Physical Activity 1

Global physical activity levels: surveillance progress, pitfalls, and prospects

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To implement effective non-communicable disease prevention programmes, policy makers need data for physical activity levels and trends. In this report, we describe physical activity levels worldwide with data for adults (15 years or older) from 122 countries and for adolescents (13–15-years-old) from 105 countries. Worldwide, 31·1% (95% CI 30·9–31·2) of adults are physically inactive, with proportions ranging from 17·0% (16·8–17·2) in southeast Asia to about 43% in the Americas and the eastern Mediterranean. Inactivity rises with age, is higher in women than in men, and is increased in high-income countries. The proportion of 13–15-year-olds doing fewer than 60 min of physical activity of moderate to vigorous intensity per day is 80·3% (80·1–80·5); boys are more active than are girls. Continued improvement in monitoring of physical activity would help to guide development of policies and programmes to increase activity levels and to reduce the burden of non-communicable diseases.

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This is the first in a **Series** of five papers about physical activity

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Physical activity in a changing world

Since the industrial revolution, the development of new technologies has enabled people to reduce the amount of physical labour needed to accomplish many tasks in their daily lives. As the availability of new devices has continued to increase, the effects on physical labour and human energy expenditure have grown to include many aspects of the lives of more and more people. The effects of some of these technologies on physical activity are obvious (eg, steam, gas, and electric engines; trains; cars; and trucks), whereas others are more subtle and complex (eg, televisions, computers, electronic entertainment, the internet, and wireless communication devices).

The use of many of these technologies has been driven by the goal of increased individual worker productivity and reduced physical hardships and disabilities caused by jobs entailing continuous heavy labour. However, the human body has evolved in such a way that most of its systems (eg, skeletal, muscle, metabolic, and cardiovascular) do not develop and function in an optimum way unless stimulated by frequent physical activity.[1] Although the technological revolution has been of great benefit to many populations throughout the world, it has come at a major cost in terms of the contribution of physical inactivity to the worldwide epidemic of non-communicable diseases.[2] In 2009, physical inactivity was identified as the fourth leading risk factor for non-communicable diseases and accounted for more than 3 million preventable deaths.[3]

Comparisons of patterns of participation in physical activity between countries and regions were unachievable until a decade ago,[4] largely due to the absence of standardised instruments suitable for international use. This barrier caused a so-called collective blind spot, because the evidence for the health benefits of physical activity had grown stronger since the 1970s,[5] underpinning the importance of surveillance data to guide national action.[6] Without a suitable instrument, early efforts to characterise patterns of physical activity frequently used only measures of occupational classification or only estimations of energy expenditure during leisure-time physical activity as the best available indicators, such as in early epidemiological studies[7,8] and subsequent investigations.[9]

Only in the late 1990s did an international group of academics develop a standardised instrument—the international physical activity questionnaire (IPAQ)[10]—to

Key messages

- Surveillance of physical activity levels of adult (aged 15 years or older) and adolescent (aged 13–15 years) populations has progressed substantially in the past decade. Available data obtained with standardised self-report instruments now provide estimates of physical activity for 122 countries, or two-thirds of the 194 WHO Member States; these data should be used to inform policy and practice worldwide.
- A third of adults and four-fifths of adolescents do not reach public health guidelines for recommended levels of physical activity.
- Notable disparities exist in the prevalence of physical inactivity; in most countries inactivity is higher in women than in men, and older adults are less active than are younger adults. These consistent patterns should be used to help policy makers to implement effective programmes for the prevention and treatment of non-communicable diseases.
- Trend data from high-income countries suggest that occupational physical activity is decreasing but leisure-time physical activity has increased in adults.
- Gaps in surveillance of physical activity remain. No data are available from about a third of countries, mostly those of low and middle income in Africa and central Asia. Data for trends in physical activity are scarce.
- WHO's STEPwise approach to chronic disease risk factor surveillance provides a good framework and practical ways to initiate physical activity surveillance, particularly in countries of low and middle income.
- Advances in new technologies and measurement methods, especially accelerometry, show promise for future surveillance of physical activity. These devices have potential widespread practical application if equipment costs continue to fall and sufficient efforts are directed towards increasing technical skills and workforce capacity in countries of low and middle income.

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assess physical activity worldwide, and test its validity and reliability in 12 countries. The development of IPAQ and work leading to the global physical activity questionnaire (GPAQ)[11] provided the much needed measurements to support national monitoring and the inclusion of physical inactivity in risk factor surveillance systems. As a result, IPAQ and GPAQ data from about two-thirds of countries worldwide enable a comparative assessment of global patterns of physical activity to be undertaken for the first time.

Our aim is thus to describe worldwide physical activity levels, showing differences in participation between regions and populations, and patterns of walking and vigorous-intensity activity. Because of the specific and relevant links between health, physical activity, and the environment, we also outline patterns of walking and cycling—ie, so-called active transportation. We draw attention to gaps that remain in physical activity surveillance, particularly how scarce trend data are for most countries and the absence of information from many countries of low and middle income. Because new technology might offer scope for surveillance in the future, we assess data obtained with motion sensors in adults and young people. Additionally, we present information about the emerging science of sedentary behaviours, provide an overview of what is known about trends in physical activity, and emphasise the importance of surveillance data to drive national and global action.

How inactive is the world's population?

Self-reported physical activity in adults

We obtained comparable estimates for physical inactivity in adults (aged 15 years or older) from 122 countries with the WHO global health observatory data repository.[12] The combined population of these 122 countries represents 88·9% of the world's population. For our analyses, physical inactivity was defined as not meeting any of three criteria: 30 min of moderate-intensity physical activity on at least 5 days every week, 20 min of vigorous-intensity physical activity on at least 3 days every week, or an equivalent combination achieving 600 metabolic equivalent (MET)-min per week.[13–15] 1 MET is defined as the energy spent when an individual sits quietly. With consideration of different intensities of activity components, reported weekly minutes were multiplied by 8 MET for vigorous activity, and by 4 MET for moderate activity or walking.[13–15] Inclusion criteria for country data to be used included assessment of physical activity in all domains (ie, leisure-time, occupation, transportation, and housework). The appendix contains further details about methods used to analyse data.

See **Online** for appendix

Worldwide, 31·1% (95% CI 30·9–31·2) of adults are physically inactive. This value represents the weighted average of the proportion in the countries studied, taking into account population sizes. The frequency of inactivity varied greatly between WHO regions (figure 1): 27·5% (27·3–27·7) of people are inactive in Africa, 43·3% (43·0–43·6) in the Americas, 43·2% (42·8–43·6) in the eastern Mediterranean, 34·8% (34·5–35·1) in Europe, 17·0% (16·8–17·2) in southeast Asia, and 33·7% (33·5–33·9) in the western Pacific. Women are more inactive (33·9%) than are men (27·9%). Additionally, large differences exist between countries (appendix); for example, the proportion of inactive individuals of both sexes combined ranged from 4·7% (95% CI 4·3–5·1) in Bangladesh to 71·9% (31·0–87·2) in Malta.

Inactivity increases with age in all WHO regions (figure 2), which is a pattern known to have a strong biological basis.[16] Despite the linear association in all regions, heterogeneity was substantial. Adults aged 60 years or older from southeast Asia are much more active than are individuals of the same age from all other regions, and actually more active than are young adults (aged 15–29 years) from the Americas, the eastern Mediterranean, Europe, and the western Pacific.

Physical inactivity is more common in countries of high income than in those of low income (figure 3). For years, surveys focusing solely on leisure-time physical activity suggested that, within countries, physical inactivity was more frequent in people with low income than in those with higher socioeconomic status.[17,18] Only in the past decade, when standardised instruments could measure total physical activity (ie, leisure-time, occupational, housework, and transport-related activity), has a different social pattern of inactivity become apparent.[4,19] Whether or not it will persist in the future is unknown, but evidence from Brazil[20] suggests that although prevalence of physical inactivity increased greatly in people with low income between 2002 and 2007, no significant differences were reported in those with higher earnings.[20] The hypothesis that the social pattern might be shifting is reinforced by falling occupational physical activity (usually higher in people with low income than in those with high income) and increases in leisure-time exercise (more common in people with high income than in those with low income).[21]

Walking is a common, accessible, inexpensive form of physical activity and is an important component of total physical activity in adult populations.[22] It is aerobic and necessitates use of large skeletal muscles, and confers the multifarious health benefits of physical activity with few adverse effects.[23] Interventions have been implemented to increase population levels of walking and have proven this activity's effectiveness.[24] 64·1% (63·9–64·3) of adults report walking for at least 10 min consecutively on 5 or more days per week. Variation between WHO regions is modest: 57·0% (56·6–57·4) report such walking in Africa, 65·6% (65·3–65·9) in the Americas, 66·9% (66·1–67·7) in the eastern Mediterranean, 66·8% (66·4–67·2) in Europe, 67·2% (66·7–67·7) in southeast Asia, and 65·0% (64·5–65·5) in the western Pacific. Moreover, patterns of walking hardly differ in men and women and

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A

B

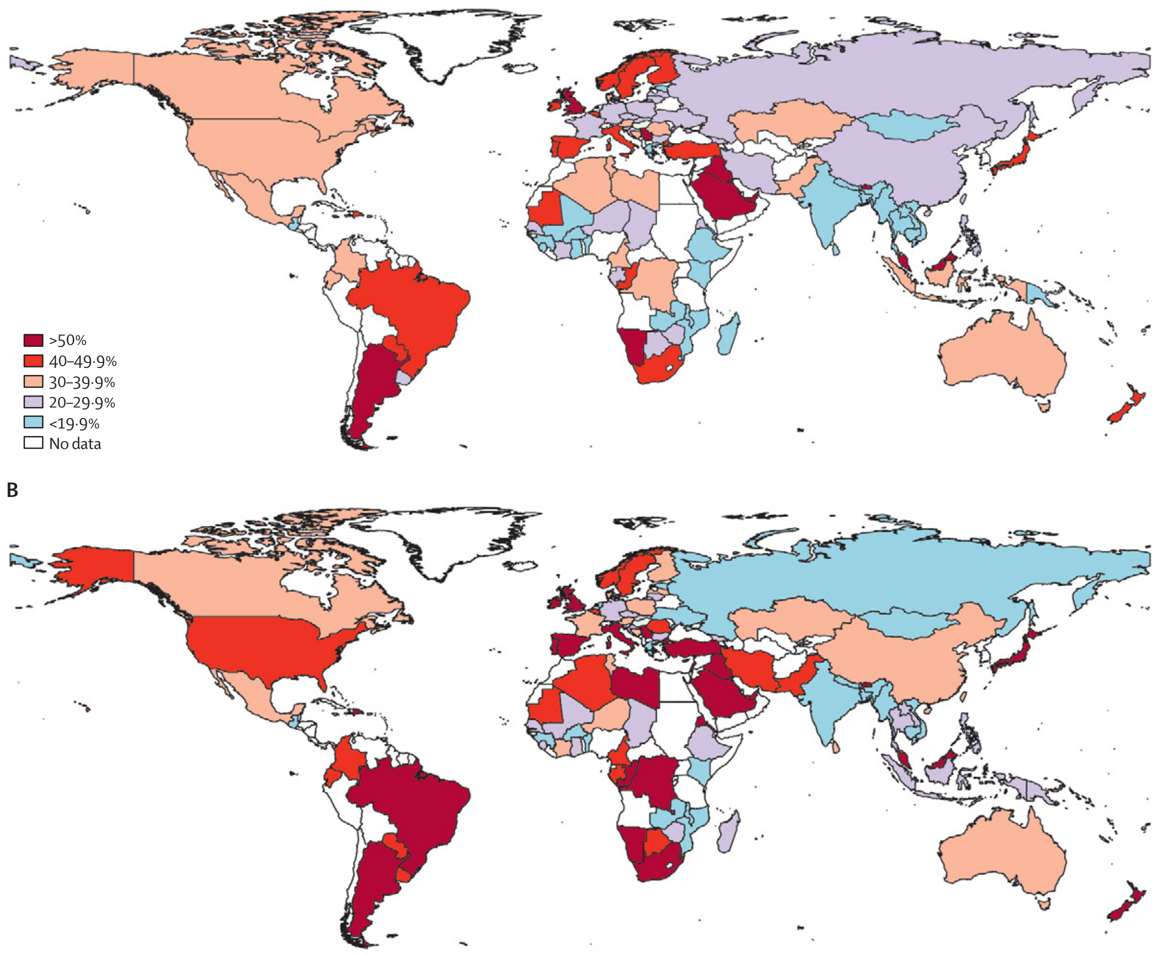

Figure 1: **Physical inactivity in adults (15 years or older) worldwide in men (A) and women (B)**

between age groups (figure 4). This finding is partly explained by the measurement of all types of walking—ie, recreational, for transport, and occupational.

Participation in vigorous-intensity physical activity is another key indicator of physical activity levels. It has well established health benefits,[5] which were recognised in the 2010 WHO global recommendations on physical activity for health.[14] Vigorous-intensity activity has higher reliability and validity than does moderate-intensity activity with standardised self-report instruments.[10] 31·4% (31·2–31·4) of adults report vigorous-intensity physical activity on 3 or more days per week. We noted large differences between regions: 38·0% (37·6–38·4) of individuals in Africa report such activity, 24·6% (24·3–24·9) in the Americas, 43·2% (42·3–44·1) in the eastern Mediterranean, 25·4% (25·0–25·8) in Europe, 43·2% (42·7–43·7) in southeast Asia, and 35·3% (34·8–35·8) in the western Pacific. Within every age group, men are more likely to participate in vigorous-intensity physical activity than are women (figure 4). Participation decreases with age (figure 4).

Self-reported physical activity in adolescents

There are substantial short-term and long-term health benefits of regular physical activity for adolescents (aged 13–15 years; some overlap with adult age group because systems are independent).[25] However, measurement of physical activity in this group is complex.[26] Although some countries monitor activity in specific age groups, repeated measures with time are rare. Worldwide, most progress has been made in the adolescent population. So far, the two most comprehensive sources of data for adolescent physical activity levels are the global school-based student health survey (GSHS)[27] and the health behaviour in school-aged children (HBSC) survey.[28]

With publicly available data from GSHS,[27] we estimated how many 13–15-year-old adolescents in 66 countries of mostly low and middle income reach the public health goal of 60 min per day or more of moderate to vigorous physical activity. We did the same with published HBSC reports and available raw data[29,30] for 38 European countries,

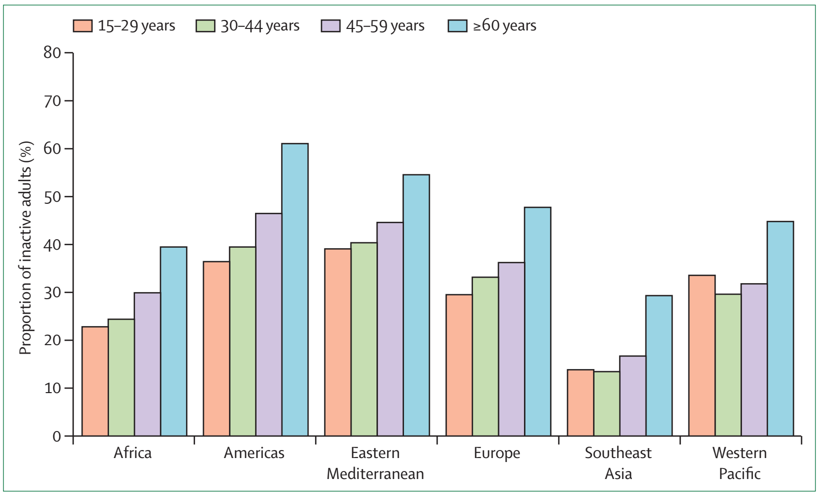

Figure 2: **Physical inactivity in age groups by WHO region**

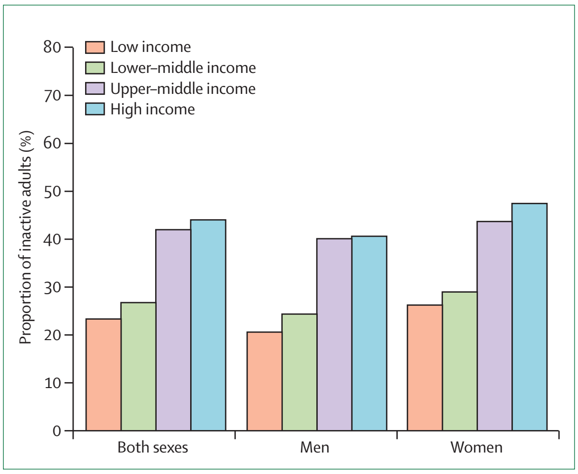

Figure 3: **Physical inactivity by sex and World Bank income groups**

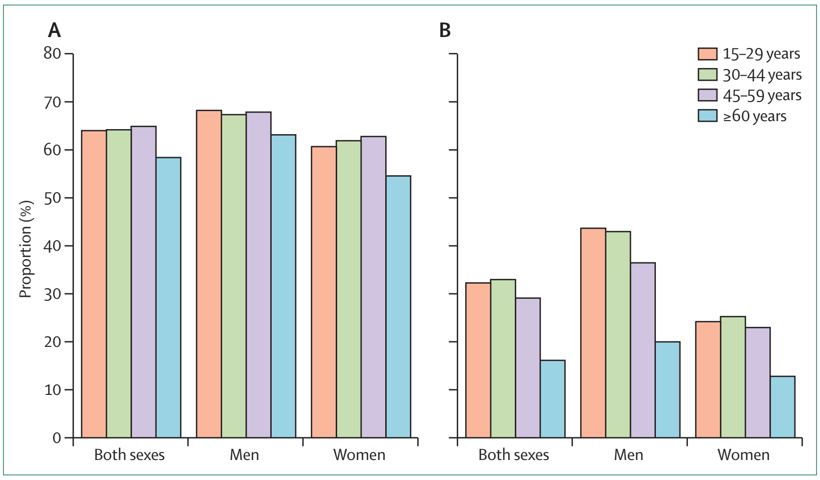

Figure 4: **Proportion of adults (15 years or older) worldwide reporting walking for at least 10 min consecutively on 5 or more days per week (A) and vigorous-intensity physical activity on 3 or more days per week (B) by age group**

the USA, and Canada. By combining information, we were able to obtain estimates for 105 countries (data from Macedonia were available in both data sources, so we used an average).

80·3% (95% CI 80·1–80·5) of 13–15-year-olds do not do 60 min of moderate to vigorous physical activity per day. Girls are less active than are boys (figure 5). Estimates were much higher than were those reported in adults. The proportion of adolescents not achieving 60 min per day was equal to or greater than 80% in 56 (53%) of 105 countries in boys, and 100 (95%) of 105 countries for girls. It is important to stress that the cutoffs for adults and adolescents are different.

Active transportation

Active transportation has health benefits[31,32] and can increase physical activity levels of whole populations.[24,33–35] Many studies have shown that commuter walking and cycling have beneficial effects on all-cause mortality[32,36] and several diseases.[36–42] In children, associations between active commuting to school and reduced body-mass index[43] and improved cardiovascular risk factor profiles[44–47] have been recorded.

Data for active transportation are derived from various sources, such as population studies and transport research. Comparisons of information from different countries are particularly difficult because instruments are not standardised and several indicators (eg, people walking or cycling to work, or percentage of trips with different transport modes) are used. Moreover, some investigators combine walking and cycling, whereas others analyse the two modes separately.

We searched PubMed and the Cochrane databases for systematic reviews[34,39,48,49] and original research published from 2010 onwards,[50–52] and tried to find online national statistics mainly from transport ministries. We identified statistics for the proportion of people walking to work in 12 countries (table).[32,39,50–69] Few individuals (<4%) walk to work in Switzerland, the USA, and Australia, but more than 20% do in China, Germany, and Sweden. We obtained data for adults cycling to work for 12 countries.[32,39,50,51,57,58,62–65,67,69] The frequency was low (<2%) in Australia, Canada, Ireland, Switzerland, the UK, and the USA, and high (>20%) in China, Denmark, and the Netherlands (table). Finally, data for all active transportation to work (walking or cycling) were available for 12 countries.[50,53,56,58–60,62–66,70–74] Overall, fewer than 5% of individuals in Australia, Switzerland, and the USA use active transportation, but many do in China, France, Germany, Sweden, and the Netherlands (table). Data from low-income countries are scarce.

Walking commuters do not travel as far as do cycling commuters and often combine walking with public transport.[75] In Stockholm, mean distances are roughly 2 km for walking and 8 km for cycling.[75] However, cyclists could be limited by unsafe environments and few bike lanes.[75] However, major differences exist even between

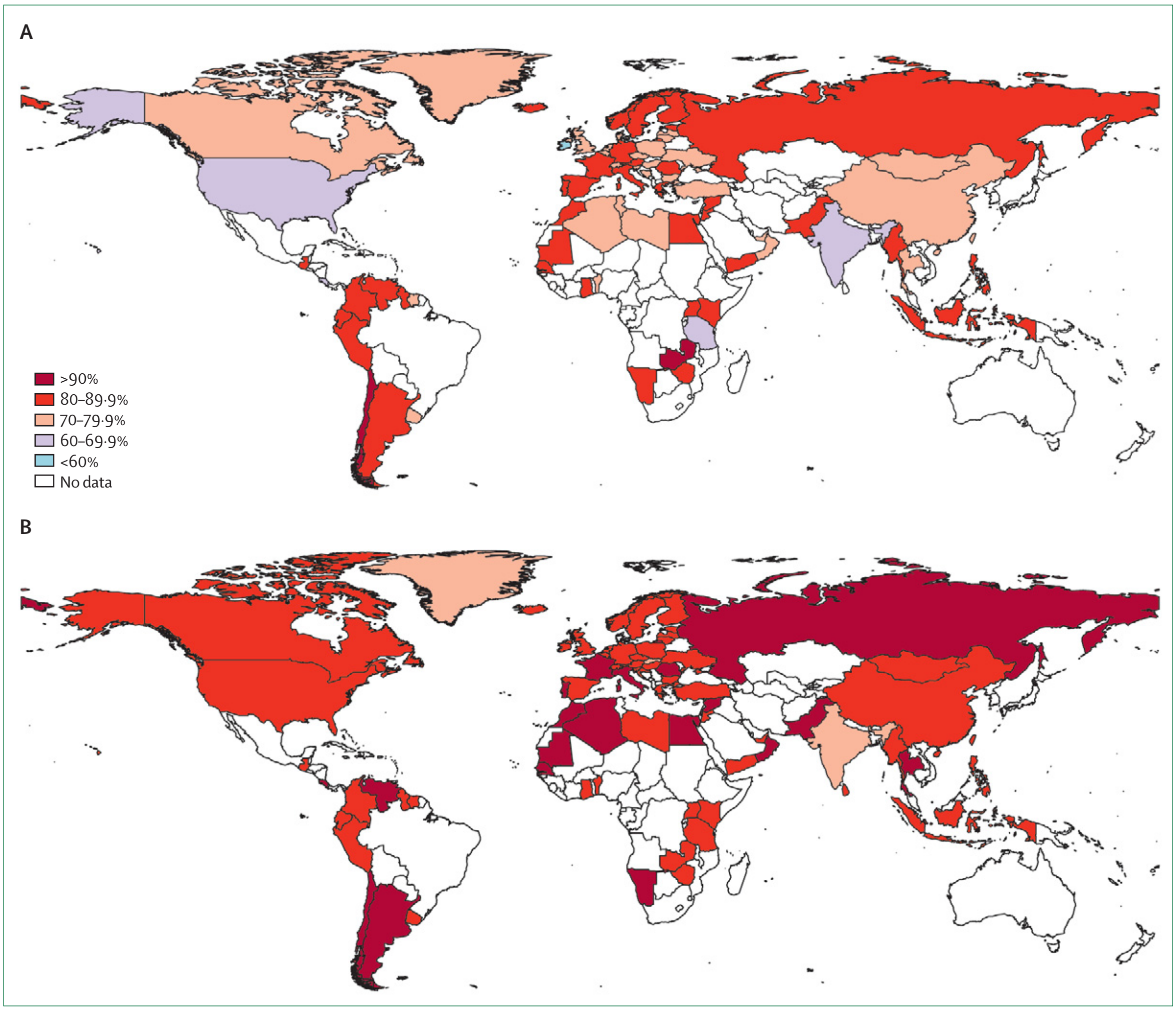

Figure 5: **Proportion of 13–15-year-old boys (A) and girls (B) not achieving 60 min per day of moderate to vigorous physical activity**

countries with similar geography, population density, and climate—eg, fewer people in the UK cycle to work than in Denmark and the region of Holland (table)—suggesting that other factors play a part. In Denmark, building of infrastructure to promote cycling has resulted in a 50% increase in cycling in the past two decades.[76]

Although active transportation is beneficial for health and the environment, its promotion should take into account unintended effects. In several places, pedestrian and cyclist safety are serious concerns, even though the benefits from cycling outweigh the risks. If all non-cyclists in Denmark became cyclists, about 12 000 deaths linked to little physical activity would be prevented every year as a result of cycling activity; there, only 30 cyclists are killed in traffic accidents annually.[32] However, the situation is probably different in many large cities in countries of all incomes. The global challenge is to help to improve pedestrian and cyclist safety, and city environments, so that active transportation becomes not only a healthy alternative, but also a safe one.

Objectively measured physical activity

New technologies applied to the measurement of body movement have emerged as an alternative method for assessment of physical activity. Instruments such as accelerometers provide new ways to estimate the frequency, duration, and intensity of physical activity in free-living individuals.[77] Importantly, these methods avoid some of the inherent limitations of self-report instruments—ie, recall bias. Accelerometry is widely used in small-scale research studies, and in the past 10 years its application has been tested within population-based surveillance systems in several developed countries (panel 1).

To assess accelerometry data for moderate to vigorous physical activity in adults, we searched Medline and Web of Science for reports in which physical activity was measured with the Actigraph accelerometer. We included population-based studies of healthy adult participants older than 18 years, in which activity was measured for at least 4 days and for at least 600 min per day. All reports

	Walk to work	Cycle to work	Walk or cycle to work
Australia[53,54]	3·8%	0·9–1·7%*	4·7%
Austria[55]	5·0–6·6%*	··	··
Brazil[56]	··	··	11·9%
Canada[50,51,57]	6·6%	1·0–1·2%*	··
China[58]	22·6%	23·5%	46·1%
Denmark[32]	··	25·0%	··
Finland[59]	··	··	19·5%
France[60]	··	··	34·9%
Germany[52,61]	23·0%	9·0%	32·0%
Ireland[62]	10·9%	1·9%	12·8%
New Zealand[63]	7·0%	2·5%	··
Switzerland[64]	2·2%	0·3%	2·5%
Sweden[65]	23·5%	9·5%	22·2–33·0%*
Netherlands[66,67]	12·1%	21·0–25·8%*	37·9%
UK[68]	12·5%	2·0%	14·5%
USA[39,50,51,69]	3·1–4·0%*	0·5–3·4%*	4·0–16·7%*

*Interval reported in several studies or data obtained from several regions or states.

***Table:* Proportion of adults reporting walking to work, cycling to work, or using any type of active transportation (walking or cycling) by country**

used the same definition of moderate to vigorous physical activity of 2020 activity counts per min or more. Two studies[82,83] were included in separate and combined reports,[82–84] and subsequently only results from the combined report[84] were included. Data from four countries (Norway, Portugal, Sweden, and the USA)[84–86] for 9564 individuals were extracted.

For young people, we used data from the international children's accelerometer database,[87] which includes more than 30 000 individuals aged 4–18 years from 21 studies in ten countries. All raw accelerometer data files were reanalysed with the same data cleaning and data reduction criteria as for adults. To enable comparison with data for adults, moderate to vigorous physical activity was defined as more than 2000 counts per min, adjusted for sex and age.

For adults, the mean accumulated minutes of moderate to vigorous physical activity is roughly 35·5 min per day (95% CI 34·0–37·0) in men and 32·0 min per day (23·5–40·4) in women. Mean time spent doing moderate to vigorous physical activity is similar in men from different countries, ranging between 33·0 min per day in the USA to 37·5 min per day in Portugal. Variation is increased in women, ranging from 19·0 min per day in the USA to 44·6 min per day in Portugal. In young people, the highest amounts of such activity are done in Norway, Switzerland, Estonia, and Australia; values from Belgium, Brazil, and the USA were substantially lower than the pooled adjusted mean of roughly 65 min per day. Highly significant heterogeneity between countries was recorded (appendix).

Caution is warranted in comparisons of accelerometry data and self-report. Most time in moderate to vigorous physical activity recorded by accelerometry is accumulated in periods shorter than 10 min,[88] whereas self-report instruments usually prompt the respondent to report activities lasting at least 10 min.[10] Additionally, most accelerometer data presented here are derived from high-income countries, in which people are less active than are those from low-income and middle-income countries (figure 3).

Sedentary behaviour

Another aspect of the human movement range that has received attention is sedentary behaviour, which is usually defined as time spent sitting. Similarly to physical activity, sedentary behaviours occur in different domains (ie, at work, for leisure and entertainment, and while commuting).[89] So far, little is known about the patterns of sedentary behaviour in different countries,[90] mainly because it has been recognised as a public health issue only in the past 10 years and therefore few standardised instruments are available for its assessment.[91] However, with available data from the WHO STEPwise approach to chronic disease risk factor surveillance (STEPS) surveys and the Eurobarometer, we could assess and compare time spent sitting in 66 countries both of high and low income.

Overall, the proportion of adults spending 4 or more h per day sitting is 41·5% (41·3–41·7). The value varied greatly in WHO regions: 37·8% (37·4–38·2) of individuals sit for 4 or more h per day in Africa, 55·2% (54·3–56·1) in the Americas, 41·4% (40·1–42·7) in the eastern Mediterranean, 64·1% (63·5–64·7) in Europe, 23·8% (23·1–24·5) in southeast Asia, and 39·8% (39·3–40·3) in the western Pacific. For adults aged 15–59 years, the proportion spending 4 h or more per day sitting does not vary substantially, and both sexes are similar; for individuals aged 60 years or more, the frequency is increased (figure 6).

Bauman and colleagues[90] presented time spent sitting in 20 countries. They reported a median of 300 min per day (IQR 180–480), wide variation between countries, and longer times in middle-aged adults (40–65 years-old) than in young adults (18–39 years-old)[92]—a finding that was not replicated in our analysis of 66 countries.

With HBSC data from 40 countries in Europe and North America, we estimated that 66% of boys and 68% of girls aged 13–15 years spend 2 h or more per day watching television. In every country studied—with the exception of Switzerland—more than half of the boys and girls spent 2 h or more per day watching television. Guthold and colleagues[93] used data for 34 countries from GSHS and reported that, in more than half of the countries, more than a third of students spend 3 h or more per day doing sedentary activities.

Trends in physical activity

Several behavioural and environmental factors, and megatrends (major forces in societal development that affect people's lives) affect population levels of physical activity.[94] Rapid urbanisation, mechanisation, and increased use of motorised transport could have caused global changes in physical activity.[95,96] Examples of national surveillance systems that aim to assess trends in physical activity are scarce, most are fairly recent, and most are in high-income countries.

A systematic review[21] showed that adults' leisure-time physical activity, including sports participation, has increased in the past 20–30 years in five high-income countries. This finding seemed to be consistent and was supported by subsequent studies from Canada,[97] Spain,[98] Sweden,[99] and England.[100] Researchers have also reported a simultaneous reduction in occupational physical activity.[21,98,100] A comprehensive analysis[101] of US data showed that daily energy expenditure in work-related physical activity has fallen by more than 100 calories per day during the past 50 years. Data for time trends in physical activity from countries of low and middle income are extremely sparse and, when available, inconsistent.[20,102,103]

The magnitude and direction of changes in physical activity with time in young people are less clear than in adults. A systematic review[21] of studies from five high-income countries established that physical activity during physical education classes has decreased since the early 1990s. Additionally, use of active transportation has fallen in the USA,[104] Switzerland,[105] and Canada[106] in the past 40 years. A review focusing on different domains of activity[107] showed that available evidence does not support the notion that overall physical activity levels and sport participation have fallen in young people. As with adults, the paucity of data for changes in physical activity with time from countries of low and middle income is worrying.

Very few studies from a small number of high-income countries have examined time trends in physical activity by objective methods. In Japan, the proportion of adults achieving 10 000 steps per day fell by 5% from 2000 to 2007.[108] Reductions in physical activity have been recorded in Czech boys aged 14–18 years between 1998 and 2000, and between 2008 and 2010,[109] and in Canadian boys and girls aged 8–16 years from 2001 to 2006.[110] Conversely, a study in Sweden[111] showed that the number of accumulated steps per day increased between 2000 and 2006 in boys and girls aged 7–9 years.

Surveillance progress and gaps

Much progress has been made in the availability of national population-level data for physical activity in the past decade, particularly in adults. About two-thirds of all WHO Member States have at least some data for population levels of physical activity, which is a great surveillance achievement. Collectively, data now available for adult and adolescent populations provide a global picture of the pattern of participation and exposure to the risk of inactivity, and form the basis for national policy development as called for by the global strategy for diet, physical activity, and health[112] and for guidance of practice at the national and local community levels.

Panel 1: Physical activity surveillance in the USA

Physical activity surveillance in the USA has included national and state-based surveys. The national health and nutrition examination survey (NHANES)[78] is a population-based survey providing information about health and nutrition. Health examination surveys were done throughout the 1960s and were followed by NHANES from 1971 onwards. NHANES has two parts: home interviews and health examinations. Physical activity questions were introduced in 1999, allowing analyses of secular trends in the proportion of physical inactivity and its correlates. NHANES provides data for adults (leisure-time, transportation, and household activities) and children (leisure-time activities). In 2003, accelerometry data were obtained in addition to self-report.

Other surveys began in the 1980s to monitor the prevalence of the major behavioural risks associated with premature morbidity and mortality. Data collection was systematised as the behavioural risk factor surveillance system (BRFSS) in 1984.[79,80] Data are obtained monthly in all 50 states, the District of Columbia, Puerto Rico, the US Virgin Islands, and Guam. More than 350 000 people are interviewed every year, making BRFSS the largest telephone health survey in the world. Data from BRFSS have been widely used for research. Between 1984 and 2000, physical activity questions focused on only leisure-time activities. However, domestic and transport-related physical activity were added to the survey from 2001. Although occupational activities are included in the questionnaire, they are not part of the total physical activity score. In the 2011 version of BRFSS, eight core physical activity questions were incorporated. 15 000 young people in grades 9–12 (usually aged 15–18 years) are assessed every year in a separate part of the surveillance system (youth risk behaviour factor surveillance).[81] Leisure-time, transport-related, and domestic physical activity are assessed, as well as participation in physical education classes.

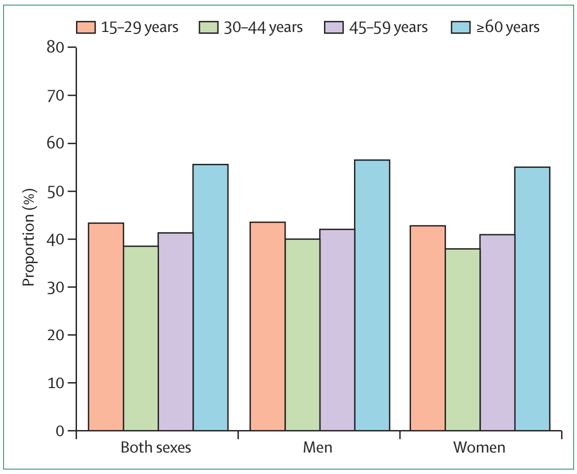

Figure 6: **Proportion of individuals reporting 4 h or more of sitting per day by age category**

However, notable gaps remain. One is the absence of continuous surveillance systems implemented at the national level, preventing most countries from analysing trends data. Well established surveillance systems for physical activity are a luxury available in only very few countries, most of which are highly developed (panel 1). Additionally, the distribution of countries with no data is not random. Data gaps are concentrated in Africa, and the poorest parts of Latin America and central Asia. A good example of how physical activity surveillance can be

Panel 2: The WHO STEPwise approach to chronic disease risk factor surveillance

The WHO STEPwise approach to chronic disease risk factor surveillance (STEPS) was initiated in 2000, to assist countries of low and middle income to obtain information about risk factors for major non-communicable diseases. The overall goal is to build and strengthen country capacity to undertake surveillance within an integrated, systematic, sustainable framework.[113] With the same standardised questions and protocols, all countries can use STEPS information not only for monitoring within-country trends, but also for making comparisons between countries. The global physical activity questionnaire was developed for STEPS. This instrument measures physical activity at work and in the household, for transport, and for leisure separately.[11] The use of show cards and culturally specific examples for each activity type contained in the questionnaire ensures complete understanding of the questions and cultural adaptation.

In 2000, physical activity data were available for only two countries in the WHO African region.[4] 2 years later, professionals working in Ministries of Health, and other health professionals and statisticians in ten of the 46 African countries had received training about implementation of the STEPS approach; this number had increased to 35 by early 2006. By then, the remaining 11 countries had already successfully undertaken a STEPS survey. Since 2006, all African countries have received STEPS training, and physical activity data are now available for the 35 countries that have completed surveys, including five countries that have done two surveys. 26 countries have published the results in country reports or journal articles, or both.[114] In ten countries that have completed a STEPS survey, eSTEPS—ie, hand-held computers to input data introduced in 2009—has been implemented.

initiated and sustained in countries of low and middle income is the WHO STEPwise approach (panel 2).

Translation of knowledge into action

Our findings are troubling. Roughly three of every ten individuals aged 15 years or older—about 1·5 billion people—do not reach present physical activity recommendations.[5,14] The situation in adolescents is even more worrying, with a worldwide estimate that four of every five adolescents aged 13–15 years do not meet present guidelines. As summarised by Lee and colleagues,[115] these individuals are at increased risk of coronary heart disease, diabetes, some types of cancer, several other diseases, and premature death.

Some methodological issues with available surveillance data should be raised. Our estimates were corrected for the well known over-reporting of physical activity with IPAQ (appendix),[116–119] and we adjusted values for age and region (urban *vs* rural), which are two factors known to affect physical activity behaviours. With these strategies, the well known limitations of self-reporting in adult populations were minimised. However, self-reports are unreliable, especially for housework and occupational physical activity, and in countries of low and middle income,[120] where transport, occupational, and housework activities are often mixed in daily life.

Additionally, perceptions about the meaning of physical activity might vary between countries, sexes, and age groups, particularly because people tend to compare themselves with peers when replying to physical activity questions.[99] Fortunately, ways to overcome this issue have been proposed and implemented, such as the use of show cards and culturally relevant examples (panel 2). Another difficulty is that not all samples are representative of a whole country's population. These limitations of available self-reported data could partly explain the large differences in prevalence of physical inactivity between countries. Finally, the limitations of data presently available for sedentary behaviour should be acknowledged, because surveillance information is typically restricted to single items instead of standardised and validated instruments.[121] Furthermore, available information about active transportation comes from different sources and few countries.

As public health efforts to increase physical activity and decrease sedentary time proceed, standardised physical activity surveillance procedures need to be implemented broadly and repeatedly. These measures are necessary to understand which intervention strategies work for which populations, and to identify target populations at greatest risk. Two validated questionnaires have been successfully implemented across countries and cultures, but many existing systems would have to be expanded to assess specific domains of physical activity, especially active transportation and sedentary behaviours. Existing surveillance systems would have to be expanded to include these specific aspects. Advances in new technologies and measurement methods, especially accelerometry, show promise for future surveillance of physical activity. These devices could have widespread practical application if equipment costs continue to fall and sufficient efforts are directed towards increasing technical skills and workforce capacity in countries of low and middle income.

Alteration of population levels of physical activity through improved use of existing surveillance data is a major challenge for the 21st century, because societal trends are leading to less not more activity than previously. The traditional public health approach based on evidence and exhortation has—to some extent—been unsuccessful so far. With few exceptions, health professionals have been unable to mobilise governments and populations to take physical inactivity sufficiently seriously as a public health issue. Our results show clear progress in surveillance, partly because the growing burden of non-communicable diseases has prompted governments and international agencies to monitor physical activity worldwide. These achievements were only made possible because thousands of individuals from various parts of the world kindly provided information about their behaviour. In return, governments, policy makers, and the research community should help to build societies in which the choice of being physically active is not only healthy, but also convenient, enjoyable, safe, affordable, and valued.

Contributors

All authors wrote sections of this report, provided feedback on drafts, and approved the final version.

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Conflicts of interest

We declare that we have no conflicts of interest.

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