Physical inactivity and sedentary behaviour among schoolchildren: A 24-country comparison

Regina Guthold, MPH\textsuperscript{a}, *, Melanie J Cowan, MPH\textsuperscript{a}, Christine S Autenrieth, MSc\textsuperscript{b}, Laura Kann, PhD\textsuperscript{c}, Leanne M Riley, MSc\textsuperscript{a}

\textsuperscript{a} Department of Chronic Diseases and Health Promotion, World Health Organization, Geneva, Switzerland
\textsuperscript{b} Institute of Epidemiology, Helmholtz Center Munich, German Research Center for Environmental Health, Neuherberg, Germany
\textsuperscript{c} Division of Adolescent and School Health, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

*Corresponding author. Regina Guthold, 20, Avenue Appia, 1211 Geneva, Switzerland, Tel. +41(0)22-791-1051, E-mail address: gutholdr@who.int.

Word count

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Abstract</td>
<td>255</td>
</tr>
<tr>
<td>Main text</td>
<td>3,124</td>
</tr>
</tbody>
</table>
Keywords

Adolescent, Adolescent Behavior, Exercise, Health Behavior, Health Surveys, Internationality, Motor Activity, Risk Factors, Schools, Students

Abbreviations

CDC - United States Centers for Disease Control and Prevention

CI - confidence interval

GSHS - Global School-based Student Health Survey

HBSC - Health Behaviour in school-aged children

NHANES - National Health And Nutrition Examination Survey

WHO - World Health Organization

AFR - WHO African Region

AMR - WHO Region of the Americas

EMR - WHO Eastern Mediterranean Region

WPR - WHO Western Pacific Region
Physical inactivity and sedentary behaviour among schoolchildren: A 24-country comparison

Abstract

Background
Physical inactivity and sedentary behaviour are known to be important risk factors for chronic diseases, but articles comparing prevalence in young people across countries are, especially for low and middle income countries, lacking.

Objective
To describe and compare levels of physical inactivity and sedentary behaviour in schoolchildren from 24 countries across four WHO Regions.

Methods
The analysis included 96,072 schoolchildren from 24 countries that participated in the Global School-based Student Health Survey (GSHS) and conducted data collection between January 2003 and May 2007. The physical activity module of the questionnaire included questions on overall physical activity, walking or biking to and from school and on time spent doing sitting activities.
Results

Alarmingly few students engaged in sufficient physical activity. In all countries, less than 2/3\textsuperscript{rd} of the schoolchildren met public health recommendations, with the highest prevalence of inactivity in Egypt (90.8%, 95% CI: 86.8-94.8%) and the lowest in China (70.9%, 95% CI 67.8-73.9%). The prevalence of not walking or riding a bicycle to school ranged from 16.6% (95% CI: 10.2-22.9%) in China to 81.8% (95% CI: 79.5-84.2) in Cayman Islands. In more than half of the countries, over 1/3\textsuperscript{rd} of the students spent three or more hours per day on sedentary activities, excluding the hours spent sitting at school and doing homework.

Conclusion

In all analysed countries, prevalence of physical inactivity was very high. The great majority of students did not meet public health recommendations. These findings require immediate action, and efforts should be made worldwide to increase levels of physical activity among schoolchildren.
**Introduction**

The health benefits of a physically active lifestyle are well known. They include a lower risk of obesity, coronary heart disease and stroke, type II diabetes as well as colon and breast cancer. Globally, over 1.9 million deaths per year could be prevented if everybody was sufficiently physically active.\(^1\)\(^-\)\(^4\)

These findings are, potentially due to methodological issues, more evident for adulthood physical activity than for physical activity at a younger age. However, it has been shown that physical activity during childhood and adolescence reduces the risk of childhood as well as adulthood obesity,\(^5\)\(^-\)\(^8\) has a positive effect on blood pressure\(^9\) and is associated with emotional well-being.\(^10\)\(^,\)\(^11\) Overall, health benefits from physical activity at a young age are likely to be similar to those from adulthood physical activity.\(^12\)\(^,\)\(^13\) Furthermore, individuals active during childhood have a greater likelihood of being active as adults, and are thus more likely to continue receiving the health benefits of physical activity throughout their adult years.\(^14\)\(^-\)\(^18\)

Given these findings, the opportunity to prevent deaths and morbidity and to reverse the rising trend of chronic diseases in developed and developing nations\(^4\)\(^,\)\(^19\) through increasing physical activity levels at a young age should not be missed.

Along with an increase of physical activity levels, sedentary behaviour should be decreased. Many studies report that sedentary behaviour increases the risk of obesity, not only through the replacement of physical activity, but also independently, for example through an increase of fat intake during sedentary activities.\(^8\)\(^,\)\(^20\)\(^-\)\(^23\) Special attention has been paid to the risks associated with large amounts of television viewing, which,
findings suggest, not only increases the risk of obesity, but also of poor fitness, smoking and raised cholesterol.\textsuperscript{24}

Planning of effective interventions to increase physical activity levels and to decrease sedentary behaviour in children requires comparable baseline data that is already available for some European and North American countries, but is lacking for many developing countries.\textsuperscript{12,25}

This paper aims at describing patterns of physical activity and sedentary behaviour among 13-15 year-old schoolchildren from 24 mainly developing countries.

**Methods**

**Study population and design**

The self-administered Global School-based Student Health Survey (GSHS) was developed in 2001 by the WHO in collaboration with UNICEF, UNESCO and UNAIDS, and with technical and financial assistance from the United States Centers for Disease Control and Prevention (CDC).\textsuperscript{26,27} A total of 96,072 schoolchildren from 24 countries that undertook this survey between January 2003 and May 2007 were included in the analysis. While the survey targeted 13-15 year olds, only entire classes were included, and thus some students were slightly younger or older.

**Sampling**

All country samples were drawn using a standardised two-stage sample design, the first stage being the selection of schools and the second stage the selection of classes within
these schools. Schools were selected with probability proportional to size. Classes were randomly selected within each selected school using class lists provided by the school. Within each selected class, every student was asked to participate in the survey. All countries drew nationally representative samples with the exception of Chile (Metropolitan Region), China (Beijing), United Republic of Tanzania (Dar-es-Salaam), Venezuela (Lara) and Zimbabwe (Harare). Cayman Islands did a census of all schoolchildren aged 13 to 15 years.

Data collection
Data collection was conducted during one regular class period. Student privacy was protected through anonymous and voluntary participation, and informed consent was obtained as appropriate from the students, parents and/or school officials.
Countries put together their questionnaires by choosing from a range of modules with standardized questions. All questions provided several answer options, and students were asked to fill in circles for the corresponding answer option. Country questionnaires are available at the GSHS sections of the CDC and the WHO home pages. They were translated into the appropriate languages and pilot tested for comprehension.

Assessment of physical activity and sedentary behaviour
The physical activity module included five questions and was divided into three sections: overall physical activity, sedentary behaviour, and active transportation to and from school.
Overall physical activity

The first two questions on overall physical activity represented the PACE+ Adolescent Physical Activity Measure and have been tested for validity and reliability. They asked about the number of days with physical activity of at least 60 minutes (herein referred to as "active days") during the past seven days and during a typical week. Introductory statements to the questions included country specific examples of the activities and specified that physical education or gym class should not be included. According to the scoring protocol of the PACE+ Adolescent Physical Activity Measure and existing guidelines, physical inactivity was defined as not obtaining at least 60 minutes of physical activity per day on at least five days per week. For analysis, the number of active days "during the past week" and the number of active days "during a typical week" were averaged.

Sedentary behaviour

The question on sedentary behaviour asked about the time spent on a typical day sitting and watching television, playing computer games, or talking with friends, excluding the time spent sitting in school and for homework. A child was considered "sedentary" if he/she spent three or more hours per day in these sitting activities.

Transport-related physical activity

In addition to being included in the overall analysis of physical activity, active transportation to and from school was assessed separately through two questions on days having walked or ridden a bicycle to and from school during the past seven days, and on
time spent on getting to and from school. Children have been classified as those never
riding a bicycle or walking to and from school and those engaging in this activity on one
or more days per week. Both the question on sedentary behaviour and those on transport-
related physical activity were based on the National Health And Nutrition Examination
Survey (NHANES) questionnaire from 1999-2000\textsuperscript{33} and adapted for use in children.

Data processing
All observations with valid information on sex, age and all physical activity variables
were included in the analysis. Data were weighted for non-response and probability of
selection. STATA 9.2 was used for data analysis. The survey commands of this statistical
package take the sampling design into account.

Results

Sample size and complete data
Analytical sample size ranged from 1,114 (Saint Vincent and the Grenadines) to 14,487
(United Arab Emirates). The percentage of complete data (sex, age and all physical
activity variables available) was relatively high across countries, and only for five
countries (Kenya, Senegal, Trinidad and Tobago, Uganda and Zambia), this percentage
was below 70\% (Table 1).
Demographics

The percentage of boys in the final sample ranged from 41.9% (Philippines) to 59.7% (Senegal). Mean age was lowest for the sample from Tanzania (Dar-es-Salaam) (12.8 years) and highest for the samples from Botswana and Uganda (14.9 years) (Table 1).

Table 1. Survey year, coverage, sample sizes and demographics, GSHS, 2003-2007.

<table>
<thead>
<tr>
<th>WHO Region</th>
<th>Country</th>
<th>Survey year</th>
<th>Coverage</th>
<th>Initial sample size</th>
<th>Analytical sample size* (% of initial sample size)</th>
<th>% Boys in final sample</th>
<th>Mean age of final sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFR</td>
<td>Botswana</td>
<td>2005</td>
<td>national</td>
<td>2,313</td>
<td>1,982 (85.7)</td>
<td>47.9</td>
<td>14.9</td>
</tr>
<tr>
<td>AFR</td>
<td>Kenya</td>
<td>2003</td>
<td>national</td>
<td>4,246</td>
<td>2,920 (68.8)</td>
<td>47.7</td>
<td>14.2</td>
</tr>
<tr>
<td>AFR</td>
<td>Namibia</td>
<td>2004</td>
<td>national</td>
<td>7,374</td>
<td>5,291 (71.8)</td>
<td>44.5</td>
<td>14.6</td>
</tr>
<tr>
<td>AFR</td>
<td>Senegal</td>
<td>2005</td>
<td>national</td>
<td>5,245</td>
<td>2,942 (56.1)</td>
<td>59.4</td>
<td>14.0</td>
</tr>
<tr>
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<td>Uganda</td>
<td>2003</td>
<td>national</td>
<td>4,218</td>
<td>2,712 (64.3)</td>
<td>50.8</td>
<td>14.9</td>
</tr>
<tr>
<td>AFR</td>
<td>United Republic of Tanzania (Dar-es-Salaam)</td>
<td>2006</td>
<td>subnational</td>
<td>2,492</td>
<td>1,994 (80.0)</td>
<td>44.3</td>
<td>12.8</td>
</tr>
<tr>
<td>AFR</td>
<td>Zambia</td>
<td>2004</td>
<td>national</td>
<td>3,021</td>
<td>1,590 (52.6)</td>
<td>53.0</td>
<td>14.4</td>
</tr>
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<td>AFR</td>
<td>Zimbabwe (Harare)</td>
<td>2003</td>
<td>subnational</td>
<td>2,380</td>
<td>1,790 (75.2)</td>
<td>47.6</td>
<td>14.6</td>
</tr>
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<td>AMR</td>
<td>Cayman Islands</td>
<td>2006-07</td>
<td>(census)</td>
<td>1,455</td>
<td>1,117 (76.8)</td>
<td>48.6</td>
<td>13.9</td>
</tr>
<tr>
<td>AMR</td>
<td>Chile (Metropolitan)</td>
<td>2004</td>
<td>subnational</td>
<td>2,492</td>
<td>2,027 (81.3)</td>
<td>50.8</td>
<td>13.8</td>
</tr>
<tr>
<td>AMR</td>
<td>Guyana</td>
<td>2004</td>
<td>national</td>
<td>1,516</td>
<td>1,121 (73.9)</td>
<td>48.4</td>
<td>14.3</td>
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<tr>
<td>AMR</td>
<td>Saint Lucia</td>
<td>2007</td>
<td>national</td>
<td>1,556</td>
<td>1,165 (74.9)</td>
<td>45.2</td>
<td>14.0</td>
</tr>
<tr>
<td>AMR</td>
<td>Saint Vincent and the Grenadines</td>
<td>2007</td>
<td>national</td>
<td>1,583</td>
<td>1,114 (70.4)</td>
<td>45.2</td>
<td>13.7</td>
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<td>AMR</td>
<td>Trinidad and Tobago</td>
<td>2007</td>
<td>national</td>
<td>3,786</td>
<td>2604 (68.8)</td>
<td>48.9</td>
<td>14.2</td>
</tr>
<tr>
<td>AMR</td>
<td>Uruguay</td>
<td>2006</td>
<td>national</td>
<td>4,560</td>
<td>3,263 (71.6)</td>
<td>45.0</td>
<td>14.2</td>
</tr>
<tr>
<td>AMR</td>
<td>Venezuela (Lara)</td>
<td>2003</td>
<td>subnational</td>
<td>2,421</td>
<td>2,018 (83.4)</td>
<td>47.4</td>
<td>13.2</td>
</tr>
<tr>
<td>AMR</td>
<td>Egypt</td>
<td>2006</td>
<td>national</td>
<td>6,023</td>
<td>4,864 (80.8)</td>
<td>51.6</td>
<td>13.2</td>
</tr>
<tr>
<td>AMR</td>
<td>Jordan</td>
<td>2004</td>
<td>national</td>
<td>2,589</td>
<td>2,285 (88.3)</td>
<td>50.5</td>
<td>14.8</td>
</tr>
<tr>
<td>AMR</td>
<td>Libyan Arab Province</td>
<td>2003</td>
<td>national</td>
<td>2,322</td>
<td>1,999 (87.2)</td>
<td>49.3</td>
<td>13.8</td>
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<td>EMR</td>
<td>Jamahiriya</td>
<td>2007</td>
<td>national</td>
<td>3,175</td>
<td>2,385 (75.1)</td>
<td>54.3</td>
<td>14.4</td>
</tr>
<tr>
<td>EMR</td>
<td>Morocco</td>
<td>2006</td>
<td>national</td>
<td>3,072</td>
<td>2,782 (90.6)</td>
<td>52.6</td>
<td>14.3</td>
</tr>
<tr>
<td>EMR</td>
<td>Oman</td>
<td>2005</td>
<td>national</td>
<td>17,263</td>
<td>14,487 (83.9)</td>
<td>49.2</td>
<td>14.0</td>
</tr>
<tr>
<td>EMR</td>
<td>Emirates</td>
<td>2005</td>
<td>national</td>
<td>2,382</td>
<td>2,257 (94.8)</td>
<td>50.3</td>
<td>13.8</td>
</tr>
<tr>
<td>WPR</td>
<td>China (Beijing)</td>
<td>2003</td>
<td>subnational</td>
<td>8,618</td>
<td>6,507 (75.5)</td>
<td>41.9</td>
<td>14.7</td>
</tr>
<tr>
<td>WPR</td>
<td>Philippines</td>
<td>2003</td>
<td>national</td>
<td>96,072</td>
<td>73,216 (76.2)</td>
<td>46.9</td>
<td>14.1</td>
</tr>
</tbody>
</table>

*analytical sample size: respondents with complete data on age, sex, and all physical activity variables
Physical inactivity

Across all countries, most schoolchildren did not engage in a sufficient amount of physical activity. Prevalence of inactivity was lowest in Uruguay (59.1%) and China (75.0%) and highest in Zambia (91.0%) and Egypt (95.9%) for boys and girls, respectively. For more than half of the countries, prevalence was higher than 80% for boys. This was true for all but two countries (China and United Republic of Tanzania) for girls. In all countries, with the exception of Zambia, girls were less active than boys. The difference between the two sexes was more than ten percent in two countries of the Eastern Mediterranean Region, Oman and Libyan Arab Jamahiriya, and in four countries of the Region of the Americas, Uruguay, Trinidad and Tobago, Chile and Cayman Islands. Overall, the variation of the levels of physical activity within the WHO Regions was similar, and percentages of schoolchildren not engaging in a sufficient amount of physical activity were very high (Figure 1).
Figure 1. Percentage of boys and girls who did not engage in a sufficient amount of physical activity (not obtaining at least 60 minutes per day on at least 5 days per week), by WHO region, sorted by percentage for boys, GSHS, 2003-2007.

The median of the days on which the students were active for at least 60 minutes along with the 25\textsuperscript{th} and 75\textsuperscript{th} percentile are shown in Table 2. For boys, the median ranged from 1.0 (Namibia, Zambia, Guyana and Philippines) to 4.0 days (Uruguay) and for girls from 0.5 (Saint Vincent and the Grenadines) to 2.0 days (United Republic of Tanzania, Cayman Islands, Uruguay, United Arab Emirates and China), indicating that in nine countries, more than half of the boys were active for at least 60 minutes on less than two days per week. This was true in 19 countries for girls. In seven countries, 25\% of the boys were not active for at least 60 minutes on all days (Botswana, Namibia, Zimbabwe, 
Guyana, Saint Lucia, Saint Vincent and the Grenadines, Philippines), which was the case for 14, or more than half of the countries, for girls. The percentage of boys and girls who did not walk or ride a bike to and from school during the past seven days ranged from 17.6 (China) to 77.9 (Cayman Islands) for boys and from 15.5 (China) to 89.4% (United Arab Emirates) for girls (Table 2). China showed a markedly low prevalence for both boys and girls. In ten countries across all regions, more than 50% of the boys were not active for transport to and from school, while this was the case in twelve countries for girls. Within each of the WHO Regions, percentages varied a lot across countries in the African Region. Prevalence of no transport activity in the United Republic of Tanzania was high compared to the other countries. All the island countries in the Region of the Americas showed a high prevalence. In the Eastern Mediterranean Region, many schoolchildren from Oman (63.3%; 95%CI: 59.4-67.1%) and in particular from the United Arab Emirates (81.6%; 95%CI: 78.9-84.3%) were not active for transport. Only in these two countries, the difference between boys and girls was greater than 10%, and for most of the other countries, prevalence was only slightly higher for girls as compared to boys.
Table 2. Median (P25-P75) days per week on which boys and girls engaged in physical activity for at least 60 minutes, and percentage of boys and girls who did not walk or ride a bike to and from school, GSHS, 2003-2007.

<table>
<thead>
<tr>
<th>WHO Region</th>
<th>Country</th>
<th>Median active days per week, boys (P25-P75)</th>
<th>Median active days per week, girls (P25-P75)</th>
<th>% transport inactive, boys (95% CI)</th>
<th>% transport inactive, girls (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFR</td>
<td>Botswana</td>
<td>1.5 (0.0-3.5)</td>
<td>1.0 (0.0-3.5)</td>
<td>47.3 (43.6-51.0)</td>
<td>53.8 (51.2-56.4)</td>
</tr>
<tr>
<td>AFR</td>
<td>Kenya</td>
<td>2.0 (1.0-4.0)</td>
<td>1.5 (0.5-3.5)</td>
<td>43.2 (37.8-48.6)</td>
<td>47.4 (42.6-52.3)</td>
</tr>
<tr>
<td>AFR</td>
<td>Namibia</td>
<td>1.0 (0.0-3.0)</td>
<td>1.0 (0.0-3.0)</td>
<td>44.6 (41.2-48.1)</td>
<td>49.0 (45.1-53.0)</td>
</tr>
<tr>
<td>AFR</td>
<td>Senegal</td>
<td>2.0 (0.5-4.0)</td>
<td>1.0 (0.0-2.5)</td>
<td>38.0 (32.6-43.4)</td>
<td>41.0 (33.9-48.1)</td>
</tr>
<tr>
<td>AFR</td>
<td>Uganda</td>
<td>2.0 (1.0-4.0)</td>
<td>1.5 (0.5-3.5)</td>
<td>42.2 (34.4-50.0)</td>
<td>51.3 (44.0-58.6)</td>
</tr>
<tr>
<td>AFR</td>
<td>United Republic of Tanzania (Dar-es-Salaam)</td>
<td>2.0 (0.5-5.5)</td>
<td>2.0 (0.5-4.0)</td>
<td>62.2 (57.2-67.3)</td>
<td>68.6 (65.4-72.2)</td>
</tr>
<tr>
<td>AFR</td>
<td>Zambia</td>
<td>1.0 (0.5-2.5)</td>
<td>1.0 (0.5-3.0)</td>
<td>38.2 (33.1-43.3)</td>
<td>35.5 (30.9-40.0)</td>
</tr>
<tr>
<td>AFR</td>
<td>Zimbabwe (Harare)</td>
<td>1.5 (0.0-3.5)</td>
<td>1.0 (0.0-3.5)</td>
<td>36.0 (32.3-39.6)</td>
<td>44.8 (40.4-49.2)</td>
</tr>
<tr>
<td>AMR</td>
<td>Cayman Islands Chile</td>
<td>3.0 (1.0-5.0)</td>
<td>2.0 (1.0-4.0)</td>
<td>77.9 (74.1-81.6)</td>
<td>85.6 (82.8-88.4)</td>
</tr>
<tr>
<td>AMR</td>
<td>Saint Lucia</td>
<td>2.0 (0.0-4.5)</td>
<td>1.5 (0.0-4.0)</td>
<td>71.6 (66.8-76.4)</td>
<td>78.9 (75.0-82.8)</td>
</tr>
<tr>
<td>AMR</td>
<td>Saint Vincent and the Grenadines</td>
<td>1.5 (0.0-3.5)</td>
<td>0.5 (0.0-2.5)</td>
<td>63.2 (57.9-68.4)</td>
<td>67.4 (62.8-72.0)</td>
</tr>
<tr>
<td>AMR</td>
<td>Trinidad and Tobago</td>
<td>3.0 (1.0-6.0)</td>
<td>1.5 (0.0-4.0)</td>
<td>74.4 (68.8-80.1)</td>
<td>78.3 (73.7-82.9)</td>
</tr>
<tr>
<td>AMR</td>
<td>Uruguay</td>
<td>4.0 (2.0-6.0)</td>
<td>2.0 (1.0-3.5)</td>
<td>23.6 (20.5-26.7)</td>
<td>24.6 (21.6-27.7)</td>
</tr>
<tr>
<td>AMR</td>
<td>Venezuela (Lara)</td>
<td>1.5 (0.5-4.0)</td>
<td>1.0 (0.0-3.0)</td>
<td>66.4 (61.9-70.9)</td>
<td>74.4 (69.6-79.2)</td>
</tr>
<tr>
<td>EMR</td>
<td>Egypt</td>
<td>2.0 (1.0-3.0)</td>
<td>1.0 (0.0-2.0)</td>
<td>45.3 (38.2-52.3)</td>
<td>36.7 (26.5-46.9)</td>
</tr>
<tr>
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<td>Jordan</td>
<td>1.5 (0.5-4.0)</td>
<td>1.0 (0.0-3.0)</td>
<td>44.8 (38.2-51.4)</td>
<td>45.8 (40.6-51.0)</td>
</tr>
<tr>
<td>EMR</td>
<td>Libyan Arab Jamahiriya</td>
<td>2.0 (0.5-4.0)</td>
<td>1.0 (0.0-2.0)</td>
<td>37.7 (32.9-42.6)</td>
<td>39.4 (36.2-42.6)</td>
</tr>
<tr>
<td>EMR</td>
<td>Morocco</td>
<td>2.0 (1.0-4.0)</td>
<td>1.5 (1.0-3.0)</td>
<td>42.5 (38.0-47.0)</td>
<td>47.9 (42.9-52.9)</td>
</tr>
<tr>
<td>EMR</td>
<td>Oman</td>
<td>3.0 (1.0-6.5)</td>
<td>1.5 (0.5-3.5)</td>
<td>55.8 (52.0-59.6)</td>
<td>71.6 (67.6-75.5)</td>
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<tr>
<td>EMR</td>
<td>United Arab Emirates</td>
<td>3.0 (1.0-5.0)</td>
<td>2.0 (0.5-4.0)</td>
<td>73.6 (70.4-76.7)</td>
<td>89.4 (87.1-91.6)</td>
</tr>
<tr>
<td>EMR</td>
<td>China (Beijing)</td>
<td>3.0 (1.0-6.0)</td>
<td>2.0 (0.5-5.0)</td>
<td>17.6 (11.6-23.6)</td>
<td>15.5 (7.7-23.3)</td>
</tr>
<tr>
<td>WPR</td>
<td>Philippines</td>
<td>1.0 (0.0-2.5)</td>
<td>1.0 (0.0-2.0)</td>
<td>55.3 (51.3-59.4)</td>
<td>56.4 (52.2-60.7)</td>
</tr>
</tbody>
</table>

Sedentary behaviour

Prevalence of spending three or more hours on a typical day sitting and watching television, playing computer games, talking with friends or doing other sitting activities (excluding the time spent sitting at school and doing homework) ranged from 21.4
(China) to 56.7 (Saint Lucia) and from 21.5 (Senegal) to 61.6% (Cayman Islands) for boys and girls, respectively. Percentages of 50% or higher were found in Cayman Islands and Saint Lucia for both boys and girls and additionally in Chile, Saint Lucia, Trinidad and Tobago and Uruguay for girls. For all countries, prevalence among boys and girls was similar with the one for girls tending to be slightly higher for most countries. The only country with a difference of more than 10% between boys and girls was Chile.

Table 3. Percentage of boys and girls spending three or more hours per day sitting and watching TV, playing computer games, talking with friends or doing other sitting activities, GSHS, 2003-2007.

<table>
<thead>
<tr>
<th>WHO Region</th>
<th>Country</th>
<th>% sedentary, boys (95% CI)</th>
<th>% sedentary, girls (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFR</td>
<td>Botswana</td>
<td>35.6 (32.8-38.3)</td>
<td>33.1 (30.0-36.3)</td>
</tr>
<tr>
<td>AFR</td>
<td>Kenya</td>
<td>40.0 (36.3-43.7)</td>
<td>37.3 (33.0-41.7)</td>
</tr>
<tr>
<td>AFR</td>
<td>Namibia</td>
<td>28.8 (25.0-32.6)</td>
<td>30.9 (29.1-32.8)</td>
</tr>
<tr>
<td>AFR</td>
<td>Senegal</td>
<td>29.1 (25.6-32.7)</td>
<td>21.5 (16.7-26.4)</td>
</tr>
<tr>
<td>AFR</td>
<td>Uganda</td>
<td>26.2 (22.8-29.5)</td>
<td>25.8 (22.2-29.3)</td>
</tr>
<tr>
<td></td>
<td>United Republic of Tanzania (Dar-es-Salaam)</td>
<td>28.9 (26.1-31.7)</td>
<td>29.3 (25.4-33.2)</td>
</tr>
<tr>
<td>AFR</td>
<td>Zambia</td>
<td>30.7 (26.1-35.3)</td>
<td>32.5 (28.8-36.3)</td>
</tr>
<tr>
<td>AFR</td>
<td>Zimbabwe (Harare)</td>
<td>44.7 (40.3-49.2)</td>
<td>44.7 (39.6-49.9)</td>
</tr>
<tr>
<td>AMR</td>
<td>Cayman Islands</td>
<td>53.2 (48.7-57.6)</td>
<td>61.6 (57.7-65.6)</td>
</tr>
<tr>
<td>AMR</td>
<td>Chile (Metropolitan)</td>
<td>38.5 (34.5-42.4)</td>
<td>50.0 (46.8-53.2)</td>
</tr>
<tr>
<td>AMR</td>
<td>Guyana</td>
<td>42.6 (36.4-48.8)</td>
<td>34.2 (30.2-38.2)</td>
</tr>
<tr>
<td>AMR</td>
<td>Saint Lucia</td>
<td>56.7 (51.7-61.8)</td>
<td>52.1 (46.8-57.5)</td>
</tr>
<tr>
<td>AMR</td>
<td>Saint Vincent and the Grenadines</td>
<td>41.1 (36.6-45.8)</td>
<td>37.1 (32.6-41.6)</td>
</tr>
<tr>
<td>AMR</td>
<td>Tobago</td>
<td>44.7 (41.2-48.2)</td>
<td>52.8 (47.8-57.7)</td>
</tr>
<tr>
<td>AMR</td>
<td>Uruguay (Venezuela (Lara))</td>
<td>48.7 (45.5-51.8)</td>
<td>53.0 (49.9-56.2)</td>
</tr>
<tr>
<td>AMR</td>
<td>Egypt</td>
<td>22.3 (17.8-26.8)</td>
<td>24.7 (16.5-33.0)</td>
</tr>
<tr>
<td>EMR</td>
<td>Jordan</td>
<td>44.0 (38.6-49.4)</td>
<td>42.7 (40.1-45.2)</td>
</tr>
<tr>
<td>EMR</td>
<td>Libyan Arab Jamahiriya</td>
<td>30.0 (26.3-33.7)</td>
<td>27.9 (24.7-31.1)</td>
</tr>
<tr>
<td>EMR</td>
<td>Morocco</td>
<td>29.9 (27.1-32.7)</td>
<td>30.3 (25.9-34.8)</td>
</tr>
<tr>
<td>EMR</td>
<td>Oman</td>
<td>33.1 (30.1-36.1)</td>
<td>35.0 (29.0-40.9)</td>
</tr>
<tr>
<td>EMR</td>
<td>United Arab Emirates</td>
<td>38.2 (36.2-40.1)</td>
<td>39.8 (37.5-42.1)</td>
</tr>
<tr>
<td>EMR</td>
<td>China (Beijing)</td>
<td>21.4 (17.5-25.3)</td>
<td>22.4 (19.2-25.5)</td>
</tr>
<tr>
<td>WPR</td>
<td>Philippines</td>
<td>26.5 (21.9-31.1)</td>
<td>31.8 (27.6-36.1)</td>
</tr>
</tbody>
</table>
**Physical inactivity and sedentary behaviour**

To identify the percentage of children who were physically inactive and sedentary, and therefore have a high risk with regards to health outcomes, we classified them into four groups. Table 4 shows that 25.1% of the boys and 29.7% of the girls were inactive as well as sedentary.

**Table 4.** Categorization by activity level and sedentary behaviour, by sex, GSHS 2003-2007.

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th></th>
<th></th>
<th>Girls</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active</td>
<td>Inactive</td>
<td></td>
<td>Active</td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td>Not sedentary</td>
<td>13.3%</td>
<td>52.9%</td>
<td></td>
<td>8.3%</td>
<td>56.2%</td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>8.7%</td>
<td>25.1%</td>
<td></td>
<td>5.9%</td>
<td>29.7%</td>
<td></td>
</tr>
</tbody>
</table>

**Discussion**

We found very high levels of physical inactivity across all 24 countries analysed. Regional differences were not observed, and the variations of physical activity levels across countries within a region were similar for all regions. Within countries, girls were less active than boys, which is consistent with the results from many other studies.\(^{12,25,34-37}\)

The Health Behaviour in school-aged children (HBSC) study, another international survey, has been undertaken in 41 countries across Europe and North America and used the same questions for the assessment of physical activity. The most recent wave has been carried out in 2005/2006. Prevalence of physical inactivity among 13-year olds was 75% for boys and 85% for girls on average for all countries. The values were higher for
15-year olds with 80\% for boys and 88\% for girls.\textsuperscript{37} In our study, 78.1\% of the 13-15-year-old boys and 85.9\% of girls were physically inactive. Comparability between the two studies is however limited due to the fact that in the HBSC, unlike our study, children were not asked to exclude physical education class when reporting physical activity, and a higher cut-off was used to reflect this (engaging in at least 60 minutes of activity every day, as compared to 5 or more days per week in our study). Although in general, prevalence estimates can vary dramatically when using different guidelines,\textsuperscript{35} cut-offs used in the HBSC and our study were still similar enough to conclude that the overall difference in physical activity levels between a sample of schoolchildren from mainly high income countries (HBSC) and one from mainly low and middle income countries (our study) is very small. Lack of physical activity among young people has become a major public health problem in most countries around the globe and needs to be addressed urgently. Immediate action should be taken especially in those countries where we found extremely high prevalence of physical inactivity: In Zambia, over 90\% of boys were not sufficiently active, and in Philippines, Egypt, Venezuela and Senegal this was true for girls.

An effective strategy to augment physical activity levels among children that has already been implemented in several countries is to increase active transportation to and from school.\textsuperscript{38-40} Prevalence of not engaging in active transport to and from school varied a lot across countries within all regions in our study, which indicates that influential factors are likely to be at the country level. Country transport policies and environmental factors, such as availability of cycling lanes, may play an important role, and countries with a very high prevalence of no transport activity, for example the United Arab Emirates,
Venezuela, and the three Caribbean Islands Saint Lucia, Trinidad and Tobago and Cayman Islands should use the results provided by this study as an opportunity to implement programmes and interventions related to active transport for schoolchildren. We also found that in most of the analysed countries, more than a third of boys and girls engaged in sedentary activities for more than three hours per day on top of sitting at school and during homework. It was difficult to compare our results to those from other studies, as the questions posed as well as the cut-offs used vary a lot across different studies. The HBSC specifically assessed hours spent watching television, and chose the cut-off at two hours per day.\textsuperscript{37} Seventy percent of 13-year-old boys and 69\% of girls watched TV two or more hours per day, while these were 69 and 67\% among 15-year-old boys and girls, respectively. In our study, which used a higher cut-off and a broader definition of sedentary behaviour, overall prevalence was lower with 33.8\% for boys and 35.6\% for girls.

Additionally, we found that 25.1\% of the boys and 29.7\% of the girls were inactive as well as sedentary. The relationship between sedentary behaviour and physical activity is currently not entirely clear. Results from other studies have been inconsistent\textsuperscript{41} and have found no\textsuperscript{23} or weak negative relationships.\textsuperscript{21,42} As both sedentary behaviour and lack of physical activity have been shown to have negative health effects,\textsuperscript{5-13,20-23} interventions should target a decrease of sedentary behavior as well as an increase of physical activity.

The findings of this study need to be interpreted in light of several limitations. First, assessing physical activity through self-report in paediatric populations may over- or underestimate true physical activity levels.\textsuperscript{36,43,44} A recently published review from Adamo and colleagues\textsuperscript{43} found that overall, indirect measures tend to overestimate
physical activity levels in children when compared to direct measures such as
accelerometry. In contrast, Riddoch et al. reported relatively high directly-measured
levels of physical activity for samples of children from four European countries, which is
not in line with the results from the HBSC. It has been speculated that the potential
underestimation of physical activity levels through self-report may be explained by using
a definition that is based on at least moderate intensity activity, as we do in our study, as
this kind of activity is generally more sporadic and non-planned, and therefore less
memorable. Not specifying the intensity level in the questions may have
disadvantages as research questions related to intensity remain unanswered. It has also
been discussed that vigorous intensity activity has a greater effect on preventing obesity
in children than does moderate activity. However, when developing the questionnaire
used in this study, Prochaska et al. found that children had difficulty distinguishing
between intensity levels.

A second limitation stems from the fact that the questions assessing overall activity in our
study have only been tested in one country, the United States. Although they were
tested in an ethnically diverse sample, future research should include them being tested in
developing countries. Additionally, the transport- and sedentary behaviour related
questions have not been tested in validity or reliability studies. Measuring of children’s
physical activity already being difficult due to the nature of their movement patterns and
various types of activities, it is very difficult to test questions that aim to assess only
part of children’s physical activity (for transport) or sedentary behaviour (excluding
school and homework).
Furthermore, our study did not assess the time spent in physical activity during physical education class. For countries including the physical activity module into the country questionnaire, it was optional whether or not they wanted to assess this aspect, and only seven of the analysed countries have done so (Cayman Islands, Jordan, Libyan Arab Jamahiriya, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago and Uruguay). Results are available on the GSHS websites.\textsuperscript{26,27}

Finally, our study only includes schoolchildren. This approach misses those adolescents that do not go to school.

This article is the first one that presents comparable data on physical activity and sedentary behaviour among schoolchildren from such a wide range of mainly developing countries. This kind of data for young people has only been previously published for four of the 24 countries (China, Chile, Philippines, United Arab Emirates)\textsuperscript{34,48-51} Our results derive from 73,216 individuals and are based on mostly national samples with few losses due to missing data. They reveal that levels of physical activity are alarmingly low in all analysed countries and that physical inactivity among children has become a truly global problem.

**Conclusion**

The results provided by this study should be used by countries as baseline information to formulate policy, set public health priorities and plan programmes and interventions. Effective strategies to increase physical activity levels and to decrease sedentary behaviour must be implemented urgently in all countries before a new generation is
programmed to suffer from the chronic disease epidemic. Successful interventions to increase physical activity levels and to decrease sedentary behaviour are encouraging and should serve as examples, and schools have been shown to be a good setting for effective interventions. For a greater impact, interventions should be long-term can include several health behaviours and should be integrated in comprehensive multi-level strategies. WHO documents are available that provide policy-makers, communities and schools with guidelines and best practice to promote physical activity in and through schools, and that can assist countries in implementing strategies to increase physical activity levels in schoolchildren.

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