration of engagement (months) are described as medians and interquartile ranges, and compared across years using the Kruskal-Wallis test. Pairwise comparisons adjusted by the Bonferroni correction were applied to identify statistically significant differences.

To evaluate factors associated with physical activity while ensuring model robustness within a comprehensive bivariate approach, the chi-square test for association was utilized after adequate variable categorization. When a significant association was detected, adjusted standardized residuals were calculated and corrected according to the MacDonald and Gardner proposal (MacDonald & Gardner, 2000) to pinpoint specific local points of significance. Expected frequencies were also calculated for precise observational mapping. Finally, to measure the exact magnitude and effect size of the associations rather than relying solely on significance levels, the Phi coefficient was calculated for 2 x 2 contingency tables, and Cramer's V was applied for larger tables.

Odds Ratios (OR) were calculated and interpreted based on a 95% confidence interval (CI). The level of significance was set at 0.05 for all inferential analyses. All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 20.0.

Results

The baseline characteristics and behavior modifications of the targeted sample across the three study waves (2006, 2014, and 2019) are summarized in Table 1. The temporal trend analysis revealed a distinct, non-linear trajectory in the prevalence of physical-sports activities (PSA) during leisure time. As illustrated in Figure 1, a significant increase in structural PSA engagement was achieved from 2006 to 2014, which was subsequently reversed by a sharp decline in 2019, effectively returning adolescent activity rates to historical baseline levels ($p < 0.001$).

Table 1. Characteristics of the adolescents of the city of Rio de Janeiro in 2006, 2014, and 2019

Investigated variables	Year in which investigations were conducted						Cramer's V	p-value
	2006		2014		2019			
	n	%	n	%	n	%		
Sex								
Male	379	41.6	277	44.5	585	47.2	0.049	0.037
Female	532	58.4	345	55.5	655	52.8		
Socioeconomic class								
A	27	3.0	14	2.3	45	3.6	0.073	<0.001
B	370	40.6	282	45.3	470	37.9		
C	469	51.5	317	51.0	645	52.0		
DE	45	4.9	9	1.4	80	6.5		
"Did you practice any other PSA?"								
No	448	49.2	269	43.2	655	52.8	0.074	<0.001
Yes	463	50.8	353	56.8	585	47.2		
PSA (duration in minutes a week)								
< 90 min/week	28	6.0	35	9.9	50	8.6	0.097	<0.001
90 to 179 min/week	131	28.3	54	15.3	116	19.9		
180 to 300 min/week	102	22.0	88	24.9	161	27.6		
> 300 min/week	202	43.6	176	49.9	256	43.9		
Duration of PSA engagement (months)								
< 6 months	131	28.3	77	21.9	83	14.5	0.121	<0.001
Between 6 months and 1 year	95	20.5	100	28.4	123	21.5		
> 1 year	237	51.2	175	49.7	367	64.0		

The percentage values presented correspond to the practice of physical-sports activities

Regarding the weekly volume of physical activity among active individuals (Table 2), the median values remained statistically stable throughout the 13-year timeframe ($p = 0.717$). Despite shifting macro-prevalence rates over the decades, adolescents who maintained engagement reported consistent physical activity workloads, ranging from a median of 270 to 340 minutes per week across the surveys.

Figure 1. Prevalence of regularly practicing PSA

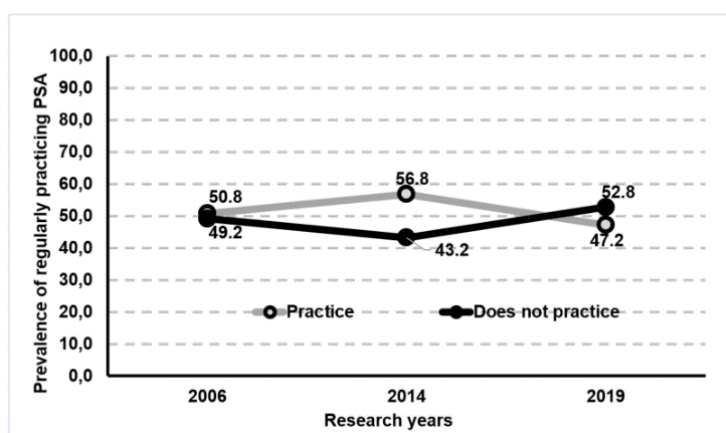


Table 2. Weekly volume of physical activity practice expressed as median and interquartile range according to survey year

	2006	2014	2019	p-value*
Practice of physical activity (min/week)	270 (180-480)	300 (165-535)	340 (180-600)	0.717

*Level of significance set at $p < 0.05$. Kruskal-Wallis Rank Test followed by Bonferroni's correction.

Table 3 displays data results regarding the investigated localized temporal trend, evaluating the specific distribution and shifting patterns of regular PSA practice across the surveys according to the adolescents' socioeconomic class and sex.

Table 3. Associations between the regular practice of PSA by adolescents in the city of Rio de Janeiro (2006, 2014, and 2019), social class and sex

Variables		Performs regular PSA				Cramer's V/Phi	p-value	OR	CI 95%
		No		Yes					
		n	%	n	%				
2006	Sex								
	Male	114	30.1	265	69.9	-0.320	<0.001	ref.	
	Female	334	62.8	198	37.2			0.255	0.193-0.338
	Socioeconomic class								
	A	11	40.7	16	59.3	0.120	<0.003	ref.	
	B	156	42.2	214	57.8			1.06	0.48-2.35
	C	256	54.6	213	45.4			1.75	0.79-3.85
	DE	25	55.6	20	44.4			1.82	0.69-4.78
2014	Sex								
	Male	70	25.3	207	74.7	-0.320	<0.001	ref.	
	Female	199	57.7	146	42.3			0.248	0.17-0.35
	Socioeconomic class								
	A	3	21.4	11	78.6	0.117	0.036	ref.	
	B	109	38.7	173	61.3			2.31	0.63-8.47
	C	152	47.9	165	52.1			3.38	0.92-12.3
	DE	5	55.6	4	44.4			4.58	0.73-28.6
2019	Sex								
	Male	206	35.2	379	64.8	-0.333	<0.001	ref.	
	Female	449	68.5	206	31.5			0.249	0.18-0.31
	Socioeconomic class								
	A	20	44.4	25	55.6	0.059	0.230	ref.	
	B	240	51.1	230	48.9			1.300	0.71-2.41
	C	346	53.6	299	46.4			1.450	0.79-2.66
	DE	49	61.3	31	38.8			1.980	0.94-4.14

Discussion

According to the results of the present investigation, when comparing prevalence rates, there was an increase in the number of physically active adolescents between 2006 (50.8%) and 2014 (56.8%), while from 2014 (56.8%) to 2019 (47.2%) there was a significant decrease in the rates of physical activity among this specific age group. Additionally, the prevalence of PSA during the proposed time frame was higher among male adolescents, and the participation of male adolescents in the sample increased over the years. Taken together, these factors could have suggested a higher prevalence of PSA in 2019. During the study period, the city of Rio de Janeiro hosted mega sporting events, such as the FIFA World Cup (2014) and the Olympic Games (2016), which would suggest a possible increase in the practice of physical activity over this period. However, the year 2019 presented the lowest prevalence of physical-sports activity. These findings suggest that temporal variations in PSA cannot be explained solely by increased opportunities for engagement, such as mega sporting events, pointing instead to broader structural determinants shaping adolescents' physical activity patterns.

One of the aspects that explains the reduction in the prevalence of physically active adolescents may be their socioeconomic status. Data from the present study allow us to verify that between 2006 and 2014, there was a reduction in the number of adolescents in social classes C, D, and E. However, between the years 2014 and 2019, there was a considerable increase, even surpassing the percentages found in the first year of data collection. Thus, studies indicate that adolescents with better socioeconomic status tend to be more physically active when compared to those from lower social classes (Hanifah; Nasrullo; & Sufyan, 2023; Lee & Lim, 2022; Pabayo et al., 2017; Johnsen et al., 2017). Thus, these findings reinforce the role of socioeconomic position not only as an associated factor, but as a structuring condition that shapes access to opportunities for physical activity.

Social determinants of health, including the means and possibilities for people to access or not health services comprising physical activity, must be considered in light of the results. In this context, social determinants of health should be understood as structuring mechanisms that condition the unequal distribution of opportunities for physical activity, rather than merely contextual variables. Previously, for instance, researchers noticed that, in Europe, adolescents from lower economic classes had a higher



prevalence of physical inactivity during their leisure time, while adolescents from higher socioeconomic classes presented a lower prevalence. These associations were also observed in samples composed of American adults of both sexes, Danish adolescents, and German children and adolescents (Pabayo et al., 2017; Johnsen et al., 2017; Schmidt et al., 2020).

Several campaigns promoted by the World Health Organization have consistently emphasized the importance of being physically active. Despite that, cross-sectional studies and temporal trend analyses conducted with different populations at global levels have found low levels of physical activity (Guthold et al., 2020; Schmidt et al., 2020; Johnsen et al., 2017; Hallal et al., 2012). Despite these global recommendations, the persistence of low levels of physical activity suggests that normative approaches alone are insufficient when structural inequalities are not addressed. Unfortunately, little attention is paid to the social determinants that involve such scenarios.

Recently, Brazil went through a political-institutional crisis, and coincidentally, since that event, several social indicators have deteriorated. In addition, public investments have been restricted since 2016 with the Constitutional Amendment 95/2016 (Expenditure Ceiling), which altered constitutional provisions by establishing a new fiscal regime whereby public expenditures were capped for twenty years following its enactment, which constitutes an important milestone of the neoliberal agenda in the country (Palma, Vilaça, Rodrigues, 2021). This same scenario has been observed in other countries, such as the United States of America (Woolhandler et al., 2021). The implementation of fiscal austerity in Brazil, characterized by the Expenditure Ceiling (EC 95/2016), aligns with a global trend where restrictions on public health funding undermine social indicators. Such measures have been shown to disproportionately affect vulnerable populations, leading to a deterioration in health promotion and the maintenance of preventive behaviors, including physical activity (Hone et al., 2019). While the present study did not directly measure macroeconomic indicators or municipal expenditures on urban sports infrastructure, it is hypothesized that the temporal decline observed in 2019 may reflect, at a contextual level, the cumulative effects of macro-structural constraints and fiscal austerity policies. These factors operate as macro-contextual hypotheses rather than direct causal variables, providing a plausible lens to discuss how macro-level restrictions might indirectly affect leisure-time physical activity.

Thus, it is possible to verify that public health investment per capita related to the Brazilian Unified Health System increased between 2003 and 2014, followed by a significant reduction. The unemployment rate also displayed a considerable increase beginning in 2016 (Neri, 2020; Palma; Vilaça; & Rodrigues, 2021). Hence, this scenario may have contributed to reduced public investments in the construction and revitalization of public spaces suitable for leisure-time physical activity, as well as to lower investment in public policies promoting PSA. Recent evidence from Brazilian urban centers highlights that the built environment remains a critical determinant of health behaviors. Studies published in 2024 demonstrate that higher residential density and better access to parks are directly associated with increased leisure-time physical activity, suggesting that urban planning operates as a key mediating factor between socioeconomic conditions and physical activity behaviors, which may have contributed to the observed decline in activity levels (Saboya et al., 2024).

When analyzing Brazil's poverty rates (Neri, 2020), it was verified that in the year 2003, 28.16% of the Brazilian population had been living in poverty conditions. From this year onwards, there was a considerable reduction in the subsequent years until 2014, when Brazil reached an 8.38% poverty rate. However, in the following three years, these rates began to increase until the year 2017 to, respectively, 10% (2015), 10.83% (2016), and 11.1% (2017). These patterns suggest a plausible relationship between worsening socioeconomic conditions and declining PSA levels, reinforcing the role of structural inequality in shaping behavioral outcomes. Furthermore, in the present investigation, it was possible to observe that, in 2006, 56.4% of the investigated sample belonged to social classes "C", "D", and "E". In 2014, this percentage dropped to 52.4% while in 2019 social classes "C", "D", and "E" represented 58.5% of the investigated sample.

The temporal trend observed in this study is similar to what was noticed in other countries. When investigating the impact of social inequality on physical activity among Danish adolescents aged 11 to 15 years, from 1991 to 2014 (Johnsen et al., 2017), it was possible to observe that the rate of leisure time physical activity in higher social classes was lower, while physical inactivity was higher among lower social classes. During the investigated time frame, differences found between social classes led the authors to observe that the lowest prevalence of physical inactivity was always among adolescents in



higher social classes. In a 23-year interval, researchers did not find changes in this previously observed pattern, indicating that socioeconomic inequalities in physical activity are persistent and structurally embedded across different contexts.

One of the most recent investigations conducted on this topic provides us with the trends of insufficient physical activity among adolescents in a globalized approach involving 146 countries (Guthold et al., 2020). The research estimated that about 81% of the adolescents aged 11 to 17 years old were insufficiently active. However, the study did not find a clear pattern between country income, categorized into four divisions according to the World Bank, and insufficient levels of PSA. Nevertheless, the results of the present study led us to this association, even though data were collected in a specific city. Therefore, macroeconomic conditions should be interpreted as structuring forces that interact with cultural and social dimensions to shape PSA levels.

Interestingly, sex was another factor associated with the prevalence of PSA. These findings highlight persistent and socially constructed inequalities in access to PSA between sexes. According to the present findings, boys were consistently more physically active in extracurricular activities than girls. This pattern aligns with Brazilian studies on students' health (Brasil, 2009; Brasil, 2013; Brasil, 2016; Brasil, 2021), with evidence from Finland between 1991 and 2014 (Johnsen et al., 2017), and with global analyses conducted from 2001 to 2016 (Guthold et al., 2020), as well as more recent multicountry evidence from the Global South (Ricardo et al., 2022). In addition, longitudinal evidence suggests that gender differences are also shaped by distinct perceived barriers to sports participation, which may contribute to the persistence of these inequalities over time (Arumi-Prat et al., 2025).

However, these disparities should also be interpreted as a failure of 'gender-neutral' public policies that often overlook the specific structural barriers faced by female adolescents. The decline observed in 2019, coupled with the worsening of socioeconomic indicators, likely exacerbated this gap. While qualitative variables – such as the perception of public safety, urban mobility barriers, and the specific distribution of domestic responsibilities – were not empirically measured by our instrument, literature suggests that these structural constraints often disproportionately affect female adolescents in periods of economic hardship. Therefore, although these dynamics remain within a hypothetical framework for the studied sample, they reinforce the need for future studies to look beyond normative behavioral recommendations and investigate the underlying social structures that may constrain female leisure-time activity. Thus, the persistence of these inequalities suggests that health must be addressed through intersectoral policies that ensure structural conditions like public safety and urban mobility, rather than through individual behavioral recommendations alone.

Changes in physical activity patterns require moving beyond normative approaches and toward analyses grounded in social structures that enable or constrain leisure-time activity. Thus, health should, in fact, be considered as a constitutional right as described in the Constitution of the Federal Republic of Brazil (1988).

It is imperative to adequately analyze the population's needs that precede an individual's opportunity to access the regular practice of PSA, such as appropriate access to property, employment, sanitation, public health, and public security. Access to these structural conditions may expand the possibilities for engagement in physical activity, rather than determining it directly.

Potential limitations of this study include the fact that only extracurricular leisure time activities were considered during investigations, excluding transportation, domestic, and occupational physical activities from the proposed analyses. However, considering an expanded concept of "health", different domains may trigger different reactions so that leisure time activities may promote more positive health benefits (Appelqvist-Schmidlechner et al., 2020; Jurakić; Pedišić; & Greblo, 2010). Crucially, the repeated cross-sectional design and the quantitative nature of the instrument do not allow for the establishment of direct causal relationships between macro-political changes in the country and adolescent behavioral shifts. Macroeconomic parameters, precise local family unemployment rates, municipal budgets allocated to sports/recreation, and individual perceptions of the built environment were not empirically tracked. Consequently, the discussion linking the decline in PSA prevalence to fiscal austerity and institutional crises must be interpreted strictly as a plausible contextual backdrop and a theoretical effort to contextualize the findings within the historical reality of the city, rather than as causal inferences derived from the generated dataset.



On the other hand, the primary strength of this study is that there is a lack of investigations regarding temporal trends in Rio de Janeiro and Brazil. Additionally, the existing studies do not provide us with a social analysis of the topic, which reinforces the relevance of the present investigation. It should also be highlighted that during the present investigation the authors were able to reproduce the previously adopted methodology, which favors the comparability of the results and reinforces the possibility for future investigations.

Conclusions

The practice of leisure-time physical activities among adolescents aged 14-15 years in Rio de Janeiro fluctuated during the analyzed time frame. From 2006, there was a significant increase in 2014, but it was possible to observe a decrease in 2019. Considering the scenario presented in 2014, with an increased prevalence of PSA compared to 2006, and the hosting of major sports events, it was expected that PSA prevalence would continue to increase in 2019, which was not supported by the present results. Nonetheless, a low prevalence was observed throughout the period, not significantly differing from 2006. The practice of physical activity was associated with the adolescent's sex throughout the analyzed time frame and, in 2006 and 2014, with their social class.

The political and economic context in Brazil in recent years may help explain these findings, particularly as increasing poverty and structural constraints tend to disproportionately affect access to leisure-time physical activity among adolescents.

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