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Global Matrix 4.0 Physical Activity Report Card Grades for Children and Adolescents: Results and Analyses from 57 Countries

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Abstract

Background: The Global Matrix 4.0 on Physical Activity for children and adolescents was developed to achieve a comprehensive understanding of the global variation in children and adolescents' (5-17 years) physical activity (PA), related measures, and key sources of influence. The objectives of this article were to: (1) summarize the findings from the Global Matrix 4.0 Report Cards; (2) compare indicators across countries; and (3) explore trends related to Human Development Index and geo-cultural regions.

Methods: A total of 57 Report Card teams followed a harmonized process to grade the 10 common PA indicators. An online survey was conducted to collect Report Card Leaders' top three priorities for each PA indicator and their opinions on how the COVID-19 pandemic impacted child and adolescents' PA indicators in their country.

Results: *Overall Physical Activity* was the indicator with the lowest global average grade (D) while *School* and *Community and Environment* were the indicators with the highest global average grade (C+). An overview of the global situation in terms of surveillance and prevalence is provided for all 10 common PA indicators, followed by priorities and examples to support the development of strategies and policies internationally.

Conclusions: The Global Matrix 4.0 represents the largest compilation of children and adolescents' PA indicators to date. While variation in data sources informing the grades across countries was observed, this initiative highlighted low PA levels in children and adolescents globally. Measures to contain the COVID-19 pandemic, local/international conflicts, climate change, and economic change threaten to worsen this situation.

Background and objectives

The lifelong benefits of physical activity (PA) for the physical and mental health and well-being of children and adolescents are now widely accepted by the international scientific community.[1,2] The World Health Organization (WHO) recommends that children and adolescents 5 to 17 years should accumulate at least 60 min per day of moderate- to vigorous-intensity physical activity (MVPA) on average, and incorporate vigorous-intensity aerobic activities, as well as muscle- and bone-strengthening activities, at least three days per week.[1] While there has been global understanding over the importance of promoting healthy levels of physical activity for years,[3,4] international studies and reports continue to show that child and adolescent PA levels are low across the globe.[5–12] Recent research has shown that some of the public health measures/mandates implemented to contain the coronavirus disease 2019 (COVID-19) pandemic has further adversely impacted PA levels worldwide.[13–16]

The Global Matrix on PA for Children and Adolescents is an initiative launched under the leadership of the Active Healthy Kids Global Alliance (AHKGA: https://www.activehealthykids.org) to achieve a comprehensive understanding of the global variation in child and adolescent PA, related indicators, and key sources of influence. With guidance from the AHKGA, Report Card teams of national experts from countries/jurisdictions (hereafter referred to as countries for simplicity) participating in the Global Matrix developed PA Report Cards based on the Canadian Report Card model.[17] Report Card teams used a harmonized process for gathering, assessing data, and assigning grades to PA indicators. Since its creation, the Global Matrix framework has evolved, expanded, become more robust, and is now widely disseminated and used to inform policy and practice.[18,19] Fifteen countries participated in the inaugural Global Matrix 1.0 (2014),[20] 38 countries participated in the Global Matrix 2.0 (2016),[21] and 49 countries participated in the Global Matrix 3.0 (2018).[22] These Global Matrices highlighted international research and surveillance gaps and limitations; showed evidence of higher PA and lower sedentary behavior in countries reporting poorer infrastructure for supporting PA, and lower PA and higher sedentary behavior

in countries reporting better infrastructure for supporting PA. The Global Matrices also presented examples of good practice promoting more PA and less sedentary behaviors in children and adolescents.[20–22]

Although the COVID-19 pandemic challenged the timeline and development of the Global Matrix 4.0, a total of 60 national/territorial Report Card teams of PA experts registered for the initiative. A total of 57 Report Card teams completed the harmonized process to grade the 10 common PA indicators (an increase of 8 countries (16%) compared with the Global Matrix 3.0).

The objectives of this manuscript are: (1) to combine, compare, and summarize the findings from the 57 Global Matrix 4.0 Report Cards; (2) to compare indicators across countries exploring trends related to geo-cultural regions and HDI classifications based on the most recent data available in participating countries; (3) to investigate the impact of the COVID-19 pandemic, war, climate change, and economic change on the PA grades of children and adolescents in participating countries; and (4) to present the global top priorities for improving the grades of each indicator.

Methods

Harmonized Report Card development

Report Card teams from 57 countries followed harmonized procedures to develop their Report Cards by grading 10 common PA indicators (*Overall Physical Activity*, *Organized Sport and Physical Activity*, *Active Play*, *Active Transportation*, *Sedentary Behavior*, *Physical Fitness*, *School*, *Family and Peers*, *Community and Environment*, and *Government*) using the best available data and evidence. Details outlining the methodology have been described previously.[22]

In brief, the AHKGA encouraged Report Card teams registered in the Global Matrix 4.0 to engage (and expand if necessary) a multi-disciplinary team of PA experts representing a variety of sectors (e.g.,

research, health, sport, education, communities, policy) and to identify an official Leader/Co-Leaders that would be in charge of (i) stewarding the development of their Report Card; and (ii) maintaining communication between the AHKGA and their Report Card team. Report Card teams gathered available data and supporting information (and performed additional analyses or collected data in some cases) that best aligned with the 10 common PA indicator benchmarks for children and adolescents aged 5 to 17 years. The definitions and associated benchmarks for each of the PA indicators are presented in Table 1. Subsequently, and based on the findings of literature reviews and data analyses, each indicator was assigned a grade by each country using the harmonized grading rubric shown in Table 2. When insufficient data/evidence were available to grade the indicators, an incomplete grade, "INC", was assigned.

INSERT TABLE 1 HERE

INSERT TABLE 2 HERE

All Report Card teams completed and submitted a standardized spreadsheet template summarizing their tentative grades for each of the 10 indicators, with rationales and references supporting the proposed grades. This information was audited by at least two AHKGA researchers who approved the grades or provided feedback that required attention to improve the alignment of the grades and their associated rationales with the benchmarks and grading rubric, potentially leading to a change of grade. Consecutive rounds of audits were performed until a final version of the grade and rationale spreadsheet was approved by all auditors. A total of 121/570 grades were changed as a function of the process (i.e., first draft grades submitted to the AHKGA for audit vs final approved grades included in the Global Matrix 4.0). The revisions to the grades were made by 42/57 participating countries mostly in response to the feedback received from the AHKGA auditing team, while a few grade changes occurred for different reasons (e.g., noticed typo mistake, got access to new/additional data). Grade adjustments ranged from

small (e.g., C to C+, A- to B+) to more substantial (e.g., D to A-, B- to F), including revisions from INC to a letter grade or vice versa. *Sedentary Behavior* was the indicator with the most grade revisions (n=17), whereas changes to the *Organized Sport and Physical Activity* indicator grades were the least frequent (n=8). The Report Card teams could also provide grades for additional indicators of their choice in their Report Card, but these were not audited due to a lack of standardised Global Matrix benchmarks for such indicators.

An online survey was created using Google Forms (Google LLC, Mountain View, CA, USA) and distributed in April 2022 to all Report Card team Leaders and Co-Leaders. As the grades could be informed by evidence dating from before the COVID-19 pandemic was officially declared (March 11th, 2020),[23] after, or by evidence from both periods, this survey was created to: (1) collect Report Card Leaders' top three priority actions for each PA indicator; (2) assess which national grades were informed by pre-COVID-19 pandemic evidence and/or current pandemic evidence; and (3) obtain Report Card Leaders' opinion on how the pandemic might have affected PA indicators, PA research, and PA surveillance. Additional questions were included to assess whether based on the Report Card Leaders' expert opinion and available information, they considered that the PA of children and adolescents in their country was currently affected by local or international wars/conflicts, local climate change/climate change mitigations, and/or local economic changes/challenges.

Statistical Analysis

The 57 participating countries were divided into three Human Development Index (HDI)[24] classifications (low and medium, high, and very high) and five geo-cultural regions (Africa and Middle East, Anglosphere,[25] Asia-Pacific, Europe, Latin America) to facilitate data synthesis. The Anglosphere corresponds to the group of countries of the world in which the English language and cultural values predominate.[25,26] As Northern Africa and the Middle East are often grouped together by major

organizations such as the United Nations, and considering the limited number of participating countries from Africa and the Middle East, these two regions were grouped together by convenience for the analyses presented in this paper. The HDI value, HDI classification, and geo-cultural region for each participating country are presented in Table 3. Average grades were calculated by country, PA indicator, HDI classification, and geo-cultural region using the letter grade corresponding to percentages presented in Table 2, and incomplete grades (INC) were treated as missing values (missing values were deleted).

INSERT TABLE 3 HERE

Each PA indicator was compared across countries exploring differences related to geo-cultural regions and HDI classification. Three aggregate indicators were generated for the analysis: (1) behavioral indicator (average grade for the indicators of *Overall Physical Activity*, *Organized Sport and Physical Activity*, *Active Play*, *Active Transportation*, and *Sedentary Behaviors*); (2) sources of influence indicator (average grade for *Family and Peers*, *School*, *Community and Environment*, and *Government*); and (3) overall average indicator (average grade of the 10 common indicators). Summary tables presenting averages and grade counts that were informed by pre-COVID-19, post-COVID-19, or both were created to support comparison. Linear and generalized regression (Poisson) models were fitted and evaluated to quantify the associations between geo-cultural regions and HDI classification (independent variables) and the prediction of grade counts (e.g., the number of A, B, and C grades) and INC grades (dependent variables) utilizing all individual grades from the 57 countries (n=570). Poisson models were used to fit models where the outcome variables were not normally distributed and exhibited a zero-inflated distributed (strong positive skew). When models were fit, missing values were deleted given that these models apply list-wise deletion to missing data. All analyses were performed using RStudio 2202.07.1 Build 554 and alpha level was set at 0.05.

Results

Participating countries

Sociodemographic and geographic characteristics showed 74% of the participating countries were classified as having very high HDI, 19% were high HDI and 7% were low or medium HDI. Geographically, 37% of the participating countries were located in Europe, followed by 23% located in Asia-Pacific, 17% Anglosphere, 12% in Africa and Middle East and 11% in Latin America.

Global Matrix 4.0 physical activity grades

The grades for the 10 common PA indicators and the three aggregate indicators (i.e., behavioral indicator, source of influence indicator, and overall average) are presented by participating country in Table 4. A total of 570 grades, including 465 (82%) letter grades and 105 (18%) "INC" grades, were assigned by the 57 Report Card teams. Countries with the highest behavioral indicator grades were Finland and Japan (B-); with the highest source of influence indicator grades were Malaysia and Sweden (B+); and with the highest overall grade were Denmark, Finland, Japan, and Slovenia (B-). Countries with the lowest behavioral indicator, source of influence indicator, and overall average grades were the United Arabic Emirates (UAE) (F); Botswana, China, Indonesia, and Lebanon (D); and Indonesia (D-), respectively.

In addition to the 10 common PA indicators, a total of 22 countries graded additional indicators that were not part of the harmonized Global Matrix 4.0 development process. Additional indicators included *Sleep* (number of countries with the indicator: n = 14), *Body Mass Index/Weight Status* (n = 12), *Physical Literacy* (n = 5), *Diet* (n = 2), and nine other additional indicators each graded by a single country (*Mental Health, Anxiety & Stress, Bullying, Student Engagement, Physical Education, Adherence to 24-hour Movement Guidelines, Yoga, Psychosocial Factors*, and *Seasonal Variation*).

INSERT TABLE 4 HERE

The average grades by HDI classification are presented for each indicator and grouped indicators in Table 5. For all countries (n = 57), the indicators with the highest average grade were *School* and *Community and Environment* (C+) while the indicator with the lowest average grade was *Overall Physical Activity* (D). For very high HDI countries (n = 42), the indicators with the highest average grade were *School* and *Community and Environment* (B-) whereas the indicator with the lowest average grade was *Overall Physical Activity* (D+). For high HDI countries (n = 11), the indicators with the highest average grade were *Active Transportation*, *Family & Peers*, *School*, and *Government* (C-) in contrast the indicator with the lowest average grade was *Active Play* (D-). For low and medium HDI countries (n = 4), the indicators with the highest average grade were *Active Play*, *Active Transportation*, and *School* (C+) the indicators with the lowest average grade were *Overall Physical Activity*, *Community and Environment*, and *Government* (D-). The average grades for the grouped indicators were almost the same when comparing all countries to the very high HDI countries (D+ for behavioral indicator, C- for overall average) with only a small difference for the source of influence indicator (C for all countries, C+ for very high HDI countries). The average grades for the behavioral indicator, the source of influence indicator, and the overall average for high HDI countries were D, C-, and D+, respectively, whereas all the grouped indicator average grades were C- for the low and medium HDI countries.

INSERT TABLE 5 HERE

The average grades by geo-cultural area are presented for each indicator and grouped indicator in Table 6. Countries from Africa and the Middle East (n=7) had the highest average grades for *Active Play* (C+), *Sedentary Behavior* (C-), and *Physical Fitness* (C+), and the lowest average grades for *Family and Peers* (D-), *Community and Environment* (D+), *Government* (C-), and the source of influence indicator (D+). Countries from Europe (n = 21) had the highest average grades for *School* (B), behavioral indicator (C-),

and for the overall average (C). For *Overall Physical Activity*, countries from the Anglosphere (n = 10) and Europe (n = 21) shared the highest average grade (D+) and countries from the Asia-Pacific had the lowest average grade (D-). For *Organized Sport and Physical Activity*, countries from the Anglosphere and Europe shared the highest average grades (C), while countries from Africa and the Middle East (n = 7), Asia-Pacific (n = 13), and Latin America (n = 6) shared the lowest average grade (D+). For *Active Transportation*, countries from the Asia-Pacific, Europe and Latin America shared the highest average grade (C), while countries from the Anglosphere had the lowest average grade (D+). For *School*, countries from Africa and the Middle East and from Latin America shared the lowest average grade (C). For the behavioral indicator, countries from the Anglosphere and Latin America shared the lowest average grade (D), while for the source of influence indicator, countries from Asia-Pacific and Europe shared the highest average grade (C+).

INSERT TABLE 6 HERE

Impact of the COVID-19 pandemic

The indicator grade counts and averages (excluding the INC grades) by data collection/evidence period (before the COVID-19 pandemic was officially declared, after, or both) are presented in Table 7. In total, 411 letter grades were informed by evidence pre-COVID-19 pandemic, 47 grades were informed by evidence after the start of the COVID-19 pandemic, and 141 grades were informed by evidence from both periods (several countries took the initiative to grade the same indicator for more than one period). The overall average grade for each period is D+.

INSERT TABLE 7 HERE

A total of 84 Report Card Leaders/Co-Leaders from 53 countries across 6 continents replied to the online survey. Their perceptions of the impact that the COVID-19 pandemic had on each of the 10 common PA indicators, on the surveillance of PA in children and adolescents, and on their activity as PA

experts/researchers are summarized in Table 8. Most Report Card Leaders reported that the COVID-19 pandemic adversely affected the 10 common PA indicators in their country. In terms of PA surveillance and their activity as PA experts, the results were more disparate. One in two Report Card Leaders reported that their activity as a PA researcher/expert was negatively affected by the COVID-19 pandemic, while 57% reported a negative impact of the pandemic on surveillance of PA among children and adolescents. A positive impact on their research/expert activity was reported by 23% of the Report Card leaders, while 14% of the Report Card Leaders reported a positive impact on surveillance of PA among children and adolescents.

Priorities to improve the Global Matrix grades

In the online survey, Report Card Leaders (n = 83) also provided the top three priorities they identified to improve each of the 10 common PA Global Matrix 4.0 indicators in the online survey. A summary of the most frequent priority themes is provided for each indicator in Table 9.

INSERT TABLE 8 AND 9 HERE

Impact of war, climate change, and economic change

In the online survey, 13 Report Card Leaders from eight countries (Colombia, Ethiopia, India, Israel, Lebanon, Lithuania, Poland, and South Africa) reported that the PA of children and adolescents is potentially currently negatively affected by local or international war/conflicts. A total of 25 Report Card Leaders from 17 countries (Basque Country, Botswana, Brazil, Colombia, Ethiopia, India, Japan, Lebanon, Malaysia, Philippines, Poland, Slovakia, Slovenia, South Africa, South Korea, Thailand and Zimbabwe) reported that the PA of children and adolescents is currently negatively affected by local climate change/climate change mitigations. Finally, more than half of the Report Card Leaders (n = 43) from 28 countries (Basque Country, Botswana, Brazil, Canada, Chile, Chinese Taipei, Colombia, Czech Republic,

England, Estonia, Ethiopia, Hong Kong, India, Indonesia, Ireland, Israel, Lebanon, Nepal, Region of Murcia, Scotland, Slovakia, Slovenia, South Africa, South Korea, Spain, Uruguay, Wales, and Zimbabwe) reported that based on their expert opinion and available information, the PA of children and adolescents in their country or territory is currently negatively affected by local economic changes/challenges.

Multivariable analyses of factors associated with the Global Matrix grades

Results from the linear model assessing the associations between HDI classification, geo-cultural regions and the number of A, B and C grades are presented in Table 10. Compared to countries from Africa and the Middle East, European countries had about two more A, B or C grades on average after controlling for HDI (β = 2.04, 95% CI = 0.06–4.03, p = 0.004). A Poisson model examining the associations among HDI classification, geo-cultural regions and the number INC grades is presented in Table 11. Similar to the linear model findings, results of the Poisson model show that in comparison with countries from Africa and the Middle East, European countries were less likely to have INC grades after controlling for HDI (IRR = 0.44, 95% CI = 0.22–0.95, p = 0.030).

INSERT TABLES 10 AND 11 HERE

Discussion

As a result of the combined efforts of the Report Card teams and the AHKGA Board of Directors leading this initiative, and despite challenges associated with the COVID-19 pandemic, the Global Matrix 4.0 on PA for children and adolescents presents grades for the 10 common PA indicators in 57 countries across six continents. Similar to the Global Matrix 3.0 findings,[22] the average grades calculated for the 10 PA common indicators were all between D and C+, indicating that we are not succeeding at promoting physical activity among children and adolescents globally. Moderate to high level of variation in grades and average grades was observed when stratified HDI classification, geo-cultural regions, and countries

(see Tables 5-7). These findings and Report Card Leaders' responses to the online survey revealed a range of challenges, some of which are shared between several countries and some of which are specific to a single country. This indicates that countries could benefit from a mutual exchange of knowledge and experiences in PA promotion among children and adolescents. However, it also shows that every country should develop its own strategy and action plan for PA promotion, tailored to its specific context. Interpretation and discussion of the findings as well as success stories from the countries with higher grades for each indicator are presented in the next section followed by a summary of the perceived impact of the COVID-19 pandemic, war/conflicts, climate change, and economic challenges on children and adolescents' PA.

Overall Physical Activity (D)

The *Overall Physical Activity* benchmark was modified in 2018 to better align with the new Canadian guidelines for PA,[27] becoming the percentage of children and adolescents who accumulate at least 60 min of MVPA per day *on average* across the week. In 2020, the WHO also released updated PA guidelines for the same age group,[1] adopting the same threshold for MVPA (i.e., 60 min per day on average). While this change is a step forward supported by scientific evidence[28,29] for the global health promotion of children and adolescents, it resulted in major challenges for the surveillance of PA,[30] and the interpretation of findings and trend analyses, challenging the Report Card teams assessing this indicator. Most PA questionnaires/surveys were not designed to evaluate this new threshold. To address this challenge, the AHKGA proposed an additional alternative benchmark: "% of children and adolescents meeting the guidelines on at least 4 days a week (when an average cannot be estimated)" to help Report Card teams using the available evidence to grade this indicator. This alternative benchmark was based on analysis of accelerometry data from the Canadian Health Measures Survey,[31] showing that children who

met the MVPA threshold of 60 min per day on average corresponded to the children meeting at least 60 min of MVPA per day, four days per week.[31] Recent work from Gammon et al. (2022) used the International Children's Accelerometry Database (ICAD) to compare PA thresholds compliance and their associations with health indicators and found that children completing 60 min of MVPA every day do not experience superior health benefits compared to adolescents completing an average of 60 min of MVPA per day.[24]

Three countries assigned an INC to the *Overall Physical Activity* indicator (i.e., Poland, Scotland, and Basque Country). Hong Kong and Sweden were the only countries that graded the indicator based solely on accelerometry data, and 10 countries had their grades informed by both device-measured and self/proxy-reported data (i.e., Czech Republic, Denmark, Finland, Germany, Guernsey, Estonia, India, Ireland, Portugal, UAE, and Zimbabwe), the grades for the remaining countries were informed by self/proxy-reported data. Among the 54 Report Card teams that assigned a grade to this indicator, 14 used the previous WHO PA guideline threshold (i.e., at least 60 min of MVPA daily), nine used the new WHO guidelines' threshold (i.e., 60 min of MVPA per day on average), and nine used the alternative benchmark proposed by AHKGA (i.e., at least 60 min of MVPA per day, four days/week) to inform their grades. The remaining countries used a combination of these three thresholds, and in a few cases, other threshold variations determined by the best available data in their country/territory (e.g., at least 60 min of MVPA per day, five days/week; 9000 steps/day; "high PA level", achieve "20-30 min of exercise and running four days or more per week"). These findings align with the top priorities reported by the Report Card Leaders calling for the development or improvement of current PA surveillance systems (see Table 9) and are consistent with recent work[7] that highlighted inconsistencies across and within PA surveillance initiatives globally, calling for the development of a new valid and reliable PA measurement instrument that would be globally accepted and harmonized. Regarding the age groups covered by the evidence informing the *Overall Physical Activity* grades, the grades for 33 countries were informed by

evidence including both adolescents and children aged below 10 years, while the grades for 20 countries were informed by evidence only including adolescents, and the grade for one country (Montenegro) was informed by evidence only including children below 10 years. Having more than half of the countries reporting evidence including children below 10 years is an encouraging outcome, as this age group is generally underrepresented compared to adolescents (11–17-year-olds) across international PA surveillance initiatives.[7]

Grades for the *Overall Physical Activity* indicator ranged from F (Chinese Taipei, Ethiopia, Extremadura, Hungary, Indonesia, Jersey, Philippines, UAE, Uruguay, Vietnam, and Wales) to A- (Slovenia and Finland). Similarly to the Global Matrix 3.0 in 2018,[22] *Overall Physical Activity* was the indicator with the lowest average grade (D) which corresponds to an estimation of only 27%–33% of children and adolescents meeting the recommended amount of MVPA. Moreover, the average grade remained within D- and D+ when stratified by HDI classification or geo-cultural region. In total, only 15 (28%) countries out of the 54 that graded this indicator had a grade of C (i.e., "we are succeeding with about half of children and adolescents (47%–53%)") or higher. Collectively, these findings, consistent with previous work,[7,9] suggest that overall, the situation regarding the PA of children and adolescents globally is alarming, with only a small proportion meeting the recommended amount of MVPA (27%–33%), and major actions (see Table 9 for priorities identified by Report Card Leaders) are needed to increase PA opportunities for all children and adolescents globally. A major and rapid shift is needed to reach the target of reducing physical inactivity by 15% by 2030 established by the WHO in their Global Action Plan for Physical Activity (GAPPA).[32]

Lessons learned/success stories from countries with the highest grade on this indicator:

- For Slovenia, the combination of strong infrastructure (e.g., *Community & Environment*) and total number of physical education minutes delivered in schools, as well as a tradition of systematic

childhood fitness surveillance is likely why the *Overall Physical Activity* grade remains high, even during and after social transition disturbances like restriction policies enacted due to the COVID-19 pandemic.[33] However, it should be noted that these traditions are not a guarantee for success, as evidenced by observing lower PA trends that occurred when children and adolescents were outside of the structured school environment,[34] and when seasonal weather disturbances occur (e.g., heatwaves).[35] Therefore, Slovenia remains vigilant that this high prevalence of PA in children and adolescents may not be sufficient activity to counteract the negative fitness trends observed over the past two years.[33]

- In Finland, the role of PA in supporting growth, development and learning of children and adolescents of different ages has been taken into consideration in documents that guide early childhood education and teaching. National PA promotion programs have been funded to create a more physically active operational culture in educational institutions. These Finnish "On the Move programs" include the *Joy in Motion* program for early childhood education, *Schools on the Move* program for basic education and *Students on the Move* program for upper secondary and vocational education.[36] The Finnish *Schools on the Move* program has aimed to promote PA and decrease excessive sitting especially during recess time and academic lessons in comprehensive schools. The program has created new administrative and functional approaches to PA promotion and has successfully linked the goals of various collaborators into a shared network.[37] According to external assessment, the *Schools on the Move* program has been successful in broadly strengthening schools' capacity to increase PA.[38]

Organized Sport and Physical Activity (C-)

The benchmark for *Organized Sport and Physical Activity* remained unchanged since the Global Matrix 3.0. As previously mentioned,[22] this indicator did not provide any information on the dose (i.e., duration, frequency, intensity) of sport participation, so the grade for this indicator depends on the availability of organized sport opportunities and of the availability of data/national reports presenting the prevalence of children and adolescents who have taken advantage of these opportunities.

Eight countries almost exclusively from Asia and Middle East (i.e., India, Jersey, Lebanon, Malaysia, Philippines, South Korea, UAE, and Vietnam) assigned this indicator an INC grade. Grades for *Organized Sport and Physical Activity* were informed in most countries by self- or proxy-reported surveys (n = 37), six countries (Botswana, France, Slovenia, Extremadura, Chinese Taipei, Uruguay) graded this indicator based on national statistics/reports from sport ministries, federations, or associations. Five countries (Croatia, Greenland, Israel, Serbia, and Estonia) graded this indicator based on both (i.e., survey and national statistics), and one country graded this indicator based on a systematic review of five studies (Brazil). These findings highlight that there is room for improvement for the surveillance of this indicator. As the majority of its evaluation comes from surveys, it would be worth investing in the development of questionnaire items more precisely assessing the dose of *Organized Sport and Physical Activity* to identify how much PA the sport participation provides, as well as qualitative information such as the specific sport(s) practiced to determine its/their associated specific physiological demands, social characteristics, potential benefits, and activity category from the Youth Compendium of Physical Activities.[39] Additionally, the small number of countries that graded this indicator using national statistics/reports suggest that national data of children and adolescents engaged in sport clubs were either nonexistent, not available, or of low quality in the majority of countries. This is a missed opportunity for collecting useful data that could inform the surveillance of the dose of this indicator and assist in planning the evaluation of sport policies and guide promotional efforts.

Organized Sport and Physical Activity grades ranged from F (China, Indonesia, and Uruguay) to A (Denmark). On average, this indicator was graded C-, corresponding to succeeding with about 40%–46% of children and adolescents. Notably, inequities were visible for this indicator as the average was C for countries from the Anglosphere and Europe, and D+ for the countries from Africa and the Middle East, Asia-Pacific, and Latin America. These findings are consistent with previous work that highlighted significant low to moderate positive associations between *Organized Sport and Physical Activity* and several sociodemographic indicators and significant low negative associations between this indicator and inequality indices (e.g., Gini index and Gender Inequality Index).[22] Physical and mental health benefits from participation in sport for children and adolescents are documented in the literature,[40] and sport participation may provide additional benefits such as improved motor skills and multiple fitness components (i.e., muscular strength, endurance, flexibility, cardiorespiratory fitness).[41] Time, cost, and location have been repeatedly identified as key practical barriers to children's participation in sports, as well as peer disapproval and gender stereotyping.[40] In high income countries, socioeconomic disparities in sport participation were recently found to be greater than in overall PA participation among children and adolescents, highlighting the importance of targeting sport programs according to socioeconomic gradients,[42] as suggested by Report Card Leaders (see Table 9). Broadening the definition and approach of organized sports to include lifelong and action sports, outdoor sports, and to use sport as an agent of inclusion, development of skills, enjoyment and not only for competition was identified as an international priority (see Table 9). The authors recommend applying the guiding principles from the Sports Club for Health (SCforH) approaches[43,44] whose development was supported by Health-enhancing physical activity (HEPA) European network. More research is needed to identify barriers and enablers in low- and middle-income countries, and to examine if accessible and attractive sport opportunities are offered to all children and adolescents locally, nationally, and globally.

Lessons learned/success stories from countries with the highest grade on this indicator:

- In Denmark, there are several national policies that support PA for children and adolescents in day care, school, transport, city planning, leisure, and health policies. In regard to organized sport and PA, the Danish legislation obliges the municipalities to make facilities available for sports clubs and other voluntary associations and to provide financial support for activities for children and young people under the age of 25.[45]

Active Play (C-)

Active play is a "form of play that involves PA of any intensity"[46] and is often related to outdoor activities. Play is identified as an essential component of child development and helps with the refinement of physical abilities and fosters social development, self-concept, and creativity.[47] More research is needed to improve the understanding of what active play is and its importance. As there is no globally approved methodology to measure *Active Play* or benchmarks to assess it against, the benchmark used for this indicator was adopted from the Canadian Report Card.[48]

Active Play is the behavioral indicator with the most INC grades as 27 countries were not able to assign a grade. The data informing the letter grades varies greatly across the 30 countries that graded this indicator: 11 had their grade informed by data that did not correspond to a duration threshold (e.g., "engage in leisure-time physical activities"; "go outside to play or be active in their free time on most of the days of the week"; "regularly engage in active play"; "report playing out a few days each week") and 19 used various duration thresholds fitting appropriately with the Global Matrix benchmarks (e.g., "engaged in unorganized PA and/or active play for at least two hours of their free time a day"; "involved in outdoor active play at different intensity for more than 2 hour per day") with the exception of one country (Montenegro) whose best available data on *Active Play* was using "unstructured/unorganized active play at least one hour per day". Active play, in contrast with sport, physical education and active

transportation, can often be accumulated in a sporadic way, rather than during organized/specific time periods – ultimately making it challenging to assess and potentially limiting the utility of time-based thresholds. These findings highlight the urgent need for the development of a valid and reliable instrument to measure *Active Play* that would be acceptable and adaptable globally and across all geo-cultural contexts while remaining true to the core meaning and importance of active play.

The *Active Play* grades ranged from F (Thailand, Brazil, Indonesia, and Chinese Taipei) to B+ (Region of Murcia), followed closely by Montenegro, Serbia, and Ethiopia (with a B). On average, this indicator was graded C-, corresponding to 40%–46% of children and adolescents meeting the criteria, but this average varied when stratified by HDI classification, ranging from D- (high HDI countries) to C+ (low and medium HDI countries, and when stratified by geo-cultural regions, ranging from D- (Asia-Pacific) to C+ (Africa and the Middle East). While these variations should be considered cautiously, such findings suggest that there are inequities in terms of barriers and opportunities for active play in children and adolescents across the world. The Childhood Obesity Surveillance Initiative (COSI) study also observed gender differences and significant variations between countries in children's active play and pointed out that these differences might be explained by different cultural values towards active play and sedentary behavior, related to different climate, and affected by the length of the day.[49] In Asia, the most frequently mentioned barrier to children and adolescents' PA was "the lack of time because of schoolwork",[50] and this specific barrier would also affect active play. In Thailand, active play is also sensitive to gender and culture: adolescent girls are disadvantaged by the Thai cultural norm dictating that girls are supposed to be neat and calm and are discouraged from engaging in vigorous outdoor activities that may produce sweat and disheveled appearance.[51] Top priorities such as increasing and improving play facilities in the public environment, raising awareness about the importance of active play, and increasing active play opportunities in the school setting were identified by Report Card Leaders globally (see Table 9).

Lessons learned/success stories from countries with the highest grade on this indicator:

- The Region of Murcia (Spain) has a dry climate throughout the year, with low rainfall levels, more than 150 days of sunshine a year, and an average temperature of 18ºC,[52] potentially encouraging unstructured play outside. The United Nations International Children's Emergency Fund pointed out that more than three out of 10 children living in households are at risk of poverty and social exclusion in the Region of Murcia,[53] potentially resulting in low access to sport and other form of structured leisure activities, however, these circumstance have potentially resulted in leaving more free time for children to engage in outdoor active play.

Active Transportation (C-)

Active transportation involves non-motorized travel modes such as walking, cycling or riding a human-powered scooter.[54] The benefits of active transportation include increases in PA at the individual level,[55] but also improvements in traffic safety, transportation mode share, air pollution , and reductions in carbon emissions on a larger scale, potentially contributing to multiple United Nation Sustainable Development Goals.[56] The benchmark for the *Active Transportation* indicator (see Table 1) does not specify a required volume to assign a grade.

Only three countries (Argentina, Greenland, and Extremadura) were unable to grade this indicator due to a lack of relevant data. All *Active Transportation* grades were informed by self/proxy-reported data mostly focusing on transportation modes to and from school, yet substantial variations were observed between these grades. A variety of specific frequency thresholds for this indicator (e.g., "used active transportation during weekdays at least two times a week"; "using active transport at least once per week"; "use active transportation any of the previous 7 days") were used by surveys assessing this indicator, as well as using active transportation as the "usual" or "single" mode of transport to and from

school. These findings suggest that the global surveillance of active transportation also needs the development of a more standardized measurement tool, widely validated, and geographically (considering the topographic variations that may affect the mode of active transportation within a country)[57] and culturally appropriate or adaptable to all settings and across all age ranges of children and adolescents.

Grades for this indicator ranged from F (UAE) to A- (Denmark and Japan). On average, this indicator was graded C-, corresponding to succeeding with about 40%–46% of children and adolescents. Minimal variation was observed across HDI classifications (Table 5) and between geo-cultural regions (Table 6). In countries with high income inequalities and with a lower HDI, a high prevalence of active transportation could potentially reflect a necessity induced by a lack of alternative motorized options rather than a choice,[58] is not necessarily associated with a safe environment for walking/cycling, and is potentially threatened by economic transition. In contrast, a high prevalence of active transportation in very high HDI countries with low-income inequalities is likely to be the results of successful policies promoting active transportation, and of local cultural norms and infrastructure. Concrete actions to improve active transportation globally were identified by the Report Card Leaders (see Table 9).

Lessons learned/success stories from countries with the highest grade on this indicator:

- The high levels of active transportation for children to school in Denmark has previously been explained by the persistent effort by the Danish government and municipalities to implement campaigns and safe route to school programs. Additionally, a decentralized school structure with half of the children having less than 1.5 km to school and a well-developed network of cycle lanes makes the case for Denmark.[59]
- In Japan, enforcement order of the Act on National Treasury's Sharing of Expenses for Facilities of Compulsory Education Schools (Act No. 189 of 1958) determines school commuting distances within

around 4 kms for public primary schools and around 6 km for public junior high schools, and 99% of primary school students and 92% of junior high school students attend public schools.[60] This policy, associated with high level of independent commuting in children, potentially led to the observed high percentage of Japanese children and adolescents walking or cycling to school, in particular in urban areas.[61]

Sedentary Behaviors (D+)

Sedentary behaviors are defined as "any waking behavior characterized by an energy expenditure ≤1.5 metabolic equivalents, while in a sitting, reclining, or lying posture".[62] The rapid evolution of technologies and ubiquity of digital media over the past century have fundamentally affected the way children and adolescents recreate, learn at school, and commute. It is hypothesized that an increased exposure to artificial light, clocks, and multiple screen-based devices (e.g., smart phones, tablets, TV, computers) in their daily life as well as the use of motorized forms of transportation led to a new norm wherein children and adolescents have become increasingly sedentary during their leisure and transportation time.[63,64] However, global assessment of sedentary behavior trends in children and adolescents is lacking. Sedentary behavior is complex, encompassing a variety of behaviors (e.g., watching TV, playing videogames, using a computer, reading a book, sitting while eating or in a car, or at school or work) that have an intricate relationship with health and generates debates across experts in the field. Systematic reviews suggests that for children and adolescents, greater time spent in sedentary behavior, in particular recreational screen time, is associated with poorer health outcomes such as lower fitness, poorer cardiometabolic health, shorter sleep duration, unfavorable measures of adiposity, and poorer mental health, while some specific sedentary behaviors, such as reading and completing homework outside of school, are favorably associated with academic achievement.[28,65–67] In contrast,

other research groups contest these interpretations of the current evidence and assert that sedentary time assessed with accelerometers is largely uncorrelated with markers of adiposity and while there is some evidence on the association between screen time and adiposity, it is not sufficient to make inferences about causality.[68] Overall, the study of sedentary behaviors is still in its early stage unlike PA research, and is challenged by its constant evolution (i.e., technological changes are still rapidly occurring, leading to new screen based devices and transportation modes that are regularly introduced into children and adolescents' life) and by the lack of standardized assessment methodology capturing its complexity that would allow more accurate and reliable global surveillance.

In this context, the WHO recently recommended that "children and adolescents should limit the amount of time spent being sedentary, particularly the amount of recreational screen time"[1] while considering that there is currently insufficient evidence to specify precise cut-offs for recreational screen time.[28] In contrast, the 2016 Canadian 24-Hour Movement Guidelines for Children and Youth stated that based on the available evidence, children and adolescents should not engage in more than two hours per day of recreational screen time and limit sitting for extended periods.[27] The benchmark used for this indicator (Table 1) was adopted based on the Canadian guidelines.[27]

Only two countries (Finland and Greenland) were unable to grade the *Sedentary Behaviors* indicator. Grades for 28 countries were informed by survey data using a screen time threshold fitting with the benchmark and grades for 12 countries were informed by survey data using a slightly different threshold (i.e., less than two hours of recreational screen time). Grades for four countries were informed by data using a threshold of "less than two hours a day" of various screen-based behaviors such as watching TV, using a computer, or playing video games that were accumulating but could not access to the raw data to calculate the prevalence of having these behaviors not cumulating more than two hours per day. Four countries graded this indicator based on self-reported sitting data using "less than three hours per day on sitting activities on a typical day". One country (UAE) graded this indicator based on accelerometer-

derived estimates of daily sedentary time using a "less than two hours" threshold. The seven remaining countries used unique screen time or sedentary time thresholds or a combination of both to inform their grades. The observed variation of data across countries for this indicator is a direct result of the aforementioned lack of consensus in terms of the link between sedentary behavior and health and of how to assess this indicator in children and adolescents, suggesting that extensive work is needed to address both issues.

Grades for the *Sedentary Behaviors* indicator ranged from F (Wales, Canada, Scotland, Thailand) to B (Philippines, Indonesia, Montenegro). Overall, the average grade was D+ (i.e., only succeeding with 34%–39%), suggesting that most children and adolescents across the world engage in recreational screen time above the recommendation. When stratified by HDI classification, the average grade is better when the HDI category is lower. These findings suggest that children and adolescents from countries of lower socioeconomic standard are potentially more protected from adverse outcomes associated with excessive screen time - but these better grades are potentially threatened by the economic transition these countries are experiencing – or that available survey data do not detect time spent on new screen devices such as smartphones. However, these results could also illustrate a general lack of access to screen devices for this specific population that would affect the possibility to acquire digital literacy, an essential skill to function in the modern world.

Lessons learned/success stories from countries with the highest grade on this indicator:

The grades for the Philippines and Indonesia were informed by the Global School-based Student Health Survey (GSHS)[69] data, assessing a variety of sedentary behaviors (e.g., sitting, talking with friends, and playing cards) in addition to screen-based behaviors (e.g., watching TV, playing computer games), suggesting a high prevalence of children and adolescents meeting the screen time benchmark.

- In the Philippines, most identified PA policies promote sports and physical education with their implementation typically occurring at the school setting, and none specifically addressed sedentary behaviors.[70] Reasons behind this high grade is that Filipino children and adolescents only have a limited access to screen-based devices,[71] and that there is a lack of good quality screen time data. The GSHS data informing this grade did not include the use of newer devices such as smartphones, which are more likely to be owned and used by Filipino adolescents.[71]
- In Indonesia, a high proportion of children and adolescents in Indonesia are from low-income families that cannot afford screen devices in their home environment. In addition, 1.17 million children and adolescents were estimated to work to earn a living or support their family,[72] and child labor is expected to keep increasing as more children and adolescents have fallen into poverty than any other age group as a result of the COVID-19 pandemic.[73] Overall, this high grade is most likely more a reflection of the lack of screen-based activity opportunities caused by poverty and competing priorities (i.e., child labor) rather than an indication of successful policies.
- In Montenegro, this grade was informed by more recent data on time spent watching TV or using electronic devices such as a computer, tablet, or smartphone (not including moving or fitness games) outside of school in children aged 6 to 9 years.[49] This high grade is an indicator of potential success in children aged below 10 years, but it is anticipated that older children and adolescents are spending more time on screen devices. One in three Montenegrin children live below the at-risk-of-poverty threshold,[74] indicating that this high grade is also likely to be caused by a lack of access to screen devices.

Physical Fitness (C-)

Physical fitness is a good summative measure of the body's ability to perform physical activity and exercise, and it also provides an important summative indicator of health.[75] To evaluate this indicator, the AHKGA developed a standardized methodology using the average percentile achieved on certain physical fitness tests based on the European normative values published by Tomkinson et al[76] (as global normative values are still lacking). As conducting standardized physical fitness tests is more burdensome than distributing self/proxy-reported surveys, more than half (n = 31) of the countries could not assigned it a grade due to lack of data, making *Physical Fitness* the indicator with the most INC grades. Among the 26 countries that were able to grade this indicator, grades were informed by a combination of 20-meter shuttle run test and other standardized fitness tests (n = 12), solely by the 20-meter shuttle run test data (n = 8), and by various standardized fitness tests not including the 20-meter shuttle run test (n = 6). These data characteristics vary greatly in terms of sample size, sample age, collection time, and availability of raw data, potentially affecting their grading and interpretation. The availability of 20-meter shuttle run test data in 20 countries participating in the Global Matrix 4.0 is also an encouraging finding as it is an appropriate field-based measure of cardiorespiratory fitness with moderate-to-high criterion-related validity and high reliability, and cardiorespiratory fitness is an important indicator of current and future health among school-aged children and adolescents.[77]

Grades for the *Physical Fitness* indicator ranged from F (Indonesia) to A (Slovenia). Countries that assigned a grade were very high HDI countries (n = 23) and high HDI countries (n = 4, Botswana, Brazil, Indonesia, and South Africa). Similarly, only five countries from the Asia-Pacific region, three countries from the Anglosphere, two countries from Africa and the Middle East, and one country from Latin America were able to grade this indicator which was mostly graded in European countries (n = 15). The high number of INC grades for this indicator highlights the need for further development of the global surveillance of physical fitness, requiring a simple and cost-effective assessment[78] that could be integrated into physical education classes and/or recreation/sport programs. Consequently, the C- (i.e.,

about 40%–46% are estimated to reach an adequate physical fitness level) observed as the average grade for *Physical Fitness* cannot be considered a generalizable global estimation, yet still emphasizes the need for the implementation of programs to improve fitness levels in children and adolescents internationally alongside surveillance.

Lessons learned/success stories from countries with the highest grade on this indicator:

- In Slovenia, in early elementary school, by grades 4 to 5, 50% of educators teaching physical education are specialists, and from grade 6 through secondary school, 100% of physical education classes are taught by PE teachers with a university degree, as decreed by law.[79,80] Therefore, children grow up with a tradition of receiving quality physical education instruction, and this may lead to increased physical literacy so a potentially better ability to maintain their fitness. The national education regulations also dictate that every primary school and secondary school must have at least one sports hall fully equipped with all the necessary sports equipment, including additional outdoor facilities for the children.[80] Finally, all schools in Slovenia have written, public, PA policies (e.g., bike racks at school, traffic calming on school property, outdoor play time),[80] so this high fitness level is likely a by-product from highly regulated education policies.

Family and Peers (C-)

Evidence from the literature shows that family members' and peers' influence are important correlates of the PA of children and adolescents.[40,81–86] The relationship between family members/peers and children and adolescents' PA is complex and needs more research to be understood in various geo-cultural settings, yet the AHKGA considered the following processes through which parent/peers may have a positive influence on PA to establish the benchmarks for this indicator (Table 1): support for PA, role modeling, and co-participation.[87]

A total of 13 countries or were unable to grade the indicator because of lack of available data. Due to a lack of valid and internationally recognized instrument for assessing the influence of family and peers on PA of children and adolescent and due to numerous benchmarks available for this indicator, the rationales and data informing this indicator's grades varied greatly across countries. Overall, the grades were informed by self/proxy-reported data with various sample size, sample age, and collection time on a variety of aspects of family and peers' influence on PA: parents meeting adult PA guidelines,[1] parents facilitating PA and sport opportunities for their children and/or placing limits on screen time, and children or adolescents participating in PA or sports with peers or an adult family member.

Grades for this indicator ranged from F (Indonesia and Ethiopia) to A+ (Nepal), followed closely by Montenegro and Extremadura (with an A). The average grade for this indicator was C-, meaning that around 40% to 46% of children and adolescents were positively influenced by their peers/family members to be active. Almost no variation of this average was observed when stratified by HDI classification (Table 5), but more substantial differences were observed when stratified by geo-cultural regions (Table 6), suggesting a cultural influence on the familial and peer support of children and adolescent's PA. This finding is commensurate with a qualitative study involving six single-ethnic focus groups of parents in England that showed additional barriers to children and adolescents' PA for ethnic groups from cultures that prioritized educational attainment over PA (e.g., Asian Bangladeshi, Chinese, Yemeni) and of Muslim faith (Asian Bangladeshi, Black Somali, Yemeni), who reported a lack of culturally appropriate opportunities for girls.[88] Another study In Israel showed that Jewish adolescents reported higher levels of PA than Arab adolescents, and family and peers' related factors (parent, sibling, and peers' engagement in PA, in-school PA breaks, and liking PA) were found positively associated with levels of PA, suggesting a potential cultural influence on the relationship between children and adolescents' PA and the *Family and Peers* indicator.[89]

Lessons learned/success stories from countries with the highest grade on this indicator:

- In Nepal, parents and schools generally expect students to participate in and win intra- and inter-school competitions. Families usually allow their children and adolescents (especially boys) to play with friends in their neighborhood after school and on weekends.[90] Activities such as playing, walking, cycling (in plain/*Terai* regions) among adolescents are considered as ordinary activities by their family members in Nepal.[91] There are ample open spaces in rural areas and the neighborhood is usually considered a safe place. However, parents may hesitate spending money on sports equipment and coaching fees, and enrolling children in sports lesson is not yet a common practice even in urban settings.

School (C+)

School represents both a learning environment where children and adolescents spend a substantial proportion of their awake time and the place where they can attend physical education class. Depending on school PA policies and the existence of a national physical education curriculum, school has the potential to provide PA opportunities through physical education, lunch and recess breaks, in-class physical activities, competitive or non-competitive activities before and after school, active transportation promotion initiatives, as well as educational activities and role modelling for an active lifestyle that may increase awareness and health literacy.[92,93] A series of benchmarks were established by the AHKGA to assess the existence of these opportunities (see Table 1).

Five countries could not grade this indicator due to insufficient data. *School* grades were informed by an extensive variety of information including surveys targeting children and/or adolescents, parents, or schools assessing specific aspects of school PA policies, attendance of physical education, participation in school sport clubs, as well as national reports and descriptions of some national physical education curricula. Deeper analysis of these materials is needed to provide a more accurate overview of the

information compiled to inform the *School* indicator at the global level. This is also the result of the complexity of concepts covered by the current *School* indicator. While physical education represents a PA domain,[94] it was included in the *School* indicator as part of the source of influence instead of as a separated behavioral indicator. While this approach is potentially more relevant for countries where the teaching of physical education is only scarce and dependent of school or municipal initiatives, having a separated behavioral indicator could be more appropriate for countries with a compulsory national physical education curriculum and would allow the Global Matrix to assess separately *Overall Physical Activity* and its four components (i.e., organized sport, active play, active transportation, and physical education).[94]

School grades ranged from F (Indonesia) to A+ (Hungary), followed closely by Portugal, Slovenia, Vietnam, South Korea (A). *School* is one of the two indicators with the highest average grade, C+, suggesting that 54%–59% of schools are PA-supportive. When stratified by HDI classification, the average grade for *School* was higher in very high HDI countries (B-), than in low and medium HDI countries (C+), and even lower in high HDI countries (C-, Table 5). When stratified by geo-cultural region, the average grade for countries from Europe (B) was above the average grades for countries from other regions.

Lessons learned/success stories from countries with the highest grade on this indicator:

- A "perfect grade" (A+) was assigned by Hungary as a national physical education curriculum including five sessions of 45 min per week (one per weekday) and recommendations for extracurricular PA as well as school sports programs were gradually introduced from 2012 in all Hungarian schools. A recent study by Dizmatsek et al.[95] found that after the introduction of daily physical education in Hungarian schools, leisure time spent on sports and exercise increased significantly, regardless of gender and age group.

Community and Environment (C+)

Characteristics of the environment are recognized as important determinants of the PA of children and adolescents. For example, better accessibility to existing and new infrastructure for walking, cycling and public transportation as well as population density, public transportation density, the connectivity of streets, access and availability of public open spaces and sports facilities are associated with increased overall and transportation-related PA,[96–98] however, relevant environmental correlates of PA may be behavior- and context-specific.[99] As a valid methodology to evaluate the environmental attributes affecting children and adolescents' PA adaptable to all contexts is lacking, the AHKGA established a series of benchmarks to capture them, and the community/municipal initiatives implemented to improve them (Table 1).

A total of nine countries could not grade the *Community and Environment* indicator due to a lack of sufficient data. The grades were informed by self/proxy-report survey data in 26 countries, by national reports/data in six countries, by a combination of both in 14 countries, and by anecdotal observations reported in newspapers (Botswana) and expert opinion (Indonesia) in two other countries. The topics evaluated in these surveys/national data varied greatly across countries, including measures of perceived safety, walkability, access to park/playground/bike paths, community initiatives. Deeper analysis focusing on this indicator is needed for providing a detailed overview of the characteristics of the *Community and Environment* indicator by HDI classification and by geo-cultural region.

Grades for the *Community and Environment* indicator ranged from D- (Botswana and China) to A+ (Slovenia, Sweden, Singapore) with an average grade of C+. Inequities are observable for this indicator as there was a distinct gap between the average grade for the very high HDI countries (B-) and the average grade for the low, medium, and high HDI countries (D+, Table 5). The average grades stratified by geo-cultural region show similar differences as the average for countries from the Anglosphere and Europe

was B- whereas the average for countries from Africa and the Middle East was D+ (Table 6). These findings are consistent with previous work that found positive associations between the *Community and Environment* indicator and socioeconomic, demographic, and geographic indicators (i.e., HDI, life expectancy at birth, mean years of schooling, gross national income per capita, public health expenditure, global food security index, urban population percentage, improved drinking water coverage, and distance to equator) and a moderate to strong negative association with inequality indicators (i.e., Gini Index and Gender Inequality Index).[22]

Lessons learned/success stories from countries with the highest grade on this indicator:

- In Slovenia, all municipalities must produce policies promoting PA and publish annual reports, including detailed infrastructure plans.[100] All communities must have accessible sport facilities, programs, and playgrounds available for public use, and they are legally obliged to provide co-funding and cooperate with local sports organizations. The grading for this indicator is high due to the selected standardized benchmarks of the Global Matrix that are all covered by Slovenia public policies. However, there is still room for improvement in Slovenia as keeping sport facilities accessible and maintaining access to community infrastructure should be implemented during pandemic times.[33]
- Sweden has long prioritized green space and the outdoor environment and providing the Swedish people with a usable outdoor environment that promotes PA and active transport. For instance, in 2012 a Swedish outdoor recreation policy was created to increase opportunities to be in nature and promote outdoor recreation.[101] Furthermore, Swedish green space managers perceived green space quality as "good", believe they have a sufficient budget for their upkeep and are optimistic for the future of Swedish green spaces.[102] Finally, the Swedish government wants to promote more cycling both for sustainable transport and to promote public health, with a special focus on children and adolescents.[103,104] Finally, in 2016, Generation Pep,[105] a non-profit organization, was established as

an initiative by the Swedish Crown Princess Couple. They have been successful in gathering actors from all of society, businesses, organizations, and government authorities in order to promote physical activity in children and adolescents through various activities in schools and in the community.

- In Singapore, public playgrounds are regarded as a basic precinct recreational facility in public housing estates. Playgrounds have evolved over the years from only functional play equipment, such as slides and swings, to thematic playgrounds with a selection of play equipment as a key feature, supporting a wider array of activities such as climbing, swinging, balancing, and jumping.[106] Parks are well maintained and widely available across the island,[107] and improving park access further has also been emphasized as one of the targets under the 'City in Nature' pillar of the Singapore Green Plan for 2030.[108] Under the pillar, "every household will be within a 10 min walk from a park" was listed as one of the targets.[108] Aside from playgrounds and parks, evidence also suggests that well-designed sports infrastructure and facilities are in place.[106]

Government (C)

Government and public policies represent a major macro-environmental source of influence on the PA of children and adolescents, as government policies, investments, decisions, resources, and programs can fundamentally impact directly the domains of PA (e.g., establishing a new compulsory physical education program with daily classes) and their source of influence (e.g., funding a national education campaign raising awareness on the importance of PA, redesigning the urban environment with safe bike paths and more green spaces).[32] The recommended grading methodology for this indicator focused on evidence of leadership and commitment, allocated funds and resources, demonstrated progress for the promotion of PA opportunities for all children and adolescents (Table 1) as well as a consensus between the Report

Card team members on how much they considered their government was investing effort in supporting children and adolescents' PA. To address this more subjective approach, the Report Card team from Wales created and tested a more structured methodology based on an adaptation of the Health-Enhancing Physical Activity Policy Audit tool Version 2 (HEPA PAT v2) to grade this indicator in 2018.[109] The AHKGA decided to add this HEPA PAT v2 as a possible, but not mandatory, methodology to grade this indicator to test it in multiple and various settings.

Only four countries (Basque Country, England, Germany, and United States) could not grade this indicator. A total of 41 countries used the original methodology to grade this indicator, while 12 countries used the HEPA PAT v2 approach: five countries from Latin America (Argentina, Brazil, Chile, Colombia, and Uruguay), three countries from Asia-Pacific (Malaysia, Philippines, and South Korea), three countries from the Anglosphere (Ireland, Scotland, and Wales), and one country from Europe (Slovakia). Further work involving these 12 countries is now required to evaluate the feasibility and satisfaction with the use of this new methodology and to identify potential issues and improvements.

Government grades ranged from F (Nepal) to A (New Zealand and South Korea), followed closely by Finland and Chile (A-). The average grade for this indicator was C and this average decreased with HDI category (Table 5). These observable disparities are consistent with previous work that found significant moderate associations between the *Government* indicator and several socio-demographic and geographic indicators (i.e., gross national income per capita, public health expenditure, Gini index, Gender Inequality Index, improved water coverage, and distance to the equator).[22] These findings suggest that the movement to support children and adolescents' PA is gaining traction, in particular in very high HDI countries, but the overall low to medium average behavioral grades emphasizes that more action is needed to have a significant positive impact. Our findings are consistent with recent work showing that PA and sedentary behavior policies are better developed in high-income countries, compared with low- and lower-middle-income countries, and in countries of European and Western-

Pacific regions, compared with other world regions, but globally have low-to-moderate comprehensiveness, implementation, and effectiveness.[110]

Lessons learned/success stories from countries with the highest grade on this indicator:

- In New Zealand, this high grade was informed by significant central and local government investments in PA and sport initiatives that have been implemented since 2018, and evidence on investments made in children and adolescents' active recreation and sport were reported by most major councils.[111] Sport NZ, Ihi Aotearoa, a key crown agency supporting children and adolescents through sport and PA initiatives, established a national PA framework, strategy, and plan, and conducted evaluations of most initiatives.[112] Ongoing evaluation is recognized by Sport NZ as one of their five leadership responsibilities, including conducting and sharing research and tracking activity over time.
- South Korea had a total of 42 PA promotion policies and programs for children and adolescents in and out of school with 33 policies with identifiable actions, 42 policies with identified responsibilities for delivery of actions and identified systems of reporting the delivery of actions, 41 policies with identified funding sources, and 35 policies with identified systems for monitoring and evaluation. Policies related directly or indirectly to providing opportunities for physical activity among children and youth are being implemented under the lead of government agencies (Ministry of Education; Culture, Sport, and Tourism; Health and Welfare). Additionally, several policies in South Korea regarding to school physical education, club activities, and after-school sports activities are being implemented in all respects. All policies have been carried out with a transparent reporting system and budget source and the effectiveness of most of the policies had been monitored and evaluated thoroughly.

Impact of the COVID-19 pandemic

Overall, the results reported in the present manuscript suggest that the COVID-19 pandemic adversely affected the 10 common PA indicators in most of the countries (see Table 8), as well as the surveillance of PA and research activity of PA experts. Only a minority of the grades were informed by evidence generated after the official start of the COVID-19 pandemic (see Table 7) so no valid comparison pre/post-COVID-19 could be performed using the grades reported in this article.

Sedentary Behavior, followed by *Organized Sport and Physical Activity*, and *Overall Physical Activity*, were the indicators that most Report Card Leaders reported as affected negatively by the COVID-19 pandemic (96%, 93%, and 89%, respectively). In an open comment section of the online survey, several Report Card Leaders justified these ratings by explaining that the COVID-19 safety measures were very strict, potentially putting completely on hold all sport activities and physical education classes at the national level, as well as restricting access to parks and playgrounds. For example, the Report Card Leader from Estonia reported that the impact of COVID-19 on PA behavioral indicators varied depending on the period of the pandemic:

- In March 2020, there was complete lockdown where children and adolescents stayed home, attending remote classes, while all sports were cancelled, outdoor playgrounds prohibited, and meeting with friends was not allowed.
- In September 2020 to May 2021 most schools and kindergartens were still on distance learning most of the time, indoor sports were not allowed, but outdoor sports in small groups were permitted, and it was possible to go outside to play with friends and use outdoor facilities.
- In September 2021 to May 2022, most schools were open and hosting in person classes, and sports sessions occurred both indoors and outdoors while COVID-19 testing and vaccination became the main contingency measure.

Family and Peers and *Community and En*vironment were the two indicators that were least negatively affected by the pandemic, as reported by the Report Card Leaders. Report Card Leaders from Israel reported that the pandemic had a small positive affect on the *Family and Peers*, *School*, and *Community and Environment* indicators as there were some increased activities within the family and in the community, and the school system made efforts to incorporate PA remotely by the education staff. In Australia, two of the biggest cities trialed "pop up bike lanes" - replacing one lane of car traffic as a bike lane with infrastructure separating the bike lane from other traffic. Recent evaluation data showed this initiative improved active transport particularly for families.[113]

Remaining physically active is important for children and adolescents to maintain a healthy immune system and build a strong defense against infections, to help alleviate feelings of depression and anxiety that may come with isolation from friends and peers, and to process and adjust to the new normal lifestyle and restrictions during this uncertain moment of their lives.[114] Accordingly, the AHKGA published guidance on healthy movement behaviors for kids during the COVID-19 pandemic.[115]

Impact of war, climate change, economic change

The Report Card Leader survey findings highlight that the influence of war, climate change, and/or economic circumstances should not be neglected in global/international PA surveillance or promotion initiatives. Report Card Leaders from 14% (n = 8) of the countries participating in the Global Matrix 4.0 reported that war/local conflict was potentially affecting the PA of children and adolescents in their country. The Report Card Leader from Poland reported that the Russian invasion of Ukraine resulted in (1) hosting about 2-3 million refugees which could indirectly impact access to PA opportunities in the near future; (2) reallocations of Poland's national budget to military expense; and (3) restrictions on Russia leading to inflation which will affect families' budgets and consequently their access to leisure

activities. Report Card Leaders from South Africa reported that political instability resulted in riots and strikes and an overall lack of safety in the country impacting transport, schools, and livelihoods, thereby indirectly affecting the PA of children and adolescents. Report Card Leaders from Colombia reported that a historical internal conflict has displaced people from their communities, limited opportunities for safe and healthy development of children, and has neglected the public health priority to create environments that promote active and healthy living.

Report Card Leaders from almost a third of the countries participating in the Global Matrix 4.0 considered that children and adolescents PA was currently affect by local climate change/climate change mitigations. Report Card Leaders from India estimated that the frequency and length of heat waves has increased substantially across India: “Summers are starting earlier in the northern regions, and becoming hotter”, increasing risk to human health, and limiting children and adolescents' ability to engage in PA in general. Report Card Leaders from Slovakia described that winters are getting milder/warmer and there is less snow and ice in comparison with previous decades, limiting typical winter physical activities (e.g., skiing, skating, snowshoeing) in villages, cities, and even in the mountains, while this also potentially led to some seasonal activities (e.g., cycling) becoming all-year round activities. The Report Card Leader from Slovenia detailed that as summers in Slovenia are becoming hotter and drier, pilot data from ongoing unpublished work demonstrates that children are less active during summertime and report being thirstier than their adult counterparts. Report Card Leaders from Thailand relayed that climate change has created an uncertainty in determining the rainy season, potentially constraining outdoor PA, as well as extremely high fine particulate matter levels and high temperatures in summer. Air pollution is also a potential threat to PA in East Asian countries. South Korea Report Card leaders considered that the increasing number of days of worsening air pollution particularly during warm days discourage parents and schools to support PA among children and adolescents. The GAPPA presented pathways of action through which PA promotion could meaningfully contribute to climate change mitigation,[32] and actions

such as disincentivizing driving could be a complementary strategy to maximize the effectiveness of PA promotion, in particular in settings where car dependence is high for addressing physical inactivity, air quality issues, traffic-related deaths, and climate change.[56]

Finally, more than half of the Report Card Leaders estimated that the PA of children and adolescents in their country was currently affected by local economic changes/challenges. Report Card Leaders from several countries (Botswana, Colombia, India, South Africa) reported that most resources have always been directed towards competing priorities in terms of food security, health care, and education, and the current economic crisis seems to be widening the gap of inequality between the richest and the poorest. The Report Card Leader from Lebanon reported that since 2019, Lebanon has been going through an important economic crisis and the Lebanese people have been solely focused on surviving.[116] Similarly, Ethiopia's Report Card Leader reported that economic challenges resulting in a struggle for the basic needs to survive may divert the attention of Ethiopian parents and children to engage in PA, and high inflation occurring in Ethiopia since 2021 is potentially increasing these challenges. Welsh Report Card Leaders reported that inflation is also currently at its highest level in decades in Wales, inevitably impinging on investment in PA opportunities for children and adolescents and forcing Welsh parents to select priorities for their families, potentially putting PA at the bottom of the list. A Report Card Leader from Nepal reported that with the current national economic transition, open spaces, particularly in urban areas, are diminishing and this has reduced PA opportunities at the community level, while children have increased access to shared and personal screen devices such as television, tablets, and phones. Overall, economic challenges such as inflation are impacting a variety of countries across all HDI classifications, and are expected to negatively impact the PA of children and adolescents through the reduction of their access to opportunities for PA; and low-income countries are facing upcoming additional challenges associated with economic transition such as decreasing access to green spaces,

increasing pollution, the introduction of multiple screen-based devices in children and adolescents' daily life as well as the increase use of motorized forms of transportation.

Integrated discussion

Overall, the Global Matrix 4.0 brought together 57 Report Card teams to evaluate 10 common PA indicators, involving almost 700 PA experts in the process.[117] Further analysis is required to study the additional indicators submitted by Report Card Teams, and the AHKGA will explore the interest of adding the most popular ones in future Global Matrices. A global network map of the countries and leaders, researchers, and advocates participating in the Global Matrix 4.0, as well as a summary of AHKGA academic output and a summary of the overall impact of AHKGA efforts across multiple sectors are presented elsewhere.[117]

Even as the 57 countries participating in the Global Matrix 4.0 correspond to a 16% increase in comparison with the Global Matrix 3.0, representing 80 more indicator grades, a general decrease of INC (n = 105/18% in the Global Matrix 4.0 vs n = 121/24% in the Global Matrix 3.0) was observed. This encouraging decrease of INC and deeper analysis providing a synthesis of international trends for behavioral and sources of influence grades that occurred from 2014 to 2022 are discussed in another article which is part of the present special issue.[118] However, the remaining high prevalence of INC and the reliance on smaller regional surveys or studies in the absence of consistently nationally representative data, highlights the need for advocacy to promote regular, national surveillance of PA in children and adolescents worldwide.

Findings presented in Tables 11 and 12 highlight inequities in terms of grades and surveillance (difference in INC) across geo-cultural regions. These findings are consistent with the differences observed in aggregate indicators across HDI classifications and geo-cultural regions (see Tables 6 and 7)

and highlight the persistence of inequities between countries for the surveillance and promotion of PA in children and adolescents. Further inequity analysis across gender, age, area of residence, and ability levels were explored using Global Matrix 4.0 compiled data from participating countries.[119] In general, children and adolescents with a disability tend to be ignored/overlooked in both PA surveillance initiatives (including in the Global Matrix national Report Cards on PA for children and adolescents)[7] and PA promotion initiatives and policies.[120] Actions are needed in PA research, surveillance, and promotion to develop tools ensuring the valid assessment and study of PA indicators in children and adolescents with a disability and to develop effective PA promotion targeting this specific population.

As reported in this paper, climate change is another rising concern for PA among children and adolescents at present, which will continue to threaten children and adolescents' ability to engage in PA freely, especially outdoors. Furthermore, different patterns of the grades for behavioral indicators and the sources of influence by HDI shown in this paper, combined with the close link between climate change and country-level economic factors,[121] suggest these factors together likely influence Report Card grades and shape global PA and health inequities. To better understand such associations between macro-level factors and PA patterns in children and adolescents worldwide, and gain potential insights into developing multi-level PA action, the patterns and relationships between economic freedom, climate culpability, and PA grades among the 57 participating countries were explored in another article of the present special issue.[122] Based on the main finding that Report Card grades are not equitable by climate culpability for each economic freedom group, it is recommended that global PA promotion strategies should consider incorporating inequities in the global political economy and climate change.

The challenges for assessing the PA behavioral indicators highlighted in the present discussion are consistent with previous work that led to a call for the development of a PA measurement instrument/protocol that would be globally accepted, harmonized, utilized, translated, and culturally adaptable.[7] A research funding application involving several AHKGA PA experts was recently approved

by the Canadian Institutes of Health Research to develop and validate a "Global Adolescent and Child Physical Activity Questionnaire (GAC-PAQ)" in a study to be implemented in 14 countries across six continents.[123] This initiative may bring solutions and contribute to addressing the current PA surveillance issues.

Strengths and limitations

The Global Matrix 4.0 represents the largest synthesis of children and adolescents' PA indicators to date, particularly for *Active Play*, *Active Transportation*, *Sedentary Behavior*, and for the four source of influence indicators. This project also identified major research and surveillance gaps and presented global priorities for each indicator. The most recurring priorities' themes presented in Table 9 could also be used as recommendations in relevant contexts. Completing this project in the context of the COVID-19 pandemic was a massive achievement that required significant efforts from the 57 Report Card teams and from the AHKGA Board of Directors leading its development.

For all 10 common PA indicators, variation in the data informing the grades across countries was observed and transparently acknowledged and reported, requiring careful considerations of the international comparisons presented in this manuscript. Even when focusing solely on the *Overall Physical Activity* indicator, variation in data collection methods is a reality for all PA global surveillance initiatives, that was challenged even more with the new WHO guidelines.[7] The pragmatic and inclusive approach of using the "best available data/evidence" to inform the PA grades (which deliberately use a 5-6% prevalence range to help accommodate comparable variations in data sources) is a strength of the Global Matrix 4.0. In the current context, limiting the participation to countries with data/evidence perfectly fitting the official benchmarks would lead to a selection bias and result in only a handful of countries (or for some indicators zero countries) being able to assign grades, hence, there would be no

Global Matrix. More in-depth analyses are required to explore the effect of these variations on grades for each indicator.

As physical education represents one of the main PA domains for children and adolescents,[94] not including it as an extracted and separated behavioral indicator from the *School* indicator is a potential limitation of the Global Matrix model. AHKGA will explore the possibility of addressing this issue in the future Global Matrices.

An unequal distribution of participating countries across HDI classification categories and geo-cultural regions was observed in the Global Matrix 4.0, meaning that the interpretation of their comparisons should be considered carefully. There is a need for increased participation of low and medium HDI countries and countries from Africa and the South Pacific Islands to enable the Global Matrix initiative to capture a more "global" perspective. Overall, a decline in participation of low and medium HDI countries in the Global Matrix 4.0 was observed in comparison with previous Global Matrices, potentially illustrating the inherent challenges of prioritizing physical inactivity among many competing public health issues that were exacerbated by the COVID-19 pandemic in these countries.[117] In addition, there was a general lack of representativeness of some specific child and adolescents' populations (i.e., children under 10, children and adolescents living in rural areas, children and adolescents with a disability, not attending public school, from indigenous populations, LGBTQ2S+ and other visible or non-visible minorities). This is a direct consequence of their underrepresentation in national/international surveys, studies, surveillance systems, and this is consistent with previous findings.[7] Global harmonized efforts should be invested in to build local capacity and support the inclusion of these specific populations in future PA surveillance systems and PA promotion actions, both nationally and internationally.

Finally, for the first time and as an experiment, the AHKGA allowed the participation of three autonomous communities/regions (Basque Country, Extremadura, and Region of Murcia) within a country also producing a national report card (Spain). This initiative allowed different communities/regions to carry out a more local Report Card on PA that could be useful to perform a diagnostic of the research/surveillance gaps and policy/program needs at the local level. This approach permitted to the three autonomous communities/regions to (1) become aware of the lack of high-quality studies in this region evaluating PA and its associated factors; (2) to know the current status of the 10 common PA indicators; and (3) to compare these results with those from other autonomous communities in Spain, as well as with Spanish national results. This initiative was however limited by the fact that not all regions of Spain were part of it, and the lack of available data at the regional level for some indicators. More time and work are needed to evaluate the impact and feasibility of this initiative.

Conclusion

The Global Matrix 4.0 represents the largest compilation of children and adolescents' PA characteristics to date. While a variation in the data informing the grades across countries was transparently acknowledged and reported, this initiative highlighted that the global situation regarding the PA of children and adolescents remains a serious public health concern, with only a small proportion (27%–33%) meeting the recommended amount of MVPA required for ongoing health and wellbeing. Governmental measures to contain the COVID-19 and future pandemics, as well as local/international war or conflicts, climate change, and economic change have the potential to decrease the level of PA in all countries. The Global Matrix 4.0 provides an overview of the global situation in terms of surveillance and prevalences are provided for the 10 common PA indicators. We offer concrete priority actions and examples from successful countries, to support the development of needed PA policies internationally.

There are several opportunities to increase Report Card grades for all indicators in all countries and improve PA promotion among children and adolescents globally.

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Table 1. Global Matrix 4.0 indicators, definitions and benchmarks used to guide the grade assignment process.

Indicator	Definition	Benchmark
Overall Physical Activity	Any bodily movement produced by skeletal muscles that requires energy expenditure.	% of children and adolescents who meet the Global Recommendations on Physical Activity for Health, which recommend that children and adolescents accumulate at least 60 min of moderate- to vigorous-intensity PA per day on average. Or % of children and adolescents meeting the guidelines on at least 4 d a week (when an average cannot be estimated).
Organized Sport and Physical Activity	A subset of PA that is structured, goal-oriented, competitive and contest-based.	% of children and adolescents who participate in organized sport and/or PA programs.
Active Play	Active play may involve symbolic activity or games with or without clearly defined rules; the activity may be unstructured/unorganized, social or solitary, but the distinguishing features are a playful context, combined with activity that is significantly above resting metabolic rate. Active play tends to occur sporadically, with frequent rest periods, which makes it difficult to record.	% of children and adolescents who engage in unstructured/unorganized active play at any intensity for more than 2 h a day. % of children and adolescents who report being outdoors for more than 2 h a day.
Active Transportation	Active transportation refers to any form of human-powered transportation – walking, cycling, using a wheelchair, in-line skating or skateboarding.	% of children and adolescents who use active transportation to get to and from places (e.g., school, park, mall, friend's house).
Sedentary Behavior	Any waking behavior characterized by an energy expenditure ≤1.5 metabolic equivalents, while in a sitting, reclining or lying posture.	% of children and adolescents who meet the Canadian Sedentary Behavior Guidelines (5- to 17-y-olds: no more than 2 h of recreational screen time per day). Note: the Guidelines currently provide a time limit recommendation for screen-

		related pursuits, but not for nonscreen-related pursuits.
Physical Fitness	Characteristics that permit a good performance of a given physical task in a specified physical, social, and psychological environment.	Average percentile achieved on certain physical fitness indicators based on the normative values published by Tomkinson et al.[76]
Family and Peers	Any member within the family who can control or influence the PA opportunities and participation of children and adolescents in this environment.	% of family members (e.g., parents, guardians) who facilitate PA 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 min of moderate-intensity aerobic PA throughout the week or do at least 75 min of vigorous-intensity aerobic PA throughout the week or an equivalent combination of moderate- and vigorous-intensity PA. % of family members (e.g., parents, guardians) who are physically active with their kids. % of children and adolescents with friends and peers who encourage and support them to be physically active. % of children and adolescents who encourage and support their friends and peers to be physically active.
School	Any policies, organizational factors (e.g., infrastructure, accountability for policy implementation) or student factors (e.g., PA options based on age, gender or ethnicity) in the school environment that can influence the physical activity opportunities and	% of schools with active school policies (e.g., daily physical education (PE), daily PA, recess, “everyone plays” approach, bike racks at school, traffic calming on school property, outdoor time). % of schools where the majority (≥80%) of students are taught by a PE specialist.

	participation of children and adolescents in this environment.	% of schools where the majority (≥80%) of students are offered the mandated amount of PE (for the given state/territory/region/country). % of schools that offer PA opportunities (excluding PE) to the majority (>80%) of their students. % of parents who report their children and adolescents have access to PA opportunities at school in addition to PE classes. % of schools with students who have regular access to facilities and equipment that support PA (e.g., gymnasium, outdoor playgrounds, sporting fields, multipurpose space for PA, equipment in good condition).
Community and Environment	Any policies or organizational factors (e.g., infrastructure, accountability for policy implementation) in the municipal environment that can influence the PA opportunities and participation of children and adolescents in this environment.	% of children or parents who perceive their community/municipality is doing a good job at promoting physical activity (e.g., variety, location, cost, quality). % of communities/municipalities that report they have policies promoting PA. % of communities/municipalities that report they have infrastructure (e.g., sidewalks, trails, paths, bike lanes) specifically geared toward promoting PA. % of children or parents who report having facilities, programs, parks, and playgrounds available to them in their community. % of children or parents who report living in a safe neighborhood where they can be physically active. % of children or parents who report having well-maintained facilities, parks, and playgrounds in their community that are safe to use.

Government	Any governmental body with authority to influence physical activity opportunities or participation of children and adolescents through policy, legislation, or regulation.	Evidence of leadership and commitment in providing PA opportunities for all children and adolescents. Allocated funds and resources for the implementation of PA promotion strategies and initiatives for all children and adolescents. 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). HEPA PAT v2 and the scoring rubric published by Ward et al.[109]

Table 2. Global Matrix 4.0 grading rubric.

Grade	Interpretation	Corresponding number for analysis
A+	94%–100%	15
A	We are succeeding with a large majority of children and adolescents (87%–93%)	14
A-	80%–86%	13
B+	74%–79%	12
B	We are succeeding with well over half of children and adolescents (67%–73%)	11
B-	60%–66%	10
C+	54%–59%	9
C	We are succeeding with about half of children and adolescents (47%–53%)	8
C-	40%–46%	7
D+	34%–39%	6
D	We are succeeding with less than half but some children and adolescents (27%–33%)	5
D-	20%–26%	4
F	We are succeeding with very few children and adolescents (<20%)	2
INC	Incomplete—insufficient or inadequate information to assign a grade	Missing value

Table 3. Human Development Index (HDI) rating, HDI classification, and geo-cultural region for each participating country/jurisdiction.

COUNTRY	HDI (2019)	HDI Classification	Geo-Cultural Region
Argentina	0.845	Very high	Latin America
Australia	0.944	Very high	Anglosphere
Botswana	0.735	High	Africa & Middle East
Brazil	0.765	High	Latin America
Canada	0.929	Very high	Anglosphere
Channel Islands (Guernsey, UK)	0.932	Very high	Anglosphere
Channel Islands (Jersey, UK)	0.932	Very high	Anglosphere
Chile	0.851	Very high	Latin America
China	0.761	High	Asia-Pacific
Chinese Taipei	0.907	Very high	Asia-Pacific
Colombia	0.767	High	Latin America
Croatia	0.851	Very high	Europe
Czech Republic	0.900	Very high	Europe
Denmark	0.940	Very high	Europe
England (UK)	0.932	Very high	Anglosphere
Estonia	0.892	Very high	Europe
Ethiopia	0.485	Low	Africa & Middle East
Finland	0.938	Very high	Europe
France	0.901	Very high	Europe
Germany	0.947	Very high	Europe
Greenland	0.839	Very high	Europe
Hong Kong SAR, China	0.949	Very high	Asia-Pacific
Hungary	0.854	Very high	Europe
India	0.645	Medium	Asia-Pacific
Indonesia	0.718	High	Asia-Pacific
Ireland	0.955	Very high	Anglosphere
Israel	0.919	Very high	Africa & Middle East
Japan	0.919	Very high	Asia-Pacific
Lebanon	0.744	High	Africa & Middle East
Lithuania	0.882	Very high	Europe
Malaysia	0.810	Very high	Asia-Pacific
Mexico	0.779	High	Latin America
Montenegro	0.829	Very high	Europe
Nepal	0.602	Medium	Asia-Pacific
New Zealand	0.931	Very high	Anglosphere
Philippines	0.718	High	Asia-Pacific
Poland	0.880	Very high	Europe
Portugal	0.864	Very high	Europe

Scotland (UK)	0.932	Very high	Anglosphere
Serbia	0.806	Very high	Europe
Singapore	0.938	Very high	Asia-Pacific
Slovakia	0.860	Very high	Europe
Slovenia	0.917	Very high	Europe
South Africa	0.709	High	Africa & Middle East
South Korea	0.916	Very high	Asia-Pacific
Spain	0.904	Very high	Europe
Spain (Basque Country)	0.904	Very high	Europe
Spain (Extremadura)	0.904	Very high	Europe
Spain (Region of Murcia)	0.904	Very high	Europe
Sweden	0.945	Very high	Europe
Thailand	0.777	High	Asia-Pacific
United Arab Emirates	0.890	Very high	Africa & Middle East
United States	0.926	Very high	Anglosphere
Uruguay	0.817	Very high	Latin America
Vietnam	0.704	High	Asia-Pacific
Wales (UK)	0.932	Very high	Anglosphere
Zimbabwe	0.571	Medium	Africa & Middle East

Note: HDI = Human development index, UK = United Kingdom.

Table 4. Grades assigned to the 10 common PA indicators and aggregate indicators grades for the 57 countries/jurisdictions of the Global Matrix 4.0.

Country	OPA	SP	AP	AT	SB	PF	F&P	SCH	C&E	GOV	Behavioral average	Sources of influence average	Overall average
Argentina	D+	C-	INC	INC	D+	INC	INC	INC	C-	D+#	D+	D+	D+
Australia	D-	B-	INC	D+	D-	D+	C+	C+	A-	C-	D+	C+	C-
Botswana	D+	D+	C-	C	C-	C+	C-	C-	D-	D-	D+	D	D+
Brazil	D	C-	F	C	D	D+	C-	B	C	D+#	D	C	D+
Canada	D	C+	D-	C-	F	INC	C	B-	B	B-	D	C+	C-
Chile	D+	C-	INC	D	D-	INC	D	C	D+	A-#	D	C	D+
China	C	F	C-	C	D+	INC	C-	D	D-	D	D+	D	D
Chinese Taipei	F	D-	F	C-	D+	INC	D-	A-	A-	B+	D-	B-	C-
Colombia	D+	D+	INC	B	D+	INC	INC	D+	B-	C+#	C-	C	C-
Croatia	B-	C-	C	C-	D+	INC	D+	B-	B-	D+	C-	C	C-
Czech Republic	C+*	B-	C	B-	D	INC	B-	B+	B	D+	C	C+	C+
Denmark	D*	A	B-	A-	D+	B-	C+	B+	B+	B+	C+	B	B-
England	C-	D	INC	C+	D+	INC	INC	B+	C	INC	D+	B-	C-
Estonia	C+*	B-	D	D+	D-	C+	C-	C+	B+	B	D+	C+	C
Ethiopia	F	C-	B	B-	C+	INC	F	A-	C-	C	C-	C-	C-
Finland	A-*	C+	C-	B+	INC	C-	B-	B	B	A-	B-	B	B-
France	D-	C	C	D+	D-	C	B	B	B	B	D+	B	C
Germany	D-*	B-	C-	C	C	D+	C	B-	B-	INC	C-	C+	C-
Greenland	D-	D	INC	INC	INC	INC	INC	INC	D+	B	D-	C	D+
Guernsey	C+*	C+	INC	C-	C	INC	D	B-	INC	C+	C	C	C
Hong Kong	D-**	B-	D	B+	D	D	INC	B	B	C+	C-	B-	C
Hungary	F	C-	C	B-	D	INC	D+	A+	INC	B	D+	B-	C
India	C*	INC	INC	B-	D-	INC	INC	C	D	C+	C-	C-	C-
Indonesia	F	F	F	D-	B	F	F	F	D+	B-	D-	D	D-
Ireland	C-*	C	INC	D	C-	INC	D+	C-	B+	B#	D+	C+	C-
Israel	D-	D	INC	C-	C+	INC	D-	C+	C-	C	D+	C-	D+

Japan	B-	B-	INC	A-	C-	B	C-	B+	B	B	B-	B-	B-
Jersey	F	INC	INC	D	D	INC	B	B+	INC	C	D-	B-	C-
Lebanon	D-	INC	INC	D+	C	INC	INC	D	INC	D	D+	D	D
Lithuania	D+	B-	B-	D	D+	C	C	C+	B	C+	C-	C+	C
Malaysia	D-	INC	INC	D-	C	B	INC	A-	INC	B#	D	B+	C
Mexico	D	C	C+	C+	D-	INC	B-	D+	D	C	C-	C-	C-
Montenegro	C-	C	B	D+	B	C+	A	A-	C	C	C	B-	C+
Nepal	D+	C-	C+	C	C	INC	A+	C	C	F	C-	C	C-
New Zealand	C+	B-	INC	D	C-	INC	D	C+	INC	A	C-	C+	C
Philippines	F	INC	INC	D	B	INC	INC	C-	INC	B#	D+	C+	C-
Poland	INC	C+	INC	C-	D	C	C-	B+	C	C	C-	C	C
Portugal	D-*	C-	D+	D-	C+	C	B	A	B	B	D+	B	C
Scotland	INC	B-	INC	C-	F	INC	D-	INC	B-	C#	D+	C-	D+
Serbia	D+	C-	B	B	C-	INC	C-	B+	C+	D+	C	C	C
Singapore	C-	B-	C-	C	C-	INC	C-	INC	A+	B	C-	B	C+
Slovakia	B-	C-	C-	C	C-	D+	C-	B	B-	B-#	C-	C+	C
Slovenia	A-	C	C	C	C+	A	B+	A	A+	D	C+	B	B-
South Africa	B-	D-	INC	B-	C-	B-	C-	D-	D	C	C-	D+	C-
South Korea	D-	INC	INC	B+	D	INC	C-	A	B-	A#	C-	B	C+
Spain	B-	B+	B-	B-	D	C-	B-	C-	B	C	C+	C+	C+
Spain (Basque Country)	INC	B-	INC	C+	B-	INC	INC	INC	INC	INC	C+	INC	C+
Spain (Extremadura)	F	D+	INC	INC	D	C+	A	C+	B	C-	D-	B-	C-
Spain (Region of Murcia)	D	B	B+	B	D+	D-	C	C+	D+	D	C+	C-	C-
Sweden	D+**	B+	INC	C	D	C+	B+	B	A+	B	C-	B+	C+
Thailand	D	D+	F	C+	F	D-	A-	B-	C-	B	D-	B-	D+
United Arab Emirates	F*	INC	INC	F	D-**	INC	D-	A-	INC	B+	F	C+	D+
United States	B-	C	INC	D-	D	C-	INC	D-	C	INC	D+	D+	D+
Uruguay	F	F	INC	C	D+	INC	INC	B+	C-	C#	D-	C+	D+
Vietnam	F	INC	INC	D+	C-	INC	C	A	C	B-	D	B-	C-
Wales	F	C	C+	C-	F	C-	D+	B-	C	C#	D	C	D+

Zimbabwe	C+*	B-	C+	B	C	INC	INC	C	C-	D	C+	D+	C

Notes: OPA = *Overall Physical Activity*; SP = *Organized Sport and Physical activity*; AP = *Active Play*; AT = *Active Transportation*; SB = *Sedentary Behavior*; PF = *Physical Fitness*; F&P = *Family and Peers*; SCH = *School*; C&E = *Community and Environment*; GOV = *Government*; * = grade informed by both self-reported and device-based data; ** = grade solely informed by device-based data; # = GOV grade informed using the HEPA PAT v2 and the scoring rubric published by Ward et al.[109]

Table 5. Indicator and aggregate indicator grades by HDI classification.

Indicator	All countries (n = 57)	Very high HDI (n = 42)	High HDI (n = 11)	Medium/low HDI (n = 4)
OPA	D	D+	D	D+
SP	C-	C	D	C
AP	C-	C-	D-	C+
AT	C-	C-	C-	C+
SB	D+	D	D+	C-
PF	C-	C	D+	INC
F&P	C-	C-	C-	C
SCH	C+	B-	C-	C+
C&E	C+	B-	D+	D+
GOV	C	C+	C-	D+
Behavioral average	**D+**	**D+**	**D**	**C-**
Sources of influence average	**C**	**C+**	**C-**	**C-**
Overall average	**C-**	**C-**	**D+**	**C-**

Notes: HDI= Human Development Index; OPA = Overall physical activity; SP = Organized sport and physical activity; AP = Active Play; AT = Active transportation; SB = Sedentary behavior; PF = Physical fitness; F&P = Family and peers; SCH = School; C&E = Community and environment; GOV = Government.

Table 6. Indicator and aggregate indicator grades by geo-cultural regions.

Indicator	All countries (n = 57)	Africa and the Middle East (n = 7)	Anglosphere (n = 10)	Asia-Pacific (n = 13)	Europe (n = 21)	Latin America (n = 6)
OPA	D	D	D+	D-	D+	D
SP	C-	D+	C	D+	C	D+
AP	C-	C+	D+	D-	C	D
AT	C-	C-	D+	C	C	C
SB	D+	C-	D-	D+	D+	D
PF	C-	C+	D+	D+	C	D+
F&P	C-	D-	D+	C-	C+	C-
SCH	C+	C	C+	C+	B	C
C&E	C+	D+	B-	C	B-	C-
GOV	C	C-	C+	C+	C	C
Behavioral average	**D+**	**D+**	**D**	**D+**	**C-**	**D**
Sources of influence average	**C**	**D+**	**C**	**C+**	**C+**	**C-**
Overall average	**C-**	**D+**	**D+**	**C-**	**C**	**D+**

Notes: OPA = *Overall Physical Activity*; SP = *Organized Sport and Physical activity*; AP = *Active Play*; AT = *Active Transportation*; SB = *Sedentary Behavior*; PF = *Physical Fitness*; F&P = *Family and Peers*; SCH = *School*; C&E = *Community and Environment*; GOV = *Government*.

Table 7. Indicator grade counts and averages by data collection/evidence period.

	Pre-COVID		Post-COVID		Both	
Indicator	**Count**	**Average grade**	**Count**	**Average grade**	**Count**	**Average grade**
OPA	43	D	6	D+	12	D+
SP	41	D+	5	C-	13	D+
AP	43	F	5	D+	11	D
AT	43	C-	4	D+	13	C
SB	44	D+	6	D-	12	D
PF	42	D-	3	D-	14	F
F&P	44	D	6	C	9	D
SCH	38	C	4	C+	18	B-
C&E	39	C	4	C+	16	D+
GOV	34	C	4	C-	23	C
Behavioral average	**214**	**D**	**26**	**D**	**61**	**D+**
Sources of influence average	**155**	**C-**	**18**	**C**	**66**	**C-**
Overall average	**411**	**D+**	**47**	**D+**	**141**	**D+**

Notes: OPA = *Overall Physical Activity*; SP = *Organized Sport and Physical activity*; AP = *Active Play*; AT = *Active Transportation*; SB = *Sedentary Behavior*; PF = *Physical Fitness*; F&P = *Family and Peers*; SCH = *School*; C&E = *Community and Environment*; GOV = *Government*.

Table 8. Perceived impact of the COVID-19 pandemic on the 10 common PA indicators, on the surveillance of PA in children and adolescents, and on the activity of PA experts/researchers reported by international PA experts (n = 84) from 53 countries or jurisdictions across 6 continents.

	No impact	Affected positively	Affected negatively
OPA	7%	4%	89%
SP	6%	1%	93%
AP	27%	11%	62%
AT	33%	7%	60%
SB	2%	1%	96%
PF	15%	2%	82%
F&P	38%	14%	48%
SCH	24%	2%	74%
C&E	36%	7%	57%
GOV	33%	7%	60%
Surveillance of PA in children & adolescents	29%	14%	57%
Activity as PA expert/researcher	27%	23%	50%

Notes: OPA = OPA = *Overall Physical Activity*; SP = *Organized Sport and Physical activity*; AP = *Active Play*; AT = *Active Transportation*; SB = *Sedentary Behavior*; PF = *Physical Fitness*; F&P = *Family and Peers*; SCH = *School*; C&E = *Community and Environment*; GOV = *Government*; PA = Physical Activity.

Table 9. Most recurring priorities' themes reported by Report Card Leaders (n = 83) to improve the grades in their country/jurisdiction for each indicator.

Indicator	Most recurring priorities' themes
Overall Physical Activity	- Increasing the opportunities for being physically active at school (active recesses, extracurricular programs, active breaks) and increasing the amount of physical education per week as well as making physical education a compulsory subject for all school levels. - Developing a national surveillance system or improving the current one to include underrepresented populations (i.e., children aged below 10 years, children with a disability, children living in rural areas, minorities), to become nationally and regionally representative, to include device-based assessment of PA, and to better inform research on PA nationally. - Developing access to public spaces, green space, playgrounds, sport facilities, and active transportation infrastructures, as well as addressing the issue of safety of the environment as a priority in their country/territory. - Developing PA policies or programs addressing inequalities by specifically targeting girls, children, and adolescents with a disability, from low-income families, and/or facing segregation or marginalization, as well as adolescents to reduce the age-related physical activity decline. - Developing a large advocacy/information campaign on the importance and benefits of PA targeting either policymakers, teachers, healthcare workers, parents, and children and adolescents, as well as establishing a national PA plan and/or developing national PA guidelines.
Organized Sport and Physical Activity	- Developing and offering more equitable, accessible, inclusive, flexible, and attractive sport program opportunities for all children and adolescents (particularly targeting girls, adolescents, low-income families, children with a disability, and vulnerable minorities). - Developing collaborations between schools and sport clubs to promote sports practice at school and provide resources to schools to support the implementation of sport opportunities at school during breaks and after class. - Develop or improve the collection of quality national/local data about organized sport and PA to evaluate implemented sport policies/programs and inform the development of future evidence-based policies; and develop research on sport and PA preferences of all children and adolescents to design better future sport strategies. - Broaden the definition and approach of organized sports to include lifelong and action sports, outdoor sports, and to use sport as an agent of inclusion, development of skills, enjoyment and not only for competition by applying the guiding principles from the Sports Clubs for Health and Health-Promoting Sports Clubs approaches[43] developed by HEPA Europe (European network for the promotion of health-enhancing physical activity). - Develop and promote cost subsidization measures to support families in need to access sport and recreation programs and provide resources to increase the number of sport clubs/associations offering sport opportunities to children and adolescents for free or at low cost. - Increase and improve the training of certified sports instructors/coaches and improve their working conditions.

	- Develop more sport facilities in the public domain in and outside of schools and improve their accessibility and the safety of their environment.
Active Play	- Increase and improve public spaces/play facilities quality (i.e., more green spaces, bike paths, more "natural" playgrounds, appropriate to the culture and geography particularities including indoor spaces for areas with high pollution or very extreme weather), their maintenance, and the security of their environment. Play facilities should be fun and attractive to all children and adolescents, and Report Card Leaders stressed the importance to work with them when designing active play environments to suit their needs and raise their endorsement and autonomy of such settings. - Address research gaps on *Active Play* (i.e., develop standardized measurement tool, its benefits, its barriers) in all settings and develop the global data collection/surveillance of *Active Play* - Develop public education campaigns to raise awareness of parents/teachers about the importance of active play and outdoor play as part of a healthy and happy development of children and potentially create national Active Play guidelines for children and adolescents. - Provide better play facilities in schools that should be accessible to students to come in and play afterschool and during weekends. National policies allowing/increasing active play opportunity in the school settings and decreasing the academic pressure (homework, school class hours) on children and adolescents should be implemented.
Active Transportation	- Improve the general walkability and bikeability through the development of safe infrastructure (sidewalks, trails, and cycle paths) considering the local specific needs (e.g., covered sidewalks are necessary in hot and humid areas), in particular in rural areas. - Develop national policies adopting whole school approach programs facilitating active commuting, supporting walking school bus programs, establishing an active school travel plan, and providing safe and weatherproof bicycle racks at schools. - Implement national education campaign targeting parents, teachers, and children, raising awareness on the benefits of active transportation and of independent mobility, and teaching how to safely active transport. - Improve the surveillance of active transportation and develop research on its determinants/barriers/enablers, interventions, and monitor and improve on-going policies and strategies on creating safe and supportive built environments. - Deprioritize cars in cities and reduce speed limits to return the streets to children and pedestrians. Roads should be made user friendly to promote cycling. Employ and enforce traffic calming or even traffic diverting strategies near schools to encourage active transportation.
Sedentary Behavior	- Develop aggressive and sustained communications campaign raising awareness in parents, children, teachers, and decision makers about the adverse effects of excessive sedentary behavior and screen time in children and adolescents, educating on the reduction in the availability of TVs and electronic devices in children's bedrooms, on strategies to promote not eating while using screens, and on how to improve competencies for careful handling of screen devices in all age children.

	- Develop specific policies to reduce sedentary behavior at school and promote sedentary breaks: enforce the Sedentary Behavior Research Network recommendations for school-related sedentary behaviors,[124] reduce access to mobile phone at school, increase the number of physical education, encourage outdoor activities, and reduce the workload of children's homework after school. - Improve the quality of national sedentary behavior surveillance data and develop a valid measurement tool. Further research is needed to understand the differences across the week and across countries, as well as research to understand public opinion and attitude towards PA, sedentary behaviors, and health. - Promote alternative activities through the development of leisure, outdoors, active play, and active transportation in the neighborhood and communities by providing better and safer environments.
Physical Fitness	- Implement systematic annual national assessment of children's physical fitness, that could be school based, with the integration of physical fitness scores in relation to national standards on school transcripts. In addition, more research is needed to improve existing batteries of fitness tests with a valid and reliable set of motor tests and somatic measurements, as well as developing health-related criteria that give meaning to fitness indicators. - Promote physical fitness through a whole school approach with implementing interventions, increasing physical education course per week and the offer of extracurricular sport at school. Establish mandatory fitness levels test for the entrance in universities and make physical fitness markers as part of the overall school curriculum. - Educational campaigns to raise awareness of the importance of physical fitness and how to improve it targeting parents, children, teachers, policy makers; the government should recognize that fitness is a reflection of PA, rather than the target of policy itself. - Increase organized sport opportunities for all children (in particular from lower income backgrounds) and promote and educate in games, play and activities with effect on physical fitness in the organized sport setting adjusted to age levels.
Family and Peers	- Include the evaluation of family and peers influence/support in national surveys and fund research to develop better tool to assess it and to better understand its impact on children and adolescents' PA in all contexts and across all stages of early childhood, childhood, and adolescence. More research is needed to examine the link between peer influence and structured and unstructured PA. - Develop PA programs for families and peers in school and in public spaces increasing opportunities for co-participation (parents and children) in PA and increase access to PA infrastructure (e.g., workout equipment at sports grounds). - Develop educational programs/campaigns for parents and other referent adults on the importance of PA benefits on physiological/mental health and academic performance, and on reducing sedentary behaviors. Educate and facilitate families to develop responsible media plans to moderate digital screen use.
School	- Whole-school approach: improve regulation to promote PA at school nationwide, adopting active recess (indoor recesses caused by inclement weather should not be spent on screens), offering extracurricular sport and PA

	programs, implementing of active learning/education, delivering active travel to school initiatives, and preventing long periods of sedentary behaviors in schools. - Daily physical education, starting in primary school, should be added in national curriculum while normalizing active lessons, active homework, and active assignments. Investment for a better training and greater availability of physical education teachers are needed to ensure the implementation of quality physical education course for all school going children and adolescents. - Improved sport facilities and provide more resources in both public and private schools and improve the design of open spaces at schools for promoting active play.
Community and Environment	- Improve the access at no cost, quality, and security (limiting crime, pollution, car speed) of public spaces, in particular in disadvantaged areas, in all seasons. Equitable access to parks, local amenities, and better walking, cycling and public transportation infrastructure should be developed, outside gyms/playground should be settled in big cities as well as in smaller towns, villages, and urban areas. Ensure that all the infrastructure is adapted for children and adolescents with a disability. - More research is needed to improve the assessment of this indicator in all contexts and establish its national surveillance. Studies mapping the access of children and adolescents to PA infrastructure, the time available for using it, as well as how the opportunities offered in playgrounds and gyms consider different ages, skills and interests, are needed. Promote a culture of evaluation of current and future PA program and policies, including the evaluation of the possible impact of new PA infrastructure. - Develop education campaigns increasing awareness of the influence of social conditions and the built environment on movement behaviors and health of the population, encouraging cycling and walking involving the whole educational community (parents, teachers, education and health care workers, politicians, etc.) in active mobility, addressing barriers to parents' perceived safety, and promoting the broader health and wellbeing, economic, social, and environmental benefits of participating in PA in outdoor and green spaces. - Support the development of more PA public community centers and programs, offered on a sustained and regular basis, improving the opportunities for all children and adolescents to engage in PA in their local areas at no cost and supporting PA outside the sport context.
Government	- Whole of government approach: improve communication across federal, provincial, territorial and local governments, different ministries, different public agencies, academia health charities and NGOs better align inter-jurisdictional programs and responsibilities and better coordinate efforts using the Global Action Plan for PA[32] as a central point for implementing PA in all policies. - PA policies require better implementation, monitoring, and evaluation. Honor and provide regular evaluations of progress towards meeting the WHO targets to reduce physical inactivity by 15%. Greater transparency and clearer accountability on the implemented policies in terms of resources allocated should be communicated publicly. - Increased the budget for supporting scientific research and improving the surveillance of the 10 Global Matrix common indicators. Clearer reporting and

	availability of national data relating to PA levels and evaluations of national policy is essential. - Official commitment of the government towards improvement of PA in general, identify children and adolescents' PA as a priority. Substantially increase funding for the promotion of PA and the necessary structures to allow the sector to thrive.

Notes: PA = physical activity; WHO = World Health Organization; NGO = Non-Governmental Organization

Table 10. Linear model presenting the associations between HDI classification, geo-cultural region and the count of A, B, and C grades.

Predictors	**Estimates**	**95% CI**	***p*-value**
Intercept	4.67	2.86 – 6.48	**<0.001**
High HDI (ref: very high)	-0.52	-2.13 – 1.10	0.523
Medium/low HDI (ref: very high)	1.42	-0.87 – 3.72	0.218
Anglosphere (ref: Africa and the Middle East)	0.33	-1.84 – 2.49	0.762
Asia-Pacific (ref: Africa and the Middle East)	0.31	-1.49 – 2.11	0.732
Europe (ref: Africa and the Middle East)	2.04	0.06 – 4.03	**0.044**
Latin America (ref: Africa and the Middle East)	-0.75	-2.93 – 1.44	0.496
Observations	57		
R^2 / R^2 adjusted	0.285 / 0.199		

Notes: CI = confidence interval; HDI = Human Development Index.

Table 11. Poisson model presenting associations between HDI classification, geo-cultural regions and the count of INC grades.

Predictors	**Incidence Rate Ratios**	**95% CI**	***p*-value**
Intercept	2.68	1.38 – 4.79	**0.002**
High HDI (ref: very high)	0.67	0.37 – 1.20	0.182
Medium/low HDI (ref: very high)	0.79	0.33 – 1.73	0.576
Anglosphere (ref: Africa and the Middle East)	0.93	0.46 – 1.99	0.852
Asia-Pacific (ref: Africa and the Middle East)	0.89	0.47 – 1.73	0.716
Europe (ref: Africa and the Middle East)	0.44	0.22 – 0.95	**0.03**
Latin America (ref: Africa and the Middle East)	1.04	0.48 – 2.25	0.917
Observations	57		
R^2 Nagelkerke	0.204		

Notes: CI = confidence interval; HDI = Human Development Index.