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ORIGINAL RESEARCH

Ten-Year Trends in Total Physical Activity Practice in Brazilian Adults: 2002-2012

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***Background*:** One-third of adults worldwide are physically inactive causing over 5.3 million deaths annually. Despite a growing focus on physical activity and health, population-based data on physical activity trends in low- and middle-income countries are still limited. To help fill the gap, this study provides trend data over a 10-year period in Pelotas, a southern Brazilian city. ***Methods*:** The short version of the International Physical Activity Questionnaire was used to assess the prevalence of physical inactivity in 2002 (n = 3119), 2007 (n = 2969), and 2012 (n = 2868). Levels of inactivity and trends were assessed according to sex, age, schooling, and socioeconomic position (SEP). ***Results*:** The prevalence of physical inactivity rose from 41.1% (95% CI: 37.4–44.9) in 2002 and 52.0% (95% CI: 49.1–53.8) in 2007 to 54.4% (95% CI: 51.8–56.9) in 2012 ($P < .001$). Physical inactivity significantly increased in all subgroups except in the highest SEP and 70+ year age subgroups. ***Conclusions*:** After a sharp increase in the prevalence of physical inactivity from 2002–2007, levels plateaued from 2007–2012. However, it is important to stress that current levels are still unacceptably high, and that efforts must be intensified to reverse the trend.

***Keywords*:** surveillance, epidemiology, public health

Around one-third of the world's adult population is physically inactive, failing to reach the recommended 150 minutes per week of moderate-intensity physical activity.[1] Even more concerning is the fact that societal trends are leading to decreasing, and not increasing, levels of energy expenditure.[2] In spite of over 50 years of knowledge generation on the correlates of physical activity behaviors, most studies so far focused on cross-sectional analyses.[3] Although many types of interventions have proven to be effective,[4] the widespread adoption of effective physical activity interventions is still rare.[5]

Physical activity surveillance has progressed notably over the last 10-years, particularly after the development of the International (IPAQ) and Global Physical Activity Questionnaires (GPAQ).[1] Data on physical activity levels of adult populations using information collected with these instruments are now available for over 120 countries, but a key gap is the lack of regular monitoring of physical activity practice in these countries, precluding the analyses of time trends.[1] Data on time trends are relevant for several reasons. First, surveillance data might be used as a means of monitoring the real-life effectiveness of physical activity interventions (ie, are populations from cities which implemented large-scale interventions experiencing increasing levels of activity?). Second, surveillance data can be used by policy makers to predict the main health threats in a given society (ie, if the prevalence of inactivity is increasing, it is expected that the incidence of coronary heart disease will increase at some point in the future).

Data on time trends of physical activity are scarce in low- and middle-income countries.[1] In Brazil, the national telephone surveillance system monitored by the Brazilian Ministry of Health reported very minor changes in adults' physical activity behaviors from 2005 to 2009.[6] In the city of Pelotas, Brazil, a substantial decline in total physical activity was reported from 2002–2007, particularly due to sharp reductions in physical activity levels of low-income subgroups of the population in the 5-year period.[7] A third cross-sectional survey using the same methodology was undertaken in 2012. The aim of the present paper is to report 10-year trends in physical activity levels of adults living in the South of Brazil.

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Methods

Surveys Design

In 2002, 2007, and 2012, cross-sectional surveys were carried out to determine the prevalence of physical inactivity in Pelotas, Brazil. The municipality of Pelotas currently has a population of 340,000 inhabitants, 93.2% of whom live within the urban area. Sampling strategies were nearly identical in all years. Detailed information on the methods used in the 2002[8] and 2007[7] studies is available elsewhere. Only relevant methodological aspects are presented here.

Sampling Approaches

A systematic approach was used to select the sample in all 3 surveys. Primary sampling units were the city's census tracts (ie, delimited areas with approximately 300 households), which were sampled taking into account tract size. All households in each sampled tract were listed, and approximately 11 households were systematically selected for sampling. All residents aged 20 years or older were eligible for participation, with the exception of those unable to answer the questionnaire due to severe physical or mental impairment.

Sample Size and Power

To detect a statistically significant difference of 4.5 percentage points or more (considered by the authors as relevant for public health) with a confidence level of 95% and 80% power, a sample size of 3000 individuals was needed in each survey. There were 3372 subjects eligible in 2002, 3180 in 2007, and 3337 in 2012. There was a slight decline in the achieved sample size from 2002 to 2012; nonresponse rates were 5.6% in 2002, 6.1% in 2007, and 13.4% in 2012. Respondents did not significantly differ from

nonrespondents in terms of sex and age, and there were no clear differences in response rates across neighborhoods of the city. The percentage of participants with missing data on physical activity was lower in 2012 as compared with the previous years. The analytical sample comprised 3119 individuals in 2002, 2969 in 2007, and 2868 in 2012.

Logistics of the Fieldwork

Data were collected by means of face-to-face interviews, carried out by trained female interviewers with at least secondary education. Similarly to most population-based studies in Brazil, we opted to use females as interviewers due to safety concerns of women to accept being interviewed by men, particularly when alone at home. To ensure data quality, field supervisors revisited 10% of interviewees. All surveys were conducted during periods with similar environmental temperatures. In 2002 and 2012, surveys were carried out in the late summer/early autumn and in 2007 surveys were administered in late spring/early summer. Nonresponders were identified and contacted on at least 4 additional occasions. There was no replacement for nonresponse.

Instruments and Variables

To assess physical activity level, the short version of IPAQ was applied through face-to-face interviews, with a recall period of the previous 7 days. The full interview comprised approximately 200 questions. Physical activity questions were placed at the beginning of all questionnaires. Six questions were used to determine the number of days in the previous week and the daily duration of (a) walking, (b) moderate-intensity, and (c) vigorous-intensity physical activity, within 4 domains (household, occupational, transportation, and leisure-time). Only activities practiced for at least 10 consecutive minutes were considered.

A physical activity score was calculated to determine physical activity status, by adding of the numbers of minutes per week walking and moderate-intensity physical activity, and twice the number of minutes per week of vigorous-intensity physical activity.[8–11] Physical inactivity was defined as a score below 150 minutes per week in accordance with the World Health Organization (WHO) physical activity recommendations for adults.[12]

Physical inactivity was assessed according to sex, age (in decades), socioeconomic position based on the Brazilian Market Research Criterion,[13] which divides families into 5 groups from A (richest) to E (poorest), and schooling (number of school years completed). The same variables and categories were collected in the 3 surveys.

Data Analyses

Physical inactivity levels were determined according to subgroups of the covariates for each survey using chi-squared tests for heterogeneity. Poisson regression models were then used to provide estimates for the adjusted prevalence ratios within each subgroup with mutual adjustment for other variables studied.[14] Further analyses on the trends in the prevalence of inactivity were performed; differences were expressed in percentage points. Chi-squared tests were used to compare the proportions over time. All analyses were carried out using Stata and accounted for the clustering of the sample by using the *svy* group of commands. All regression analyses from the 2002 and 2007 surveys were conducted previously and outcomes are included in this paper.[7,8]

Ethical Issues

The Ethics Committee of the Federal University of Pelotas Medical School approved the study protocols, and written informed consent was obtained from each responder before data collection. Confidentiality was ensured.

Results

Characteristics of respondents were similar across all years. In 2012, the majority of respondents were female (58.9%) and the mean age was 45.7 years. The percentage of individuals with no schooling was slightly lower in 2012 (4.2%) than in other years (7.0% in 2002 and 6.4% in 2007). Detailed comparisons of the 2002, 2007, and 2012 study characteristics are presented in Table 1.

The prevalence of physical inactivity in 2002 was 41.1% (95% CI: 37.4–44.9). It increased to 52.0% (95% CI: 49.1–53.8; $P < .001$)

Table 1 Comparison Between the 2002, 2007, and 2012 Surveys on Physical Activity (PA) Among Adults; Pelotas, Brazil

Indicator	2002 survey	2007 survey	2012 survey
Households visited (n)	1530	1460	1555
Eligible subjects (n)	3372	3180	3337
Nonresponse rate (%)	5.6	6.1	13.4
Sample size (n)	3182	2986	2927
Missing PA score (%)	63 (2.0)	17 (0.6)	14 (0.5)
Sample size for PA (n)	3119	2969	2868
Males (%, 95% CI)	43.2 (41.5–44.9)	43.1 (41.3–44.8)	41.1 (39.3–42.9)
Mean age (SD[2])	44.0 (16.3)	44.7 (17.0)	45.7 (16.6)
No schooling (%, 95% CI)	7.0 (6.1–7.9)	6.4 (5.5–7.3)	4.2 (3.3–5.2)
Smokers (%, 95% CI)	27.9 (26.3–29.4)	25.7 (24.2–27.3)	20.7 (18.8–22.7)
Obese (body mass index > 30 kg/m2) (%, 95% CI)	14.3 (13.1–15.6)	16.6 (15.2–18.0)	20.5 (18.9–22.2)
Poor health status (%, 95% CI)	4.0 (3.3–4.6)	5.1 (4.3–5.9)	3.9 (3.1–4.8)

Abbreviations: 95% CI, confidence interval at the 95% level; SD, standard deviation.

in 2007 and slightly increased to 54.4% (95% CI: 51.8–56.9) in 2012, although the latter difference was not statistically significant. Associations between physical activity and sex, age, schooling, and socioeconomic level are presented in Table 2. Similar to 2002 and 2007, the 2012 study found that physical inactivity increases significantly according to age ($P < .001$) with individuals from 20 to 49 being the most active (51%), those aged 50 to 59 years (55%), 60 to 69 years (56%), and 70+ years (73%) being the least active. Schooling was a significant correlate of inactivity in 2002 and 2007 ($P < .001$ in both cases). In 2012, differences were less marked and failed to reach statistical significance. Physical inactivity was significantly associated with socioeconomic position in 2002 ($P = .01$) and 2012 ($P = .04$). In both years, physical inactivity was the highest in the middle- to upper-income group (class B) with 47% inactive in 2002 and 57% in 2012. Women tended to be less active than men in all surveys, but the only significant difference was in 2007 ($P = .02$). We repeated these analyses using Poisson regression to adjust each variable in the table for the others, and results were virtually unchanged.

Over the 10-year time period (Table 3), physical inactivity increased in all population subgroups, with the exception of the highest socioeconomic level (class A) and those aged 70+ years. The largest increases were for females (13.9 percentage point increase), 50 to 59 year olds (15 percentage point increase), those with 5 to 8 years of schooling (18.4 percentage point increase), and for the poorest socioeconomic category (15.4 percentage point increase).

Over the first 5-year time period from 2002–2007, there were substantial increases in inactivity in all subgroups; while during the second 5-year time period from 2007–2012, there were only marked increases for 20- to 29-year-olds (6.4 percentage point increase) and those with 5 to 8 years of schooling (5.5 percentage point increase). In contrast, inactivity did not change significantly from 2007–2012 in the 2 older age groups, in the poorest socioeconomic position groups or among those with no or low schooling. A significant decline was observed in the richest socioeconomic group (5.5 percentage point decline).

Discussion

This study found that over the past decade physical inactivity in a Brazilian city has significantly increased from 41.1% in 2002% to 54.4% in 2012. The increase was observed in most subgroups of the population, defined on the basis of age, sex, schooling, and socioeconomic position. Compared with recent estimates of the

Table 2 Prevalence of Physical Inactivity (PI) by Subgroup of the Population in 2002 (N = 3119), 2007 (N = 2969), and 2012 (N = 2868); Pelotas, Brazil

	2002 Survey		2007 Survey		2012 Survey	
Variable	**% PI (N)**	***P*[a]**	**% PI (N)**	***P*[a]**	**% PI (N)**	***P*[a]**
Overall	41.1 (3119)		52.0 (2969)		54.4 (2868)	
Sex		0.47		0.02		0.07
Males	40.2 (1353)		49.5 (1278)		52.5 (1183)	
Females	41.8 (1766)		54.0 (1691)		55.7 (1685)	
Age (years)		<0.001		<0.001		<0.001
20–29	39.4 (710)		44.8 (714)		51.2 (607)	
30–39	37.0 (671)		47.9 (553)		51.4 (535)	
40–49	37.8 (657)		49.1 (593)		50.7 (584)	
50–59	39.7 (526)		53.3 (514)		54.7 (505)	
60–69	43.8 (297)		57.3 (316)		56.3 (380)	
70+	64.7 (258)		76.3 (279)		72.8 (257)	
Schooling (years)		<0.001		<0.001		0.05
0	56.7 (215)		72.0 (189)		69.1 (110)	
1–4	40.6 (635)		57.0 (509)		53.7 (391)	
5–8	36.6 (1050)		49.5 (937)		55.0 (798)	
9–11	41.6 (771)		48.6 (760)		53.2 (809)	
12+	44.1 (444)		49.6 (573)		53.0 (757)	
Socioeconomic position		0.01		0.90		0.04
A (richest)	46.9 (145)		50.6 (160)		45.1 (175)	
B	47.8 (586)		52.2 (937)		57.0 (1154)	
C	41.0 (1251)		51.5 (1368)		53.5 (1234)	
D + E (poorest)	37.1 (1125)		53.7 (473)		52.5 (284)	

[a] Chi-squared test for differences in proportions.

Table 3 Percentage (pct) Point Differences in the Prevalence of Physical Inactivity by Subgroup of the Population From 2002–2012; Pelotas, Brazil

Variable	5-year (2002–2007) Diff in pct points	5-year (2007–2012) Diff in pct points	10-year (2002–2012) Diff in pct points	*P**
Overall	10.9	2.4	13.3	<0.001
Sex				
Males	9.3	3.0	12.3	<0.001
Females	12.2	1.7	13.9	<0.001
Age (years)				
20–29	5.4	6.4	11.8	<0.001
30–39	10.9	3.5	14.4	<0.001
40–49	11.3	1.6	12.9	0.001
50–59	13.6	1.4	15.0	<0.001
60–69	13.5	–1.0	12.5	0.01
70+	11.6	–3.5	8.1	0.11
Schooling (years)				
0	15.3	–2.9	12.4	0.02
1–4	16.4	–3.3	13.1	<0.001
5–8	12.9	5.5	18.4	<0.001
9–11	7.0	4.6	11.6	0.001
12+	5.5	3.4	8.9	0.04
Socioeconomic position				
A (richest)	3.7	–5.5	–1.8	0.75
B	4.4	4.8	9.2	0.004
C	10.5	2.0	12.5	<0.001
D + E (poorest)	16.6	–1.2	15.4	<0.001

* Chi-squared test.

worldwide physical inactivity rate (31.1%) and the rate in the Americas (43.2%),[1] Brazilians living in the Southern city of Pelotas are considerably less active. The rapid increase in physical inactivity represents a major public health threat. Worldwide megatrends show that as physical inactivity increases the risk of several major noncommunicable diseases (NCDs) including heart disease, cancers, and type 2 diabetes and can substantially decrease life expectancy.[15] Whereas NCD mortality has been falling in Brazil in recent years,[16] the present results suggest that progress may be curtailed unless declining levels of physical activity are effectively addressed.

In Brazil, policies directed toward healthy diets and active lifestyles began in 2001. Initial efforts, however, largely promoted healthy food habits,[17] while the promotion of physical activity remained less visible. By 2007, after almost 3 years after adopting the WHO Global Strategy on Diet, Physical Activity and Health, the Brazilian Ministry of Health implemented the National Policy on Health Promotion. This plan provided financial support for municipalities to implement local projects concerning physical activity, including facilities, rebuilding, training of health workers, and distribution of education material and communication about health.[18,19] In 2011, the Ministry of Health also developed a strategic action plan to tackle NCDs from 2011 to 2022 that incorporates actions to promote physical activity.[19] Recent global recommendations reinforced the continued development of programs and strategies guided by national plans to promote physical activity.[5] Therefore, national efforts to increase physical activity were intensified in the recent past. This may partly explain our findings of a sharp increase in inactivity (10.9 percentage points) between 2002 and 2007, compared with a much smaller increase in the following 5 years (2.4 percentage points from 2007–2012). In spite of the positive finding that physical inactivity in the city appears to be reaching a plateau, it is important to stress that current levels are still unacceptably high, and that efforts must be intensified to reverse the trend observed in the recent past.

In this study, sex, age, socioeconomic position, and schooling were used to stratify trends in physical inactivity over the past decade. The results of this study align with global physical inactivity trends that show a similar decline in physical activity with an increase in age, particularly for those older than 60 years of age.[1] The increase by age and consistent high rates of inactivity over time suggests physiological changes, limitations in access to age-appropriate physical activity, and changes in occupational position may prevent this population from becoming more or less active. Physical inactivity trends among young adults (age 20 to 29) also did not vary significantly from 2002 to 2012. Global data show that this tends to be the most active adult age group[1] and that it predicts future trends in inactivity due to tracking over age, this is reason for concern. In 2011, *Academia da Saude*, a countrywide program to promote physical activity classes in community settings, was launched based on the success of local and state initiatives in the Northeast regions. This program targets all ages,[17] but the development of programs that

target young adults and older populations may positively influence future physical activity trends.

This study also indicates significant shifts in physical inactivity by socioeconomic position. Previously, 2002–2007 trends suggested that the poorest populations were at the highest risk of becoming inactive,[7] but after 2007, inactivity rates among the poor appear to stabilize. There are fewer individuals in the richest subgroup, but it appears that increases in inactivity in 2002–2007 were reversed in 2007–2012 resulting in no significant change over time. There were also significant increases in the prevalence of inactivity in both 5-year periods for the middle- to upper-socioeconomic level (class B). Possible shifts in behavioral patterns may explain these findings. Global trends show that occupational physical activity is declining with higher socioeconomic position, while leisure-time physical activity is increasing with lower socioeconomic position.[1] In Brazil, being in the middle- to upper-socioeconomic level may provide the ideal conditions for reduced occupational physical activity, and minimal, if any, increases in leisure-time physical activity. Current national efforts such as *Academia da Saúde* are preferentially reaching the poorest strata of the population.[20] While these efforts are important, this study suggests that initiatives are also need to improve activity in middle- to upper- income populations.

Conclusions about what domains of physical activity should be targeted, however, are limited in this study because the surveys only provide information on total physical activity. Exploration of socioeconomic differences to identify indicators of physical activity and collecting data on temporal trends within the different domains of physical activity may provide further information on the patterns of inactivity in Brazil. Trends in specific domains may also help design better policies and programs. A limitation of this study was the use of self-report; it is possible that trends in objectively-measured physical activity are different from the ones found in studies using self-report.

Sex and schooling, although significant correlates of inactivity in some years, were not significant factors in 2012. Findings in this study contradict the evidence that males are more active than females, observed in most countries.[1] In 2002 and 2007, lack of any schooling was a significant risk factor for inactivity, but the effected disappeared in 2012. These results reflect the increase in the percentage of Brazilians who attended school over the past decade. In this study, there were a lower percentage of individuals who had no schooling compared with other years; in 2002, 7.0% of the participants had no schooling compared with 6.4% in 2007 and 4.2% in 2012.

In summary, the current study shows significant increases in physical inactivity among the Brazilian adult population. The use of a similar population over a 10-year period increases the confidence in the results of this study. The use of similar methodologies in all surveys results in high comparability of indicators over time. The initiative taken by the Ministry of Health to promote a physical activity as part of the national action plans and the series of initial innovative strategies has created the right social environment and capacity for a dialogue on how to improve the health of Brazilians. Although this study was limited to 1 city in Southern Brazil, which may not accurately represent other areas, efforts to continue surveillance of this population improve the capacity to compile of data from other regions of Brazil and Latin America. Such data are important in assessing national physical activity trends and in providing insight for effective programs and policies in Brazil. Moreover, these trends help to fill the literature gap on trends of physical inactivity in low- and middle- income countries and contribute to the development of evidence-based global recommendations for physical activity programs and policies.

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References

1. Hallal PC, Andersen LB, Bull FC, et al. Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet*. 2012;380:247–57. PubMed doi:10.1016/S0140-6736(12)60646-1
2. Pratt M, Sarmiento OL, Montes F, et al. The implications of megatrends in information and communication technology and transportation for changes in global physical activity. *Lancet*. 2012;380:282–293. PubMed doi:10.1016/S0140-6736(12)60736-3
3. Bauman AE, Reis RS, Sallis JF, et al. Correlates of physical activity: why are some people physically active and others not? *Lancet*. 2012;380:257–271. PubMed doi:10.1016/S0140-6736(12)60735-1
4. Heath GW, Parra DC, Sarmiento OI, Andersen LB, et al. Evidence-based physical activity interventions: lessons from around the world. *Lancet*. 2012;380:272–281. PubMed doi:10.1016/S0140-6736(12)60816-2
5. Kohl HW, III, Craig CL, Lambert EV, et al. The pandemic of physical inactivity: global action for public health. *Lancet*. 2012;380:294–305. PubMed doi:10.1016/S0140-6736(12)60898-8
6. Hallal PC, Knuth AG, Reis RS, et al. Time trends of physical activity in Brazil (2006-2009). *Rev Bras Epidemiol*. 2011;14:53–60. PubMed doi:10.1590/S1415-790X2011000500006
7. Knuth AG, Bacchieri G, Victora CG, Hallal PC. Changes in physical activity among Brazilian adults over a 5-year period. *J Epidemiol Community Health*. 2010;64:591–595. PubMed doi:10.1136/jech.2009.088526
8. Hallal PC, Victoria CG, Wells JCK, Lima RC. Physical inactivity: prevalence and associated variables in Brazilian adults. *Med Sci Sports Exerc*. 2003;35:1894. PubMed doi:10.1249/01.MSS.0000093615.33774.0E
9. Physical Activity Guidelines Advisory Committee. *Physical Activity Guidelines Advisory committee report*. Washington, DC: U.S. Department of Health and Human Services; 2008.
10. Baretta E, Baretta M, Peres KG. Nível de atividade física e fatores associados em adultos no Município de Joaçaba, Santa Catarina, Brasil Physical activity and associated factors among adults in Joaçaba, Santa Catarina, Brazil. *Cad Saude Publica*. 2007;23:1595–1602. PubMed doi:10.1590/S0102-311X2007000700010
11. Hallal PC, Matsudo SM, Matsudo VKR, Araújo TL, Andrade DR, Bertoldi AD. Physical activity in adults from two Brazilian areas: similarities and differences. *Cad Saude Publica*. 2005;21:573–580. PubMed doi:10.1590/S0102-311X2005000200024
12. World Health Organization. *Global recommendations on physical activity for health*. Geneva, Switzerland: World Health Organization; 2010.
13. Associacao de Empresas de Pesquisa. *Adocao do CCEB 2008 Criterio de Classificacao Economica Brasil*. Sao Paulo, Brazil: ABEP; 2008.
14. Barros A, Hirakata V. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. *BMC Med Res Methodol*. 2003;3:21. PubMed doi:10.1186/1471-2288-3-21
15. Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet*. 2012;380:219–2. PubMed doi:10.1016/S0140-6736(12)61031-9

16. Schmidt MI, Duncan BB, Azevedo e Silva G, et al. Chronic non-communicable diseases in Brazil: burden and current challenges. *Lancet*. 2011;377:1949–1961. PubMed doi:10.1016/S0140-6736(11)60135-9
17. Coitinho D, Monteiro CA, Popkin BM. What Brazil is doing to promote healthy diets and active lifestyles. *Public Health Nutr*. 2002;5:263–267. PubMed doi:10.1079/PHN2001302
18. Malta DC, Morais Neto OL, Silva Junior JB. Presentation of the strategic action plan for coping with chronic diseases in Brazil from 2011 to 2022. *Epidemiol Serv Saude*. 2011;20:425–438. doi:10.5123/S1679-49742011000400002
19. Brasil Ministério da Saúde. *Strategic action plan to tackle chronic noncommunicable disease in Brazil 2011-2022*. Brasília, Brazil: Brasília: Ministério da Saúde, 2011 (in Portuguese); 2012.
20. Simões EJ, Hallal PR, Pratt M, et al. Effects of a community-based, professionally supervised intervention on physical activity levels among residents of Recife, Brazil. *Am J Public Health*. 2009;99:68–75. PubMed doi:10.2105/AJPH.2008.141978