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Worldwide prevalence of physical inactivity and its association with human development index in 76 countries

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ABSTRACT

Objective. To describe the worldwide prevalence of physical inactivity and to analyze its association with development level of each country.

Methods. Pooled analysis of three multicenter studies, conducted between 2002 and 2004, which investigated the prevalence of physical inactivity in 76 countries, and comprised almost 300,000 individuals aged 15 years or older. Each study used the International Physical Activity Questionnaire to assess physical inactivity. The level of development of each country was analyzed by the Human Development Index (HDI).

Results. The crude worldwide prevalence of physical inactivity was 21.4% (95%CI 18.4–24.3), being higher among women (mean = 23.7%, 95%CI 20.4–27.1) than men (mean = 18.9%, 95%CI 16.2–21.7). It ranged from 2.6% (in Comoros) to 62.3% (in Mauritania), with a median equal to 18%. After weighting for the total population of each country, the worldwide prevalence of physical inactivity was 17.4% (95%CI 15.1–19.7). There was a positive association between HDI and prevalence of physical inactivity (rho = 0.27). Less developed countries showed the lowest prevalence of physical inactivity (18.7%), while physical inactivity was more prevalent among the most developed countries (27.8%).

Conclusions. One out of five adults around the world is physically inactive. Physical inactivity was more prevalent among wealthier and urban countries, and among women and elderly individuals.

Introduction

Physical inactivity is now identified as the fourth leading risk factor for global mortality (WHO, 2010). Physical inactivity levels are rising in many countries with major implications for increases in the prevalence of noncommunicable diseases and the general health of the population worldwide (WHO, 2010). The 2002 World Health Report suggested that around 3% of the global burden of disease in developed countries and more than 20% of cardiovascular diseases and 10% of strokes were caused by physical inactivity (WHO, 2002), placing physical inactivity among the 10 leading causes of death and disabilities in the developed world (WHO, 2002). The World Health Organization estimates that nearly 2 million deaths per year are caused by physical inactivity (World Health Assembly 57.17, 2004). Based on these findings, physical inactivity has been identified as one of the biggest public health problems of the 21st century (Blair, 2009).

Despite the well known benefits of regular physical activity, a global report from 2000, comprising 14 sub-regions (WHO, 2002), indicated that 17.7% of the global population (aged 15 years and over) were not engaged in any kind of physical activity, and that nearly 58% was not achieving the recommended amount of moderate-intensity activity to be considered physically active (2.5 h/week) (USDHHS, 2008). However, a number of direct and indirect data sources and a range of survey instruments and methodologies were used to estimate activity levels. Most data were available for leisure–time activity only, with fewer direct data available on occupational activity and even less direct data available for activities related to transport and household tasks.

There have been three multicenter studies that investigated the prevalence of physical inactivity using the same instrument and definition (Bauman et al., 2009a,b; Guthold et al., 2008; Sjöström et al., 2006). Although these studies do not include all world countries, they encompass low, middle and high-income nations. By combining the data from these studies it is possible to generate an international estimate of physical inactivity that covers a variety of countries and regions in the world. The aim of this study was to estimate and describe the worldwide prevalence of physical inactivity and to

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analyze this information according to the development level of each country.

Methods

This study consists of a pooled analysis of three multicenter studies, which investigated the prevalence of physical inactivity in several countries using a standardized instrument. Study number 1 was published by Guthold et al. (2008), using data from the "World Health Survey". It was conducted in 2002–2003 with 51 countries, most of which were low and middle income, and included data from 212,021 adults (18–69 years old). Study number 2 was published by Bauman et al. (2009a,b), named "International Prevalence Study" of physical activity. It comprised 52,746 individuals (18–65 years old) from 20 countries, who were interviewed between 2002 and 2004. Study number three, named "Eurobarometer Wave 58.2," was published by Sjöström et al. (2006). It was conducted in 2002 among 15 countries from the European Union, with sample sizes of around 1000 individuals per country, and included people aged 15 years or over.

These three independent studies were carried out in different countries and regions, in the same period (2002–2004). The samples were randomly selected in all countries, except China, Comoros, Republic of the Congo, Côte d'Ivoire, India, and Russian Federation (study 1), and India and Japan (study 2). The instrument to collect data about physical activity was the International Physical Activity Questionnaire (IPAQ) – short form, which had its reliability and validity investigated in 12 countries and six continents (Craig et al., 2003). This instrument comprises activities with moderate-to-vigorous intensity, lasting at least 10 min, in four contexts or domains: at work, transportation, home and leisure time. In studies number 1 and number 3, physical activity was collected by means of face-to-face interviews, and in study number 2, it was collected by self-administration, face-to-face interviews or by telephone, depending on the country (Bauman et al., 2009a,b; Guthold et al., 2008; Sjöström et al., 2006). The recall period of these three studies consisted of the last week, and physical inactivity was defined as reporting to be engaged in less than 20 min/day of vigorous-intensity physical activity on at least 3 days/week, or less than 30 min/day of moderate-intensity physical activity on at least 5 days/week, or less than 600 MET-min/week combining both criteria.

The level of development of each country was analyzed using the Human Development Index (HDI). The HDI is a composite index that measures the average achievements in a country in three basic dimensions of human development: a long and healthy life, as measured by life expectancy at birth; knowledge, as measured by the adult literacy rate and the combined gross enrolment ratio for primary, secondary and tertiary schools; and a decent standard of living, as measured by gross domestic product (GDP) per capita in purchasing power parity US dollars (UNDP, 2005). According to this index (ranging from 0 to 1), the countries are classified as low human development (HDI<0.500), middle (HDI between 0.500 and 0.799) and high human development (HDI≥0.800). The HDI used for this study refers to the calendar year 2003, a midpoint in the surveys included in this analysis. Because Taiwan HDI was not evaluated, we excluded this country from analyses.

For the data analysis, we prepared a data sheet in Stata, version 10 (StatCorp, College Station, TX, USA), extracting the prevalence of physical inactivity of each country and its respective HDI. The overall prevalence of physical inactivity in each country was calculated by the average prevalence of each gender. When the same country took part in more than one study, we calculated the average prevalence of physical inactivity across studies. For pooled analyses including all countries, we conducted crude and weighted analyses, in which we considered the total population of each country in the midpoint of the year 2003. The correlation between physical inactivity and HDI was obtained by the Spearman coefficient (rho). HDI was further divided into quartiles (from the lowest to the highest value) to determine the degree of a linear association between physical inactivity prevalence and HDI; Kruskal–Wallis test was used to test statistical significance. The significance level was 5% for two-sided tests. To construct a world map with the prevalence of physical inactivity, we used the program Quantum Geographic Information System (QGIS), version 1.5.0.

Results

Overall, physical activity data were available for 76 countries, comprising about 80% of the world estimated population for the year 2003. Seven countries (Belgium, Brazil, China, Czech Republic, India, Portugal and Sweden) were included in two studies and one country (Spain) entered in the three studies. The prevalence of physical inactivity within each of these countries was very similar, except for India, where the prevalence found by one study (Bauman et al., 2009a, b) was almost twice as high as the one found by the other (Guthold et al., 2008). Mean HDI across all countries considered in our study was 0.740, whereas this average for the world in the year 2003 was 0.741 (UNDP, 2005). In our study there was an overrepresentation of high human development countries (43% versus 32% in the world), although the percentage of countries classified as low human development was very similar (16% versus 18% in the world) (UNDP, 2005).

The overall prevalence of physical inactivity was 21.4% (95%CI 18.4–24.3), being higher among women (mean = 23.7%, 95%CI 20.4–27.1) than men (mean = 18.9%, 95%CI 16.2–21.7). After weighting for the total population of each country, the worldwide prevalence of physical inactivity was 17.4% (95%CI 15.1–19.7). It ranged from 2.6% (in Comoros) to 62.3% (in Mauritania), with a median equal to 18%. The prevalence of physical inactivity in each country, stratified by gender, is shown in Fig. 1. The world map containing the gender average prevalence of physical inactivity can be seen in Fig. 2. In most countries (80%), the prevalence of physical inactivity was higher among women, with a mean difference equal to 4.7 percentage points (95%CI 3.4–6.0). When analyzed by HDI, we observed that the difference of physical inactivity between genders was more evident among low human development countries. In these countries, all studies found that women were more inactive than men, while in the high human development countries, in 30% the prevalence of physical inactivity was greater among men.

Fig. 3 shows the worldwide prevalence of physical inactivity according to the HDI. The variability of physical inactivity prevalence seems to be greater among low HDI countries, although the density of countries with a higher prevalence of physical inactivity increased as a function of HDI. Looking at Fig. 4, it is possible to verify that there was a positive relationship, although not linear, between HDI and prevalence of physical inactivity (rho = 0.27). This association was more evident among men (rho = 0.35) than women (rho = 0.20). Dividing the HDI into quartiles (Fig. 5), less developed countries showed the lowest prevalence of physical inactivity (18.7%), while physical inactivity was more prevalent among the most developed countries (27.8%) with a significant difference (p = 0.03). When we analyzed each one of the three indexes that compose the HDI, the association with physical inactivity was greater to the GDP index (rho = 0.38), intermediate to the life expectancy index (rho = 0.28) and lower to the education index (rho = 0.17).

Discussion

This study provided estimates of a worldwide prevalence of physical inactivity. We compiled data from three multicenter studies, with similar protocols, carried out during the same time period. Data from 76 countries were represented in these three studies (Bauman et al., 2009a, b; Guthold et al., 2008; Sjöström et al., 2006), and the pooled results yielded the largest international estimate of physical inactivity so far. This approach also allowed exploring whether physical inactivity is more or less prevalent according to the development level of each country.

Roughly one fifth of the world population was inactive. This prevalence was generally higher among women and increased with age. Urban and wealthier countries presented a higher prevalence of physical inactivity. We reinforce that the term 'physical inactivity' encompasses those who are also insufficiently active, because its definition corresponds to those who do not meet the recommendation to be considered as physically active.

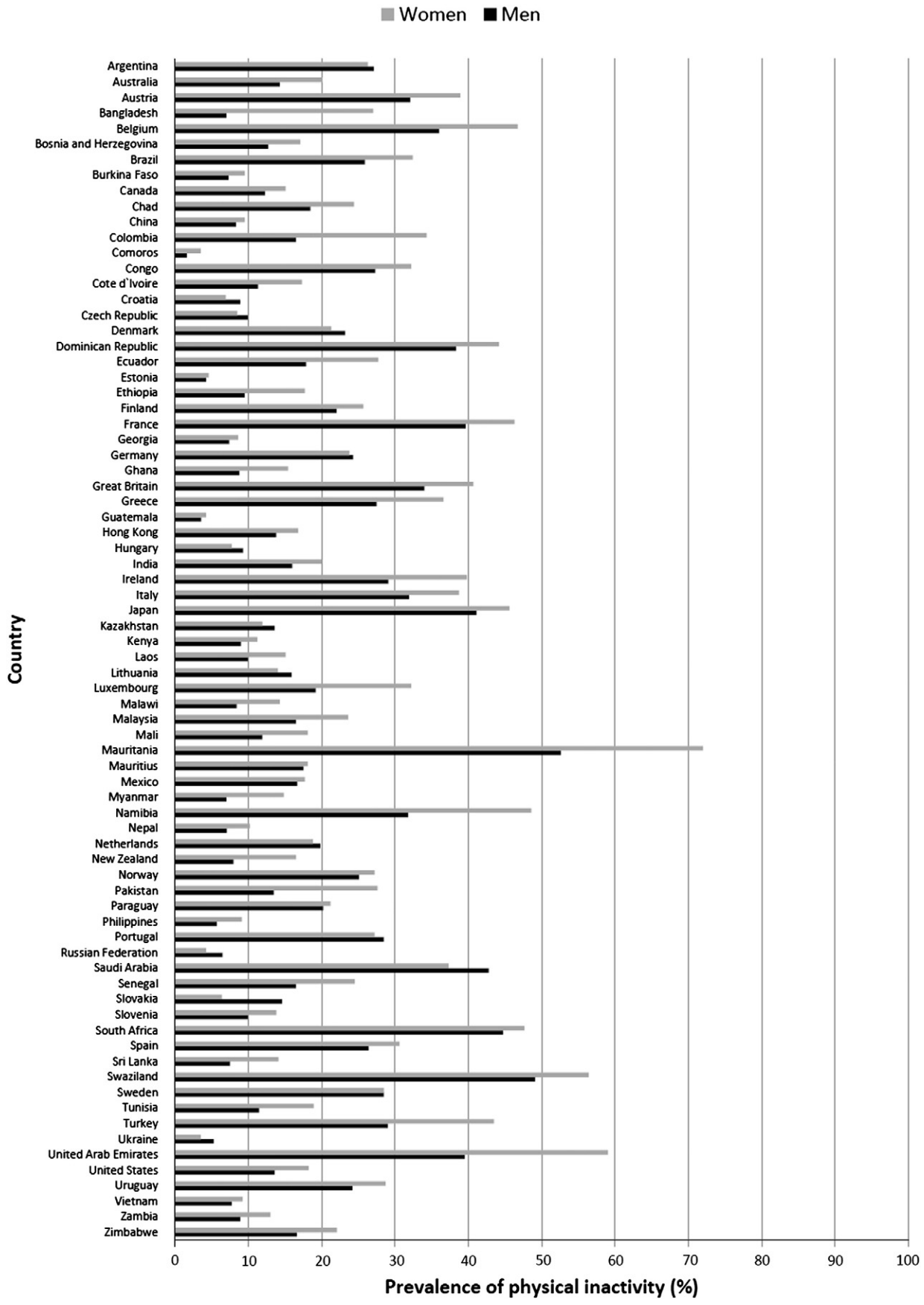

Fig. 1. Prevalence of physical inactivity in 76 countries, stratified by gender.

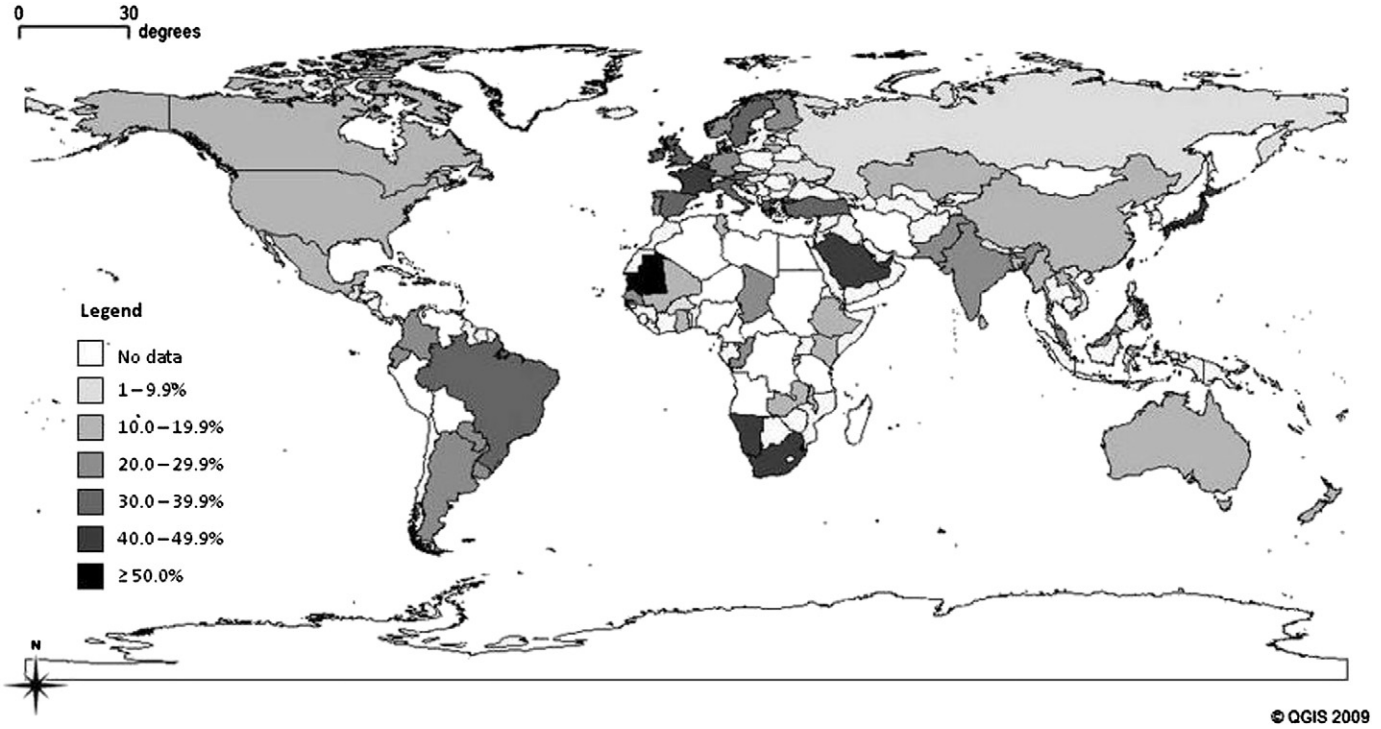

Fig. 2. World map illustrating the prevalence of physical inactivity in 76 countries.

The between-countries comparison of physical activity data, using different measures, is however difficult. A simple example can be observed comparing two studies that evaluated physical activity in the European Union in similar periods (Martinez-Gonzalez et al., 2001; Sjöström et al., 2006). These two studies used different instruments: one comprised only leisure–time physical activity, while the other considered its four domains (leisure, transportation, occupation, household). The most active countries in one study were the least active in the other study (Martinez-Gonzalez et al., 2001; Sjöström et al., 2006). This suggests that even in the same country, physical activity prevalence estimates can vary markedly depending on the instrument. Nevertheless, when we compared the prevalence of physical inactivity in countries included twice or three times, in our paper, we saw similar prevalence estimates, indicating that IPAQ produces consistent results, at least within country. India was the only exception, but this was likely due to the use of a convenience sample in the two studies.

The instrument used in the three studies included here has some strengths. The IPAQ short form instrument was considered brief enough for physical activity surveillance, flexible enough to be used in telephone interview or self-administered applications, and adaptable enough to be applied across cultures (Craig et al., 2003). It encompasses moderate-to-vigorous physical activities performed in four domains: leisure (sports and recreation), occupational (paid/unpaid work, involving physical efforts), commuting (walking or cycling) and household chores (gardening, cleaning, etc.). However, the IPAQ potentially overestimates the prevalence of physical activity of populations (Ainsworth et al., 2006; Ekelund et al., 2006; Rzewnicki et al., 2003). In general, it is very challenging to use the same questionnaire

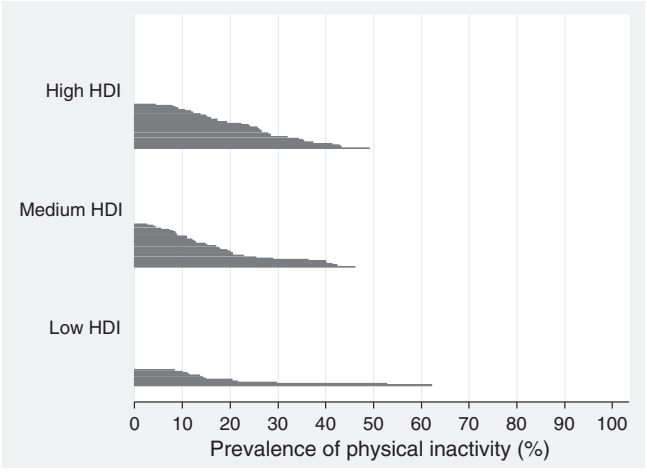

Fig. 3. Worldwide prevalence of physical inactivity according to the Human Development Index (HDI).

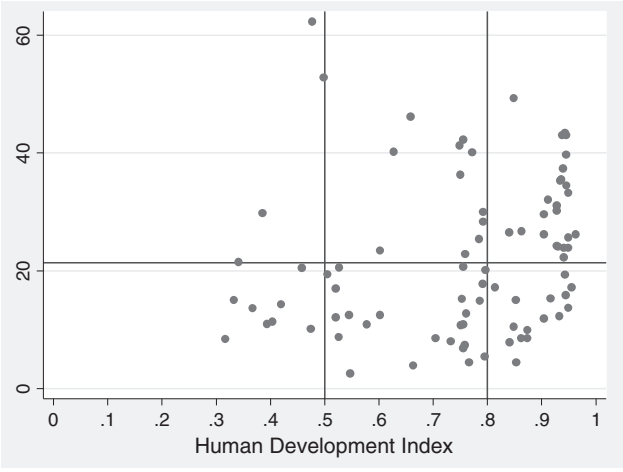

Fig. 4. Prevalence of physical inactivity according to the Human Development Index (HDI, 2003). The horizontal line corresponds to the worldwide prevalence of physical inactivity (21.4%). The two vertical lines indicate the cut-off points to classify the low HDI countries (<0.500) and the high HDI countries (≥0.800).

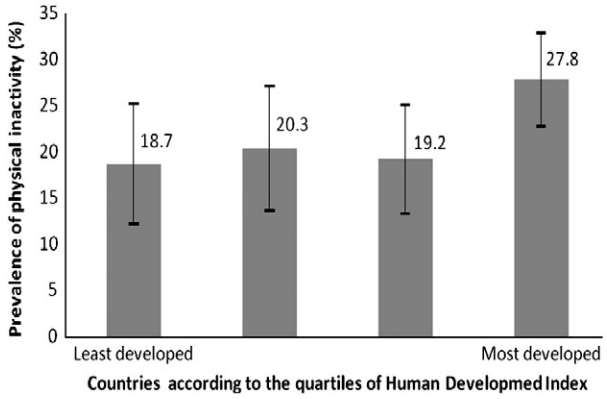

Fig. 5. Worldwide prevalence of physical inactivity according to quartiles of the Human Development Index (HDI).

across different countries and cultural settings, given that it is difficult to control for factors such as the interpretation of questions, the understanding of the intensity of physical activity, or the recall period (Bauman et al., 2009a,b). Hence, the problem of physical inactivity is likely to be underestimated by the IPAQ. Another limitation of the instrument is that at least part of the differences observed across countries may relate not only to varying physical activity levels, but also to varying validity of IPAQ to capture physical activity in that specific context.

Cognitive interviews with Australian adults aged ≥65 years revealed problems with using the self-report during past 7 days form of IPAQ (Heesch et al., 2010). Errors included recalling physical activity in an "average" week, rather than in the previous 7 days; including physical activities lasting less than 10 min; reporting the same physical activity twice or thrice; and including the total time of an activity for which only a part of that time was at the intensity specified in the question (Heesch et al., 2010). Given the nature of the errors made by participants, it is possible that similar errors occur when IPAQ is used in younger populations (Heesch et al., 2010).

There is research discouraging the use of the housework and occupation sections of the questionnaire in Latin America (Hallal et al., 2010). Leisure–time and transportation sections are also the most relevant domains for public health intervention and surveillance (Hallal et al., 2010). Then, the recommendation is that the use of the IPAQ short version should be limited to time trend studies which used this instrument at baseline (Hallal et al., 2010). Another global instrument to measure physical activity, and recommended by World Health Organization is the Global Physical Activity Questionnaire (GPAQ) (Armstrong and Bull, 2006). Its validity and reliability has been reported elsewhere (Bull et al., 2009).

Some limitations of this study should be pointed out. Firstly, although most of the samples include in our study were representative of their countries, some of them were selected by convenience, which may not reflect the actual estimate of physical inactivity. Secondly, the response rate was low within some countries, despite the acceptable rates (higher than 70%) when considered the average of all countries researched. Thirdly, we cannot rule out the effect of seasonality over the physical inactivity estimate, because it can vary according to the season and climate (Belanger et al., 2009). Finally, our inference concerning physical inactivity prevalence and development level of each country may be subject to the ecological fallacy, that is, we cannot attribute to the individual a finding observed at the population level.

Concluding, we found that one out of five adults around the world does not meet minimal levels of physical activity necessary for health enhancement, and can be defined as physically inactive. This estimate may be underestimated, because the IPAQ tends to overestimate the physical activity level. Physical inactivity was more prevalent among wealthier and urban countries, and among women and elderly. Population surveillance should include repeat surveys every few years to assess changes in physical inactivity prevalence and evaluate trend data. For future investigations, objective measures of physical activity might be added, to minimize concerns regarding self-reported estimate.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

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