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Results from South Korea's 2018 Report Card on physical activity for children and youth

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ABSTRACT

Background/Objective: South Korea's 2018 Report Card on Physical Activity for Children and Youth is the second comprehensive evaluation of physical activity and the sources of influence based on the 10 core indicators provided by the Active Healthy Kids Global Alliance. It will serve as an advocacy tool to promote physical activity among children and youth.

Methods: Three national surveillance data (i.e., 2017 Korea Youth Risk Behavior Web-based Survey, 2016 Korea National Health and Nutrition Examination Survey, 2016 Physical Activity Promotion System) were used as main sources to evaluate the indicators. Descriptive statistics were performed to obtain prevalence estimates of physical activity-related indicators. In addition, expert opinions as well as the most recently available published or unpublished relevant sources were synthesized.

Results: South Korea's 2018 Report Card, compared to the 2016 Report Card, showed favourable changes in the Active Transportation (B+), Organized Sports Participation (C), Sedentary Behaviours (D), and School (D+) indicators, while unfavourable changes were shown in Overall Physical Activity (F) and Government (D). Physical Fitness was graded as D+. In parallel with the 2016 Report Card, Active Play, Family and Peers, and Community and Environment remain ungraded due to insufficient data.

Conclusions: Successes as well as gaps and research needs were identified in the 2018 Report Card. Though some indicators have shown improvement, most children and youth continue to be insufficiently physically active with overall poor grades (Average of D+). To achieve substantial improvement in all

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grades in future Report Cards, more institutional and governmental support and investment is needed to promote physical activity. Furthermore, effort should be made to generate data pertaining to the indicators that were ungraded.

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Background/objective

The period between childhood and adolescence is critical for health and development that can have a lasting impact into adulthood.^{1,2} Physical activity is an important behavior that can be established early in life for the current and future health of young people.³ The World Health Organization (WHO) recommends that children and youth aged 5–17 years engage in at least 60 min of moderate-to vigorous-intensity physical activity (MVPA) daily for health benefits.⁴ Additionally, sedentary behavior guidelines in a few countries (e.g., Canada, Australia, New Zealand) suggest that children and youth should limit their recreational screen time to no more than two hours per day.^{5–7} Furthermore, with a recent scientific recognition that the 24-h day comprises three mutually exclusive behaviors — physical activity, sedentary behavior, and sleep^{8,9} — Canada developed the world's first *24-h Movement Guidelines for Children and Youth* in 2016 that includes recommendations for all three movement behaviors.⁵

Despite the existing and constantly evolving international- and national-level recommendations for physical activity, South Korea's (henceforth Korea) 2016 Report Card on Physical Activity in Children and Youth (henceforth Report Card) showed that most Korean children and youth are not sufficiently active; rather, they are sedentary.¹⁰ This is a concern given that physical inactivity may be a contributing factor to consistently permeating and worsening physical and mental health observed in young Koreans.¹¹ For example, the prevalence of obesity among Korean adolescents has been steadily increasing since 2005. In a 2017 representative sample of Korean youth the prevalence of obesity was 19% in boys and 9% in girls.¹² Additionally, suicide is the leading cause of premature death among Korean teenagers with a death rate of 4.9 per 100,000 people in 2016.¹³ Furthermore, a recent study suggested that meeting more recommendations within the 24-h Movement Guidelines for Children and Youth was favorably associated psychological health among Korean youth.¹⁴

Given these findings, it is important to monitor and evaluate physical activity behaviors and the sources of influence among Korean children and youth. From a population health perspective, the levels and correlates of physical activity behaviors can help researchers and policy makers identify at-risk people (e.g., those with low physical activity and high sedentary behaviors) and to develop appropriate preventive strategies while making the informed allocation of limited public resources.¹⁵ The development of the *Report Card on Physical Activity for Children and Youth* is one such effort. It first started in Canada in 2005,¹⁶ and expanded globally in 2014, when Report Cards grades from 15 countries (including Canada) were presented as part of the *Global Matrix 1.0*.¹⁷ The Report Card is a comprehensive evaluation of the physical activity behaviors and sources of influence indicators and has been used widely in many countries as an advocacy tool to increase physical activity among children and youth.¹⁸ In 2015, Korea joined the Active Health Kids Global Alliance (AHKGA) and developed its first Report Card,¹⁰ which was published in 2016 as part of the *Global Matrix 2.0*.¹⁸

This study summarizes the process and results of the 2018 Report Card using the most recent available data in order to

evaluate the nation's progress in providing physical activity opportunities for Korean children and youth.

Methods

The Report Card Team comprised a Research Working Group (RWG) and a Development Team (DT). The RWG comprised 16 members including a principal investigator who was responsible for identifying key evidence, grading the predefined 10 core indicators endorsed by AHKGA, and producing the final Report Card. The DT comprised eight members involved in data handling and analysis, acquiring and processing published/unpublished data, and the general operation and coordination of the study. The first RWG meeting for the 2018 Report Card was held in August 2017 at the Korea Health Promotion Institute located in Seoul, Korea, where 12 physical activity, health, physical education pedagogy, physiology, sport science, and/or medical experts participated. A series of meetings were subsequently held amongst DT members from November 2017 to February 2018 for data collection and interpretation, as well as evidence synthesis and preparation for the 2018 Report Card. The second RWG meeting was then held to grade each indicator based on the evidence accumulated and synthesized by the DT in April 2018 at Seoul National University, Seoul, Korea.

The 2018 Report Card assessed 10 core indicators: (1) Overall Physical Activity, (2) Organized Sport and Physical Activity, (3) Active Play, (4) Active Transportation, (5) Sedentary Behaviors, (6) Physical Fitness, (7) Family and Peers, (8) School, (9) Community and Environment, and (10) Government.¹⁹ Unlike the 2016 Report Card, Physical Literacy was removed from the list of core indicators given that was an optional indicator and that the RWG agreed that there were insufficient data with which to evaluate. Instead, Physical Fitness was included in the 2018 Report Card as it is now one of the core indicators endorsed by the AHKGA for the *Global Matrix 3.0*. Detailed descriptions of the main data sources for each indicator are shown in [Table 1](#).

The Korea Youth Risk Behavior Web-based Survey (KYRBS) and the Korea National Health and Nutrition Examination Survey (KNHANES) are conducted annually to create nationally representative databases. These surveys assess risk behaviors and health and/or nutritional status of the population, monitor trends in health risk factors and the prevalence of major chronic diseases, and provide evidence to develop and evaluate Korean health policies and programs.^{12,20} Physical Activity Promotion System (PAPS), administered by the Korean Ministry of Education, is a national system aimed at monitoring physical fitness among children and youth. Cardiorespiratory fitness was measured by the 20-m shuttle run test, with peak oxygen uptake (peak $\dot{V}O_2$) estimated from an equation developed by the Korea Institute of Sport Science.²¹ Peak $\dot{V}O_2$ values were assessed using age- and sex-specific norms developed by Tomkinson et al.,²² with muscular strength (handgrip strength) and flexibility (sit-and-reach) assessed using age- and sex-specific norms developed by Tomkinson et al.²³ Data related to national policies and reports pertaining to the physical activity of children and youth were additionally collected and used to assess the Government indicator.

Additionally, a systematic literature search, in Korean and English, identified recent evidence on the physical activity and

Table 1
Main data sources used to grade the indicators.

Data source	Nature of data collected and study population	Related indicators
2017 KYRBS	Self-reported questionnaire using YRBSS for 12- to 17-year-olds (N = 57,469)	Overall Physical Activity, Organized Sport and Physical Activity, Sedentary Behaviors, School
2016 KNHANES	Self-reported questionnaire using GPAQ for 12- to 17-year-olds (N = 524).	Active Transportation
2016 PAPS	Direct observation among 11- to 17-year-olds according to the School Health Act and School Physical Education Promotion Act (These data are based on the national average record statistics for each category of the National Education Information System provided by Ministry of Education)	Physical Fitness

Abbreviations: GPAQ, Global Physical Activity Questionnaire; KYRBS, Korea Youth Risk Behavior Web-based Survey; KNHANES, Korea National Health and Nutrition Examination Survey; PAPS, Physical Activity Promotion System; YRBSS, Youth Risk Behavior Surveillance System.

Table 2
Global Matrix 3.0 indicators and benchmarks used to guide the grade assignment process.

Indicator	Benchmark
Overall Physical Activity	% of children and youth who meet the Global Recommendations on Physical Activity for Health, which recommend that children and youth accumulate at least 60 min of moderate- to vigorous-intensity physical activity per day on average. Or % of children and youth meeting the guidelines on at least 4 days a week (when an average cannot be estimated).
Organized Sport and Physical Activity	% of children and youth who participate in organized sport and/or physical activity programs.
Active Play	% of children and youth who engage in unstructured/unorganized active play at any intensity for more than 2 h a day.
Active Transportation	% of children and youth who report being outdoors for more than 2 h a day.
Sedentary Behaviors	% of children and youth who use active transportation to get to and from places (e.g., school, park, mall, friend's house). % of children and youth who meet the Canadian Sedentary Behavior Guidelines (5- to 17-year-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 non-screen-related pursuits.
Physical Fitness	Average percentile achieved on certain physical fitness indicators based on the normative values. ^{22,23}
Family and Peers	% of family members (e.g., parents, guardians) who facilitate physical activity and sport opportunities for their children (e.g., volunteering, coaching, driving, paying for membership fees and equipment). % of parents who meet the Global Recommendations on Physical Activity for Health, which recommend that adults accumulate at least 150 min of moderate-intensity aerobic physical activity throughout the week or do at least 75 min of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity physical activity. % of family members (e.g., parents, guardians) who are physically active with their kids. % of children and youth with friends and peers who encourage and support them to be physically active. % of children and youth who encourage and support their friends and peers to be physically active.
School	% of schools with active school policies (e.g., daily PE, daily physical activity, recess, “everyone plays” approach, bike racks at school, traffic calming on school property, outdoor time). % of schools where the majority ($\geq 80\%$) of students are taught by a PE specialist. % of schools where the majority ($\geq 80\%$) of students are offered the mandated amount of PE (for the given state/territory/region/country). % of schools that offer physical activity opportunities (excluding PE) to the majority ($>80\%$) of their students. % of parents who report their children and youth have access to physical activity opportunities at school in addition to PE classes. % of schools with students who have regular access to facilities and equipment that support physical activity (e.g., gymnasium, outdoor playgrounds, sporting fields, multi-purpose space for physical activity, equipment in good condition).
Community and 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 physical activity. % of communities/municipalities that report they have infrastructure (e.g., sidewalks, trails, paths, bike lanes) specifically geared toward promoting physical activity. % 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	Evidence of leadership and commitment in providing physical activity opportunities for all children and youth. Allocated funds and resources for the implementation of physical activity promotion strategies and initiatives for all children and youth. 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).

sedentary behaviors of Korean children and youth between 2016 and 2018. However, evidence was lacking in both quantity (N = 27) and quality. For these reasons, independent studies were not directly used in the grading of each indicator; however, they were used in the discussion of each grade.

Complex Samples Design Cross Tabulations were calculated to describe the prevalence of Overall Physical Activity, Organized Sport and Physical Activity, Active Transportation, Sedentary Behaviors, and School. Weighted average time spent in recreational, screen-based sedentary behavior per day was calculated

([weekday*5 + weekend day*2]/7). Lastly, school grade (middle school and high school) and sex (boys and girls) stratified analyses were performed to determine whether any disparities existed across different categories. PASW Statistics 18.0 (Chicago, SPSS Inc, 2009) was used for all analyses. The grading benchmarks and scheme used for each indicator for the *Global Matrix 3.0* are provided in Table 2 and Table 3, respectively. A detailed description on how each of the indicators were evaluated and translated into a letter grade can also be found elsewhere.¹⁹

Table 3
Global Matrix 3.0 grading scheme for the 2018 Report Card.

Grade	Interpretation
A+	94–100%
A	We are succeeding with a large majority of children and youth (87–93%)
A–	80–86%
B+	74–79%
B	We are succeeding with well over half of children and youth (67–73%)
B–	60–66%
C+	54–59%
C	We are succeeding with about half of children and youth (47–53%)
C–	40–46%
D+	34–39%
D	We are succeeding with less than half but some children and youth (27–33%)
D–	20–26%
F	We are succeeding with very few children and youth (<20%)
INC	Incomplete-insufficient or inadequate information to assign a grade

Table 4
Grades for Korea's 2016 and 2018 Report Cards on Physical Activity for Children and Youth.

Indicator	2016 Grades	2018 Grades
Overall Physical Activity	D–	F
Organized Sport and Physical Activity	C–	C
Active Play	INC	INC
Active Transportation	C+	B+
Sedentary Behaviors	F	D
Physical Literacy	INC	NA
Physical Fitness	NA	D+
Family and Peers	INC	INC
School	D	D+
Community and Environment	INC	INC
Government	C	D

Note, the grade for each indicator is based on the percentage of children and youth meeting the following defined grading scheme provided by the AHKGA: (a) 2018 Report Card: A+ = 94–100%; A = 87–93%; A– = 80–86%; B+ = 74–79%; B = 67–73%; B– = 60–66%; C+ = 54–59%; C = 47–53%; C– = 40–46%; D+ = 34–39%; D = 27–33%; D– = 20–26%; F is <20%; INC is Incomplete data;¹⁹ and (b) 2016 Report Card: A = 81–100%; B = 61–80%; C = 41–60%; D = 21–40%; F is <20%; INC is Incomplete data.¹⁸ NA: Not applicable.

Discussion

Overall physical activity: F

Benchmark: Percentage of children and youth who meet the Global Recommendations on Physical Activity for Health, which recommend that children and youth accumulate a total of ≥ 60 min of MVPA daily.

The 2017 KYRBS data were used to assess Overall Physical Activity. Results showed that 5.8% of youth engaged in MVPA for ≥ 60 min daily (7.0% and 4.7% of middle and high school students, respectively; 8.6% and 2.8% of boys and girls, respectively), which is why an F grade was given. Unfortunately, school grade- and sex-related disparities in physical activity participation remained. Moreover, the grade dropped from D– to F between the 2016 and 2018 Report Cards. The corresponding percentage in the 2016 Report Card (5.9%) was very similar to that of the present study; however, there were additional sources indicating physical activity levels among elementary school students (21%). Based on qualitative assessment and expert opinion, a grade of D– was given in the 2016 Report Card.¹⁰ For the 2018 Report Card, no data involving elementary school students that may have shown higher levels of physical activity were available. This unfavorable change should be interpreted with caution.

Organized Sport and Physical Activity: C

Benchmark: Percentage of children and youth who participate in organized sport and/or physical activity programs.

According to the 2017 KYRBS data, 50.6% of students participated in at least one organized sport (68.6% and 33.2% of middle and high school students, respectively; 55.5% and 45.4% of boys and girls, respectively). The KYRBS was the primary data source used to grade Organized Sport and Physical Activity given its representativeness and large sample size; however, we also used additional data that included a younger age group. For instance, the Ministry of Education reported that among 3,704,787 school-aged children and youth (5–17 years), 68.0% were registered with school sports clubs in 2016.²⁴ Additionally, reports from two independent studies showed that elementary school students who participated in club sport or after-school sport activities ranged from 41.6% to 73.6%.^{25,26} Unfortunately, these data sources were not used to grade Organized Sport and Physical Activity because: (a) the proportion of children and youth participating in organized sport reported by the Ministry of Education²⁴ is likely to be overestimated because it indicates the participant count in organized sport, not the number of students who participated in at least one sport (i.e., students who



Fig. 1. Front cover of the Korea's 2018 physical activity report card.

Results

Table 4 presents the final grades of the 10 core indicators. Overall, Korea received an average grade of D+. Unfortunately, three indicators were not graded due to a lack of data.

Fig. 1 presents the front cover of the 2018 Report Card.

participated in multiple organized sports were counted multiple times), and (b) the independent studies^{25,26} were based on small convenience samples of elementary school children. Nonetheless, the percentages derived from these studies^{25,26} appear to be plausible given that physical activity participation is higher in younger than in older children.²⁷

Active play: INC

Consistent with the 2016 Report Card, Active Play could not be graded owing to the lack of data. One study examined outdoor play among children in the early years (0–5 years) and found that less than a quarter (~22%) engaged in organized sport and/or active outdoor play for three or more hours per week.²⁸ Given that overall physical activity levels decline with age,²⁷ low levels of active play among Korean children and youth can be assumed. Additionally, as the surrounding living environment becomes urbanized, open natural spaces for free, children-led active play become limited especially in urban areas.²⁹ Parental concerns associated with environmental pollution and safety also impact children's play.³⁰ Korea is one of the world's most technologically advanced countries, thus, screen-based devices are affordable and accessible.³¹ Therefore, with decreased opportunities for active free play and increased opportunities for screen time, it is expected that active play among Korean children and youth would be low and declining. This however needs to be confirmed in future research. In a meta-study of qualitative research investigating the determinants of children's independent active free play,³⁰ parents' perceived safety concerns were the primary barrier to children's participation, whereas, with increased independent mobility, older age was associated with more time spent in active free play (5–14 years).

Active play is an emerging area of research in the field of physical activity; however, to the authors' knowledge, there are no reliable and valid self- or proxy-report measures to quantify and evaluate active play among children and youth. Although the definition of active play exists among young children aged 2–6 years (i.e., “a form of gross motor or total body movement in which young children exert energy in a freely chosen, fun, and unstructured manner”³²), no inclusive definition exists for children and youth (5–17 years), because of varying stages of growth and development, and different meanings and attitudes toward active play.³³ Efforts should be made to universally define active play and subsequently to develop valid, reliable, and age-appropriate measures in children and youth. Such needs were also highlighted in the *Global Matrix 2.0* main paper, which compiled Report Card results from 38 countries including Korea.¹⁸

Active transportation: B+

Benchmark: Percentage of children and youth who use active transportation to get to and from places.

Active Transportation was given the highest grade amongst all indicators. According to the 2016 KNHANES data, 79.4% of middle and high school students used active modes of transport (i.e., walking or cycling) for an average of 39 min per day (76.2% and 82.2% of middle and high school students, respectively; 84.3% and 73.8% of boys and girls, respectively). Therefore, a B+ was assigned to this indicator. The corresponding percentage in the 2016 Report Card was 77.0% with an average of 25 min of active commuting; the corresponding grade in 2016 was C– based on the collective expert opinion that schools and other services are conveniently located within almost all residential areas in Korea.¹⁰ Given these differences, comparisons between the results of the 2016 and 2018 Report Cards should be made with caution.

Sedentary behaviors: D

Benchmark: Percentage of children and youth who meet the Canadian Sedentary Behavior Guidelines (5- to 17-year-olds: no more than two hours of recreational screen time per day).

According to the 2017 KYRBS data, a total of 32.7% of middle and high school students spent less than two hours per day in recreational, screen-based sedentary behavior (31.2% and 34.1% of middle and high school students; 35.2% and 29.9% of boys and girls, respectively), hence the appears that the grade improved from an F to a D. It should be noted that there was no significant change in the prevalence of recreational screen time of Korean children and youth in the past two years; however, the grade improved by evaluating the indicator strictly based on the grading criteria provided by AHKGA. Though it did not inform the grading of this indicator, health survey data from the Ministry of Education indicate that 32.7% of children and youth (n = 80,484; 5–18 years) watched television for more than two hours per day. In addition, the proportion of middle and high school students who use the Internet to play video games for more than two hours per day was 39.4% and 26.8%, respectively.³⁴ These findings, support the D grade for Sedentary Behavior.

In the 2016 Report Card, inconsistency in defining and evaluating sedentary behavior in the literature was highlighted.¹⁰ In 2017, the Sedentary Behavior Research Network (SBRN) published consensus definitions of terms relating to sedentary behavior.³⁵ Sedentary behavior is defined as “any waking behavior characterized by an energy expenditure ≤ 1.5 metabolic equivalents (METs), while in a sitting, reclining, or lying posture” while screen time is defined as “the time spent on screen-based behaviors”. Screen time can be spent while being sedentary or physically active. The benchmark of the *Global Matrix 3.0* clearly states screen-based sedentary behavior should be evaluated only for recreational, not non-recreational (e.g., academic) pursuits. Ultimately, a clear definition and benchmark for this indicator addressed the gap identified in the 2016 Report Card (i.e., inconsistency in defining and operationalizing sedentary behavior) and enabled the appropriate estimation and evaluation of the prevalence of screen-based sedentary behavior among Korean children and youth.

Physical fitness: D+

Benchmarks: Average percentile achieved from peak oxygen uptake (peak $\dot{V}O_2$ in mL/kg/min) centiles by age and sex²² and handgrip strength and sit-and-reach centiles by age and sex²³

Physical Fitness is new to the 2018 Report Card and *Global Matrix 3.0*. Data used to inform the grade were from the PAPS administered by the Ministry of Education. Owing to privacy and confidentiality issues, the Ministry of Education only released the average letter grades of different physical fitness components by sex. These included: cardiorespiratory fitness (boys = C, girls = C–), muscular strength (boys = C–, girls = C–), and flexibility (boys = F, girls = F). Physical Fitness was given an overall D+.

Corresponding to the global trend,^{36,37} Korea has observed a temporal decrease in physical fitness among children and youth over the years.³⁸ This is alarming given that childhood physical fitness is highly associated with current health³⁹ as well as morbidity and mortality in later years,⁴⁰ independent of physical activity levels.⁴¹ Therefore, evaluating physical fitness among children and youth for the 2018 Report Card and collectively in the *Global Matrix 3.0* is timely and important.

Family and Peers: INC

Consistent with the 2016 Report Card, Family and Peers could

not be graded owing to the lack of data. However, after the grades of all indicators were submitted to the AHKGA, one paper examining physical activity levels among 1342 Korean youth and their parents using multiple cross-sectional KNHANES data was published.⁴² This study pooled parent-child matched pairs data using household identification numbers in the six cycles of KNHANES data and reported that MVPA among youth was significantly correlated with that of their mothers, but not fathers, suggesting that mothers may be important agents for children's physical activity. Though it does not provide information necessary to grade this indicator (i.e., "percentage of parents meeting the World Health Organization's physical activity guidelines," "percentage of parents/guardians who facilitate physical activity and sport opportunities for their children," or "percentage of parents/guardians who are physically active with their kids [co-participation]"), it suggests an important methodological approach to grade this indicator using national data (i.e., KNHANES) in future Report Cards.

Efforts should be made to obtain data pertaining to the influence of peers on physical activity. The relevant benchmarks of the indicator for the *Global Matrix 3.0* included "percentage of children and youth with friends and peers who encourage and support them to be physically active" and "percentage of children and youth who encourage and support their friends and peers to be physically active".¹⁹ Future independent studies examining physical activity among children and youth can answer these questions by incorporating valid and reliable survey items relating to peers support for physical activity. Furthermore, surveys such as the KNHANES and KYRBS should consider benchmarking national-level surveys used to grade this indicator in other countries. For example, the grading of Family and Peers indicator for Canada's 2018 Report Card was, in part, informed by the COMPASS study (<https://uwaterloo.ca/compass-system/>), which is an ongoing prospective cohort study that examines longitudinal associations between school policies/programs and youth health behaviors (i.e., physical activity, healthy eating, smoking, alcohol and cannabis use) and includes survey items relating to parental and peer support for physical activity.⁴³

School: D+

Benchmark: Percentage of schools with active school policies (e.g., daily PE, daily physical activity, recess, "everyone plans" approach, bike racks at school, traffic calming on school property, outdoor time).

The 2017 KYRBS data was the source for School. Instead of the grading benchmark provided by the AHKGA (i.e., "percentage of schools where the majority ($\geq 80\%$) of students are offered the mandated amount of physical education [PE] for the given country"), "percentage of students who participated in three or more PE classes per week" was used based on the availability of data. The results showed that 34.6% of students participated in PE for three days a week (a total of 135–150 min/week), either in an outdoor field or in the school gymnasium (53.6% and 16.3% of middle and high school students, respectively; 40.3% and 28.5% of boys and girls, respectively). Similarly, an independent study showed that students' participation rate of physical activity in school more than three times a week was 35.8%.⁴⁴ Schools can provide equal opportunities for physical activity and sport participation to all children and youth.⁴⁵ Furthermore, reductions in physical activity opportunities within the school (e.g., PE class) is a factor that can potentially explain the age-related decline in physical activity.⁴⁶ Combined with the cultural context of Korea pertaining to PE (e.g., not valued, neglected, regarded as a minor subject),⁴⁷ the importance of physical activity in school should be reintroduced and emphasized. The new national curriculum, launched by the Ministry of Education in March 2018, requires schools to provide at

least three PE classes per week for students in Grades 3–6, at least four PE classes including sports club activities for middle school students (Grades 7–9), and totally 10 PE credits (one credit = one PE class) over six semesters, with at least one credit per semester, for high school students (Grades 10–12).⁴⁸ Further research is needed to investigate how much physical activity students obtain by different doses (e.g., frequency, intensity, duration, type) during PE class and to evaluate how effectively the mandatory PE program is being implemented.

Community and Environment: INC

Consistent with the 2016 Report Card, Community and Environment could not be graded owing to insufficient data. The Ministry of Health and Welfare conducts an annual, comprehensive evaluation of the local health care and promotion plans in 228 municipalities, cities, and provinces nationwide.⁴⁹ It is indicated that 100% of them are equipped with adequate infrastructure for citizens' physical activity promotion.⁵⁰ However, it is difficult to confirm whether the basic physical and organizational structures and facilities needed for the physical activity promotion of children and youth exist and are being used and maintained. Future Report Cards could use Survey on Citizens' Sports Participation⁵¹ to grade this indicator. The survey was developed by the Korea Institute of Sport Science in collaboration with the Ministry of Culture, Sports, and Tourism and first initiated in 1994 to monitor physical activity and sport participation, facilities, and support among citizens in Korea. Unfortunately, this survey was not used in 2016 and 2018 Report Cards due to accessibility issues.

Government: D

Benchmark: Evidence of leadership and commitment in providing physical activity opportunities for all children and youth.

The Ministry of Education has implemented basic plans for the promotion of school PE every year since 2016, including: (1) strengthening PE in school, (2) revitalizing school-based organized sport, (3) facilitating a school PE network, and (4) raising public awareness on school-based physical activity.²⁴ Despite this, the RWG concluded that Government should be graded D owing to the recent budget cuts for physical activity-related policies and initiatives.²⁴ The budget cuts affecting the School PE Support Project, in particular, had the greatest impact on downgrading this indicator compared to the 2016 Report Card (C). The School PE Support Project is a 3-year nationally funded program for physical activity promotion in school-aged children and youth that has been rolled out since 2016. Due to governmental budget cuts in the special education fund, the original budget for the School PE Support Project in 2016 was reduced by 14% (~61 billion Korean Won) in 2017 and by 35% (~46 billion Korean Won) in 2018.²⁴ These progressive budget cuts potentially hinder the ability of each school to implement sustainable and stable physical activity promotion programs.²⁴ The difficulty of identifying meaningful changes and the absence of a specific outcome report showing the successful implementation and performance of the School PE Support Project may also have contributed to a lower grading. The 2016 and 2018 Report Cards should be used as an important advocacy tool to inform policy makers and important stakeholders to allocate adequate investment and resources to school-based physical activity promotion initiatives and programs in the future.

Strengths and limitations

This is the second, comprehensive assessment of physical activity and relevant indicators among Korean children and youth as

part of an international collaborative project, the *Global Matrix 3.0*. This work extends the findings from the 2016 Report Card by identifying successes and important gaps and research needs to promote physical activity among young people in Korea. This work was also based on scientific evidence and collaboration among a group of experts in various fields relating to physical activity, which gives the outcomes credibility. Most quantifiable indicators were informed by large nationally representative datasets.

The 2018 Report Card should be widely used to influence relevant stakeholders and policy makers to make favorable and sustainable changes to physical activity programs for children and youth. For example, the Report Card Advisory Committee, which included government personnel from the Ministry of Education and the Ministry of Culture, Sports and Tourism, school principals, PE teachers, and those responsible for planning and implementing physical activity promotion for young people, can use the 2018 Report Card by actively engaging in knowledge translation activities across different sectors to influence physical activity promotion.

Despite its scientific and practical implications, the 2018 Report Card does possess some limitations. Data from children aged 5–11 years were largely lacking; thus this age group was excluded from the analysis and grading of indicators. Given that younger children are more likely to be active than older children,²⁷ omitting 5- to 11-year-olds from data synthesis may have affected the results of each indicator (e.g., underestimating physical activity levels) and the final grading. Furthermore, since the majority of the data sources used to inform the grades were self-reported, measurement errors (e.g., recall bias, social desirability) may have occurred. Nonetheless, prevalence estimates for physical activity indicators were comparable to those in the past.¹⁰ Also, although the PAPS, which informed the Physical Fitness grade, was objectively measured and performed nationwide, we cannot be certain about the completeness or representativeness of the data. PE teachers in participating schools, who were required to follow standardized data collection procedures, administered the PAPS. It is possible that some data may have been contaminated during the process. It is also noteworthy that some important surveys and methodological approaches that could inform the grading of the INC indicators were missed. Furthermore, developing a valid and reliable measure of active play among school-aged children and youth is needed locally and globally given that no established measures for active play currently exist.

Future recommendations

- Korean children and youth continue to be physically inactive and sedentary with an average overall grade of D+. Although some indicators have shown improvement since 2016, temporal changes in prevalence estimates were trivial. Greater effort is required to make positive and meaningful changes in the future. Institutional and governmental commitment to sustainably support, invest in, and promote children's physical activity is critical.
- Data on children aged 5–11 years were not used in the grading process due to a lack of data. It is challenging to collect physical activity data in younger age group using existing national surveillance systems due to the absence of valid and reliable self-report measures of physical activity. Nonetheless, obtaining more physical activity and relevant data in this age group will enable a more comprehensive evaluation in the future Report Cards. Researchers are encouraged to accumulate evidence for this age group by collecting proxy-report physical activity data or using objective measures of physical activity (e.g., pedometer, accelerometer).

- Active Play, Family and Peers, and Community and Government are not graded in the 2016 and 2018 Report Cards due to the lack of important evidence for data synthesis. In future Report Cards, Family and Peers can be graded using the KNHANES data (parent-child pairing), Physical Fitness can be informed by the National Fitness Award Project data in addition to the PAPS, and Community and Environment can be graded using the Survey on Citizens' Sports Participation.
- The importance of active outdoor play was emphasized in the *Position Statement on Active Outdoor Play*, published as part of Canada's 2015 Report Card.⁵² It includes recommendations on providing children with increased opportunities for self-directed play outdoors in various settings (e.g., home, school, child care, community, and nature). Therefore, instruments that can inform the evaluation of Active Play should consider measuring it in different settings, in addition to appropriate age and cultural considerations.
- Expanding research collaboration links and knowledge translation activities within and outside of Korea is necessary to obtain knowledge on available resources that can be useful for future Report Cards.
- More independent studies and national surveys are required to cross-validate the findings and to obtain more detailed data than the sex-specific average grades for physical fitness.

Conclusion

Korea's 2018 Report Card comprehensively summarizes important indicators of physical activity behaviors and sources of influence based on standardized protocols provided by the AHKGA as part of the *Global Matrix 3.0*, in which 49 countries participated. The findings suggest that, compared to the 2016 Report Card, some improvement has been made; however, evidence gaps and research needs have also been identified. The findings from Korea's 2018 Report Card can be used as an important advocacy tool to influence physical activity promotion strategies and policies for children and youth both locally and abroad. Future research is required to continue joining the global effort of promoting children's physical activity by developing and advancing comprehensive evaluation of the physical activity behaviors of children and youth, and the settings and sources of influence.

Conflicts of interest

All authors have agreed with the content of the manuscript and approved its submission to the journal. This manuscript has not been previously published, and is not presently under consideration by another journal. This work was supported by a grant from the Ministry of Health and Welfare. There are no conflicts of interests associated with this paper.

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