

Active Healthy Kids Global Alliance Global Matrix 4.0—A Resource for Physical Activity Researchers

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Background: This brief report provides an overview of the Active Healthy Kids Global Alliance (AHKGA); an introduction to the Global Matrix 4.0; an explanation of the value and opportunities that the AHKGA efforts and assets provide to the physical activity research, policy, practice, and advocacy community; an outline of the series of papers related to the Global Matrix 4.0 in this issue of the *Journal of Physical Activity and Health*; and an invitation for future involvement. **Methods:** The AHKGA was formed to help power the global movement to get kids moving. In 2019–2021, we recruited countries to participate in the Global Matrix 4.0, a worldwide initiative to assess, compare, and contrast the physical activity of children and adolescents. **Results:** A total of 57 countries/jurisdictions (hereafter referred to as countries for simplicity) were recruited. The current activities of the AHKGA are summarized. The overall findings of the Global Matrix 4.0 are presented in a series of papers in this issue of the *Journal of Physical Activity and Health*. **Conclusions:** The Global Matrix 4.0 and other assets of the AHKGA are publicly available, and physical activity researchers, practitioners, policy makers, and advocates are encouraged to exploit these resources to further their efforts.

Keywords: international surveillance, report cards, movement behaviors, research, advocacy

This brief report provides an overview of the Active Healthy Kids Global Alliance (AHKGA), an introduction to the Global Matrix 4.0, an explanation of the value and opportunities that the AHKGA efforts and assets provide to the physical activity research, policy, practice, and advocacy community, an outline of the series of papers related to the Global Matrix 4.0 in this issue of the *Journal of Physical Activity and Health*, and an invitation for future involvement.

Active Healthy Kids Global Alliance

Officially located in Ottawa, Canada, the AHKGA is an international not-for-profit organization of researchers, health professionals, and stakeholders working together to advance the physical activity of children and adolescents around the world. The Alliance was established in 2014 following the success of the

Global Summit on the Physical Activity of Children in Toronto, Canada¹ and has a vision of a world of active, healthy kids. The AHKGA is committed to powering the global movement to get kids moving through thought leadership, knowledge translation/exchange and mobilization, capacity building, and advocacy. This is facilitated by sustainable partnerships and cross-sectoral collaborations that enable best practice exchanges, networking, and cross-fertilization. The AHKGA is committed and attentive to principles of justice, equity, diversity, and inclusion (JEDI). For example, we are committed to being inclusive by assisting and accommodating low- and middle-income countries by scaling fees for participation in the Global Matrix (an initiative involving the collaboration and cooperation of multiple jurisdictions working together to produce country report cards on the physical activity of children and adolescents following a harmonized process—described in further detail later) based on country World Bank classification, making exceptions based on country circumstances (eg, extraordinary inflation in Argentina and Lebanon), discounting fees for attending the Global Matrix release, and trying to generate funding support centrally for countries in greatest need. The AHKGA Board of Directors is constituted to ensure representation from all inhabited continents. Further details on the AHKGA are available at www.activehealthykids.org.

Although still a relatively new organization, the AHKGA has been, and continues to be, involved in several efforts to advance our mission and pursue our vision. We maintain and populate a state-of-the-art website that contains extensive information on our initiatives, successes, and impact as well as research and news related to our mission. The website is open access and available to

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all but with a “members-only” password-protected area for confidential or sensitive materials specific to the Global Matrix development for country report card leaders. The AHKGA has created and supports 6 standing committees, including the executive committee, nominations committee, fundraising committee, communications committee, partnership committee, and publications committee (see website for committee members). With leadership from the communications committee, we have an active presence on social media and networking platforms (Twitter, Facebook, LinkedIn, and ResearchGate) and distribute quarterly newsletters to all AHKGA Global Matrix participants and alumni. These communication vehicles are used to disseminate our work, support and promote report card teams, and share news and events related to physical activity in children and adolescents. A series of awards (eg, Best Report Card, Best Report Card Poster, Best Contributor to the Global Matrix, Most Responsive Report Card Leader, and Best Report Card Promotor) were developed to acknowledge the great quality of the work from deserving teams and/or experts involved in the Global Matrix initiative. Webinars on topics of common interest have been prepared and delivered to participating country leaders and are preserved in the members-only area. A partnership with the *International Society for Physical Activity and Health* has been established. In this regard, the Global Matrix 2.0 and 4.0 were released at *International Society for Physical Activity and Health* congresses, and the main findings for all Global Matrices have been published in the *International Society for Physical Activity and Health Journal (Journal of Physical Activity and Health)*. In relation to capacity building, to date, the AHKGA has trained at least 18 master’s students, 22 PhD students, 10 postdoctoral fellows, and 44 professors/academic staff (overall total 94; 56 women and 16 from low- or middle-income countries) on the report card process, and physical activity monitoring and surveillance more generally, in >70 countries. To further build global capacity, the AHKGA has secured support from the Sun Life Assurance Company of Canada to assist with report card development and promotion in Hong Kong, Indonesia, Malaysia, The Philippines, and Viet Nam. We recently committed funds to support one “AHKGA Fellow” per Global Matrix initiative to help build capacity and leadership within the sector. The AHKGA Fellow will provide support for the Global Matrix initiative, including providing progressively increasing leadership for recruiting countries, managing the global harmonization process, liaising with participating country leaders, developing evaluation procedures, writing research papers, and knowledge translation and mobilization efforts. The fellowship will include an internship at the AHKGA office in Ottawa, Canada, and support will ensure that the fellow can attend the launch of the Global Matrix. Academic outputs from the AHKGA are summarized in Figure 1, and a detailed catalogue of publications and presentations is available on the website. A summary of the overall impact of AHKGA efforts is provided in Table 1, and further details are available elsewhere.^{2,3}

The dominant effort of the AHKGA, to date, has been its *Global Matrix* initiative.⁴⁻⁷ The *Global Matrix* initiative involves the collaboration and cooperation of multiple jurisdictions working together to produce country report cards on the physical activity of children and adolescents, following a harmonized process⁸ that allows for comparability, cross-fertilization of ideas to improve the grades, global networking, and the compilation and aggregation of international data across a series of indicators related to the physical activity of children and adolescents. Report cards are prepared by groups of experts in each country using the best available data and

information to inform grades for a series of indicators related to the physical activity of children and adolescents.^{7,8} A registration fee is levied on participating countries to offset organizational costs of leading the Global Matrix process, mentor and guide country leaders through the process, provide training webinars, assist in securing funding, enforce milestone adherence and timelines, lead the preparation of aggregated research manuscripts and pay for open-access publishing, plan and deliver Global Matrix launch presentations, prepare media and public relations strategies, maintain and populate country report card webpages, purchase and present awards and thank-you gifts, host prelaunch and postlaunch workshops/debriefing sessions, facilitate global networking opportunities, and perform and publish an evaluation of the process among other services. These country report cards have been shown to be very effective and influential across multiple sectors (eg, academia, research, education, recreation, health, policy, surveillance, fundraising—see Table 1 for examples) for creating awareness; transferring interventions, policies, and practices; improving surveillance; and advocacy purposes^{2,3} and have now been replicated in >70 countries.⁴⁻⁷ A flattering side effect of the report card success is that some countries have copied the process without participating in the Global Matrix,⁹⁻¹¹ and papers are being published by other authors not involved in the Global Matrix.¹² And as desired, papers are being published with suggestions for improvements to the Global Matrix methodology.^{13,14} After successful Global Matrix releases at events in Toronto, Canada (Global Matrix 1.0, 15 countries, 2014), Bangkok, Thailand (Global Matrix 2.0, 38 countries, 2016), and Adelaide, Australia (Global Matrix 3.0, 49 countries, 2018), the Global Matrix 4.0 was released in Abu Dhabi, United Arab Emirates on October 24, 2022 with 57 countries participating.

Going forward, the AHKGA aims to maintain and expand existing initiatives and commitments; increase country recruitment for the Global Matrix initiative; explore additional funding opportunities; expand capacity-building efforts; and provide leadership in the development of robust, valid, and reliable measurement instruments to assist countries with their surveillance efforts and to improve comparability of findings across countries. The AHKGA is particularly committed and active in addressing global surveillance gaps and inequities. We routinely encourage participating countries to collect, consider, and grade inequities (eg, by gender, race/ethnicity, disability/ability, socioeconomic status, urban/rural living), and we hosted a webinar specifically on this topic for participating Global Matrix 4.0 country leaders, consistent with our commitment to JEDI principles. In at least 3 instances, countries took the initiative to publish report card papers specifically focused on children with a chronic disease, a disability, or special education needs.¹⁵⁻¹⁷ The AHKGA also strongly supported an independent initiative led by Ng et al¹⁸ to use the Global Matrix framework for evaluating the 10 common physical activity indicators among children and adolescents with a disability or chronic condition from 15 countries or territories across 5 continents.

Global Matrix 4.0

A network map illustrating the 682 participating leaders, researchers, and advocates participating in the Global Matrix 4.0 is provided in Figure 2 to demonstrate the global representation, connections, and opportunities. The Global Matrix 4.0 is the largest and most globally representative effort of the AHKGA to date. Figure 3 illustrates the progression in country participation across Global Matrix 1.0 to 4.0 by country-level Human Development

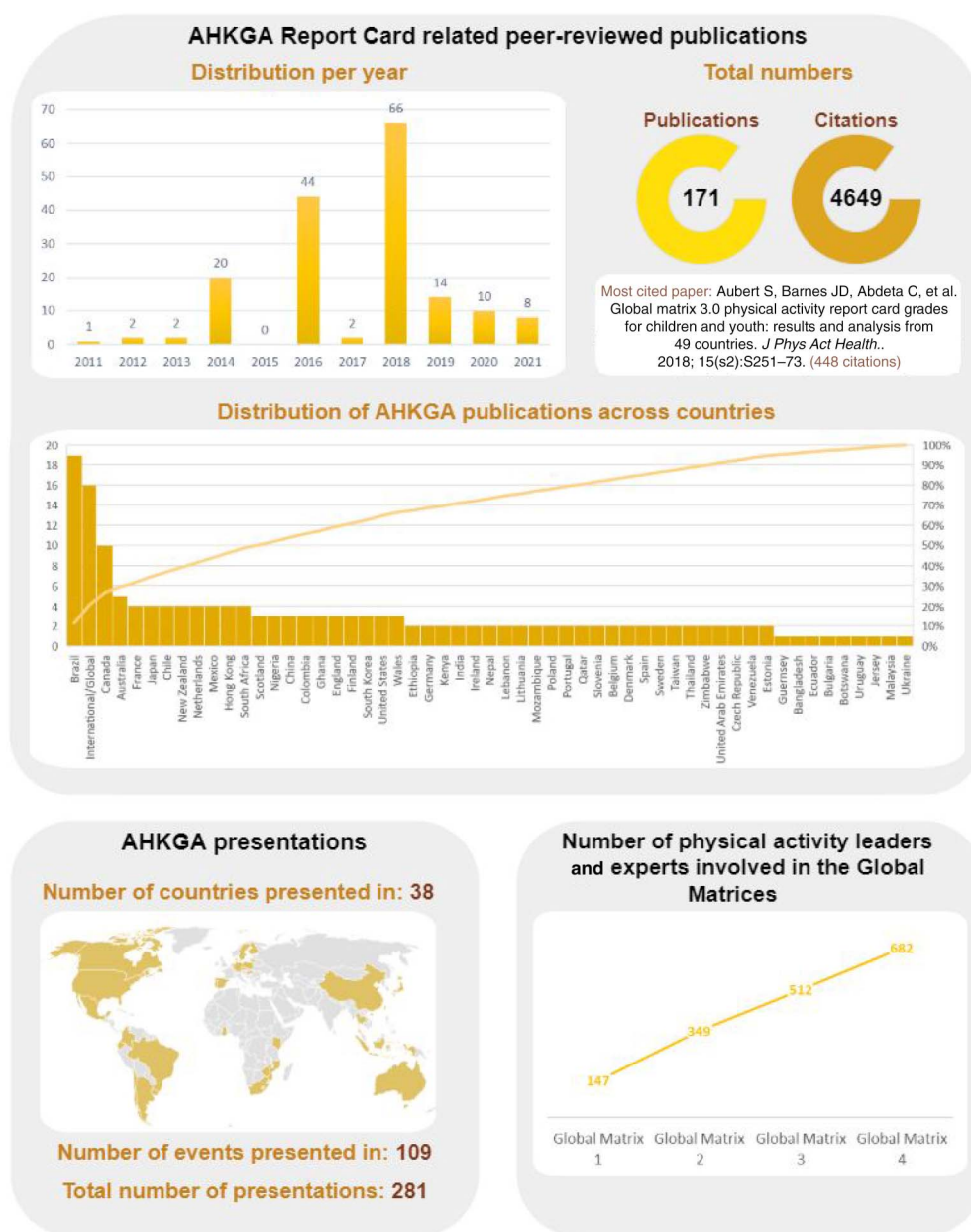


Figure 1 — Infographic summarizing academic outputs from the AHKGA (March 2022). AHKGA indicates Active Healthy Kids Global Alliance.

Index.¹⁹ The decline in participation among low and medium human development countries shown in Figure 3 for the Global Matrix 4.0 may be a manifestation of the inherent challenges of prioritizing physical inactivity among many competing public health issues in these countries, exacerbated by the COVID-19 pandemic amid scarce resources. As an experiment, for the Global Matrix 4.0, we allowed the inclusion of 3 semiautonomous regions within a country to produce report cards in a country that is already developing a national report card (Spain; as well as Basque Country, Extremadura, and Region of Murcia). The successes and limitations of this experiment are described in the accompanying paper by Aubert et al.⁷

Whereas some international physical activity monitoring and surveillance processes employ standardized and often centralized data collection and analysis procedures, the Global Matrix initiative empowers teams of experts within countries to gather and

interpret what they believe to be the best available evidence for their country for each indicator in the report card. These contrasting approaches each have strengths and limitations, as was discussed in detail recently by Aubert et al.²⁰ For example, the former (eg, Health Behaviour in School-aged Children Study²¹; Global School-Based Student Health Survey²²) use the same instrument in each jurisdiction, allowing for methodological comparability and precise prevalence estimates, but may lack the cultural validity to legitimately capture habitual physical activity within the local context and, thereby, sacrifice prevalence estimate accuracy. Furthermore, these standardized approaches are generally narrow in scope, for example, getting at proportions meeting guidelines but gathering little or no information related to the sources of influence of those behaviors (eg, family, peers, school, community, government). The fact that the report cards contain at least 10 indicators related to the physical activity of children and adolescents is,

Table 1 Summary of the Overall Impact of AHKGA Efforts Across Multiple Sectors

Impacts	Indicators
Capacity building	<p>Leveraged funding: The AHKGA fundraising committee has pursued many avenues for funding support, including competitive grants (notably several European Union applications), establishment of an ESG fund (in progress), and partnerships providing bilateral benefit. Notable successes include a signed memorandum of understanding with the International Society for Physical Activity and Health and a funding donation from the Sun Life Assurance Company of Canada to support report card development and promotion in Hong Kong, Indonesia, Malaysia, The Philippines, and Vietnam.</p> <p>Research tools and methods: The AHKGA Report Card harmonized development methodology has been completed more than 180 times across 68 countries or territories between 2005 and 2022.</p> <p>Career trajectory of researchers: More than 900 physical activity experts have been part of report card team between 2014 and 2022. In 2018, 96% of the report card leaders reported that participating in the Global Matrix initiative was professionally rewarding, and 91% reported that participating in the Global Matrix was personally rewarding.</p> <p>Student training: At least 18 master's students, 22 PhD students, and 10 postdoctoral fellows contributed to/were involved in the development of an AHKGA Report Card or supported the Global Matrix development and/or evaluation.</p>
Advancing knowledge	<p>Bibliometrics: More than 170 AHKGA Report Card-related publications, resulting in approximately 4700 citations.</p> <p>Collaborations and partnerships: The AHKGA Partnership Committee navigated signed memoranda of understanding with the International Sport and Culture Association and the International Society for Physical Activity and Health. In 2018, 89% of the report card leaders who participated in the Global Matrix 3.0 reported that the Global Matrix initiative was contributing to increasing scientific knowledge.</p>
Informing decision making	<p>Influence on policies: There are multiple examples of success stories of public release of national report cards that contributed to raising awareness on children's physical inactivity to policy makers (eg, Flanders, United Arab Emirates, Venezuela, Wales). In Chile and Ghana, report card team members were consulted for the development of new active school policies following the publication of their report card. Results of the Global Matrix 3.0 and Poland's report card were used by the Polish Ministry of Sport and Tourism to inform their decision and support funding of the "SCOUT" Program as part of developing sport by supporting ventures in the field of promoting children and youth sport. Details and further examples are available elsewhere³ and on the AHKGA website.</p>
Health	<p>Summary of impact on behavioral indicators: It is too early to observe significant change in active behaviors in children, and any potential change in behavior (observed by grade temporal change for behavioral indicators) cannot be directly linked to the impact of the AHKGA Report Cards. However, our analysis of secular trends in report card grades between Global Matrices 1.0 and 4.0²⁴ found some modest international improvements in grades for both behavioral indicators and sources of influence indicators as well as modest improvements in surveillance of report card indicators, as indicated by a reduction in incomplete grades. In 2018, 89% of the report card leaders who participated in the Global Matrix 3.0 reported that in their opinion, the Global Matrix initiative was contributing to power the movement to get kids moving.</p>
Economic and social benefits	<p>Intellectual property and licensing spin outs, economic returns: In many countries, new organizations or networks have been created (eg, Active Healthy Kids <i>country name</i>). The AHKGA developed its logo in 2014 and was incorporated as a not-for-profit corporation in 2018. Work to develop an ESG fund rooted in AHKGA values is ongoing.</p> <p>Jobs: In 2022, the AHKGA launched a new "AHKGA Fellowship" program—one fellow per Global Matrix to help build capacity and leadership within the sector. The fellowship includes a \$25,000 (Canadian Dollar) stipend and an internship at the AHKGA office in Ottawa, Canada, and travel support will ensure that the Fellow can attend the launch of the Global Matrix. For the Global Matrix 5.0 and beyond, a call will go out to the AHKGA network, and an application process (criteria, eligibility, and responsibility) will be developed and posted on the AHKGA website. In 2018, a project coordinator position was developed to help support the daily operations of the AHKGA, and a part-time webmaster position was also created.</p>
Social engagement	<p>Public involvement: The AHKGA Communications Committee impact includes the release of new handles in social media with respect to previous Global Matrices (Facebook) and an increase in the number of people following the AHKGA profiles as well as the number of interactions. Main findings of the Global Matrix 3.0 have been disseminated and report card leaders profiled through our social media. New and more infographics and videos have been created to reach the general public and inform about the initiative. Platforms such as "The Conversation" have been used to disseminate our findings in a more general language while creating awareness among stakeholders.</p> <p>Dissemination: A total of more than 200 report card documents/knowledge translation products were launched in the public domain across 68 countries or territories from 6 continents between 2005 and 2022 and at least 281 conferences and scholarly or professional presentations delivered. Media coverage has been extensive with global media hits (stories) for the Global Matrix 1.0 >1100, Global Matrix 2.0 >700, and Global Matrix 3.0 >1000.</p>

Abbreviations: AHKGA, Active Healthy Kids Global Alliance; ESG, Environmental, Social, and Governance.

indeed, a strength. Although the Global Matrix initiative allows for multiple data sources and multiple indicators to be included, synthesized, and interpreted by experts within the country, it results in reduced comparability across jurisdictions and, consequently, uses a crude grading system that groups prevalence estimates into 5% to 6% clusters by grade.^{6,7} Different intercontinental physical activity monitoring and surveillance initiatives also vary by age ranges, timing of data collection, representativeness of the sample, sampling methodology, questions used to assess physical activity

behaviors, and criteria for meeting guidelines/standards/benchmarks, and this includes the Global Matrix initiatives. Collectively, these limitations lead to substantial inconsistencies across and even within surveillance initiatives, resulting in varying estimates of the physical activity of children and adolescents at global, regional, and national levels. This, in turn, results in dramatically varying rank order comparisons and consequent attention, advocacy, and policy action.²⁰ Given the importance of physical activity, active play, sport participation, and active transportation to the health and

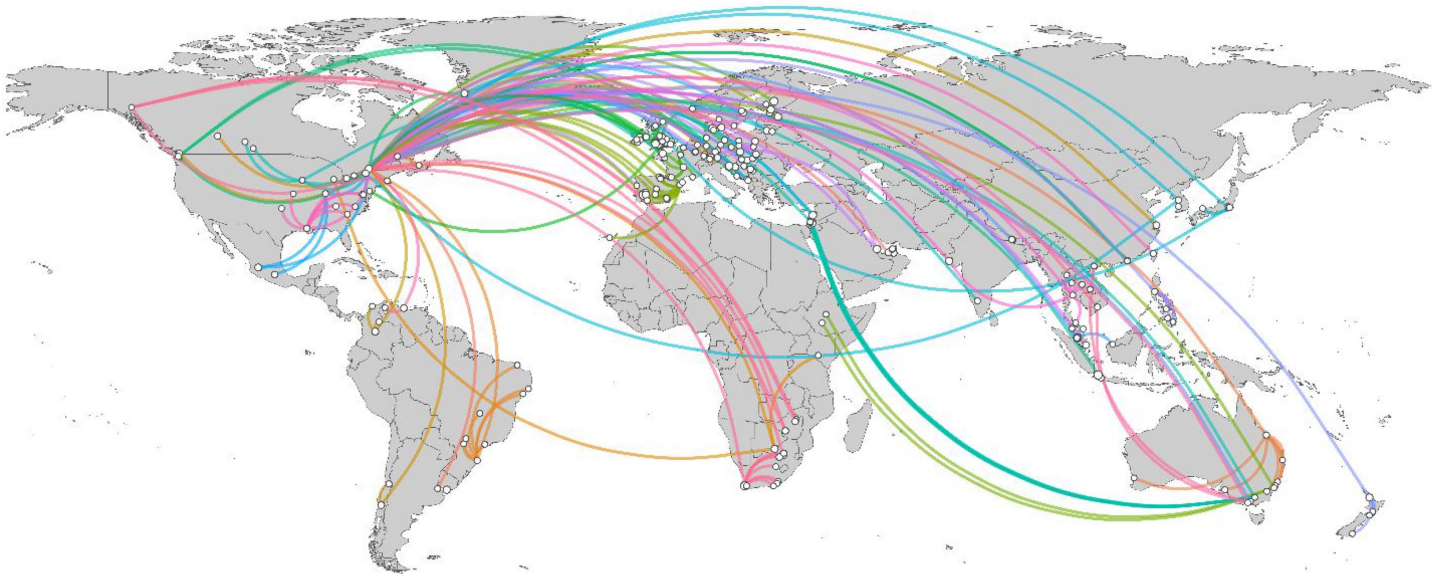


Figure 2 — Global network map of the countries and leaders, researchers, and advocates participating in the Global Matrix 4.0.

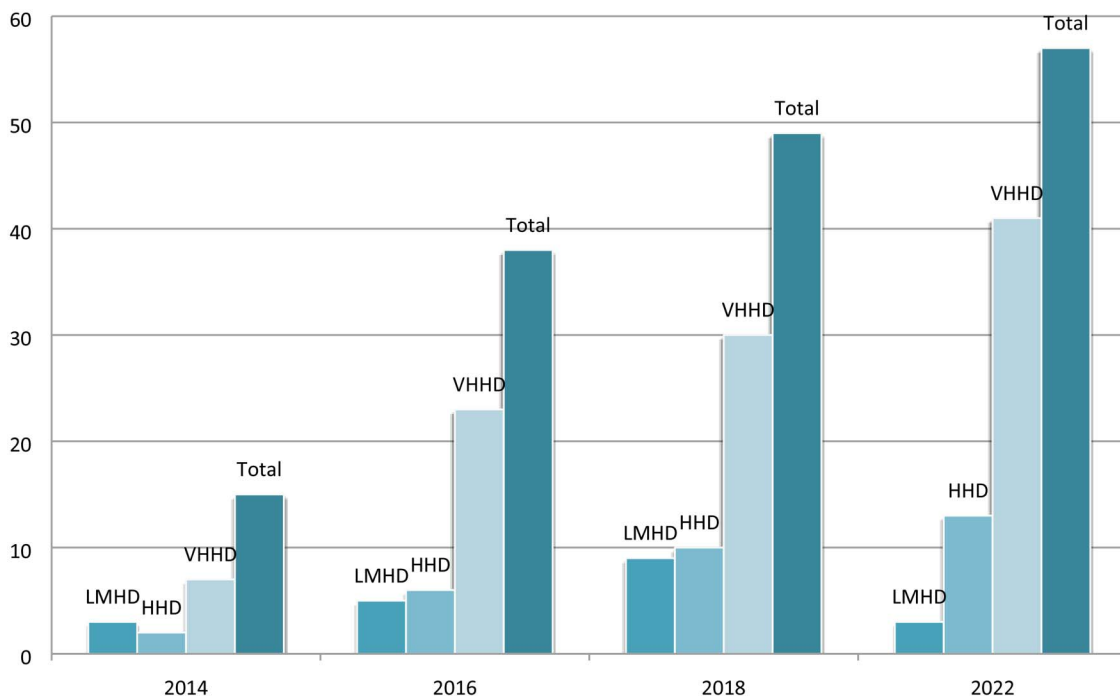


Figure 3 — Number of countries participating in the Global Matrix 1.0 (2014), 2.0 (2016), 3.0 (2018), and 4.0 (2022) sorted by country Human Development Index. HHD indicates high human development countries; LMHD, low and medium human development countries; VHHD, very high human development countries.

well-being of children and adolescents, the importance of developing a physical activity measurement instrument that is valid and reliable for *global* surveillance cannot be overstated.

The Global Matrix 3.0 was released in late 2018. Plans for the release of the Global Matrix 4.0 were initially for the third quarter of 2021. In March of 2020, the COVID-19 pandemic was declared, dramatically changing the daily life of families and children throughout the world and the routine research and surveillance

processes of governments, research institutes, and universities. Data collection procedures were stopped or dramatically altered to adhere to constantly changing local restrictions. A recently published scoping review on the movement behaviors of children and adolescents that examined the peer-reviewed literature published only *in the first year after the pandemic* found 150 published papers!²³ The papers rather uniformly found dramatic declines in self-reported or parental-reported child physical activity, sport

participation, and active outdoor play as well as dramatic increases in recreational screen time.²³ However, not all countries have data from *during* the pandemic, and those that do were required to use methods differing from those typically employed, making temporal comparisons difficult or impossible. Not surprisingly, the pandemic created many challenges to completing the Global Matrix 4.0 and interpreting the results. The other papers in this special series will dig deeper into the challenges that COVID-19 has put on measuring and interpreting physical activity monitoring and surveillance practices and data, and caution is recommended when interpreting findings particularly contaminated by the COVID-19 pandemic.

Global Matrix 4.0 Series Papers

This Brief Report is the first of 5 papers in this issue of the *Journal of Physical Activity and Health* that are focused on the findings from the Global Matrix 4.0. A detailed summary of the methods and main findings for the 10 report card indicators for all 57 participating jurisdictions, and geocultural clusters of countries, from the Global Matrix 4.0 is provided in the paper by Aubert et al.⁷ The main findings are then further dissected by Reilly et al.,²⁴ who examine temporal changes in report card findings between and within countries that participated in combinations of the Global Matrices 1.0 to 4.0. Lee et al.²⁵ explore geopolitical differences in grades with analyses considering economic freedom and climate culpability as well as specific national environmental indicators. Finally, the paper by Silva et al.²⁶ explores the evidence, and evidence gaps, related to within- and between-country variation in gender, socioeconomic, cultural, ability/disability, and urban/rural disparities observed in informing physical activity indicators for children and adolescents in countries that participated in the Global Matrix 4.0.

Encouraging the Use of AHKGA Resources

The AHKGA has accumulated substantial information, evidence, and resources related to the physical activity and related behaviors of children and adolescents around the world as well as the sources of influence of these behaviors.⁴⁻⁷ More than 170 peer-reviewed manuscripts have been published from these resources, and further exploitation of these data is invited. This information is publicly available on the AHKGA website. There are multiple opportunities and possibilities to perform new, deeper analysis for specific areas, indicators, or relationships, so we encourage such initiatives but request that you contact AHKGA (info@activehealthykids.org) first to ensure that there are no overlapping papers already in progress.

The AHKGA's framework, methodology, and resources have also been used to encourage data-driven policy making on the local level. For example, in Poland in 2021, local policy makers and local government employees (mainly working in areas of sport, physical activity, education, and built infrastructure) were encouraged to participate in a series of events between June and December 2021 (including a 2-d conference and series of webinars) during which they could learn how the AHKGA's framework could enable them to lay a strong, holistic foundation to develop their local plans and strategies, aiming to increase physical activity levels of inhabitants. That framework has been used by Wroclaw, the fourth largest city in Poland, to develop local sport and physical activity diagnosis (2019) and sport and physical activity programs (2021).

Researchers or stakeholders interested in the Global Matrix project should contact their country report card leader(s) or the AHKGA to explore initiating a report card in a new country for participation in future Global Matrix initiatives. We also welcome comments and suggestions on how we can better pursue our mission and vision. Please help us to *power the movement to get kids moving* by using our resources to advance your efforts.

Call to Action

The World Health Organization's Global Action Plan on Physical Activity 2018–2030 aims to achieve a 15% reduction in the prevalence of physical inactivity among adolescents and adults by 2030.²⁷ No similar targets were set for preadolescent children because no global monitoring or surveillance system exists. This is unacceptable because successfully addressing the inactivity pandemic will contribute to meeting many of the United Nations' Sustainable Development Goals^{28,29} while also helping to meet future adolescent and adult physical activity targets. An urgent call to action is required for countries to work together to develop a global adolescent and child physical activity questionnaire and ensure its feasibility, validity, and reliability in diverse cultural contexts. The resulting comparable evidence can be a powerful force in attracting interest and provoking change in participating countries, as has already been shown with the Global Matrix initiative. In this regard, we particularly invite countries classified as low or medium human development¹⁹ to contact us to explore participation in future Global Matrix initiatives. Many governments and nongovernment organizations have proposed action plans and/or calls to action aiming to promote physical activity to improve population health,²⁹⁻³³ though inequities across human development strata are clearly evident.⁶ The AHKGA stands behind these actions and offers a push to help them become a reality across the globe.

Acknowledgments

The authors are grateful to all country report card leaders and leadership group members who prepared the report cards and participated in the Global Matrix 4.0. The AHKGA would also like to acknowledge and thank the *International Society for Physical Activity and Health* for their collaboration and assistance in the launch, promotion, and dissemination of the Global Matrix 4.0. The authors appreciate and acknowledge the assistance of Myranda Hawthorne in the preparation of the manuscript.

References

1. Tremblay MS. 2014 global summit on the physical activity of children. *J Phys Act Health*. 2014;11(suppl 1):S1–S2. doi:[10.1123/jpah.2014-0182](https://doi.org/10.1123/jpah.2014-0182)
2. Tremblay MS, Barnes JD, Bonne JC. Impact of the active healthy kids Canada report card: a 10-year analysis. *J Phys Act Health*. 2014; 11(suppl 1):S3–S20. doi:[10.1123/jpah.11.s1.s3](https://doi.org/10.1123/jpah.11.s1.s3)
3. Aubert S, Barnes JD, Forse ML, et al. The international impact of the active healthy kids global alliance physical activity report cards for children and youth. *J Phys Act Health*. 2019;16(9):679–697. PubMed ID: [31412317](https://pubmed.ncbi.nlm.nih.gov/31412317/) doi:[10.1123/jpah.2019-0244](https://doi.org/10.1123/jpah.2019-0244)
4. Tremblay MS, Gray CE, Akinroye K, et al. Physical activity of children: a global matrix of grades comparing 15 countries related to the physical activity of children. *J Phys Act Health*. 2014;11(suppl 1): S113–S125. doi:[10.1123/jpah.11.s1.s113](https://doi.org/10.1123/jpah.11.s1.s113)

5. Tremblay MS, Aguilar Farias N, Akinroye K, et al. Global matrix 2.0: report card grades on the physical activity of children and youth comparing 38 countries. *J Phys Act Health*. 2016;13(suppl 1):S343–S366. doi:10.1123/jpah.2016-0594
6. Aubert S, Barnes JD, Abdeta C, et al. Global matrix 3.0 physical activity report card grades for children and youth: results and analysis from 49 countries. *J Phys Act Health*. 2018;15(suppl 1):S251–S273. doi:10.1123/jpah.2018-0472
7. Aubert S, Barnes J, Demchenko I, et al. Global Matrix 4.0 physical activity report card grades for children and adolescents: results and analysis from 57 countries. *J Phys Act Health*. 2022;19(11):700–728. doi:10.1123/jpah.2022-0456
8. Colley RC, Brownrigg M, Tremblay MS. A model of knowledge translation in health: the active healthy kids Canada report card on physical activity for children and youth. *Health Promot Pract*. 2012;13(3):320–330. PubMed ID: 22447666 doi:10.1177/1524839911432929
9. Masanovic B, Popovic S, Bjelica D, Gardasevic J. The 2018 national report on children's and adolescents' physical activity and physical fitness for Montenegro. *Iranian J Public Health*. 2020;49(10):1992–2000. doi:10.18502/ijph.v49i10.4705
10. Mandiuk A. Levels of involvement of children and adolescents in various forms of motor activity in Ukraine and member countries active healthy kids global alliance. *Slobozhanskiy Her Sci Sport*. 2018;3(65):40–44.
11. PLOVDIV. First Bulgarian active kids report card 2016. <https://www.bgbeactive.org/wp-content/uploads/2018/05/Active-Healthy-Kids-6-15-BG-Report-English.pdf>. Accessed February 3, 2022.
12. Krylovas A, Kosareva N, Dadelo S. European countries ranking and clustering solution by children's physical activity and human development index using entropy-based methods. *Mathematics*. 2020;8(10):1705. doi:10.3390/math8101705
13. Coppinger T, Milton K, Murtagh E, et al. Global matrix 3.0 physical activity report card for children and youth: a comparison across Europe. *Public Health*. 2020;187:150–156. PubMed ID: 32979606 doi:10.1016/j.puhe.2020.07.025
14. Ward MR, Tyler R, Edwards LC, Miller MC, Williams S, Stratton G. The AHK-Wales report card 2018: policy measures—is it possible to “score” qualitative data? *Health Promotion Int*. 2021;36(4):1151–1159. doi:10.1093/heapro/daaa118
15. Burghard M, de Jong NB, Vliegiers S, et al. 2017 Dutch report card⁺: results from the first physical activity report card plus for Dutch youth with a chronic disease of disability. *Front Pediatr*. 2018;6:122. PubMed ID: 29761094 doi:10.3389/fped.2018.00122
16. Sit CH-P, Yu JJ, Huang WY, et al. Results from Hong Kong's 2019 report card on physical activity for children and youth with special educational needs. *J Exerc Sci Fit*. 2020;18(3):177–182. PubMed ID: 32641926 doi:10.1016/j.jesf.2020.05.004
17. Takken T, de Jong N, Duijff M, van den Berg S, Wendel-Vos W. Results from the Netherlands' 2018 report card and report card+ on physical activity for children and youth with and without chronic medical condition. *Public Health*. 2020;185:161–166. PubMed ID: 32634607 doi:10.1016/j.puhe.2020.04.044
18. Sit C, Aubert S, Carty C, et al. Promoting physical activity among children and adolescents with disabilities: the translation of policy to practice internationally. *J Phys Act Health*. 2022;19(11):758–768. doi:10.1123/jpah.2022-0351
19. United Nations Development Programme. Human Development Index (HDI). <http://hdr.undp.org/en/content/human-development-index-hdi>. Accessed January 27, 2022.
20. Aubert S, Brazo-Sayavera J, Gonzalez SA, et al. Global prevalence of physical activity for children and adolescents; inconsistencies, research gaps, and recommendations: a narrative review. *Int J Behav Nutr Phys Act*. 2021;18(1):81. PubMed ID: 34187486 doi:10.1186/s12966-021-01155-2
21. Centers for Disease Control and Prevention. Global School-Based Student Health Survey. 2016. <https://www.cdc.gov/gshs/background/index.htm>. Accessed January 27, 2022.
22. Roberts C, Freeman J, Samdal O, et al. The health behaviour in school-aged children (HBSC) study: methodological developments and current tensions. *Int J Public Health*. 2009;54(suppl 1):140–150. doi:10.1007/s00038-009-5405-9
23. Paterson DC, Ramage K, Moore SA, Riazi N, Tremblay MS, Faulkner G. Exploring the impact of COVID-19 on the movement behaviors of children and youth: a scoping review of evidence after the first year. *J Sport Health Sci*. 2021;10(6):675–689. PubMed ID: 34237456 doi:10.1016/j.jshs.2021.07.001
24. Reilly JJ, Barnes J, Gonzalez S, et al. Recent secular trends in child and adolescent physical activity and sedentary behavior internationally: analyses of Active Healthy Kids Global Alliance Global Matrices 1.0–4.0. *J Phys Act Health*. 2022;19(11):729–736. doi:10.1123/jpah.2022-0312
25. Lee E-Y, Abi-Nadar P, Aubert S, et al. Economic freedom, climate culpability, and physical activity indicators among children and adolescents: report card grades from the Global Matrix 4.0. *J Phys Act Health*. 2022;19(11):745–757. doi:10.1123/jpah.2022-0342
26. Silva DAS, Aubert S, Ng K, et al. Association between physical activity indicators and human development index at national level: information from Global Matrix 4.0 physical activity report cards for children and adolescents. *J Phys Act Health*. 2022;19(11):737–744. doi:10.1123/jpah.2022-0321
27. World Health Organization. *Global Action Plan on Physical Activity 2018–2030: More Active People for a Healthier World*. World Health Organization, 2018.
28. United Nations. United Nations Sustainable Development Goals. 2015. <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>.
29. Salvo D, Garcia L, Reis RS, et al. Physical activity promotion and the United Nations sustainable development goals: building synergies to maximize impact. *J Phys Act Health*. 2021;18(10):1163–1180. PubMed ID: 34257157 doi:10.1123/jpah.2021-0413
30. Kraus WE, Bittner V, Appel L, et al. The national physical activity plan: a call to action from the American heart association: a science advisory from the American Heart Association. *Circulation*. 2015;131(21):1932–1940. PubMed ID: 25918126 doi:10.1161/CIR.000000000000203
31. Public Health Agency of Canada. *Let's Get Moving: A Common Vision for Increasing Physical Activity and Reducing Sedentary Living in Canada*. Public Health Agency of Canada; 2018.
32. Spence JC, Faulkner G, Bradstreet CC, Duggan M, Tremblay MS. Active Canada 20/20: a physical activity plan for Canada. *Can J Public Health*. 2015;106(8):e470–e473. doi:10.17269/CJPH.106.5041
33. United States Department of Health & Human Services. Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities. 2015. <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>.