



Report Card Grades on the Physical Activity of Children and Youth Comparing 30 Very High Human Development Index Countries

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Original Research

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25 **Abstract**

26 **Background**

27 To better understand the childhood physical inactivity crisis, Report Cards on physical activity of children
28 and youth were prepared concurrently in 30 very high HDI countries. The aim of this article was to
29 present, describe, and compare the findings from these Report Cards.

30 **Methods**

31 The Report Cards were developed using a harmonized process for data gathering, assessing, and assigning
32 grades to ten common physical activity indicators. Descriptive statistics were calculated after converting
33 letter grades to interval variables, and correlational analyses between the ten common indicators were
34 performed using Spearman's rank correlation coefficients.

35 **Results**

36 A matrix of 300 grades was obtained with substantial variations within and between countries. Low
37 grades were observed for behavioral indicators, and higher grades were observed for sources of influence
38 indicators, indicating a disconnect between supports and desired behaviors.

39 **Conclusion**

40 This analysis summarizes the level and context of the physical activity of children and youth among very
41 high HDI countries, and provides additional evidence that the situation regarding physical activity in
42 children and youth is very concerning. Unless a major shift to a more active lifestyle happens soon, a high
43 rate of non-communicable diseases can be anticipated when this generation of children reaches adulthood.

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50 Introduction

51 A compelling body of empirical work shows moderate to high levels of physical activity to be associated
52 with a lower risk of cardiovascular disease and all-cause mortality among adults.¹ Conversely, physical
53 inactivity has been recognized by some as “the biggest public health problem of the 21st century”.^{2,3}
54 Among school-aged children and adolescents, meeting physical activity guidelines is associated with
55 positive physical, psychological, social, and cognitive health indicators^{4,5} while physical inactivity,
56 defined as not meeting physical activity guidelines, is associated with adverse physical, mental, social and
57 cognitive health outcomes.⁴⁻⁷

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59 The Human Development Index (HDI) is a composite index, ranging from zero to one, calculated using
60 education, life expectancy, and per capita income.⁸ This index was created by the United Nations
61 Development Programme to rank countries on a scale of human development conceptualized in terms of
62 capabilities of humans within the countries to function.⁹ To be classified as very high HDI, the score of a
63 country must be equal or superior to 0.80. Among children living in countries categorized as being very
64 high by the HDI, moderate-to-vigorous intensity physical activity (MVPA) was positively related to
65 markers of cardiovascular health¹⁰⁻¹³ and self-reported health-related quality of life.¹⁴ Physical inactivity
66 has been estimated to be responsible for at least 10% and 9% of all-cause mortality in North-American
67 and in European countries, respectively.¹⁵ Furthermore, very high-income countries bear the largest
68 proportion of economic burden of physical inactivity worldwide (81% of health-care costs and 60% of
69 indirect costs).¹⁶ However, the majority of children¹⁷⁻²¹ and youth¹⁹⁻²⁵ do not meet the current
70 recommendations of 60 minutes of MVPA per day²⁶ in very high HDI European and North American
71 countries and regions. Similar findings were observed among children and/or adolescents from other very
72 high HDI countries or regions such as Australia,²⁷ Chile,²⁸ Chinese Taipei (Taiwan),²⁹ Hong Kong,³⁰
73 Japan,³¹ South Korea,³² Qatar,³³ and United Arab Emirates.³³⁻³⁵ Very high HDI countries share similar
74 characteristics in terms of education, life expectancy and income; however, differences also exist

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3 75 geographically, politically, culturally, religiously, and environmentally that may influence physical
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5 76 activity behavior differently across the very high HDI countries. Cooper et al.³⁶ found that there was
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7 77 substantial between-country variation in objectively measured MVPA in the International Children's
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9 78 Accelerometry Database, even between apparently similar countries, and concluded that further research
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11 79 is needed to explore environmental and sociocultural explanations for these differences.
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17 81 To develop a better understanding of childhood physical activity and inactivity across countries, the first
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19 82 Global Matrix (Global Matrix 1.0) of Report Card grades on physical activity was launched in 2014.³⁷
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21 83 Report Cards, based on the Canadian Report Card model,³⁸ were developed by research teams from 15
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23 84 countries (including eight very high HDI countries) using a harmonized process for data gathering,
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25 85 assessing, and assigning grades.³⁷ For each participating country, grades were assigned to nine common
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27 86 physical activity indicators: Overall Physical Activity, Organized Sport Participation, Active Play, Active
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29 87 Transportation, Sedentary Behaviors, Family and Peers, School, Community and the Built Environment,
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31 88 and Government Strategies and Investments. Global Matrix 1.0 grades provided new information upon
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33 89 which researchers, advocates, practitioners, and policy-makers could reflect and derive inspiration for
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35 90 children's physical activity research projects and promotion activities around the world.³⁷
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41 92 Building on the Global Matrix 1.0, investigators from each participating country committed to repeat and
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43 93 further develop the Global Matrix initiative along with teams of researchers from 23 new countries. The
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45 94 Global Matrix 2.0, which was released in 2016 in Bangkok, presented a comprehensive summary of the
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47 95 physical activity behaviors and sources of influence indicators from 38 countries (including 24 very high
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49 96 HDI countries).³⁹ Findings suggested the presence of a complex variety of strengths and limitations across
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51 97 the participating countries, with some universal patterns emerging when comparing countries by
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53 98 continent, HDI, or income inequality. For example, a strong positive correlation was found between the
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99 source of influence grades (combining the grades from Family and Peers, School, Community and the
100 Built Environment, and Government Strategies and Investments) and HDI.³⁹

101
102 In 2017, the Active Healthy Kids Global Alliance⁴⁰ (AHKGA) called for more countries to participate in
103 the Global Matrix 3.0. Forty-nine countries registered and followed the harmonized steps to develop their
104 country's Report Card. Out of the 49 participating countries, 30 (61%) were very high HDI countries,
105 from five different continents: Asia (n = 6), Europe (n = 19), North America (n = 2), Oceania (n = 2) and
106 South America (n = 1). The aim of this article is to present, describe, and compare the Report Card grades
107 from the very high HDI countries and regions participating in the Global Matrix 3.0: Australia, Belgium
108 (Flanders), Canada, Chile, Chinese Taipei (Taiwan), Czech Republic, Denmark, England, Estonia,
109 Finland, France, Germany, Guernsey, Hong Kong, Japan, Jersey, Lithuania, Netherlands, New Zealand,
110 Poland, Portugal, Qatar, Scotland, Slovenia, South Korea, Spain, Sweden, United Arab Emirates, United
111 States, and Wales. Companion papers published in this issue of the *Journal of Physical Activity and*
112 *Health* present the collective results from the low and medium HDI countries, and the high HDI countries.

113

114 **Methods**

115 The AHKGA distributed an open call through established networks for interested countries and opened
116 registration for the Global Matrix 3.0 in April, 2017. As a result, 49 countries from five different
117 continents fully participated in the Global Matrix 3.0. Workgroups consisting of experts and stakeholders
118 were established in each country to gather the highest quality and most recently published and
119 unpublished evidence. The workgroups critically appraised the available evidence and reported on 10
120 common indicators (Overall Physical Activity, Organized Sport and Physical Activity, Active Play,
121 Active Transportation, Sedentary Behaviors, Physical Fitness, Family and Peers, School, Community and
122 the Built Environment, and Government) for school-aged children and youth (~5-17 years-old). Through

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3 123 a harmonized and transparent Report Card development process, each country's workgroup compiled the
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5 124 available evidence from local, national or international studies, national surveys and official reports, and
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7 125 then synthesized findings and reached consensus for the grading of each indicator. Full details of the
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9 126 Report Card development process based on the Canadian Report Card model³⁸ have been previously
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11 127 described and the detailed methods for the Global Matrix 3.0 are described in a companion paper
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13 128 published in this issue of the *Journal of Physical Activity and Health*.⁴¹
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16 129 For each of the 49 registered countries, up to three joint Report Card leaders were charged with forming a
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18 130 multidisciplinary research workgroup (including physical activity experts, stakeholder groups, and
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20 131 communication specialists) to manage the Report Card project, and to ensure the effective communication
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22 132 between AHKGA and the Report Card team. The workgroups identified and finalized the list of indicators
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24 133 to be graded (i.e., the ten common indicators and potential additional ones that would be included in their
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26 134 national Report Card but not in the Global Matrix 3.0), and compiled potentially relevant datasets and
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28 135 documents that would be used to inform the grades. Countries were advised to consider and synthesize
29
30 136 the best available evidence from approximately the past five years for each indicator. Common
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32 137 benchmarks, presented in Table 1, and a common grading scheme, shown in Table 2, were provided by
33
34 138 the AHKGA to the 49 Report Card workgroups. Experts in each country evaluated the compiled evidence
35
36 139 and reached consensus on the grade assigned for each indicator. Draft country Report Card grades were
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38 140 submitted along with their rationale and were audited by the members of the AHKGA Executive
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40 141 Committee to ensure that the grades were consistent with the harmonized benchmarks and grading
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42 142 scheme. The Report Card leaders were also asked to report details concerning the datasets used to inform
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44 143 their overall physical activity grade (i.e., subjective or objective measures, representativeness, instrument
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46 144 used, age range, and sample size).
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51 145 For analysis purposes, the 49 participating countries and regions were divided into three categories using
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53 146 the United Nations' HDI groupings (low or medium, high, and very high). The results and analyses
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55 147 presented in this article are on the 30 very high HDI participating countries.
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3 148 Descriptive statistics (average grade and standard deviation) were calculated after converting categorical
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5 149 variables (letter grades) to interval variables (see corresponding numbers in Table 2), and the incomplete
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7 150 grades (INC) converted into “No Grade” which was treated as a missing value. Averages were calculated
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9 151 from the interval values and the floor (for a given value, the greatest integer less than or equal to the
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11 152 average value) was converted back to a letter grade. Three scores were computed for analysis: 1) Overall
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13 153 score, 2) Behavioral score (Overall Physical Activity, Organized Sport and Physical Activity
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15 154 Participation, Active Play, Active Transportation, and Sedentary Behaviors), and 3) Sources of influence
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17 155 score (Family and Peers, School, Community and the Built Environment, and Government). Scores for
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19 156 each group of indicators were calculated by summing the relevant interval data. INC grades were
20
21 157 removed and the scores were re-weighted accordingly. Categorical variables (letter grades) were grouped
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23 158 into one of four levels (“A-B”, “C”, “D-F”, and “No grade”) based on the overall score. These categories
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25 159 were then used to rank countries by letter grade/score and category level in scatter plot data
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27 160 visualizations. Correlational analyses between the ten common indicators were performed using
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29 161 Spearman's rank correlation coefficients. Pairwise deletion was used to treat missing data (incomplete
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31 162 grades) instead of other techniques (e.g., list-wise deletion) in order to minimize the number of cases
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33 163 excluded from the analysis. All statistical analyses were performed using R version 3.4.1 (The R
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35 164 Foundation for Statistical Computing, Vienna, Austria). Several packages were loaded to extend base R
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37 165 including corrplot,⁴² ggplot2,⁴³ UpSetR,⁴⁴ and VIM.⁴⁵ In addition, descriptive statistics of the qualitative
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39 166 information regarding the measurement of overall physical activity were performed.
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168 Results

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49 169 The sociodemographic characteristics of the 30 very high HDI countries are presented in Table 3. The
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51 170 HDI scores ranged from 0.840 for United Arab Emirates to 0.939 for Australia. Chile was the country
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53 171 with the lowest Gross National Income per capita, the highest Gini Index (highest income inequality), and
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55 172 the highest child poverty rate (0.225). Qatar had the highest Gross National Income per capita, the lowest
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3 173 relative public health expenditure and the highest Gender Inequality Index. Slovenia had the lowest Gini
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5 174 Index (least income inequality) and the lowest percentage of urban population (49.8%). The life
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7 175 expectancy at birth was above 80 years for most of the countries (23 countries, 77%), with a maximum of
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9 176 84.2 years for Hong Kong. Lithuania had a notably lower life expectancy of 73.5 years compared to other
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11 177 countries. The mean years of schooling ranged from 8.9 years in Portugal to 13.3 years in the United
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13 178 Kingdom nations (England, Scotland, and Wales). Finally, population density ranged from 3.2
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15 179 people/km² of land area for Australia, to 6987.2 people/km² of land area for Hong Kong. In summary,
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17 180 despite all 30 countries being within the very high HDI category, countries varied substantially in other
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19 181 characteristics.

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23 182 The 30 country grades for the 10 core Report Card indicators (300 grades or INC in total) and the average
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25 183 grades for each country are shown in Table 4, and the corresponding descriptive information are
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27 184 presented in Table 5. In total, 233 letter grades and 67 INC grades were assigned (Table 4). The country
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29 185 with the highest average grade was Slovenia with “B”, and the countries with the lowest average grade
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31 186 were Chile and the United States with “D”. All 30 countries assigned a grade to Sedentary Behaviors, 29
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33 187 countries (97%) to Overall Physical Activity, and 28 countries (93%) to Organized Sport and Physical
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35 188 Activity and to Active Transportation. Active Play was the indicator with the largest number of INC
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37 189 grades (n = 20), followed by Physical Fitness (n = 13), and Family and Peers (n = 13). The indicator with
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39 190 the highest average grade was Community and the Built Environment with “B-”, while the indicator with
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41 191 the lowest average grade was Overall Physical Activity with “D-”. An average grade of “D+” was
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43 192 obtained for the behavioral indicators combined, “C+” for the source of influence indicators combined,
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45 193 and “C-” was the overall average for the 233 grades. Qatar’s Report Card workgroup decided not to
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47 194 evaluate Active Transportation and considered it “not applicable (N/A)” because of unsafe road
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49 195 conditions and the hot climate during most times of the year.⁴⁶ Correlation analyses showed that there
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51 196 were no relationships between the Overall Physical Activity grade and any of the other nine core indicator
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53 197 grade (results not shown). Frequency plots illustrating the distribution of the overall 233 grades as well as

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3 198 the behavioral and the sources of influence indicators are presented in Figure 1A and Figure 1B,
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5 199 respectively. A normal distribution of the letter grades is evident in both Figures 1A and 1B, with the
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7 200 mode being “C” for the 233 letter grades overall, “D” for the behavioral indicators, and “B” for the
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9 201 sources of influence indicators.

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12 202 A plot for the overall score for each country estimated from the 10 indicators is presented in Figure 2, and
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14 203 the behavioral and the source of influence scores in Figure 3 and Figure 4, respectively. For the overall
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16 204 score, Slovenia ranked first while Chile ranked 30th (see more rankings in Figure 2). In terms of the
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18 205 grading completion, the United Arab Emirates had only four graded indicators that were included in the
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20 206 calculation of this score while four other countries (Slovenia, Finland, Czech Republic and Canada) had
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22 207 all 10 indicators graded. For the behavioral score, Japan ranked first while Estonia ranked 30th (see more
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24 208 rankings in Figure 3). The United Arab Emirates had only two out of five indicators, and Japan and Qatar
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26 209 only had three graded indicators that were included in the calculation of the behavioral score. Similar to
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28 210 the overall score, Slovenia also ranked first for the sources of influence score while Guernsey, with only
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30 211 one out of four graded indicators available, ranked 30th (see more rankings in Figure 4).

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34 212 Finally, the description of the data sources used to inform the Overall Physical Activity grade for each
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36 213 country (except for Japan that had an INC) are presented in Supplemental File 1. In total, 87 surveys or
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38 214 studies informed the grades of the very high HDI countries, representing a total sample size of 1,005,989
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40 215 children and youth. A total of 21 surveys/studies used an objective measurement of physical activity
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42 216 while 66 used a subjective method, mostly via self-administered questionnaires. Out of 21 surveys/studies
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44 217 that measured physical activity objectively, 20 used accelerometry and one study used pedometry. A
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46 218 minimum wear time for accelerometer ranged between 3 to 7 consecutive days, and nine different
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48 219 accelerometer cut-points were applied for analysis across 20 surveys/studies with the most commonly
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50 220 used cut-points (n = 8) from Evenson et al.⁴⁷ Regarding the subjective measurement of physical activity,
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52 221 survey-specific questionnaires were used in a significant number of surveys (n = 35), followed by original
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54 222 or adapted versions of the *Health Behaviour in School-Aged Children* questionnaire (n = 14), uniquely in

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223 European countries), the *Global School-based Student Health Survey* questionnaire (n = 5), the *Youth*
224 *Risk Behavior Surveillance System* questionnaire (n = 4), the *International Physical Activity*
225 *Questionnaire* (n=3), and others (n=5).

226

227 **Discussion**

228 The objective of this paper was to present, describe, and compare the Report Card grades from the 30
229 very high HDI countries and nations participating in the Global Matrix 3.0. A wide range of grades was
230 observed for most indicators across countries. These 30 countries are geographically distributed across
231 Asia, Europe, North America, Oceania, and South America and have very different climatic, geographic,
232 demographic, and cultural characteristics. Despite these contextual differences, most of these countries
233 shared concerning low grades for Overall Physical Activity and Sedentary Behaviors. No country was
234 consistently leading nor falling behind the others across the 10 common indicators, however some
235 countries showed greater or less success than others. The characteristics of the most and the least
236 successful countries are discussed below, followed by a discussion of the findings for each indicator, and
237 an integrated discussion of the findings including the strengths and limitations of this study.

238

239 *Most successful countries*

240 Slovenia had sufficient data to inform the 10 indicators and obtained the best grades for Overall Physical
241 Activity (“A-”), Family and Peers (“B+”), and Government (“A”), as well as on average (“B”); and
242 shared the best grades for Sedentary Behaviors with Spain (“B+”), and for School (“A”) with Finland and
243 Portugal. A notable feature of Slovenia is the importance of sport for the culture of this almost 30-year
244 old country as “Slovenes tend to view sports as an effective tool in fostering national identity among
245 citizens and making successful global identity claims”.⁴⁸ Every April since 1987, a national school-based
246 surveillance system of physical fitness (named *Slofit*) takes place, targeting the majority of Slovenian

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3 247 school children and youth aged 6 to 19 years.⁴⁹ Negative trends in motor skills and physical fitness were
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5 248 observed for over two decades in Slovenia, but since 2011, these trends has been reversed after the
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7 249 implementation of a health-oriented physical activity intervention program, which offers children two
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9 250 (optional) additional hours of physical activity per week.⁵⁰ The estimated proportion of Slovenian
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11 251 children and youth meeting the recommended levels of daily physical activity is now high (over 80%),
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13 252 and this encouraging outcome seems to be the result of the collective support for childhood physical
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15 253 activity from the government, the educational system, and the parents themselves.⁵¹

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18 254 The next two most successful countries were Denmark and Japan with an average grade of “B-”. The
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20 255 positive result for these two countries should be interpreted with caution as both had “INC” grades for
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22 256 some indicators. Active Play, Physical Fitness, and Family and Peers for Denmark, and Overall Physical
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24 257 Activity and Active Play for Japan were not graded due to the lack of data. Nonetheless, Denmark was the
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26 258 country with the best grade for Organized Sport and Physical Activity (“A-”), and also obtained a grade
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28 259 of “A-” for both School and Government indicators. Sport is an important part of the Danish culture, and
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30 260 considered important not only for individual and population health, but also in relation to issues such as
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32 261 social inclusion and community cohesion.⁵² Despite Denmark performing rather well on the strategic and
33
34 262 political levels, low grades were attributed to Overall Physical Activity (“D-”) and Sedentary Behaviors
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36 263 (“D+”), indicating an implementation gap between the governmental and individual levels.⁵³

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40 264 Japan had the best grades for Active Transportation (“A-”) and Physical Fitness (“A”), and had no grades
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42 265 lower than “C-”. In fact, Japan has a highly established “walking to school practice” that has been
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44 266 implemented since the School Education Act enforcement order, enacted in 1953, stating that public
45
46 267 elementary schools should be sited within no more than 4 kilometers, and for public junior high schools
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48 268 no more than 6 kilometers from the student’s home. This policy is still successful today at promoting
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50 269 active transportation among Japanese children and youth.⁵⁴ The Physical Fitness grade was assigned
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52 270 based on the performance of Japanese children and youth on the 20-meter shuttle run test. On average,
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54 271 Japanese children were in the 90th percentile,⁵⁵ based on age- and sex-specific international normative

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272 data.⁵⁶ The Organized Sport and Physical Activity participation (graded “B-”) and the favorable School
273 environment (graded “B+”) may explain this high level of physical fitness; however, this is speculative
274 and more research is necessary. It was observed that only a minority of time in physical education classes
275 was spent in MVPA (27.3%/45 min/class) in Japanese primary school students.⁵⁷

276 *Least successful countries*

277 Chile and the United States were the two countries with the lowest average grade: “D”. They were
278 followed by Guernsey, Jersey, Scotland, South Korea, United Arab Emirates, and Wales, who obtained an
279 average grade of “D+”. Chile had the lowest grades for Active Transportation (“F”), Family and Peers
280 (“F”), and shared the lowest grades for Organized Sport and Physical Activity with Taiwan (“D-”), and
281 for Physical Fitness with Canada, Hong Kong and Jersey (“D”). In Chile’s first Report Card (2016), all
282 indicators had low grades, and data from different surveys indicated that there were consistent disparities
283 across genders, socioeconomic status, and school types.⁵⁸ In 2018, Chile’s grades remained low in
284 comparison with the first Report Card in 2016 but progress was made on environmental and policy
285 aspects,⁵⁹ raising hope that these improvements will positively affect behavioral indicators in the future.

286 The low average grade of the United States should be interpreted carefully because three indicators were
287 assigned an “INC” grade: Active Play, Family and Peers, and Government. The United States shared the
288 lowest grades with the United Arab Emirates for School (“D-”), and the Community and the Built
289 Environment (“C”) with England, Jersey, Lithuania, and Poland. Overall, none of the indicators were
290 graded above “C” in the United States. This is the third Report Card for the United States, and the grade
291 for Overall Physical Activity (“D-”) remained consistent with the 2014 and 2016 Report Card.^{60,61}
292 Similarly to Chile, major disparities in physical activity participation across gender, race/ethnicity, age,
293 and socioeconomic status were observed.⁶²

295 *Overall Physical Activity*

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3 296 Among the 30 very high HDI countries, only Japan assigned an “INC” grade for Overall Physical
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5 297 Activity. The grades ranged from “F” to “A-” for this indicator; however Slovenia was the only country
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7 298 with a “good” grade (“A-”), and all the other countrys’ grades fell between “F” and “C”. Five countries
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9 299 received an “F” (Flanders, Scotland, South Korea, Taiwan, and the United Arab Emirates), four countries
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11 300 assigned “C” grades (England, Hong Kong, Lithuania, and Netherlands), and all the remaining countries
12
13 301 had a “D-”, “D”, or “D+”. The comparison and interpretation of the Overall Physical Activity grades
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15 302 should be conducted carefully given the important variation in the methods used to measure Overall
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17 303 Physical Activity between the countries, as seen in Supplemental File 1. In fact, objective data were used
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19 304 in 13 of 29 countries with an Overall Physical Activity letter grade, and subjective data in 27 countries
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21 305 (11 countries combined subjective and objective data to inform their Overall Physical Activity indicator).
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23 306 In addition, even among the subjective or the objective data, the methods differed largely in terms of
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25 307 instruments, analysis, age range, sample size, and representativeness of samples.

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29 308 The correlational analyses showed that there was no relationship between Overall Physical Activity, and
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31 309 the physical activity related indicators (Organized Sport and Physical Activity, Active Play, and Active
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33 310 Transportation). For example, only 56% of children and 33% of adolescents met the international physical
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35 311 activity recommendations in the Netherlands despite a high level of Organized Sport and Physical
36
37 312 Activity, Active Play, and Active Transportation (graded “B”, “B”, and “B-”, respectively).⁶³ A similar
38
39 313 pattern was observed in Belgium (Flanders), Denmark, Scotland, South Korea and Spain where Overall
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41 314 Physical Activity was graded “F” or “D/D-” despite the fact that grades between “A” and “C” were
42
43 315 assigned to Organized Sport and Physical Activity, Active Play, and Active Transportation (note: an
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45 316 “INC” grade was assigned to Active Play for Flanders, Denmark, Scotland, and South Korea).^{53,64-67} The
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47 317 opposite situation was observed in Slovenia where Overall Physical Activity was graded “A-”, while
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49 318 Organized Sport and Physical Activity, Active Play and Active Transportation were graded “C+”, “D”,
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51 319 and “C”, respectively.

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3 320 The absence of a relationship between Overall Physical Activity and other behavioral indicators can
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5 321 potentially be explained by the aforementioned differences in methods used to measure these indicators
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7 322 and the diversity of benchmarks between countries. The recommended benchmark for physical activity
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9 323 was “% of children and youth [...] who accumulate at least 60 minutes MVPA per day on average, or %
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11 324 of children and youth meeting the guidelines on at least four days a week (when an average cannot be
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13 325 estimated)” (Table 1). The available data in each country did not necessarily allow them to use either of
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15 326 these benchmarks strictly when estimating the prevalence of physically active children and youth in their
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17 327 sample. For example, in France, a “high level of physical activity” corresponded to engage in physical
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19 328 activity five or more days a week, and the regular use of active transportation, for 6-10 year olds (reported
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21 329 by the parents); and practicing a MVPA at least five days a week for 11-17 year olds (self-reported).⁶⁸
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23 330 While in England’s 2018 Report Card, the percentage of children and youth accumulating at least one
24
25 331 hour of MVPA seven days a week was evaluated.⁶⁹ In addition, among the countries where objective
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27 332 methods were used to measure physical activity, the estimated number of children meeting the physical
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29 333 activity guidelines could also have been significantly affected by the cut-off point that defines the count
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31 334 per minute threshold for MVPA.⁷⁰ Although the majority of studies included in Global Matrix 3.0 used
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33 335 the Evenson cut-off point,⁴⁷ several studies used different ones. For example, the Freedson cut-off point⁷¹
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35 336 was used in Hong-Kong, while the Puyau cut-off point⁷² was used in Canada (Supplemental File 1).
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39 337 Notwithstanding the presented methodological issues across countries, 29 out of 30 very high HDI
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41 338 countries assigned a letter grade to the Overall Physical Activity indicator, and for 28 of them, this grade
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43 339 was between “C” and “F”, with an average of “D-”. These results are consistent with the current
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45 340 literature. A systematic review of physical activity in European children and adolescents found that 5%-
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47 341 47% of children and adolescents when measured subjectively, or 0%-60% of children and adolescents
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49 342 when measured objectively, achieved the recommended levels of physical activity.⁷³ In another study
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51 343 describing objectively-measured physical activity and sedentary time patterns in children and youth in 10
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53 344 countries (nine very high HDI countries and Brazil), only 9% of boys and 2% of girls accumulated ≥ 60
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3 345 minutes of MVPA on all measured days.³⁶ The present study provides additional evidence that the
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5 346 situation regarding the physical activity of children and youth is very concerning in very high HDI
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7 347 countries, and public investment to implement effective interventions for increasing physical activity
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9 348 opportunities are needed urgently. Unless a major shift to a more active lifestyle happens soon, a high rate
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11 349 of premature non-communicable diseases can be anticipated when this generation of children will reach
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13 350 adulthood.

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19 352 *Organized Sport and Physical Activity*

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21
22 353 Most of the countries assigned a letter grade to Organized Sport and Physical Activity, excepting Jersey
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24 354 and the United Arab Emirates. With an average grade of “C+”, Organized Sport and Physical Activity
25
26 355 was the most successful behavioral indicator in the very high HDI countries. Only three countries had a
27
28 356 low grade for this indicator: Chile (“D-”), Taiwan (“D-”), and France (“C-”); while 12 countries had
29
30 357 relatively higher grades (“B+”, “B”, “B-”) behind the lead of Denmark (“A-”). In Canada, Organized
31
32 358 Sport and Physical Activity was the only behavioural indicator with a high grade (“B+”),⁷⁴ in which the
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34 359 high participation rate (77%) has been relatively stable since 2005.⁷⁵ Similarly, Organized Sport and
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36 360 Physical Activity was also the highest graded indicator in Sweden.⁷⁶ In relation to its geographical and
37
38 361 population size, Sweden is considered as one of the world’s most sporting nations: out of the seven
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40 362 million inhabitants between the ages of 7 and 70, more than three million were active members of sport
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42 363 clubs and more than two million were competing regularly in 2012.⁷⁷ However, as presented before, these
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44 364 high rates of sport participation were not associated with a sufficient level of physical activity in the
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46 365 population.

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50 366 Given that the benchmark for Organized Sport and Physical Activity (“% of children and youth who
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52 367 participate in organized sport and/or physical activity programs”) does not specify intensity, duration, or
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54 368 frequency, we are missing important contextual information of this indicator. These characteristics should

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3 369 be evaluated to estimate the dose of physical activity associated with sport participation among children
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5 370 and youth. However, the popularity of sport among children and youth from very high HDI countries
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7 371 suggests that increasing organized sport opportunities and accessibility could be a strategic solution to
8
9 372 address the prevalence of childhood physical inactivity in these countries. Further research focusing on
10
11 373 this indicator is needed to evaluate if the available organized physical activity opportunities are indeed
12
13 374 saturated. Moreover, are all countries providing free or affordable and appealing physical activity and
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15 375 sport participation opportunities for the entire youth population including different age, gender,
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17 376 socioeconomic, ethnic, and special population groups (e.g., children with learning and/or physical
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19 377 disabilities)?
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379 *Active Play*

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28 380 The main finding concerning Active Play was the amount of missing data: 20 out of the 30 very high HDI
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30 381 countries assigned an “INC” grade to this indicator. Among the 10 countries with a letter grade, the
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32 382 Netherlands attained the highest grade (“B”); Estonia the lowest grade (“F”); and the eight remaining
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34 383 countries had “C”s or “D”s. The average grade of “D+” for this indicator suggests that there is a low level
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36 384 of engagement in this behavior, and/or that researchers were not able to detect it with the measurement
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38 385 instruments they used. Indeed, valid and reliable tools to assess active play is largely limited.⁷⁸ In the
39
40 386 Czech Republic, Active Play was measured using self-reports of unstructured/unorganized active play for
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42 387 at least two hours per day;⁷⁹ while in New Zealand, surveys asked parents/guardians or youth report to
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44 388 indicate if the children or youth had been active while playing (on their own or with others) in the last
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46 389 seven days, if they had been active while playing for at least seven hours in the last seven days, and if
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48 390 they were allowed to go out on their own in the neighborhood.⁸⁰ The development of standardized tools
49
50 391 for the measurement of Active Play is challenged by the need for consensus on a definition. In a recent
51
52 392 systematic review synthesizing the literature to identify key concepts used to define and describe active
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54 393 play among young children, Truelove et al.⁷⁸ proposed the following definition: “a form of gross motor or
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394 total body movement in which young children exert energy in a freely chosen, fun, and unstructured
395 manner”. But a consensus definition needs to be officially internationally agreed upon and acknowledged
396 to advance the development and acceptance of standardised measurement tools.

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398 *Active Transportation*

399 For Active Transportation, the grades ranged from “A-” (Japan) to “F” (Chile), with an average of “C-”.
400 Qatar and the United Arab Emirates were the only two countries that did not assign a letter grade to this
401 indicator. Interestingly, three of the four countries from Eastern Asia are leading this indicator: Japan
402 (“A-”), Hong Kong (“B+”), and South Korea (“B+”). The successful school policy that has been
403 identified underlying this high prevalence of active transportation among children and youth in Japan was
404 discussed previously in this paper. In Hong Kong, a high proportion of children using active
405 transportation can be explained by the very high population density of the city: most districts are highly
406 self-contained so children usually attend schools close to their home.⁸¹ Similarly, because most students
407 live within 10-minute walking distance to/from school, national data showed that active commuting is
408 prevalent in South Korea: 79.4% of children and youth reported that they take active modes of transport
409 to/from places.⁶⁶ Previous research has shown that active transportation is associated with increased
410 physical activity,⁸² however, the Active Transportation indicator was not correlated with Overall Physical
411 Activity among children in very high HDI countries in this study. Similar to Organized Sport and
412 Physical Activity and Active Play, the benchmark for this indicator does not indicate duration or intensity
413 of activity. Therefore, it is not possible to evaluate the extent to which this indicator is contributing to the
414 Overall Physical Activity of children and youth.

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416 *Sedentary Behaviors*

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3 417 Sedentary behavior corresponds to any waking behavior characterized by an energy expenditure ≤ 1.5
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5 418 metabolic equivalents (METs), while in a sitting, reclining, or lying posture.⁸³ For example, in children
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7 419 and youth, it includes to the use of electronic devices while sitting, reclining or lying, as well as reading,
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9 420 writing, or drawing while sitting.⁸³ While reading is associated with positive outcomes such as higher
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11 421 academic achievement, screen time, often used as a proxy for sedentary behavior in research, has been
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13 422 shown to be associated with a variety of negative health outcomes among children and youth.⁸⁴ For this
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15 423 reason, guidelines focusing specifically on screen time were developed for the first time in Canada in
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17 424 2011, recommending limiting screen time to two hours daily for the 5-17 year-olds.⁸⁵ Consistent with the
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19 425 current guidelines, the benchmark for Sedentary Behaviors was solely based on screen time: “% of
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21 426 children and youth who meet the *Canadian Sedentary Behaviour Guidelines* (5- to 17-year-olds: no more
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23 427 than 2 hours of recreational screen time per day)”.
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27 428 Sedentary Behaviors was the only indicator without any “INC” grades. Estonia, Scotland, and Wales were
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29 429 the three countries with the lowest grade for this indicator (“F”), while Slovenia and Spain had the highest
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31 430 grade (“B+”). The remaining countries all had “C”s or “D”s, and the average for this indicator was “D+”.
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33 431 In total, only five out of the 30 very high HDI countries had a grade of “C” or higher. A small
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35 432 methodological difference was observed between the very high HDI as few countries such as Estonia,
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37 433 France, and Sweden reported the percentage of children and youth who had less than two hours (<2
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39 434 hour/day) of daily screen time, while most of the countries reported those spending two hours or less (\leq
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41 435 hour/day) in front of a screen. Another potential source of bias was not taking into account the potential
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43 436 multi-tasking use of screens (e.g., using a phone while watching a movie) as it was the case for France,
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45 437 which could have led to an overestimation of screen time.⁶⁸ Despite these potential methodological issues,
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47 438 the grades observed for this indicator are extremely concerning among the very high HDI countries. In
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49 439 Estonia, the prevalence of children meeting the screen time recommendation was estimated as low as
50
51 440 7%.⁸⁶ The development of more effective interventions targeting the reduction of screen time among
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53 441 children and youth in very high HDI countries should be a public health priority.
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443 *Physical Fitness*

444 This is the first time that Physical Fitness has been evaluated in the Global Matrix. Physical fitness
445 corresponds to a state characterized by an ability to perform daily activities with vigor, and a
446 demonstration of traits and capacities that are associated with a lower risk of the premature development
447 of diseases associated with physical inactivity.⁸⁷ The health-related components of physical fitness are
448 cardiorespiratory endurance, muscular endurance, muscular strength, body composition, and flexibility.⁸⁸
449 A recent systematic review of the relationship between the 20-meter shuttle run performance and health
450 indicators among children and youth found that performance on this test was associated with favourable
451 indicators of adiposity, and some indicators of cardiometabolic, cognitive, and psychosocial health in
452 boys and girls, and concluded that physical fitness can be used as a holistic indicator of population health
453 in children and youth.⁸⁹

454 The benchmark for this indicator was the average percentile achieved on certain health-related physical
455 fitness component-based on the normative values published by Tomkinson et al.⁵⁶ On average, Physical
456 Fitness was graded “C-”. The highest grade was obtained by Japan (“A”), closely followed by Slovenia
457 (“A-”); and four other countries (Canada, Chile, Hong Kong, and Jersey) shared the lowest grade (“D”).
458 An “INC” grade was assigned to Physical Fitness in 13 countries. Various health-related physical fitness
459 components and different normative values were used to calculate the percentile achieved by their sample
460 of children and youth and inform this indicator from one country to another. For example, in Hong Kong
461 this indicator was graded based on peak oxygen consumption, estimated with the performance on the 20-
462 meter shuttle run performance among 9-17 year olds;⁹⁰ Jersey had data on cardiorespiratory fitness,
463 muscular strength, muscular endurance, flexibility, and motor fundamental movement skills development
464 for school-aged children.⁹¹ Lithuania had data on endurance, lower body muscular power, upper body
465 muscular endurance, and lower body muscular endurance for 11-18 year olds. Given these significant
466 variations, the comparison of the Physical Fitness indicator between very high HDI countries is

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3 467 compromised and this highlights the need for developing international standardized measurements of
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5 468 health-related physical fitness components.
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11 470 *Family and Peers*

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13 471 Similarly to Physical Fitness, 13 countries assigned an “INC” grade to the Family and Peers indicator. On
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15 472 average, this indicator was graded “C-”, with Slovenia having the highest grade (“B+”) and Chile having
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17 473 the lowest grade (“F”). Parental support and significant others support has been identified as two of the 16
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19 474 correlates that are consistently associated with physical activity of children and/or adolescents in a
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21 475 systematic review of reviews.⁹² Because of the complexity of this indicator, several benchmarks were
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23 476 proposed for its evaluation (Table 1), and measurement variations were observed. In Poland, the grade
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25 477 was based on self-report of their parents’ (material, emotional) support to their physical activity
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27 478 participation, on self-report of their parents’ regular participation in physical activity, and on the
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29 479 prevalence of youth who declared being regularly physically active with their father, their mother, and
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31 480 their siblings.⁹³ In Germany, the prevalence of parents regularly participating in physical activity and the
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33 481 prevalence of children feeling that they receive positive support from their parents and friends to be
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35 482 physically active informed the Family and Peers indicator.⁹⁴ These findings show that there is still a need
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37 483 for an established definition of Family and Peer Influence, and then standardised and validated methods
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39 484 of measurement for the Family and Peers indicator.
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46 486 *School*

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49 487 The School indicator had an average of “C+”, and only three countries had an “INC” grade for this
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51 488 indicator: Guernsey, Scotland, and Wales. The United Arab Emirates and the United States had the lowest
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53 489 grade (“D”), and Finland and Portugal shared the best grade for School (“A”). A variation in data was
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55 490 used to inform this indicator within the countries. In Finland, 87% of the schools participated in the
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3 491 national *Finnish Schools on the Move* programme. This programme aims at achieving more pleasant and
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5 492 active schooldays for children and encourages schools to increase physical activity during the school day
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7 493 as well as commuting.⁹⁵ In Portugal, physical education classes are mandatory for all students from pre-
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9 494 school to 12th grade. The time allocated to physical education classes ranges from 90 to 150 min/week
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11 495 over two or three sessions/week, and these classes are taught by a certified physical education teacher. In
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13 496 addition, 85% of Portuguese schools offer school clubs under the supervision of a physical education
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15 497 teacher, including competitions within and between schools.⁹⁶ The correlational analyses did not find an
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17 498 association between the School and the Overall Physical Activity indicators, but similarly to other
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19 499 indicators, the heterogeneity of data used to inform the School indicator are potentially affecting this
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21 500 relationship.

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25 501 A review of the relationship between academic performance and participation in school-based physical
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27 502 activities, including physical education, free school-based physical activity, and school sports, found that
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29 503 adding time to academic or curricular subjects by taking time from physical education programmes does
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31 504 not enhance grades in the corresponding academic subjects, and could be detrimental to health.⁹⁷ On the
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33 505 contrary, the authors also suggested that more time can be allocated to physical activity from other
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35 506 subjects without the risk of hindering students' academic achievement.⁹⁷ These findings suggest that the
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37 507 school environment, policy, and curriculum have the potential to increase physical activity among
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39 508 children and youth, and more specific interventions targeting the creation of daily physical opportunities
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41 509 at school need to be developed in very high HDI countries.

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47 511 *Community and the Built Environment*

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50 512 With an average of "B-", Community and the Built Environment was the highest graded indicator of the
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52 513 10 core indicators among the 30 very high HDI countries. The lowest grade for this indicator was "C",
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54 514 shared by five countries (England, Jersey, Lithuania, Poland, and the United States), and the highest

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3 515 grade, “A”, was assigned by Sweden. Eight countries assigned an “INC” grade for this indicator. With an
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5 516 “A-”, Australia was the second most successful country for this indicator. In the Australia’s 2018 Report
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7 517 Card, parent-report data showed that most of youth were not faced with problematic traffic in their home
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9 518 or school neighborhood, had access to good roads and footpaths and to public transport in their
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11 519 neighborhood, had a park or playground near their home, and lived in a safe neighborhood.⁹⁸ In Taiwan,
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13 520 where this indicator was graded “B+”, 81% of 13- to 17-year-olds felt that there were sufficient exercise
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15 521 facilities in their neighbourhood, and they reported spending an average of 9.7 min to reach their primary
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17 522 exercise facilities.⁹⁹ The lack of correlation between this indicator and the Overall Physical Activity is
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19 523 aligned with some of the research available on access to facilities.⁹² Community and the Built
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21 524 Environment. In accordance with previous Global Matrices,^{37,39} the available evidence from this indicator
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23 525 may suggest that the characteristics of the built environment potentially influencing the physical activity
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25 526 of children are already meeting the criteria to be considered favorable in the very high HDI countries.
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27 527 This indicates that having favorable environmental infrastructure alone is not sufficient to promote
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29 528 physical activity in very high HDI countries. Social factors such as family, home, school, and community
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31 529 are also important to promote physical activity among children and youth.
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531 *Government*

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41 532 The average grade for the Government indicator was “C+”, and the grades ranged from “A” (Slovenia) to
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43 533 “D” (Australia, Guernsey, Jersey, and South Korea). Five countries assigned an “INC” grade to this
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45 534 indicator. With the exception of the four countries with a “D”, all the other very high HDI countries
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47 535 obtained a favorable grade (“C” or higher) for the Government indicator. Despite the recommended
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49 536 benchmark for this indicator, Government grades were informed by different types of data in different
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51 537 countries. For example, in Wales, 21 policy documents assessed across different sectors including Health,
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53 538 Sport, Education, Environment, Transport, and Urban Design/Planning were evaluated using the *Health-*
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55 539 *Enhancing Physical Activity Policy Audit Tool*, obtaining a final score of 54% that was converted to a
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3 540 letter grade of “C+”.¹⁰⁰ In some other countries that did not have relevant quantitative data, a letter grade
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5 541 was graded primarily based on expert opinion. Although most countries reported government physical
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7 542 activity strategies and policies, the absence of a relationship between the Government grades and the
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9 543 Overall Physical Activity grades and the mostly low behavioral grades suggest that these actions are not
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11 544 singularly effective at increasing the prevalence of MVPA among children and youth.

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17 546 *Integrated Discussion*

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20 547 Generally, higher grades were reported for the source of influence indicators in comparison with the
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22 548 behavioral indicators among the 30 very high HDI countries integrated in this study. The average grade
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24 549 for the behavioral indicators was “D+” (ranging from “B-” to “D-”) while the average grade for the
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26 550 sources of influence indicators was “C+” (ranging from “A” to “D”). This finding is consistent with
27
28 551 previous Global Matrices,^{37,39} and may be partially explained by the fact that more than half of the
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30 552 countries that participated in the Global Matrix 1.0 and 2.0 belonged to the very high HDI category.

33 553 Japan, the Netherlands, and Slovenia had the highest behavioral score, while Estonia, Chile and the
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35 554 United Arab Emirates had the lowest score (Figure 3). This score was calculated based on the grades for
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37 555 five indicators, and most of the countries had four to five letter grades to inform the score, with the
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39 556 exception of the United Arab Emirates with only two letter grades, and Qatar, Jersey, and Japan with only
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41 557 three letter grades. The amount of “INC” grades for these four countries questions the accuracy of their
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43 558 ranking, in particular for Japan, in the leading position. For the sources of influence score, Slovenia,
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45 559 Denmark, and Finland led the ranking, while the United States, South Korea, and Guernsey ranked at the
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47 560 bottom (Figure 4). While the calculation of the source of influence score was based on the letter grades
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49 561 for four indicators, eight countries had only two letter grades to inform this score, and Guernsey, the
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51 562 Netherlands and Spain had only one. The amount of “INC” grades challenges the correctness of this
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53 563 classification, in particular for the three countries with only one source of influence indicator graded. The
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3 564 comparison of these groups of indicators suggests that the adequate to good grades observed for the
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5 565 source of influence indicators are not translated in good behavioral grades for the very high HDI
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7 566 countries.

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10 567 In total, 24 countries had three or less “INC” grades, but six countries were missing data to grade four to
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12 568 six indicators. Including countries with a significantly large number of “INC” grades in the Global Matrix
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14 569 3.0 is a limitation to this study as it limits the comparisons. For example, the United Arab Emirates had
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16 570 six “INC” grades,¹⁰¹ Guernsey had five “INC” grades,¹⁰² and Qatar had four “INC” grades, and a “not
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18 571 applicable” for Active Transportation.⁴⁶ Another major limitation of this study is the diversity of the data
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20 572 that were used to inform the 10 core indicators, challenging the comparativeness of the grades within the
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22 573 same indicator. Two identical grades for the same indicator can potentially reflect very different situations
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24 574 from one country to another. An alternative approach would have been to exclude the countries with
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26 575 insufficient data from the Global Matrix 3.0, and to have assigned “INC” grades to all the countries with
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28 576 data that were not fitting exactly with the benchmarks for each indicator. Yet, this strategy would have
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30 577 considerably reduced the number of countries and indicators included in the analyses of this study and
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32 578 decrease the relevance of conducting international comparisons within an HDI category. Finally, a loss of
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34 579 information potentially occurs when translating original data to a letter grade, as letter grades provide less
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36 580 information than continuous variables.

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40 581 The main strength of this study is the large number of participating countries who adopted the harmonized
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42 582 data gathering, assessing, and grading process and the quantity of data that are informing the international
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44 583 physical activity comparisons. This was possible as a result of the inclusive strategy adopted by AHKGA.
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46 584 This project offers the opportunity to paint a picture of the characteristics of childhood physical activity in
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48 585 each country, as determined and explained by a diverse group of experts within each country. In addition,
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50 586 despite the presented methodological issues, this study allows the identification of major trends
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52 587 concerning the characteristics of the physical activity of children and youth among very high HDI
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54 588 countries. The need for the development and the international adoption of standardized methods to
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3 589 conceptualise and measure the ten indicators was also highlighted in this paper. An “INC” grade can be
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5 590 useful for advocacy in individual countries in future cards, and the Global Matrix project has the potential
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7 591 to influence the physical activity national surveillance systems in the short to long term. Finally, as
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9 592 demonstrated in the study presenting the international impact of the Report Cards and Global Matrices
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11 593 published in this special issue,¹⁰³ the development of a national Report Card of physical activity for
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13 594 children and youth, and the participation in the Global Matrix initiative, contributes to raising awareness
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15 595 on the childhood physical inactivity issue nationally and internationally, building capacity within
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17 596 participating countries, and potentially influencing the creation of physical activity opportunities in the
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19 597 future.
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599 Conclusion

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28 600 This analysis and comparison of the Global Matrix 3.0 grades provide a comprehensive summary of the
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30 601 level and context of the physical activity of children and youth among the participating very high HDI
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32 602 countries. While methodological limitations and research gaps were identified, this work allowed the
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34 603 portrayal of major trends across the 10 physical activity indicators. The majority of very high HDI
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36 604 countries had better grades on the sources of influence levels, but this was not translated in positive
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38 605 outcomes concerning childhood physical activity and sedentary behavior, indicating an implementation
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40 606 gap between the policy/governmental and individual level. This paper provides additional evidence that
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42 607 the situation regarding physical activity in children and youth living in very high HDI countries is
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44 608 extremely concerning. Strategic public investments to implement effective interventions within families,
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46 609 communities, and schools to increase physical activity opportunities are needed. Unless a major shift to a
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48 610 more active lifestyle happens soon, a high rate of non-communicable diseases can be anticipated when
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50 611 this generation of children will reach adulthood.
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7
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9
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12 617 Work Group, and all other members of their Report Card Committees.
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For Peer Review

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For Peer Review

RUNNING HEAD: Very High HDI Country Physical Activity Grades for Children and Youth

935 **Table 1: Global Matrix 3.0 indicators and benchmarks used to guide the grade assignment process**

Indicator	Benchmark
Overall Physical Activity	% of children and youth who meet the Global Recommendations on Physical Activity for Health, which recommend that children and youth accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity per day on average. Or % of children and youth meeting the guidelines on at least 4 days a week (when an average cannot be estimated).
Organized Sport and Physical Activity	% of children and youth who participate in organized sport and/or physical activity programs.
Active Play	% of children and youth who engage in unstructured/unorganized active play at any intensity for more than 2 hours a day. % of children and youth who report being outdoors for more than 2 hours a day.
Active Transportation	% of children and youth who use active transportation to get to and from places (e.g., school, park, mall, friend's house).
Sedentary Behaviors	% of children and youth who meet the Canadian Sedentary Behaviour Guidelines (5- to 17-year-olds: no more than 2 hours of recreational screen time per day). Note: the Guidelines currently provide a time limit recommendation for screen-related pursuits, but not for non-screen-related pursuits.
Physical Fitness	Average percentile achieved on certain physical fitness indicators based on the normative values published by Tomkinson et al. ⁵⁶
Family and Peers	% of family members (e.g., parents, guardians) who facilitate physical activity and sport opportunities for their children (e.g., volunteering, coaching, driving, paying for membership fees and equipment). % of parents who meet the Global Recommendations on Physical Activity for Health, which recommend that adults accumulate at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity physical activity. % of family members (e.g., parents, guardians) who are physically active with their kids. % of children and youth with friends and peers who encourage and support them to be physically active. % of children and youth who encourage and support their friends and peers to be physically active.

RUNNING HEAD: Very High HDI Country Physical Activity Grades for Children and Youth

School	<p>% of schools with active school policies (e.g., daily PE, daily physical activity, recess, “everyone plays” approach, bike racks at school, traffic calming on school property, outdoor time).</p> <p>% of schools where the majority ($\geq 80\%$) of students are taught by a PE specialist.</p> <p>% of schools where the majority ($\geq 80\%$) of students are offered the mandated amount of PE (for the given state/territory/region/country).</p> <p>% of schools that offer physical activity opportunities (excluding PE) to the majority ($> 80\%$) of their students.</p> <p>% of parents who report their children and youth have access to physical activity opportunities at school in addition to PE classes.</p> <p>% of schools with students who have regular access to facilities and equipment that support physical activity (e.g., gymnasium, outdoor playgrounds, sporting fields, multi-purpose space for physical activity, equipment in good condition).</p>
Community and the Built Environment	<p>% of children or parents who perceive their community/municipality is doing a good job at promoting physical activity (e.g., variety, location, cost, quality).</p> <p>% of communities/municipalities that report they have policies promoting physical activity.</p> <p>% of communities/municipalities that report they have infrastructure (e.g., sidewalks, trails, paths, bike lanes) specifically geared toward promoting physical activity.</p> <p>% of children or parents who report having facilities, programs, parks and playgrounds available to them in their community.</p> <p>% of children or parents who report living in a safe neighbourhood where they can be physically active.</p> <p>% of children or parents who report having well-maintained facilities, parks and playgrounds in their community that are safe to use.</p>
Government	<p>Evidence of leadership and commitment in providing physical activity opportunities for all children and youth.</p> <p>Allocated funds and resources for the implementation of physical activity promotion strategies and initiatives for all children and youth.</p> <p>Demonstrated progress through the key stages of public policy making (i.e., policy agenda, policy formation, policy implementation, policy evaluation and decisions about the future).</p>

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RUNNING HEAD: Very High HDI Country Physical Activity Grades for Children and Youth

942 **Table 2: Global Matrix 3.0 grading rubric**

Grade	Interpretation	Corresponding number for analysis
A+	94% - 100%	15
A	We are succeeding with a large majority of children and youth (87% - 93%)	14
A-	80% - 86%	13
B+	74% - 79%	12
B	We are succeeding with well over half of children and youth (67% - 73%)	11
B-	60% - 66%	10
C+	54% - 59%	9
C	We are succeeding with about half of children and youth (47% - 53%)	8
C-	40% - 46%	7
D+	34% - 39%	6
D	We are succeeding with less than half but some children and youth (27% - 33%)	5
D-	20% - 26%	4
F	We are succeeding with very few children and youth (<20%)	2
INC	Incomplete - insufficient or inadequate information to assign a grade	No Grade

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RUNNING HEAD: Very High HDI Country Physical Activity Grades for Children and Youth

953 **Table 3: Sociodemographic information of the 30 very high HDI countries in the Global Matrix 3.0**

Country	HDI ^a	GNI per capita ^a	Public Health Expenditure (% of GDP) ^a	Gender Inequality Index (GII) ^a	Life expectancy at birth ^a	Mean years of schooling ^a	Gini index ^b	Global Food Security Index ^c	Child Poverty Rate ^d	Urban Population Percentage ^e	Population Density (people/km ²) ^f
Australia	0.939	42822	6.3	0.12	82.5	13.2	34.7	83.3	0.13	89.4	3
Belgium	0.896	41243	8.3	0.073	81	11.4	27.7	79.8	0.11	97.5	374
Canada	0.92	42582	7.4	0.098	82.2	13.1	34	82.2	0.171	80.8	4
Chile	0.847	21665	3.9	0.322	82	9.9	47.7	74.7	0.225	89.4	24
Czech Republic	0.878	28144	6.3	0.129	78.8	12.3	25.9	75.8	0.105	73.4	137
Denmark	0.925	44519	9.2	0.041	80.4	12.7	28.2	80.3	0.029	87.1	136
England	0.909	37931	7.6	0.131	80.8	13.3	33.2	84.2	0.112	79.7	271
Estonia	0.865	26362	5	0.131	77	12.5	32.7		0.121	69.5	31
Finland	0.895	38868	7.3	0.056	81	11.2	27.1	81	0.037	83.8	18
France	0.897	38085	9	0.102	82.4	11.6	32.7	82.3	0.113	86.4	122
Germany	0.926	45000	8.7	0.066	81.1	13.2	31.7	82.5	0.095	74.1	236
Guernsey*	0.975				82.6		40				850
Hong Kong	0.917	54265			84.2	11.6				100	6987
Japan	0.903	37268	8.6	0.116	83.7	12.5	32.1	79.5		91.9	348
Jersey**	0.985				81.9		41				845
Lithuania	0.848	26006	4.4	0.121	73.5	12.7	37.4		0.191	67.2	46
Netherlands	0.924	46326	9.5	0.044	81.7	11.9	29.3	82.8	0.102	83.6	506
New Zealand	0.915	32870	9.1	0.158	82	12.5		81	0.141	86.3	18
Poland	0.855	24117	4.5	0.137	77.6	11.9	31.8	74.1	0.134	60.8	124
Portugal	0.843	26104	6.2	0.091	81.2	8.9	35.5	79	0.155	61.6	113
Qatar	0.856	129916	1.9	0.542	78.3	9.8		73.3		98.9	221
Scotland	0.909	37931	7.6	0.131	80.8	13.3	33.2	84.2	0.112	79.7	271
Slovenia	0.89	28664	6.6	0.053	80.6	12.1	25.4			49.8	103
South Korea	0.901	34541	4	0.067	82.1	12.2	31.6		0.071	83.5	526
Spain	0.884	32779	6.4	0.081	82.8	9.8	36.2	78.1	0.221	77.6	93
Sweden	0.913	46251	10	0.048	82.3	12.3	29.2	81.7	0.091	85.4	24
Taiwan***	0.885	45582			80.2		33.6				
United Arab Emirates	0.84	66203	2.6	0.232	77.1	9.5		70.9		84.7	111
United States	0.92	53245	8.3	0.203	79.2	13.2	41.5	84.6	0.199	82.6	35
Wales	0.909	37931	7.6	0.131	80.8	13.3	33.2	84.2	0.112	79.7	271

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RUNNING HEAD: Very High HDI Country Physical Activity Grades for Children and Youth

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3 955 Note: HDI = Human Development Index, GNI = Gross National Income, GDP = Gross Domestic
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5 956 Product, GII = Gender Inequality Index. Sources of information: a., United Nations Development
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7 957 Programme;⁸ b. and f., the World Bank;^{104,105} c., the Economist Intelligence Unit;¹⁰⁶ d., the Organisation
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9 958 for Economic Co-operation and Development Child (OECD) Well-Being Data Portal;¹⁰⁷ and e., United
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11 959 Nations, Department of Economic and Social Affairs.¹⁰⁸ * For Guernsey, the HDI sourced from the
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13 960 United Nations Economic and Social Commission for Asia and the Pacific,¹⁰⁹ the life expectancy at birth,
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15 961 population size, and the population density sourced from the United States Central Intelligence Agency,¹¹⁰
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17 962 and the Gini index sourced from the State of Guernsey.¹¹¹ **For Jersey, the HDI sourced from¹⁰⁹, the life
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19 963 expectancy at birth, population size, and the population density sourced from the United States Central
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21 964 Intelligence Agency,¹¹⁰ and the Gini index sourced from the State of Jersey.¹¹² ***For Taiwan, the HDI,
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23 965 the GNI per Capita, the life expectancy at birth and the Gini index come from the National Statistics,
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25 966 Republic of China (Taiwan).¹¹³ For England, Scotland, and Wales, the official data for UK were reported.
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RUNNING HEAD: Very High HDI Country Physical Activity Grades for Children and Youth

976 **Table 4: Grades assigned to the 10 core physical activity indicators for the 30 very high HDI**
 977 **countries of the Global Matrix 3.0**

	PA	SP	AP	AT	SB	PF	FAM	SCH	COM	GOV	AVG
Australia	D-	B-	INC	D+	D-	D+	C+	B+	A-	D	C-
Belgium (Flanders)	F	B	INC	C+	C	INC	C+	B-	B	B	C
Canada	D+	B+	D	D-	D+	D	C+	B-	B+	C+	C-
Chile	D-	D-	INC	F	C-	D	F	D	B	B-	D
Czech Republic	D	B-	D-	C+	D-	C+	C+	B+	B	C+	C
Denmark	D-	A-	INC	B+	D+	INC	INC	A-	B+	A-	B-
England	C-	D+	INC	C-	D+	C-	INC	B+	C	INC	C-
Estonia	D-	C	F	D	F	INC	D	C+	B	B	D+
Finland	D	C+	C	B+	D-	C	B-	A	B+	A-	C+
France	D	C-	INC	C-	D-	B-	INC	B	INC	C	C-
Germany	D-	B	D-	C-	D-	INC	B-	B+	B+	INC	C
Guernsey	D	C+	INC	D	C	INC	INC	INC	INC	D	D+
Hong Kong	C-	C	INC	B+	C-	D	D-	C	B	C	C-
Japan	INC	B-	INC	A-	C-	A	C-	B+	B-	B	B-
Jersey	D-	INC	INC	D+	C	D	C	B-	C	D	D+
Lithuania	C-	C	INC	C-	C-	C+	D	C+	C	C	C-
Netherlands	C	B	B	B-	C-	INC	INC	C	INC	INC	C+
New Zealand	D-	B	C+	C-	D	INC	C	B-	B	B+	C
Poland	D-	D	INC	C	D	C-	C-	B	C	C+	C-
Portugal	D	B-	INC	C-	C-	C	C	A	B	B	C+
Qatar	D	D+	INC	N/A	D+	INC	INC	C	INC	B+	C-
Scotland	F	B	INC	C	F	INC	INC	INC	B-	C	D+
Slovenia	A-	C+	D	C	B+	A-	B+	A	B	A	B

RUNNING HEAD: Very High HDI Country Physical Activity Grades for Children and Youth

South Korea	F	C	INC	B+	D	D+	INC	D+	INC	D	D+
Spain	D	B	C-	B-	B+	INC	INC	C+	INC	INC	C+
Sweden	D+	B+	INC	C	C+	INC	INC	C+	A	B	C+
Taiwan	F	D-	INC	C-	C-	B-	INC	B+	B+	B+	C
United Arab Emirates	F	INC	INC	INC	C-	INC	INC	D-	INC	B+	D+
United States	D-	C	INC	D-	D	C-	INC	D-	C	INC	D
Wales	D+	C+	C-	D+	F	INC	D	INC	INC	C+	D+

978 Note: PA = Physical Activity, SP = Organized Sport and Physical Activity Participation, AP = Active
 979 Play, AT = Active Transportation, SB = Sedentary Behaviors, PF = Physical Fitness, FAM = Family and
 980 Peers, SCH = School, COM = Community and the Built Environment, GOV = Government, AVG =
 981 Average, INC = incomplete grade, and N/A = not applicable.

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992 **Table 5: Descriptive statistics of the grades by indicator and group of indicators for the very high**
 993 **HDI countries of the Global Matrix 3.0**

	Grade count	Incomplete grades	Mean number grade	SD	Mean letter grade	Range
Overall physical activity	29	1	4.9	2.2	D-	F to A-
Organized sport and physical activity participation	28	2	9	2.4	C+	D- to A-
Active play	10	20	6.2	2.7	D+	F to B
Active transportation	28	2	7.8	2.7	C-	F to A-
Sedentary behaviors	30	0	6.1	2.4	D+	F to B+
Physical fitness	17	13	7.9	2.7	C-	D to A
Family and peers	17	13	7.5	2.6	C-	F to B+
School	27	3	9.9	2.9	C+	D- to A
Community and the Built Environment	22	8	10.7	1.7	B-	C to A
Government	25	5	9.6	2.7	C+	D to A
Behavioral indicators	30	0	6.8	1.6	D+	D- to B-
Sources of influence indicators	30	0	9.3	2	C+	D to A-
All indicators	30	0	7.9	1.5	C-	D+ to B

994 Note: Behavioral indicators = Average of Overall Physical Activity, Organized Sport Participation,
 995 Active Play, Active Transportation, Sedentary Behavior indicator grades; Source of influence indicators =
 996 Average of Family and Peers, School, Community and the Built Environment, and Government Strategies
 997 and Investments indicator grades. Physical fitness was not included in the behavioral indicators cluster.
 998 There are no missing grades for the bottom three rows because these scores are adjusted for missing
 999 grades.

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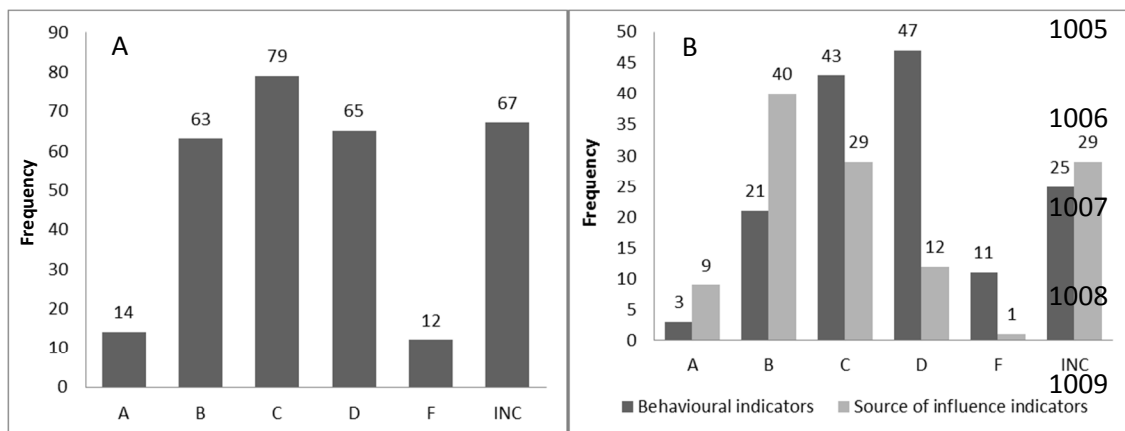
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1002 **Figure 1: Frequency plot by letter grade among 30 very high-HDI countries in the Global Matrix**

1003 **3.0. A: For the 10 core indicators. B: For the behavioral indicators and for the source of influence**

1004 **indicators.**



1010 Note: Behavioral indicators = Average of Overall Physical Activity, Organized Sport Participation,
 1011 Active Play, Active Transportation, Sedentary Behavior indicator grades; Source of influence indicators =
 1012 Average of Family and Peers, School, Community and the Built Environment, and Government Strategies
 1013 and Investments indicator grades. Physical fitness was not included in the behavioral indicators cluster.

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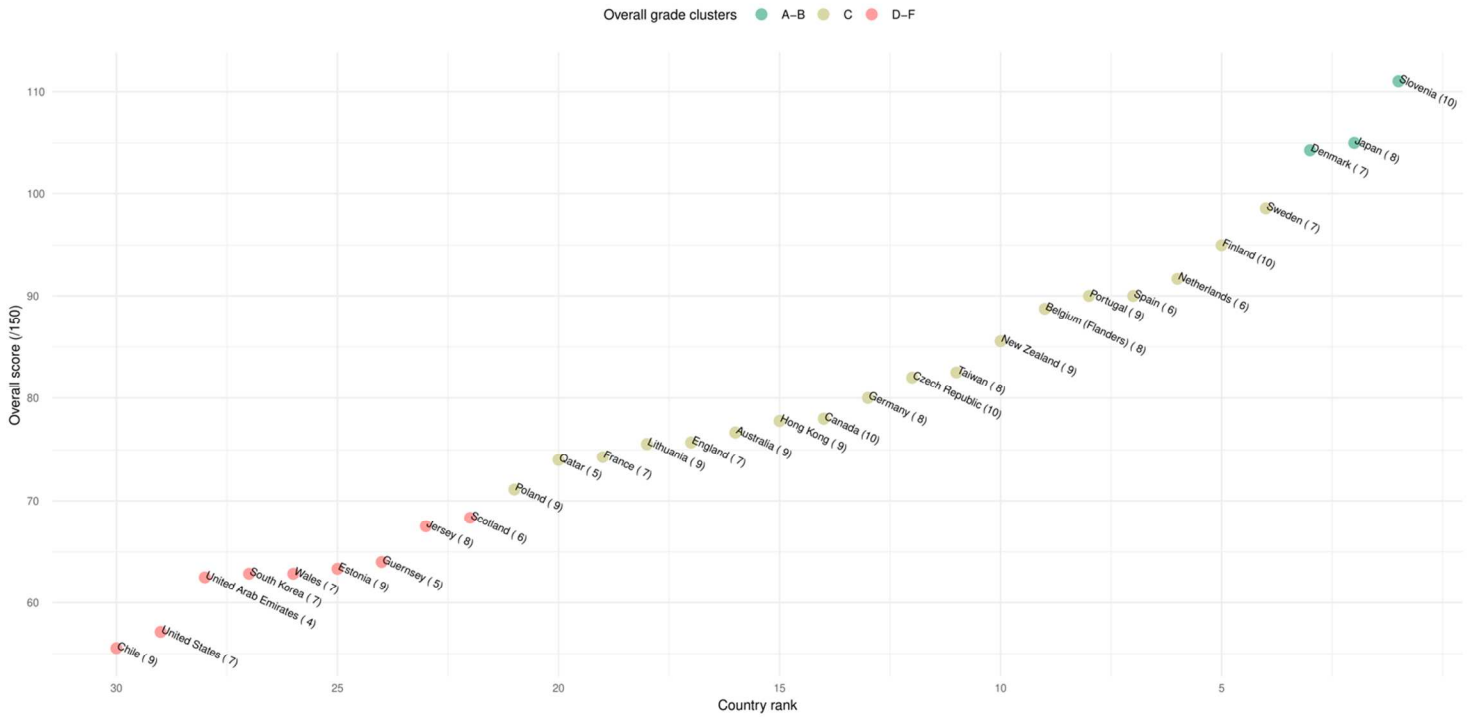
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RUNNING HEAD: Very High HDI Country Physical Activity Grades for Children and Youth

1023 **Figure 2: Plot of the overall score estimated for the 10 core indicators for the 30 very high HDI**
 1024 **countries of the Global Matrix 3.0**

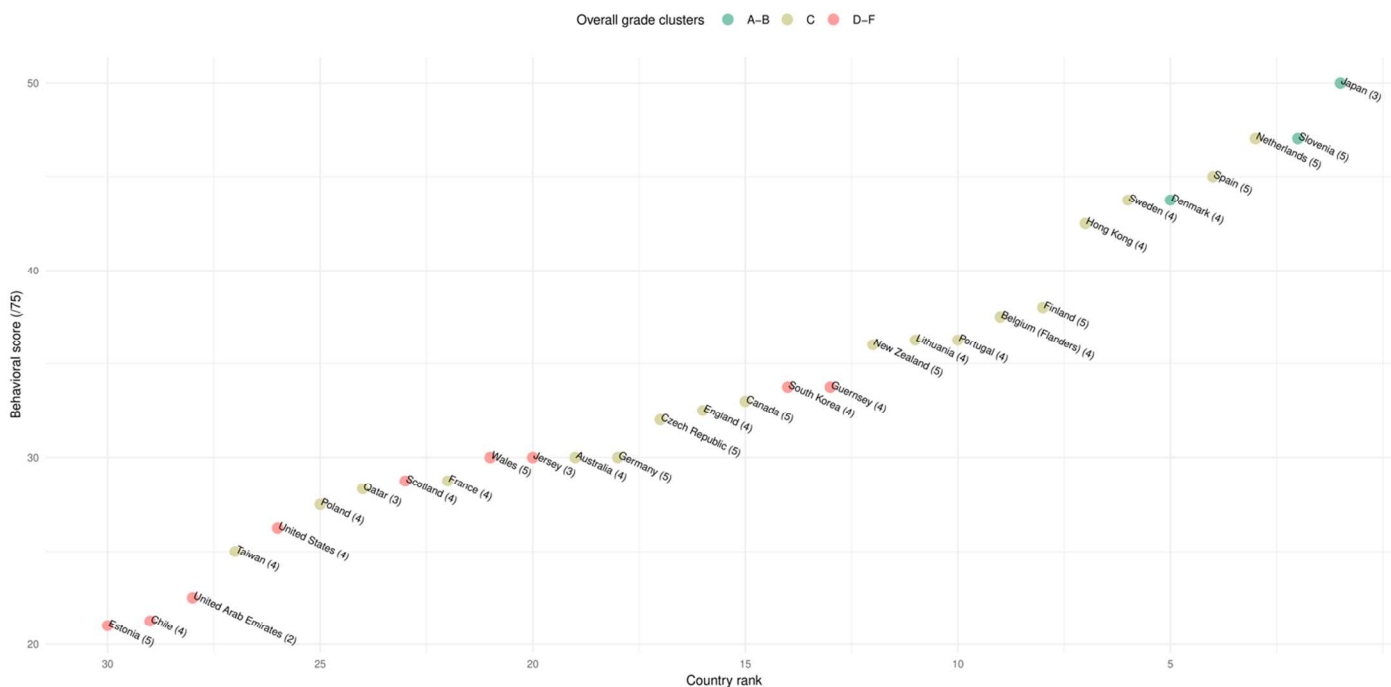


1025 Note: The overall score was adjusted for missing and incomplete grades. The number in parenthesis
 1026 shows the number of grades available for the calculation of the score.

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1035 **Figure 3: Plot of the behavioral score estimated for the very high HDI countries of the Global**
 1036 **Matrix 3.0**



1037 Note: The overall score was adjusted for missing and incomplete grades. The number in parenthesis
 1038 shows the number of grades available for the calculation of the score.

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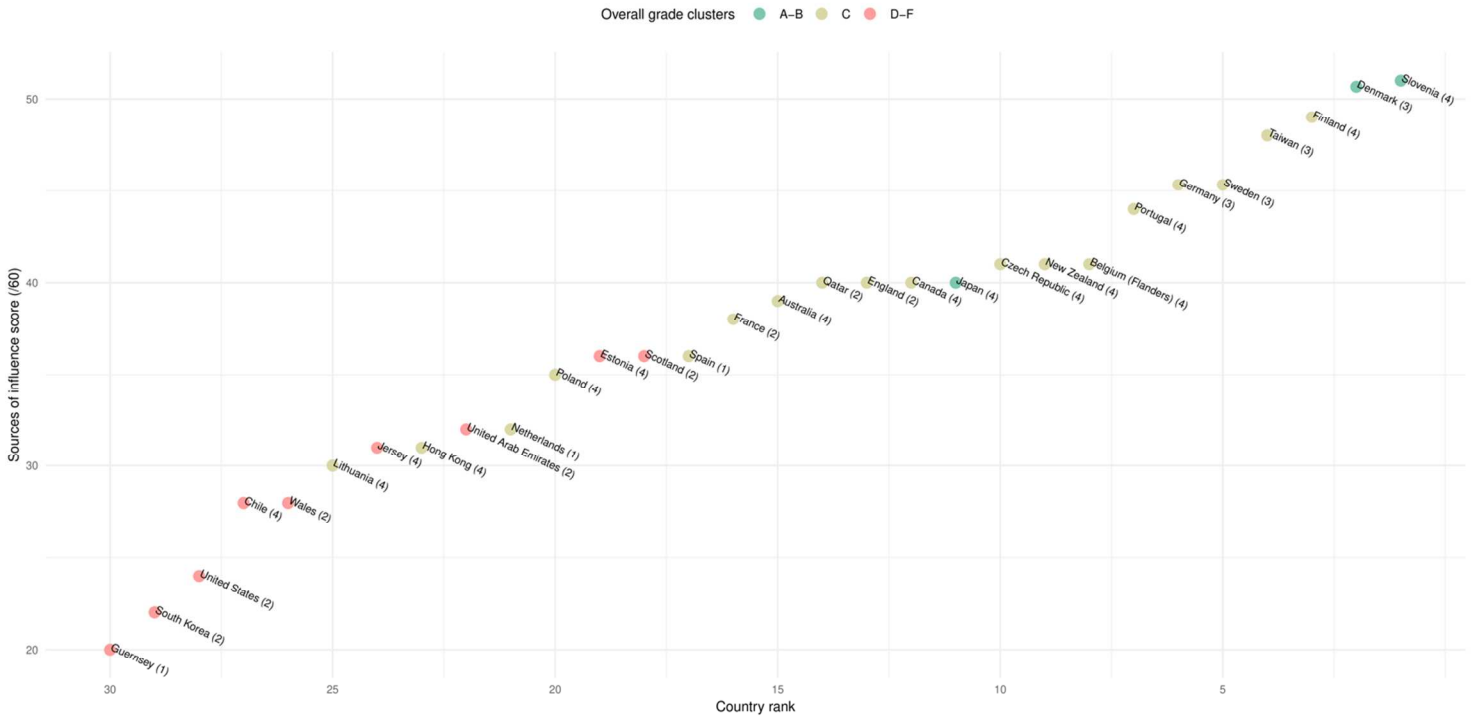
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1044 **Figure 4: Plot of the source of influence indicators score for the very high HDI countries of the**
 1045 **Global Matrix 3.0**



1046 Note: The overall score was adjusted for missing and incomplete grades. The number in parenthesis
 1047 shows the number of grades available for the calculation of the score. These estimates of sources of
 1048 influence score are interpreted with a high degree of caution as they are likely imprecise estimates of
 1049 sources of influence due to the level of missing data used to determine this score.

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Country	Method
Australia	Subjective (self-report) Subjective (self-report) Subjective (self-report) Subjective (self-report) Subjective (self-report) Subjective (self-report) Subjective (self-report) Subjective (parent/guardian-report) Subjective (self-report) Subjective (parent/guardian-report) Subjective (parent/guardian-report for 5-14 years old, self-report for 15-17years old) Subjective (parent/guardian-report for 5-10 years old, self-report for 11-15 years old)) Subjective (self-report) Subjective (parent/guardian-report)
Belgium (Flanders)	Objective
Canada	Objective
Chile	Subjective (self-report) Subjective (self-report) Subjective (self-report) Subjective (self-report)
Chinese Taipei	Subjective (self-report)
Czech Republic	Objective Objective Objective Subjective (self-report) Subjective (self-report)
Denmark	Subjective (self-report) Subjective (self-report) Subjective (self-report)
England	Subjective (self-report)

	Subjective (parent/guardian-report for 5-12 years old, self-report for 13-15) Objective Objective
Estonia	Objective Subjective (self-report) Subjective (self-report) Subjective (self-report)
Finland	Subjective (self-report) Subjective (self-report) Objective
France	Subjective (parent/guardian-report for 6-10 years old; self-report for 11-17 years old) Subjective (parent/guardian-report for 6-10 years old; self-report for 11-17 years old)
Germany	Subjective (parent/guardian-report for 3-11 years old, self report for 12-17 years old) Subjective (self-report) Objective Objective Objective
Guernsey	Subjective (self-report) Subjective (self-report) Subjective (self-report)
Hong Kong	Subjective (self-report) Subjective (self-report) Objective Objective
Japan	NA
Jersey	Subjective (self-report)
South Korea	Subjective (self-report) Subjective (self-report)
Lithuania	Subjective (parent/guardian-report)

	Subjective (self-report)
	Subjective (self-report)
Netherlands	Subjective (parent/guardian-report for 4-11 years old, self report for 12-17 years old)
	Subjective (self-report)
New Zealand	Subjective (parent/guardian-report for 5-11 years old; self-report for 12-17 years old)
	Objective
	Objective
Poland	Subjective (self-report)
	Subjective (self-report)
Portugal	Objective
	Subjective (self report)
	Subjective (self report)
Qatar	Objective
	Subjective (self-report)
Scotland	Subjective (self-report)
Slovenia	Objective
	Subjective (parent/guardian-report)
	Subjective (self-report)
Spain	Subjective (self-report)
	Subjective (parent/guardian-report)
	Subjective (parent/guardian-report)
Sweden	Subjective (self-report)
	Objective
	Objective
United Arab Emirates	Subjective (self-report)
United States	Subjective (self-report)
	Subjective (parent/guardian-report)
Wales	Subjective (parent/guardian-report)
	Subjective (self-report)

Representativeness: Survey/study (year); instrument details

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4	Nationally representative: Australian Bureau of Statistics National Health Survey (2014-2015); survey specific ques
5	Nationally Representative: National Secondary School Diet and Activity Survey (2012-2013); survey specific questi
6	State-based representative: Australian School Students Alcohol and Drug Survey South Australia (2014); survey sp
7	State-based representative: Australian School Students Alcohol and Drug Survey Queensland (2014); survey speci
8	State-based representative: Australian School Students Alcohol and Drug Survey Tasmania (2014); survey specific
9	State-based representative: Australian School Students Alcohol and Drug Survey Victoria (2014); survey specific q
10	State-based representative: ACT Year 6 Physical Activity and Nutrition Survey (2015); survey specific questionnaire
11	State-based representative: NSW Child Health Survey (2015-2016); survey specific questionnaire
12	State-based representative: NSW Secondary Schools Health Behaviours Survey (2014); survey specific questionnai
13	State-based representative: QLD Child Health Status Survey (2017-2018); survey specific questionnaire
14	State-based representative: SA Monitoring and Surveillance Survey (2016-2017); survey specific questionnaire
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20	State-based representative: NSW Schools Physical Activity and Nutrition Survey (2015); survey specific questionna
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24	State-based representative: VIC Student Health and Wellbeing Survey (2016); survey specific questionnaire
25	
26	State-based representative: VIC child Health and Wellbeing Survey (2013); survey specific questionnaire
27	Regionally representative: Belgian Food Consumption Survey (2014); accelerometer data (hip-worn ActiGraph
28	GT3Xand accelerometers for 7 consecutive days) analyzed with Evenson 2008 cut-off points
29	
30	Nationally representative: Canadian Health Measures Survey (2014-2015) ; accelerometer data (hip worn Actical
31	accelerometers for at least 4 consecutive days) analyzed with Puyau 2004 cut-off points
32	Nationally representative: PISA (2015) using a questionnaire adapted from GSHS
33	Nationally representative: GSHS (2013), GSHS questionnaire
34	Nationally representative: National Survey on Activities of children and adolescents (2012); questionnaire
35	adapted from GSHS.
36	
37	Regionally representative: Nutrition and Health Survey; Chinese version of modified IPAQ questionnaire, 3 waves:
38	2010-2011
39	2011
40	2012
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42	Regionally representative: (2013-2014); accelerometer data (ActiGraph, hip-worn for 7 consecutive days)
43	Regionally representative: IPEN study (2015–2016); accelerometer data (ActiGraph, hip-worn for 7 consecutive
44	days) analyzed with Evenson 2008 cut-off points
45	Local study (2017–2018): accelerometer data (ActiGraph, wrist-worn for 7 consecutive days) analyzed with Chand
46	Nationally representative: HBSC (2014) ; HBSC questionnaire
47	Nationally representative; (2013–2016); IPAQ-long questionnaire
48	
49	Nationally representative: National Health Survey (2017); survey specific questionnaire
50	Nationally representative: The Youth Profile (2014); survey specific questionnaire
51	Nationally representative: HBSC (2014); HBSC questionnaire
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53	Nationally representative: HBSC (2016); HBSC questionnaire
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1	Nationally representative: Health Survey for England (2015); survey specific questionnaire
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4	Regionally representative: B-PROACT1V 2012-2016; accelerometer data (hip worn Actigraph wGT3X for 5
5	consecutive days) analyzed with Evenson 2008 cut-off points
6	Regionally representative: ISCOLE 2015-2016; accelerometer data (hip worn Actigraph wGT3X+ for 7consecutive
7	days) analyzed with Evenson 2008 cut-off points
8	
9	Nationally representative: Children's Physical Activity Study (2015); accelerometer data (hip-worn GT3X for 7
10	consecutive days) analyzed with Evenson 2008 cut-off points
11	Nationally representative: HBSC (2014); HBSC questionnaire
12	Nationally representative: Health Promotion Effectiveness in Estonian Schools (2012-2015);survey specific
13	Nationally representative: Schools in Motion survey (2018); online survey specific questionnaire
14	
15	Nationally representative: National School Health Promotion Study (2017); survey specific questionnaire
16	
17	Nationally representative: LIITU study (2016); HBSC questionnaire
18	Nationally representative: LIITU study (2016) ; accelerometer data (hip-worn UKK AM30 and UKK RM42
19	monitors for 7 consecutive days) analyzed with Aittasalo 2015 cut-off points
20	
21	Nationally representative : INCA3 (2014-2015); survey specific questionnaire
22	Nationally representative : INCA3 (2014-2015); modified version of YRBSS questionnaire
23	
24	
25	Nationally representative: ESTEBAN (2015); survey specific questionnaire
26	Nationally representative: ESTEBAN (2015); modified version of YRBSS questionnaire
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29	Nationally representation: KiGGs Study (2009-2017); survey specific questionnaire
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32	Nationally representative: HBSC (2010); HBSC questionnaire
33	Regionally representative: Gini Study (2014); accelerometer data (hip worn ActiGraph GT3X for 7 consecutive
34	days) analyzed with Fredson 1997 cut-off points
35	Regionally representative: MAAS-Kids Study (2008); pedometers data (StepWatch 3™ System worn for 7
36	Regionally representative: IDEFICS Study (2011); accelerometer data (hip-worn ActiGraph GT1M for at least 3
37	consecutive days) analyzed with Evenson 2008 cut-off points
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39	Nationally representative: Guernsey Young People's Survey (2016); survey specific questionnaire
40	Nationally representative: Guernsey Young People's Survey (2016); survey specific questionnaire
41	Nationally representative: Guernsey Young People's Survey (2016); survey specific questionnaire
42	
43	Regionally representative: National Physical Fitness Survey (2011-2012); survey specific questionnaire
44	
45	Regionally representative (2012-2013); Chinese version of GYTS questionnaire
46	Regionally representative: IPEN Hong Kong study (2012-2013); accelerometer data data (hip-worn ActiGraph
47	GT3X and GT3X+ for 7 consecutive days) analyzed with Freedson 1997 cut-off points
48	Local study (2009-2010): accelerometer data (hip-worn actigraph GT3X for 8 consecutive days) analyzed with
49	
50	No representative data
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52	Nationally representative: Young People's Health and Lifestyle Survey (2014); HBSC questionnaire
53	Nationally representative: Korea National Health and Nutrition Examination Survey (2016); GPAQ
54	Nationally representative: Korea Youth Risk Behavior web-based Survey (2017), online Korean version of YRBSS q
55	Nationally representative: Lithuanian COSI study (2013); WHO COSI questionnaire
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1	Nationally representative: HBSC survey (2013-2014), HBSC questionnaire
2	Nationally representative; Lifestyle study of schoolchildren made by Lithuanian Institute of Hygiene (2016);
3	Nationally representative: survey name?? 2017; survey specific questionnaire
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7	Nationally representative (2016-2017): survey specific questionnaire
8	Nationally representative: Active NZ Survey (2018); survey specific questionnaire
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12	Local study: 2016; accelerometer data (hip worn ActiGraph GT3X+ for minimum 3 valid days) analyzed with Evenson
13	Local study: 2016; accelerometer data (hip worn ActiGraph GT3X+ for minimum 5 valid days) analyzed with Evenson
14	Nationally representative: HBSC year (2013-2014); HBSC questionnaire
15	Nationally representative: Physical Activity of School Children Aged 9 - 17 (2013); HBSC questionnaire
16	Nationally representative: Observatório da Atividade Física e do Desporto (2012); accelerometer data (hip worn
17	accelerometer for at least 3 valid days including a weekend day) analyzed with a cut-off point of 2,020
18	Nationally representative: HBSC (2014); HBSC questionnaire
19	Nationally representative: HBSC (2014); HBSC questionnaire
20	Nationally representative; IANAF Survey (2017) – IPAQ adolescents
21	Local study: School-time physical activity among Arab elementary school children in Qatar (2017); accelerometer
22	data (ActiGraph wGT3X-BT worn on non-dominant wrist at school for 5 consecutive days) analyzed with Chandler
23	Nationally representative: Qatar National School Survey (2015-2016); Questionnaire adapted from the GSHS
24	Nationally representative: HBSC (2014), HBSC questionnaire
25	Nationally representative; ACDSi research project (2013-2014); accelerometer data (hip-worn Sensewear Pro for
26	2 weekend days and minimum 3 week days) analyzed with a 4 MET cut-off point for MVPA
27	Nationally representative: ACDSi research project (2013-2014); CLASS questionnaire
28	Nationally representative: ACDSi research project (2013-2014); SHAPES questionnaire
29	Local study: ANIVA study (2013-2014 & 2014-2015); survey specific questionnaire
30	Local study (2015); Spanish version of PACE 2 (validated for 13-18 years old adolescent)
31	Regionally representative: ESCA study (2016); survey specific questionnaire
32	Nationally representative: HBSC (2013-2014); HBSC questionnaire
33	Regionally representative: IDEFICS (2014); accelerometer data (hip-worn ActiGraph for at least 3 consecutive
34	days including a weekend day) analyzed with Evenson 2008 cut-off points
35	Local study (2016): accelerometer data (right ankle worn ActiCal for 7 consecutive days) analyzed with Heil 2006
36	Nationally representative: GSHS (2016); GSHS questionnaire
37	Nationally representative: YRBSS (2017); YRBSS questionnaire
38	Nationally representative: National Survey of Children's Health (2016); survey specific questionnaire
39	Nationally representative: National Survey for Wales (2016-2017): survey specific interview
40	Nationally representative: HBSC (2017); HBSC questionnaire
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Respondents	
Age range	Sample size
15-17 years old	854
12-17 years old	8888
12-17 years old	1518
12-17 years old	3930
12-17 years old	1888
12-17 years old	3806
11 -12 years old (grade 6)	1353
5-15 years old	3217
12-17 years old	5125
5-17 years old	2663
5-17 years old	1034
5-15 years old (grades K-10)	7138
10, 13 & 16 years old (grades 5, 8 & 11)	11421
5-12 years old	4635
6-9 years old	230
10-17 years old	353
5-17 years old	1300
15 years old	245947
14-16 years old	1888
9-11 years old	2042
12-17 years old	6929
13-15 years old (grades 7-9)	1779
16-18 years old (grades 10 -12)	1169
7-12 years old (grades 1-6)	1260
7-12 years old	365
11-17 years old	367
8-18 years old	300
11-15 years old	5750
15-17 years old	3334
16-17 years old	4634
16-17 years old	40022
11-15 years old	3891
11 years old	2116
13 years old	1593
15 years old	1608

5-15 years old	3827
5-6 years old (Phase 1)	1299
8-9 years old (Phase 2)	1223
9-11 years old	374
6-13 years old	492
11, 13 & 15 years old	4057
11-14 years old	1033
10-17 years old	3853
10-11 years old	94531
14-15 years old	71695
9-15 years old	7321
9-15 years old	2931
6-10 years old	644
11-17 years old	1291
6-10 years old	1182
11-17 years old	
3 to 17 years old	12981
11-15-year	16918
Mean age= 15.6 years old	1054
6-17 year old	1020
2-10.9 years old	516
10-11 years old	564
12-13 & 14-15 years old	875
16-18 years old	800
7-12 years old	2723
13-19 years old	2517
Mean age = 14.8 year old	44478
11-18 years old	552
6-8 years old	263
NA	NA
10-15 years old	2842
12-17 years old	524
12-17 years old	57884
Survey of parents/gardians of primary school children	3802

11, 13 & 15 years-old	5730
10-17 years old (grade 5, 7 & 9)	38633
4-11 years old	837
12-17 years old	629
9-13 year old	1554
5-17 years old	5990
8-13 years old	1085
13-18 years old	314
11, 13 & 15 years old	4516
10-17 years old	3346
11-17 years old (grades 6-12)	2714
11-18 years-old	5849
13-17 years old (grades 8-12)	720
6-12 years old	183
13-17 years old	5862
11, 13 & 15 years old	10839
11 & 14 years old	245
5-10 years old	2351
11-19 years old	2907
6-9 years old	1371
3-18 years old	1055
3 -14 years old	1886
11, 13 & 15 years	8000
6-9 years	343
13-15 years	91
13-17 years-old (grades 8-12)	5849
14-18 years old (grades 9-12)	14765
6-17 years old	50212
3-17 years old	2109
11-17 years old	95591
	1005989