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The International Physical Activity Questionnaire-long form overestimates self-reported physical activity of Brazilian adults

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SUMMARY

Objective: To explore issues associated with measuring physical activity using the International Physical Activity Questionnaire (IPAQ)-long form in adults living in a mid-sized Brazilian city.

Methods: A stratified random sampling procedure was used to select a representative sample of adults living in Rio Claro. This yielded 1572 participants who were interviewed using the IPAQ-long form. The data were analysed using standard statistical procedures.

Results: Overall, 83% of men and 89% of women reported at least 150 min of combined moderate and/or vigorous physical activity per week. Reliable values of leisure and transportation-related physical activity were observed for both males and females. With regard to the household and work-related physical activity domains, both males and females reported unusually high levels of participation.

Conclusion: The IPAQ-long form appears to overestimate levels of physical activity for both males and females, suggesting that the instrument has problems in measuring levels of physical activity in Brazilian adults. Accordingly, caution is warranted before using IPAQ data to support public policy decisions related to physical activity.

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Introduction

Physical inactivity is a global health problem that causes more than two million deaths each year, making it one of the top 10 leading causes of death and disability.¹ There is strong evidence that regular physical activity is associated with

significant health benefits and improved quality of life for individuals of all ages.² In the recently published Physical Activity Guidelines for Americans, an impressive array of evidence strongly suggests that regular physical activity reduces the risk of developing numerous chronic diseases and conditions,³ and increases life expectancy by reducing

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both deaths from cardiovascular disease and all-cause mortality.^{4,5}

Despite the recognized benefits of regular physical activity, a growing consensus suggests that physical inactivity is an ongoing public health problem for many countries.^{6–8} In Brazil, estimates of physical inactivity levels in the population range from 40% to 88%.^{6,9–12} One of the reasons behind the lack of precision in population estimates of physical activity is the wide variation in methodologies used to estimate levels of participation. Adequate measurement of physical activity is important for determining trends in physical activity levels over time, evaluating the effect of physical activity interventions, and determining the health benefits of physical activity. Poor measurement of physical activity may hinder detection of important associations or effects. Challenges associated with physical activity assessment present significant problems for the establishment of public health policy guidelines. Therefore, valid and reliable measures of physical activity at the population level are needed to enhance the development and implementation of public health strategies, interventions and policies.

Although there are many different approaches to the quantification of physical activity, the most common, simple and cheap approach, especially in surveillance studies, employs self-reported physical activity questionnaires.^{13,14} Unfortunately, due to the large array of populations and settings to be studied, there is no consensus regarding a single instrument/questionnaire that best measures self-reported physical activity.^{13,14}

Although some questionnaires have been translated into several languages, an ongoing challenge in the physical activity assessment literature has been the identification of an accurate and low-cost physical activity assessment tool that can be used in different cultures and ethnic groups around the world.¹⁵ In 1997, a working group of public health and physical activity experts developed a cross-cultural physical activity assessment instrument known as the International Physical Activity Questionnaire (IPAQ).¹⁶ Available in two formats (short and long forms), the IPAQ was developed as a relatively simple self-report instrument that would be available in many languages, and which would enable researchers to estimate levels of physical activity in different countries and compare these data. Several studies have been conducted to test validity and reliability.¹⁶ In 2003, a large international survey was conducted to analyse the validity and reliability of the IPAQ in several countries, including Brazil.¹⁶ However, a recent literature review highlighted methodological problems with these validation studies.¹⁴ A key feature of the IPAQ is its ability to provide, in detail, participation estimates for multiple domains of physical activity, including leisure-time physical activity, physical activity for transportation, physical activity in the home and physical activity at work.¹⁶ An important difference between the long and short forms of the IPAQ, and a possible advantage of the long form, is that in the long form, the IPAQ provides information about time spent in physical activity for each domain, whereas in the short form, the outcome is only a total score for physical activity.

Although the IPAQ has been used across the world,^{6,16,17} there are some concerns about whether the questions are interpreted similarly by individuals from different countries

and cultures,^{18,19} thereby introducing unintended variance into physical activity estimates across different population groups. One of the challenges associated with the IPAQ is its attempt to assess both 'vigorous' and 'moderate' physical activity behaviour that extends for a minimum of 10 min per bout. There is evidence to suggest that some individuals have difficulty differentiating between 'vigorous' and 'moderate' physical activity.²⁰ Furthermore, others also have difficulty identifying the actual time spent in these activities, especially when durations are relatively short, close to the 10-min IPAQ cut-off. The IPAQ instructs respondents to disregard physical activity conducted in epochs of less than 10-min duration. Many individuals have difficulty interpreting such instructions.²⁰ All of these issues may have contributed to a tendency for studies using the IPAQ to generate unusually high estimates of levels of participation in physical activity.²¹

This study sought to investigate physical activity estimates and explore issues associated with measuring physical activity data using the IPAQ-long form in adults living in a mid-sized Brazilian city. Like most emerging economies, Brazil is undergoing an epidemiological transition from a medical system focused primarily on infectious disease control to a system increasingly focused on the prevention and treatment of chronic disease and conditions.²² Brazilians today are thought to be increasingly less active and more overweight than ever before¹²; however, there is a paucity of large-scale population data regarding the actual levels of activity of Brazilians.

Methods

A cross-sectional, population-based study was conducted in Rio Claro, São Paulo, a mid-sized city (190,000 inhabitants) located in south-eastern Brazil, during 2007 and 2008. Physical activity was assessed using the IPAQ-long form in a sample of community-dwelling adults over 20 years of age. The UNESP – São Paulo State University Ethical Committee approved the research protocol, and informed consent was obtained from each subject before data collection.

Sample

A stratified random sampling procedure was used to select a representative sample of adults living in Rio Claro. From the total number of census tracts ($n = 200$), 100 were selected at random for inclusion in the study, and eight households within each tract were selected at random for interview. This yielded a total of 800 households selected for interview. All residents in each household over 20 years of age who were able to walk independently were eligible for inclusion in the study. This procedure resulted in a final sample of 1572 individuals interviewed for the study.

Measures

Physical activity was assessed in four domains using the eighth version of the IPAQ-long form (work, transportation, housework and leisure-time). A domain-specific activity score was calculated separately for each domain of physical activity

(at work, transportation, housework and leisure). In addition, a total physical activity score was calculated as the sum of the number of minutes of total moderate activity for each sub-domain (including walking), plus two times the number of minutes of vigorous activity for each subdomain, according to the procedure of Hallal et al.¹⁰ It is important to clarify that the domain-specific activity scores were calculated similarly to the total physical activity score. The IPAQ defines moderate activity as activities performed for at least 10 min that produce an increase in respiration and heart rate, and cause sweating. Vigorous activities are defined as those activities that produce greater increases in respiration, heart rate and sweating. For the purpose of this study, insufficient physical activity was defined in accordance with the guidelines of the US Department of Health and Human Services (DHHS).³ Individuals who reported <150 min of combined moderate and vigorous physical activity per week were considered to be insufficiently active. Similarly, people who reported ≥150 min of combined moderate and vigorous physical activity per week were considered to be active.

In addition to the IPAQ-long form, the following demographic variables were collected: gender, age, education, body mass index (BMI, calculated using weight and self-reported height) and socio-economic status (SES). SES was defined according to the procedure of the Brazilian Economic Criteria Classification,²³ which classifies participants into high, medium and low SES groups.

Data collection

The questionnaire was administered face-to-face by trained interviewers who had at least a secondary school education. The interviewers received 40 h of training for administering and coding the questionnaire, and were not aware of the study objectives. The training, under supervision, consisted of interview techniques including interview dramatizations and the application of the questionnaire using a manual developed specifically for this purpose. The interviewers were also instructed on the interpretation of terms such as moderate and vigorous physical activity, and some common examples of activities in the four physical activity domains. Following the training procedures, 17 interviewers were selected to collect data. When there was more than one person eligible for the study at home at the time of data collection, the interviewers were instructed to conduct interviews with one individual at a time and in an isolated place to prevent any bias in responses. Data were collected during spring and summer. Interviews were conducted at lunch time (11:30 am) and after 5:30 pm (after work) on weekdays and at any time at weekends.

Fieldwork supervisors were responsible for checking the questionnaires completed by the interviewers. In total, 40% of the questionnaires initially completed by each interviewer were checked by fieldwork supervisors to ensure reliability and validity of the data. The interviewers' questionnaires were checked by the supervisors within 1 week of the initial interview (30% were checked by telephone and 10% were checked by a supervisor returning to the participant's house). The supervisors checked the questionnaires using a mini-questionnaire developed for the purpose, with key questions

identified which were compared with the originals. The mini-questionnaire was created extracting some questions of the original IPAQ. In the event of inconsistencies between the original interview and the validation check, the interview was repeated by a different interviewer. This process identified inconsistencies in about 3% of interviews, which were repeated.

Statistical analysis

Data were analysed using Statistical Package for the Social Sciences Version 17.0 (IBM Corporation, New York, USA). Descriptive statistics including means, standard deviations and percentages were calculated. For categorical variables, differences between groups were determined using Chi-squared test, adopting a significance level of 0.05%.

Results

The final sample consisted of 1572 individuals. Demographic data are presented in Table 1. The mean age was similar for men (44.8 years) and women (46.7 years). On average, both men and women were overweight, with BMIs of 25.8 kg/m² and 25.9 kg/m², respectively. Slightly fewer than 50% of both men and women were classified as medium SES. Almost 50% of the men had completed high school, and 41% of the women had less than 8 years of schooling.

With regard to physical activity, Table 2 shows total physical activity scores as well as activity scores for each of the physical activity domains. In the table, the sample is divided into three different categories: physical activity for ≥150 min/week, physical activity for 1–149 min/week and no self-reported physical activity. Table 2 shows that the sample reported very high levels of total physical activity, with 83% of men and 89% of women reporting at least 150 min of combined moderate and/or vigorous physical activity per week. Only 7% of men and 4% of women reported no physical activity at all. Examination of the IPAQ data also reveals relatively high levels of participation within each of the individual physical activity domains. More than 40% of men and almost 25% of women reported ≥150 min of physical activity

Table 1 – Demographic data.

	Men (n = 657)	Women (n = 915)
Age, years, mean (SD)	44.8 (17)	46.7 (17)
Body mass index, kg/m ² , mean (SD)	25.9 (4.5)	25.8 (5.1)
Socio-economic status, n (%) ^a		
A/B (high)	244 (37)	304 (33)
C (medium)	313 (48)	431 (47)
D/E (low)	96 (15)	175 (19)
Years of education, n (%) ^a		
≥11	338 (51)	358 (39)
8–11	113 (17)	179 (20)
<8	206 (31)	376 (41)

SD, standard deviation.
a Percentage within sex.

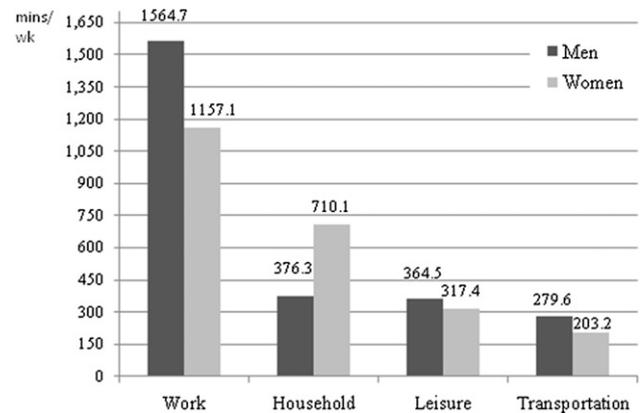
Table 2 – Self-reported physical activity using the International Physical Activity Questionnaire.

	Men (n = 657)	Women (n = 915)
PA total, n (%) ^a		
≥150 min/week	548 (83.4)	815 (89.1)
1–149 min/week	64 (9.7)	65 (7.1)
None	45 (6.8)	35 (3.8)
PA work, n (%) ^a		
≥150 min/week	273 (41.6)	232 (25.4)
1–149 min/week	50 (7.6)	49 (5.4)
None	334 (50.8)	634 (69.3)
PA household, n (%) ^a		
≥150 min/week	220 (33.5)	678 (74.1)
1–149 min/week	160 (24.4)	118 (12.9)
None	277 (42.2)	119 (13.0)
PA leisure-time, n (%) ^a		
≥150 min/week	192 (29.2)	211 (23.1)
1–149 min/week	97 (14.8)	90 (9.8)
None	368 (56.0)	614 (67.1)
PA transportation, n (%) ^a		
≥150 min/week	246 (37.4)	320 (35.0)
1–149 min/week	198 (30.1)	344 (37.6)
None	213 (32.4)	251 (27.4)

PA, physical activity.
a Percentage within sex.

at work per week. The self-reported physical activity levels were even more unusual for household physical activity, with more than 70% of women reporting that they exceeded the 150 min/week recommendation from physical activity performed doing housework. Predictably, a smaller percentage of men (34%) reported ≥150 min/week of physical activity doing housework. IPAQ physical activity estimates for leisure-time physical activity were more modest, with 29% of men and 23% of women reporting 150 min of physical activity in traditional leisure settings per week. Finally, with respect to physical activity for transportation, approximately 35% of both men and women reported at least 150 min of physical activity due to transportation per week.

Table 2 suggests that the sample may have been over-estimating their levels of physical activity. Accordingly, a series of additional analyses were performed to examine the potential causes of these very high reported levels of physical activity. First, the authors examined how many individuals in the sample reported unusually high levels of physical activity. Four hundred and sixty-three individuals reported accumulating in excess of 1500 min of combined moderate and vigorous physical activity per week, representing 29.45% of the overall sample. This means that almost 30% of the sample reported being 10 times more active than the current USA physical activity recommendations. An additional 506 individuals reported accumulating between 500 and 1500 min of combined moderate and vigorous physical activity per week. In total, 61.45% of the sample reported participating in at least 500 min of moderate or vigorous physical activity per week, which is more than three times the physical activity recommendations. Fig. 1 shows the combined data from all participants who reported at least 1 min of physical activity per week. The mean reported level of physical activity at work was unrealistically high for both men (1565 min/week) and

**Fig. 1 – Self-reported physical activity on the International Physical Activity Questionnaire by domain.**

women (1157 min/week). Similarly, the mean reported level of household physical activity was also unrealistically high for women (710 min/week). Mean data for the other domains of physical activity were also high, but not as extreme as the data for work and household activity.

As the data suggest that a significant number of participants appeared to be systematically over-reporting their levels of physical activity, the authors decided to conduct a series of analyses on two subgroups of individuals: (1) physically active individuals reporting reasonable levels of physical activity (150–300 min/week), and (2) physically active individuals reporting very high and probably unreasonable levels of physical activity (>1500 min/week). Fig. 2 shows that men who over-reported their level of physical activity (>1500 min/week) tended to over-report their level of activity at work, whereas women who over-reported physical activity tended to report unrealistically high levels of both household and work-related physical activity. In contrast, active men reporting more modest levels of physical activity (150–300 min/week) reported a relatively evenly balanced contribution of the four domains of activity to their overall levels of activity. However, for women who reported 150–300 min of physical activity per week, household physical activities continued to dominate as the primary mode of self-reported activity. The data suggest that both men and women may be having significant difficulties understanding how to estimate work and household activities, and that these difficulties result in unusually high estimates of physical activity levels in Brazilian adults when using the IPAQ-long form.

In summary, the data suggest that the eighth version of the IPAQ-long form appears to have significant problems assessing physical activity in the Brazilian adult population. The main problem appears to be related to the estimation of physical activity at work and in the household, where both men and women report unusually high values for time spent in physical activity.

Discussion

Examination of the self-reported physical activity data from this investigation revealed that Brazilian adults, living in Rio

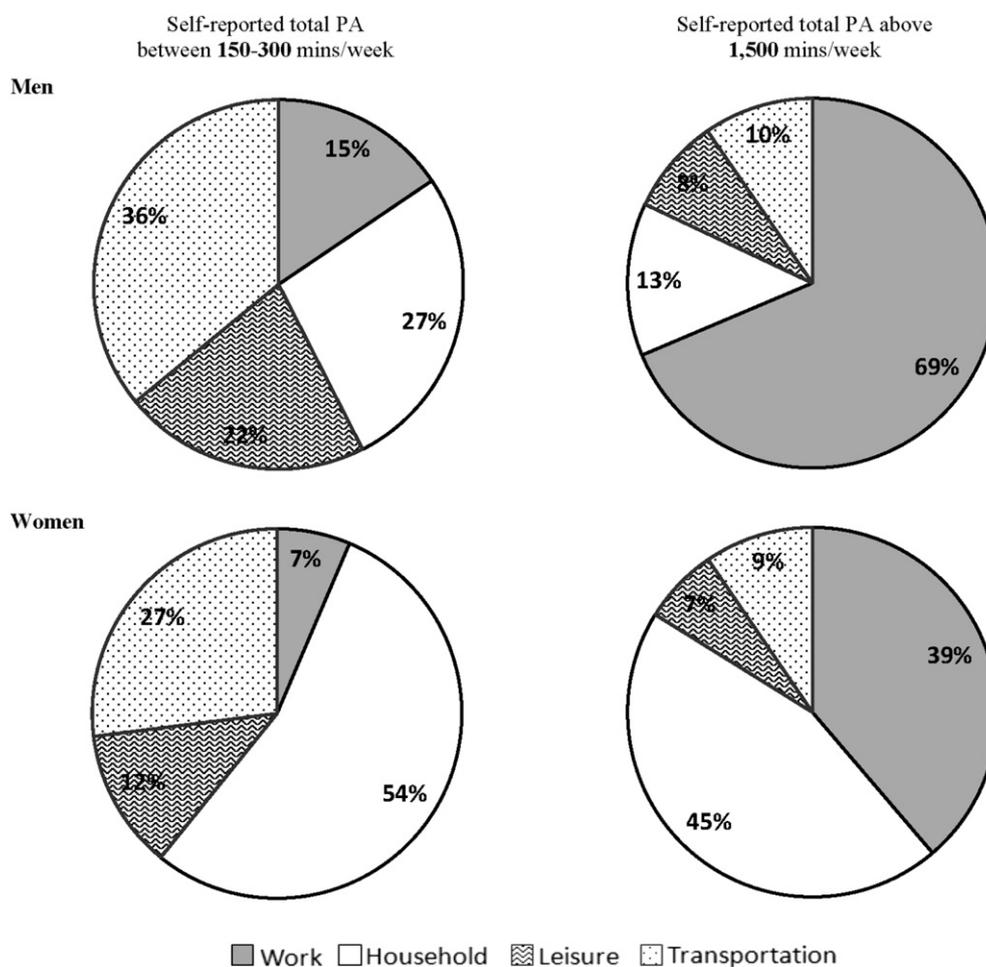


Fig. 2 – Self-reported physical activity levels on the International Physical Activity Questionnaire by domain. Comparison of individuals who reported very high levels of physical activity (<1500 min/week) with those reporting activity at or slightly above recommended levels (150–300 min/week).

Claro, São Paulo, reported very high levels of moderate and vigorous physical activity, with the highest levels reported in the physical activity at work and household domains. One interpretation of these findings is that the sample of Brazilian adults studied was much more active than has been reported previously in the literature. Another international study conducted in many different countries including Brazil reported that approximately 89% of Brazilians achieve the recommended level of physical activity,¹⁶ but this study selected a non-representative sample and also used the IPAQ. These values are similar to those presented in the present study. However, the present authors believe that a more logical and coherent explanation for the data is that the individuals in this study had difficulty with estimating their levels of physical activity accurately, particularly with respect to work-related and household physical activity (Figs. 1 and 2).

With respect to resolution of the competing explanations for the data, there is little evidence to support the hypothesis that Brazilian adults are substantially more active than individuals living in most developed and developing countries. There are several lines of evidence to suggest that the high levels of physical activity reported by participants in this

study are unlikely to be accurate reports of their true levels of physical activity.^{12,24,25} In Brazil, physical inactivity is widely considered to be a significant public health problem.¹¹ The present finding that more than 80% of both men and women self-report at least 150 min of moderate to vigorous physical activity per week (Table 2) is not consistent with prior research findings in south-east and south Brazilian areas.^{9,26,27} Existing physical activity participation data from Brazil suggest low levels of participation in physical activity. For example, a national survey of representative households²⁴ conducted by the Brazilian Institute of Geography and Statistics found that only 31% of Brazilians reported participation in any physical activity, and only about 10% of this group met the 150 min/week guidelines recommended by the DHHS³ and American College of Sports Medicine/American Heart Association.²⁸ Accordingly, based on previously mentioned published national physical activity data from Brazil, there is little evidence to support the hypothesis that Brazilians are extremely active.

Recent surveys conducted in different Latin American countries found that chronic diseases and conditions associated with physical inactivity are a substantial and growing

problem. Inactivity has been shown to be a public health concern in south-eastern Brazil,²⁴ Mexico²⁹ and Chile.³⁰ The increasing prevalence of overweight and obesity is also becoming a significant health concern throughout the region. The prevalence of overweight (BMI > 25 kg/m²), for example, ranges from 38.7% to 56.3% in men and from 30% to 44.8% in women.¹² Based on the chronic disease prevalence data from previously published national surveys, it is difficult to explain why a randomly selected representative sample of Rio Claro residents should be so much more active than other Brazilians.

Despite the high levels of self-reported physical activity, there is little evidence to suggest that Rio Claro is very different from other typical mid-sized Brazilian cities. While Rio Claro has a number of environmental attributes that might support participation in physical activity, such as good weather, flat streets and numerous venues for physical activity, the same is true for many Brazilian cities and there do not appear to be any unique characteristics that differentiate Rio Claro from other cities in São Paulo State and other south-eastern Brazilian cities. Moreover, demographic and public health data for Rio Claro suggest that the levels of overweight are similar to those of other Brazilian cities, and that the socio-economic and educational profile of the city is similar to that of other cities in Brazil.³¹ A more compelling explanation for the study data is that the sample systematically over-reported their levels of moderate and vigorous physical activity due to problems associated with interpretation of the IPAQ.³²

Barnett *et al.* reported that the item order of the IPAQ-short form affects the levels and duration of reported physical activity.³³ Previously published research has criticized this instrument for poorly defined questions and instructions which are not well understood by individuals completing the questionnaire.³⁴ In particular, participants appear to have trouble conceptualizing and differentiating between terms, such as moderate physical activity and vigorous physical activity, as well as difficulty in conceptualizing what a 10-min bout of physical activity actually means.²⁰ In the present study, participants had the most difficulty estimating physical activity at work and in the home. Many participants were prone to reporting a very large amount of physical activity. This is a concern because understanding of participation levels in physical activity at work and in the home is not well established, and there is a need for reliable data about how much physical activity is actually performed in these venues.

A number of recent research reports have suggested that the IPAQ may be associated with substantial overestimation of levels of physical activity in several different populations.^{21,34–38} When IPAQ data are compared with accelerometer-based estimates of participation in physical activity, studies have shown that IPAQ estimates are often substantially inflated relative to the accelerometer activity counts. Johnson-Kozlow *et al.*,²¹ for example, observed that the IPAQ overestimated total physical activity by 247% compared with the accelerometer data.

In the present study, the most problematic areas appear to be estimations of participation in moderate and vigorous physical activity at work and at home (Fig. 1 and Table 2). Others have also found problems with self-reports of physical activity in these venues. Ford *et al.*,³⁹ for example, studied

physical activity behaviour of people with high and low incomes, and observed unusual values of total physical activity.³⁹ Many participants in the present study appear to have based their answers on the total number of minutes spent at work or at home, rather than actual minutes spent in moderate and vigorous physical activity lasting more than 10 min. Problems with over-reporting and difficulty measuring levels of physical activity using the IPAQ-long form were reported by Hallal *et al.*³² Both males and females were much more likely to report unusually high levels of physical activity at work (men = 1564 min/week; women = 1157 min/week), and females were more likely to report unusually high levels of physical activity in household activities (average = 710 min/week). In almost all domains, the values reported for both men and women sharply exceeded the recommended level of physical activity (150 min/week). In a recent review study, Hallal *et al.*³² reported several problems with the IPAQ-long form, including critical problems with the measurement of levels of physical activity in both household and work domains.

One of the most valuable characteristics of the IPAQ is its attempt to quantify participation in physical activity in multiple domains. However, in its present form, the IPAQ has difficulty gauging the duration and intensity of these activities accurately. Future research should consider validating pencil and paper approaches against objectively measured activity counts using accelerometers, motion detectors or global positioning device systems.

In order to assess the relative contribution of the four domains of physical activity to the total amount of reported physical activity, the authors analysed physical activity data for a subset of individuals who appeared to be reporting reasonable data. Male individuals who are active at or slightly above recommended levels of physical activity (150–300 min/week) reported a relatively even distribution of physical activity across all four domains. However, women with the same level of total physical activity (150–300 min/week) reported much higher levels of household physical activity than any other form of physical activity. The women evaluated in this study reported relatively little time spent in leisure-time and transportation physical activity. Instead, women tended to report higher levels of physical activity at home and at work. These findings are similar to those reported in a study in the Baltic countries,⁴⁰ where the women reported more physical activity at work and relatively little leisure-time physical activity. Unfortunately, understanding of the health benefits of physical activity in the household and at work is less well established, possibly due to difficulty in defining these two constructs properly, and assessing their intensity and duration using self-report questionnaires.

The data suggest that Brazilians living in Rio Claro, Sao Paulo, appear to estimate their levels of physical activity during leisure-time and transportation activities somewhat more accurately. It is possible that physical activity during leisure time and transportation are better understood by the population (Fig. 1). For leisure-time physical activity, the study showed that 29% of men and 23% of women achieve the recommended level of ≥ 150 min/week, and these values are similar to those reported in other studies.^{9,41,42} With regard to physical activity for transportation, the present data differ

from some studies which have shown lower levels of physical activity for transportation.^{9,43} Most of the difference between the present findings and these studies is related to methodology and the sample selected. Florindo *et al.*,⁹ for example, collected data in a metropolis, Sao Paulo capital, where public transportation is widely used instead of walking and bicycling. Similarly, Kruger *et al.*⁴³ only assessed walking as physical activity for transportation, whereas the present study considered both walking and cycling.

The IPAQ is by far the most commonly used physical activity questionnaire internationally, and it is widely regarded as suitable for large epidemiological and community health studies. In an important study that examined the validity and reliability of the IPAQ, the researchers found huge differences in physical activity between countries. According to van Poppel *et al.*,¹⁴ the reliability of the IPAQ was poor both within and between studies, although the IPAQ-long form seemed to perform somewhat better than the IPAQ-short form for a usual week. Furthermore, the validity of the IPAQ has also been questioned. First, content validity of the IPAQ-short form seems limited because it does not discriminate between different domains of physical activity. The IPAQ-long form, which does discriminate between four domains, has better content validity but was reported to be ‘too boring and repetitive’ and too long for routine surveillance.^{14,16} Of the self-administered IPAQ forms, only for the long form was found to be significantly correlated with accelerometer data, with correlations of 0.52 reported in Finland¹⁶ and 0.55 in Sweden.⁴⁴

Although there are concerns about all methods for measuring physical activity, questionnaires appear to present the most profound challenges and the IPAQ-long form is no exception. Despite well-trained interviewers, the participants in the present study appeared to be unable to estimate physical activity accurately, especially at work and for household activities. The data suggest that, in its present format, the eighth version of the IPAQ-long form has limited value for providing accurate estimates of physical activity when used with Brazilian adults.³² There is some evidence to suggest that these problems are not unique to the Portuguese version of the IPAQ; Spanish and Swedish versions have also reported problems.^{45,46} These studies, in conjunction with the present findings, suggest that there is a need to re-evaluate the psychometric qualities of the IPAQ. Although the IPAQ has acceptable validity and test–retest reliability,¹⁶ the high levels of overestimation of self-reported daily activity greatly reduce the utility of the instrument. Therefore, additional studies to test validity and reliability, especially cultural validity, of the IPAQ are needed. In addition, there is a need for better understanding about how the construct of ‘physical activity’ and its various subdomains are interpreted in different nations and cultural groups.

This study has several strengths and limitations. Among the strengths are the large and representative sample of households selected, and the highly trained interviewers who collected the data. Additionally, a quality control procedure was implemented, where investigators conducted random validity checks to assess the accuracy of individual interviews. With regard to limitations, the present study did not include a direct measure of physical activity, such as accelerometers, which would have assisted with interpretation of the findings.

Conclusion

The Brazilian adults in this study self-reported unrealistically high levels of physical activity. This study suggests that caution is warranted before using IPAQ-long form data to support the development of community health strategies and programming. Furthermore, public health policy recommendations related to physical activity should not be based exclusively on self-reported data using the IPAQ. In order to optimize public health interventions, programmes and campaigns, additional work is needed to develop valid and reliable self-report instruments that provide realistic and affordable estimates of physical activity in the four physical activity domains (work, transportation, leisure-time and household). Despite its widespread use to assess levels of physical activity and compare data between nations, the IPAQ-long form appears to have problems measuring the levels of physical activity in Brazilian adults. Although more expensive and time consuming, the use of accelerometers accompanied by diaries or log books should be considered, whenever possible, in order to collect direct measurements of the level of physical activity in individuals.

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Ethical approval

The research protocol (Process No.: 3151; 21 August 2007) was approved by the Sao Paulo State University Ethics Committee – Institute of Bioscience. Rio Claro, Sao Paulo State, Brazil.

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Competing interests

None declared.

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