

# Shifting the Physical Inactivity Curve Worldwide by Closing the Gender Gap

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Published online: 24 June 2017  
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## Abstract

**Purpose** The aims of this study were to (i) examine gender differences in physical inactivity in countries with different levels of Human Development Index (HDI); and (ii) assess whether small changes in the prevalence of inactivity in women could achieve the World Health Organization's (WHO) global inactivity target.

**Methods** Data on inactivity were extracted for 142 countries for the year 2010 from the WHO Data Repository. Data for HDI were obtained for the year 2010 from the United Nations Development Program. Absolute and relative gender differences were calculated for countries according to four HDI categories. The potential effects of increasing women's activity levels on achievement of the WHO physical inactivity target were computed.

**Results** Overall inactivity prevalence was higher in women (27%) than in men (20%). Women were more inactive than men in all except eight countries. Absolute gender differences [median 7.5% (range –10.1 to 33.2)] did not vary by HDI category, but there was a small negative correlation between relative gender difference in inactivity and HDI

(rho –0.19;  $p = 0.02$ ), which was mostly influenced by three outlier countries with low HDI. A decrease in inactivity levels of 4.8% points among women across the world would achieve the WHO target of reducing global levels of inactivity by 10%.

**Conclusion** Gender differences in the prevalence of physical inactivity were highly variable, both within and across categories of HDI. Interventions which result in small changes in inactivity prevalence in women would achieve the 2025 WHO global target for inactivity, without any change to the prevalence in men.

## Key Points

Gender differences in the prevalence of physical inactivity are highly variable and do not vary by the Human Development Index of individual countries.

A decrease in inactivity levels of 4.8% points among women across the world would achieve the World Health Organization target of reducing global levels of inactivity by 10%.

Interventions that focus on closing the gender gap in leisure time physical inactivity could have important health benefits.

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## 1 Introduction

The role of physical activity in the prevention and treatment of non-communicable diseases (NCDs) is now so well established [1] that World Health Organization (WHO) Global Action Plan (GAP) for the Prevention and

Control of NCDs (2013–2020) has set for all countries the target of a 10% decrease in inactivity by 2025 (relative to each country's baseline) [2, 3]. In 2011, Dumith et al. [4] published data based on a pooled analysis of data from three multicentre studies, which used the short-form International Physical Activity Questionnaire (IPAQ) that assesses moderate–vigorous activity in the four domains of work, transport, home and leisure. Using data from 76 countries, these researchers reported that the average worldwide prevalence of inactivity was 21.4% (95% CI 18.4–24.3); prevalence ranged from 2.6% in Comoros (an archipelago nation situated between the eastern coast of Africa and Madagascar), to 62.3% in Mauritania (in Western Africa). They noted that physical inactivity was higher (27.8%) among countries with a high Human Development Index (HDI, a composite measure of life expectancy, education and per capita gross national income) and lower in countries with low HDI (18.7%). The overall strength of the correlation was, however, quite weak ( $\rho = 0.27$ ) [4].

Using data from more countries ( $n = 146$ ), updated estimates in 2016 suggested that 23.3% of adults worldwide were inactive (i.e. did not achieve 150 min of moderate intensity activity or 75 min of vigorous intensity activity, or an equivalent combination, per week) [5], signalling little progress towards reaching the WHO target. Only six countries improved from 2012 to 2016 (Maldives, New Zealand, South Korea, Seychelles, South Africa and USA) [5]. Using a World Bank Income Classification, these researchers also noted that the median prevalence of inactivity was higher in high-income than in low-income countries, but with very large variation across income classifications (i.e. high-income median was 28.7% and ranged from 9.5 to 61.0; low-income median was 14.8% and ranged from 4.1 to 27.5) [5].

In our 'comment' in the Lancet series on physical activity (2016) we suggested that one way to achieve the WHO goal of reducing the prevalence of physical inactivity by 10% might be to reduce the gender disparities in physical inactivity which exist in most countries across the world [6]. This was based on earlier observations by Dumith et al. [4] that the prevalence of physical inactivity was higher in women (23.7%, 95% CI 20.4–27.1) than in men (18.9%, 95% CI 16.2–21.7), and by Sallis et al. [5], who noted that gender disparities in the prevalence of activity persisted in 2016, with 137 of the 146 countries in their study showing higher inactivity among women.

Dumith et al. also reported that the association between prevalence of physical inactivity and HDI was slightly stronger in men ( $\rho = 0.35$ ) than in women ( $\rho = 0.27$ ), but that the prevalence of inactivity was higher among women than men in all low HDI countries, and in 70% of high HDI countries [4]. However, as high HDI countries were over

represented in Dumith's study, relationships between these gender differences and HDI remain unclear. The aims of this research were to (i) examine gender differences in physical inactivity in countries with different levels of HDI; and (ii) assess whether small changes in the prevalence of inactivity in women could achieve the WHO's global inactivity target.

## 2 Methods

### 2.1 Data Collection

This study used secondary data from two sources. First, prevalence data for physical inactivity in men and women were extracted from the Global Health Observatory Repository (GHOR) [7]. The GHOR provides estimates for men and women age 18+ years in 146 countries. These estimates are based on standardized surveys that consider physical activity in all domains of life, including occupational/household, transport and leisure time activity. Physical inactivity was defined as not meeting the WHO recommendation of 150 min per week of at least moderate intensity physical activities across all domains [8]. The GHOR uses regression-modelling techniques to provide standardized estimates for the year 2010 that enable comparisons among countries. For the current analyses, age-standardized estimates were used. Additional details of the standardization methods are available elsewhere [7].

Second, HDI data were obtained for the year 2010 from the United Nations Development Program (UNDP) website [9]. HDI is a composite indicator, ranging from 0 (lowest) to 1 (highest), based on three dimensions: (a) life expectancy at birth; (b) knowledge (measured by the adult literacy rate and the combined gross enrolment ratio for primary, secondary and tertiary schools); and (c) standard of living (as measured by gross domestic product per capita in purchasing power, with parity to US dollars). Countries were categorized as very high ( $\geq 0.80$ ), high (0.70–0.79), medium (0.55–0.69), or low development ( $< 0.55$ ) according to UNDP criteria [9].

### 2.2 Data Management and Statistical Analysis

#### 2.2.1 Gender Differences in Physical Inactivity

Absolute and relative gender differences in physical inactivity prevalence were calculated. Absolute difference (AD) was calculated by subtracting the prevalence of physical inactivity in men from that of women ( $P_w - P_m$ ). Thus, a positive absolute index indicates that the prevalence of physical inactivity is higher among women than men, while a negative value indicates that women are less

inactive than men in that country. Relative difference (RD) was calculated by dividing the prevalence of physical inactivity in women by the prevalence in men ( $P_w/P_m$ ).  $RD > 1.0$  indicates that the prevalence of physical inactivity is higher in women than men in a given country. These two indicators were selected because they provide different information about gender differences in physical inactivity, depending on prevalence levels. For example, in two countries presenting the same AD of 20% points (pp), the RD could be 1.4 in a country where inactivity prevalence is high (e.g. 70% in women and 50% in men) or 3.0 in another country where inactivity prevalence is low (e.g. 30% in women and 10% in men).

Mean, median and variability measures [including standard deviation (SD) and interquartile range (IQR)] were calculated for each indicator, and Spearman correlations were used to evaluate relationships between these indicators with individual country HDI. Box plots and Kruskal–Wallis tests were used to illustrate and compare indicators of difference by HDI categories. Equiplots (<http://www.equidade.org>) were used to graphically present the prevalence of inactivity in men and women in countries grouped by HDI category, and Quantum Geographic Information System (QGIS), version 2.1.0 was used to construct a world map showing relative differences in inactivity.

### 2.2.2 Changes Required to Achieve the WHO Target

To examine the change in prevalence of physical inactivity in women that would be required to achieve the WHO global inactivity target, first the overall prevalence target (PrevT) for each country was calculated by subtracting 10% from the current prevalence (PrevC).

$$\text{PrevT} = \text{PrevC} - (\text{PrevC} \times 0.1)$$

The minimal required prevalence of physical inactivity among women (PrevW) was then estimated, based on the current prevalence of physical inactivity in men (PrevM), and the proportions of men (PropM) and women (PropW) in the population. For these estimates, a gender ratio of 1:1 was assumed.

$$\text{PrevW} = \frac{\text{PrevT} - (\text{PrevM} \times \text{PropM})}{\text{PropW}}$$

Population distributions of the prevalence of physical inactivity overall, and by gender, were constructed using means and standard deviations for each indicator. These were used to graphically illustrate how changes in the prevalence of physical inactivity in women could change the overall worldwide distribution. All statistical analyses were performed using STATA, version 12.1.

## 3 Results

### 3.1 Descriptive Data

Physical inactivity prevalence and HDI data were available for adults in 142 countries (73% of the 194 WHO Member States, ranging from 68% of medium HDI countries to 88% of very high HDI countries). Mean HDI in 2010 was 0.68 (SD 0.16); it was lowest in the Democratic Republic of Congo (0.319) and highest in Norway (0.939).

Descriptive data on the prevalence of physical inactivity, overall and for men and women, by HDI category, are shown in Table 1, and the prevalence of physical inactivity in men and women in each of the 142 countries is shown by HDI category (low, medium, high and very high) in Fig. 1. Median overall prevalence of physical inactivity was lowest in low HDI countries and highest in high and very high HDI countries. The range of inactivity prevalence estimates was slightly lower in low HDI countries (4.1–45.1%) than in the other three categories, in which prevalence was between 8.4 and 63.6%. Women were more inactive than men in all except eight countries (Lebanon, Nepal, Russian Federation, Indonesia, Iraq, Republic of Moldova and Lesotho; and in Jordan, where the prevalence of physical inactivity was the same in men and women). The highest prevalences of physical inactivity among women were in Colombia (72.9%, high HDI), Saudi Arabia (68.7%, very high HDI) and Kuwait (63.9%, very high HDI) and lowest in Nepal (3.7%), Mozambique (6.2%) and Lesotho (7.0%) (all low HDI).

### 3.2 Gender Differences in Physical Inactivity

The median absolute gender difference in the prevalence of physical inactivity was 7.5 pp (see Table 1 for additional summary statistics); the absolute difference ranged from –10.1 in Lebanon to 33.2 in Bangladesh. The median absolute difference was slightly higher in high HDI countries, but, as shown in Fig. 2, there was no association between absolute gender difference and HDI (Fig. 2b;  $p = 0.217$ ). Variability in absolute gender difference was highest in high HDI countries (see Fig. 2b).

Relative gender differences in inactivity prevalence are also shown in Table 1 and Fig. 2. The median relative difference was 1.34; this ranged from 0.77 in Lebanon (women less inactive than men) to 4.25 in Bangladesh (women more inactive than men). When HDI was used as a continuous variable, Spearman's correlation showed some evidence of a negative association between relative gender difference and HDI ( $\rho = -0.19$ ;  $p = 0.021$ ), but this finding was strongly influenced by three 'outlier' countries with low HDI (Eritrea 2.73; Lao People's Democratic

**Table 1** Descriptive data on the prevalence of physical inactivity, absolute and relative gender differences

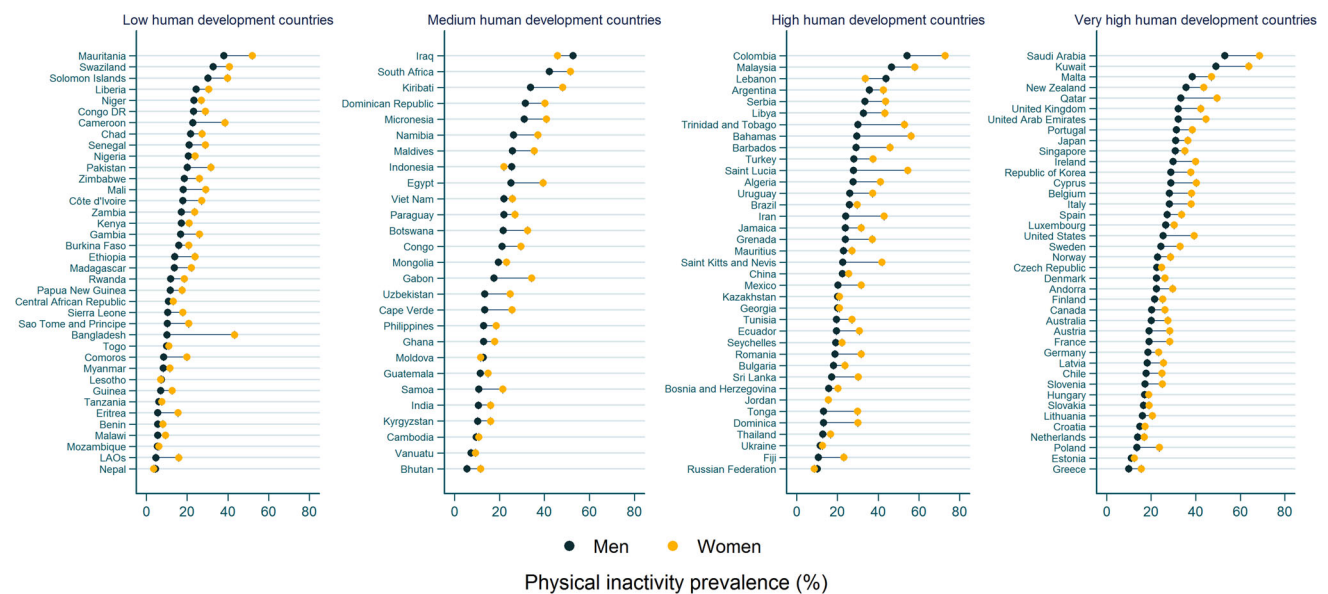
	Overall ( <i>N</i> = 142)	Country's Human Development Index			
		Low ( <i>n</i> = 38)	Medium ( <i>n</i> = 27)	High ( <i>n</i> = 37)	Very high ( <i>n</i> = 40)
<b>Prevalence of physical inactivity<sup>a</sup></b>					
All	23.8 (17.0–32.8)	18.7 (10.4–25.0)	23.7 (13.4–31.8)	26.0 (21.0–37.6)	26.0 (21.3–34.3)
Men	20.2 (13.3–27.2)	13.9 (8.3–20.6)	19.6 (11.5–25.8)	22.7 (18.2–28.1)	22.8 (18.1–30.5)
Women	27.3 (20.4–38.1)	21.7 (13.3–29.0)	25.7 (16.1–37.1)	31.8 (23.8–42.7)	30.0 (24.9–38.9)
<b>Absolute difference in prevalence<sup>b</sup></b>					
Median (IQR)	7.5 (3.8–10.9)	6.5 (3.7–9.9)	6.1 (3.6–10.7)	10.5 (3.8–13.5)	7.3 (4.5–9.9)
P10–P90	1.4–14.7	1.1–9.9	–1.2 to 14.3	0.8–19.3	2.5–13.2
Range	–10.1 to 33.2	–0.8 to 33.2	–7.0 to 16.7	–10.1 to 26.7	1.4–16.3
<b>Relative difference in prevalence<sup>c</sup></b>					
Median	1.34 (1.21–1.55)	1.40 (1.25–1.98)	1.38 (1.22–1.55)	1.33 (1.18–1.68)	1.30 (1.20–1.39)
P10–P90	1.10–1.85	1.13–2.35	0.91–1.94	1.04–1.95	1.14–1.49
Range	0.77–4.25	0.82–4.25	0.82–2.07	0.77–2.27	1.09–1.75

*IQR* interquartile range, *n* number of countries, *P10* tenth centile; *P90* 90th centile

<sup>a</sup> Values are median and interquartile range

<sup>b</sup> Prevalence in women – prevalence in men

<sup>c</sup> Prevalence in women/prevalence in men

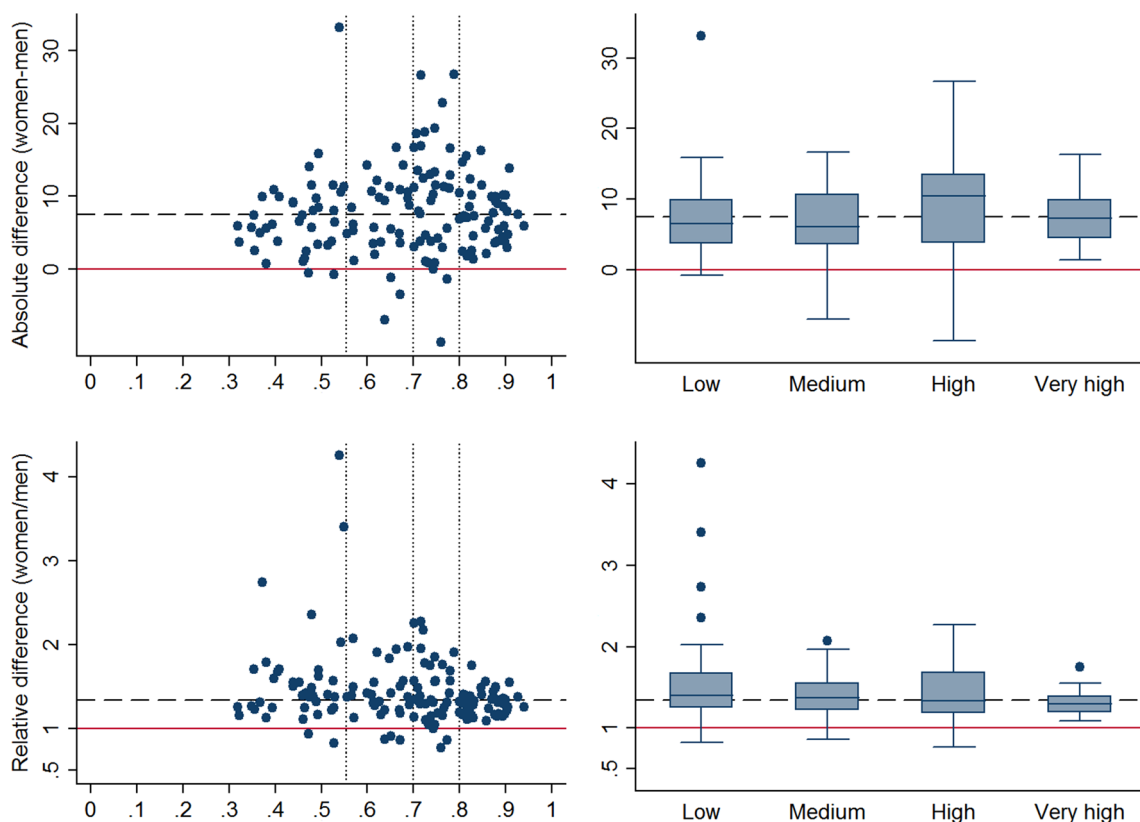


**Fig. 1** Prevalence of physical inactivity in men and women worldwide. Low human development [HDI mean 0.45 (SD 0.07)], medium [HDI mean 0.63 (SD 0.04)], high [HDI mean 0.74 (SD 0.03)] and

very high [HDI mean 0.86 (SD 0.04)]. *HDI* Human Development Index, *SD* standard deviation

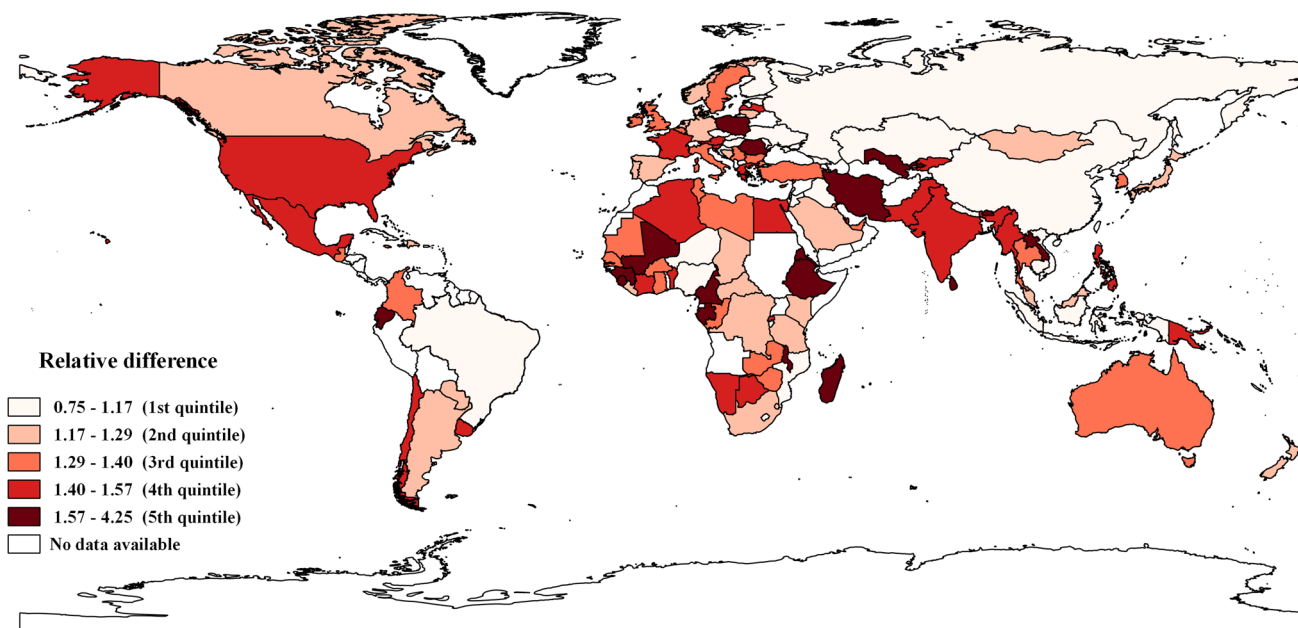
Republic 3.41; Bangladesh 4.25). When these data were excluded, the correlation was  $-0.15$  ( $p = 0.073$ ; see Fig. 2c). Box plots of relative difference by HDI are shown in Fig. 2d. There were no clear differences across HDI categories ( $p = 0.115$ ).

The relative differences in inactivity prevalence in women compared with men are shown on a map of the world in Fig. 3. Large gender differences are evident in many low and medium HDI countries in the northwest African, South-East Asian and Eastern Mediterranean



**Fig. 2** Top panel absolute difference in physical inactivity according to Human Development Index (HDI) among adults ( $\rho = 0.09$ ;  $p = 0.304$ ;  $N = 142$ ). Horizontal dashed line indicates worldwide median (adults 7.45). The three vertical lines indicate the cut-off points to classify the low, middle, high and very high HDI countries.

Bottom panel relative difference in physical inactivity according to HDI among adults ( $\rho = -0.19$ ;  $p = 0.021$ ;  $N = 142$ ). Horizontal dashed line indicates worldwide median (adults 1.34). The three vertical lines indicate the cut-off points to classify the low, high and very high HDI countries



**Fig. 3** Relative gender differences in adult physical inactivity worldwide ( $N = 142$  countries)

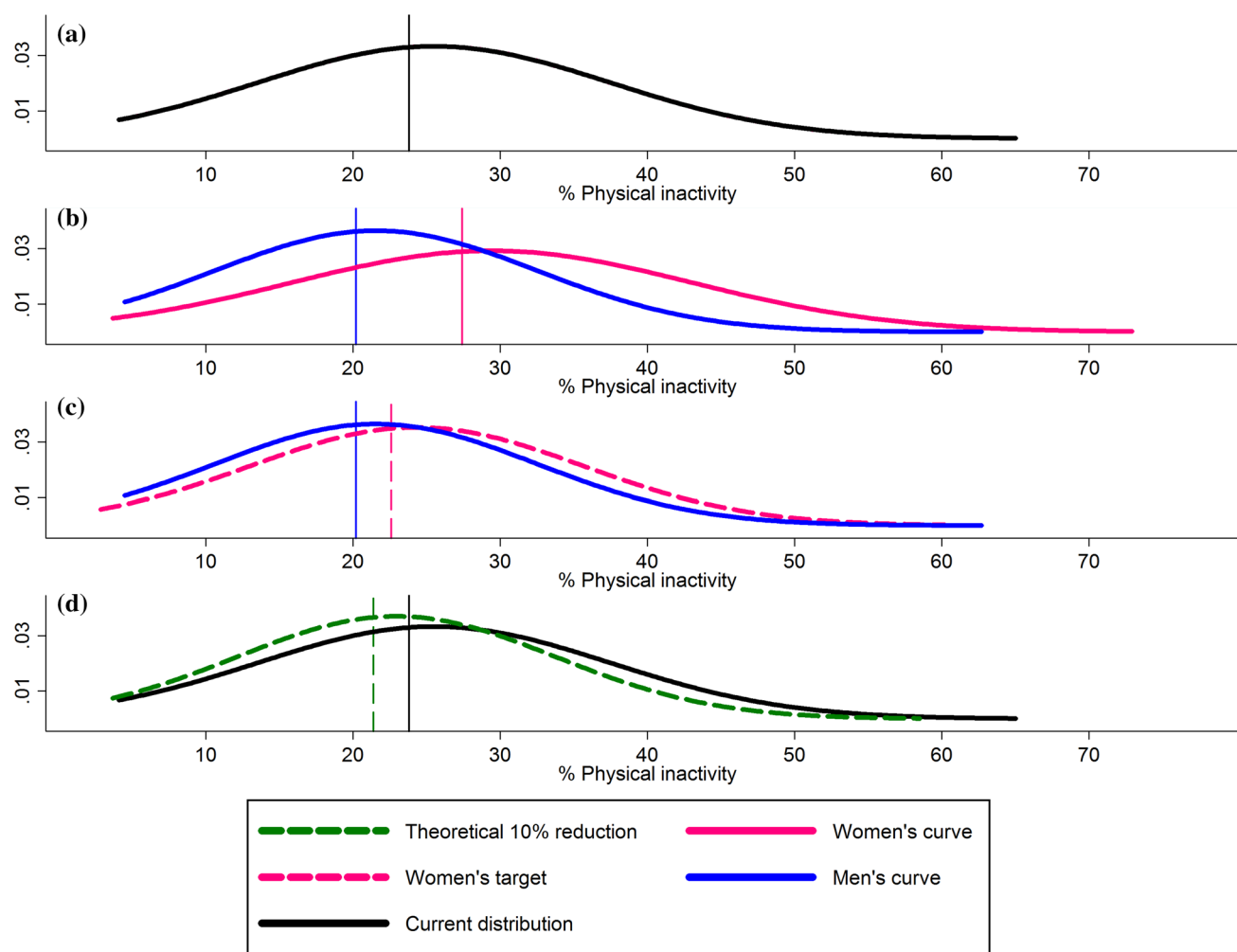
regions, but also among very high HDI countries such as the USA, France, Poland and Austria.

### 3.3 Changes Required to Achieve the WHO Target

The overall global and gender-specific distributions of physical inactivity are shown in Fig. 4a and b, respectively. The revised distribution curve for women that would achieve the 2025 WHO global target (a 10% reduction in inactivity), without any change among men, is also shown in Fig. 4c. The required median inactivity prevalence levels for women are shown by HDI category in Table 2. Our estimates suggest that, assuming no change in men, an overall decrease of 4.8 pp in inactivity prevalence in women would be necessary to achieve the WHO target. Reductions would need to be higher in high and very high HDI countries (see Table 2).

## 4 Discussion

This study examined gender differences in inactivity in countries with different levels of HDI. In line with previous reports, we found that women were more inactive than men in most countries, and that the difference was most marked in some high- and very-high-income countries, and least marked in some low HDI countries. However, in contrast with previous estimates [4], we found that, because of the high variation in inactivity within each HDI category, neither absolute nor relative gender differences in inactivity were significantly associated with HDI. The explanation is likely to be that we included data from more countries (142 compared with 76) with better representation from countries in all HDI categories. Nonetheless, our ‘world map’ showed surprisingly high relative gender differences in the US and some European countries. On the



**Fig. 4** Population distribution on the prevalence of physical inactivity. **a** Current overall distribution, **b** current distribution by gender, **c** current men’s distribution and required women’s distribution,

**d** theoretical overall distribution by reducing gender differences. *Vertical lines* indicate the median for each distribution

**Table 2** Changes required reach the WHO global target

	Country's Human Development Index				
	Overall ( <i>N</i> = 142)	Low ( <i>n</i> = 38)	Medium ( <i>n</i> = 27)	High ( <i>n</i> = 37)	Very high ( <i>n</i> = 40)
Overall target (%) required for a 10% reduction <sup>a</sup>	21.4	16.8	21.3	23.4	23.4
Required prevalence (%) in women <sup>a</sup>	22.6	18.2	21.0	25.9	24.1
Required absolute decrease (pp) <sup>a</sup>	4.8	3.8	4.8	5.3	5.2
Required % decrease <sup>a</sup>	17.4	17.1	17.2	17.4	17.3
Theoretical absolute difference <sup>b</sup>	-2.6 (-5.2 to -1.9)	-2.8 (-5.2 to -0.5)	-2.6 (-5.6 to -0.1)	-2.8 (-8.4 to 1.0)	-2.3 (-3.4 to -0.5)
Theoretical relative difference <sup>b</sup>	1.11 (1.00–1.30)	1.15 (1.02–1.41)	1.14 (1.00–1.30)	1.10 (0.96–1.41)	1.07 (0.98–1.15)

pp percentage points

<sup>a</sup> Values are median

<sup>b</sup> Values are median and interquartile range

other hand, small relative differences were observed in high populous and emerging high HDI countries such as Brazil, China and Russia. We also showed that it would be feasible to achieve the 2025 WHO target of a 10% reduction in inactivity by focussing on decreasing inactivity levels in women.

#### 4.1 Gender Differences in Physical Inactivity

Comparing rates and gender differences in inactivity across countries is challenging, because physical activity patterns are strongly influenced by participation in different *domains* of activity, which reflect the cultural and developmental contexts of each country. For example, in Nepal (low HDI, and the least inactive country in our sample, for both men and women), inactivity levels are similarly low in women and men, reflecting their high rates of participation in physically active occupational work. However, others have reported that 97% of Nepalese women were found not to have done the minimum level (at least 10 min per day) of recreational physical activity, compared with 79% of men [10]. In addition, the contribution of recreational physical activity to total activity was found to be 0.7% in women, but 6.9% in men. In contrast, in Indonesia, (a medium HDI country where there are still quite high levels of occupational activity) men are more inactive than women, because they report less time in leisure time physical activity (median 8.6 min/day, compared with 25.7 min/day in women) [11].

A study of 22 African countries [12] (mostly medium HDI) has shown that levels of occupational activity are similar in men and women, but that levels of leisure time activity are significantly higher in men [12]. This would explain the relatively low levels of inactivity, but large 'gender gaps' shown in African countries in our study. Gender differences in leisure time activity also underpin the large gender gap shown here for overall inactivity in many high HDI Middle Eastern countries (e.g. Kuwait and Saudi Arabia), where both men and women have low levels of occupational and transport activity [13, 14]. There were also surprisingly high absolute and relative gender differences in the US, UK and several European countries (e.g. France, Poland and Italy), where there are highly variable patterns of occupational, transport and leisure time activity.

Over the last decade, the WHO has been trying to standardize the physical activity measures used in national surveillance, with increasing adoption of the Global and International Physical Activity Questionnaires (GPAQ and IPAQ) [15, 16] in many countries. Although the data from these two questionnaires are not *directly* comparable (because the questions differ slightly), the data can improve our understanding of levels, and changes over time, in activity in different domains in men and women. In this study, we were unable to analyse the data by activity domain, as only a few countries provided these data, and they were expressed in ways that made synthesis impossible (e.g. in mins/day or percentages in each domain, etc.). Standardizing the *re-*

porting of data for the WHO repository would enable researchers to interrogate changes in inactivity over time, as low and medium HDI countries experience changes in urbanization, and with this, likely changes in occupational work and transport activity.

## 4.2 Changes Required to WHO Target

The second aim of this study was to assess the change in prevalence of inactivity in women that would be required to achieve the WHO global inactivity target of a 10% reduction by 2025. Our data show that shifting the ‘distribution’ of inactivity among women, without changing the distribution in men, could achieve this goal. We estimate that an overall improvement of 4.8 pp (17%) in the median inactivity prevalence among women would be required. Considering countries with different HDI levels, smaller changes (3.8 and 4.8 pp) would be required in low and medium HDI countries than in very high and high HDI countries (5.3 and 5.2 pp, respectively).

We advocate that an increase of 4.8 pp among women would be feasible, but that both macro and micro level strategies would be required. Creating opportunities and empowering women in society could be a first step to closing the gender gap in physical inactivity. Indeed, we consider that overall gender equality would naturally increase women’s physical activity levels and, consequently, global levels of physical activity.

As suggested in our recent ‘comment’ in the 2016 Lancet series on physical activity, one way to achieve these targets would be to encourage women’s participation in sport and physical activity [6]. Although the International Olympic Committee (IOC) has almost achieved its equal participation target for the Olympic Games [18], the ‘trickle down’ effect has been small and large gender gaps in population levels of sports participation and leisure-time physical activity are still evident [5]. National mass media campaigns, like the ‘This Girl Can’ campaign in England [19] or ‘Kau Mai Tonga: Netipol’ (Come on Tonga, let’s play netball!), are showing signs of success in increasing women’s participation in sports [20].

## 4.3 Strengths and Limitations

The major strength of this study was that we assessed associations between inactivity and HDI using data from 142 countries, with good representation of countries with varying levels of HDI. Another strength was the use of HDI as a robust indicator of the social and economic characteristics of each country.

One limitation was that data were not available for 52 countries. In this scenario, if the ‘missing’ countries have high relative gender differences, the relationship between HDI and gender differences might be slightly different.

However, the proportion of countries with physical inactivity did not vary in HDI ( $p = 0.234$ ). As noted earlier, other limitations are that all the data were self-reported, and the use of two surveys (even though both are well validated) [16, 17] may mean that prevalence data are not directly comparable within each HDI category. However, gender differences, which were the main focus of this paper, were always based on data from the same survey. In relation to the survey methods, availability of domain-specific data to the database would have improved our ability to interrogate the underlying causes of the gender differences.

## 5 Conclusion

Gender differences in the prevalence of physical inactivity were highly variable, both within and across categories of HDI. Absolute differences were somewhat higher in HDI countries, but there were no significant associations between inactivity and HDI. Interventions that focus on decreasing physical inactivity in women could reduce both absolute and relative gender differences, and ‘shift the inactivity curve’ sufficiently to meet the 2025 WHO global inactivity target. A focus on leisure time and transport activity will be important, especially in those countries where occupational levels of activity are continuing to decline.

### Compliance with Ethical Standards

**Conflicts of interest** Gregore I. Mielke, Inacio Crochemore M. da Silva, Tracy L. Kolbe-Alexander and Wendy J. Brown declare that they have no conflicts of interest relevant to the content of this paper. The authors alone are responsible for the views expressed in this publication and they do not represent the decisions, policy or views of the World Health Organization.

**Funding** No specific financial support was received for the conduct of this study or for the preparation of the manuscript. Gregore Mielke and Tracy Kolbe-Alexander were funded by a strategic grant from the University of Queensland which supported research fellows in the Centre for Research on Exercise, Physical Activity and Health at The University of Queensland.

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