THE 2018 INDIA REPORT CARD ON PHYSICAL ACTIVITY FOR CHILDREN & YOUTH

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2018 RESEARCH WORKING GROUP

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INTRODUCTION: 2018 INDIA REPORT CARD

INDIA: A NATION OF DIVERSITY

The Republic of India, with 29 states and 7 union territories, is the seventh-largest country by area and the second largest country by population, which makes it the most-populous democracy in the world.[1,2] According to the most recent 2011 Census data, India's population was 1,210,193,422 as of March 1, 2011. India is also a country of incredible geographic and cultural diversity.[3,4] With India being the birthplace of Hinduism, Buddhism, Jainism and Sikhism,[5] it is not surprising that it exhibits deep religious and cultural roots, with religion playing a central role in the lives of many people. This multicultural heritage is also reflected in the number of actively spoken languages. According to the national census, India has 122 major languages spoken by more than 10,000 individuals, and 30 languages spoken by more than a million individuals.[6]

India's population size and distribution, and the great diversity of geography, climate and culture, provides a glimpse into the complexity that needs to be comprehended before understanding patterns of active living evidence and developing active living policies and programs.

STATE OF THE EVIDENCE

Physical activity is associated with numerous health benefits, and research has shown that regular moderate to vigorous physical activity (MVPA) reduces the risk of cardiovascular diseases, metabolic syndrome, colon and breast cancer, and depression.[7,8] While there are clear benefits associated with physical activity, evidence indicates a physical inactivity epidemic among children and youth in India, as the majority of this population does not meet physical activity guidelines.[9-11]

The 2016 India Report Card on Physical Activity for Children and Youth found that multiple factors contributed to this epidemic.[12] A lack of upstream active living policies, family and peer support, and built environment conducive to active transportation, have contributed to physical inactivity among Indian Children.[12-14] The 2016 India Report Card demonstrates that almost half of children and youth in India do not meet recommended guidelines for physical activity and sedentary behaviour.[12] Moreover, the 2016 India Report Card identified several gaps in evidence, including lack of nationally representative data on active living and contextual indicators such as "Active Play" and "Family and Peers." With India's youth projected to be a major proportion of the world's workforce,[15,16] evaluating active living in India has implications for the world economy. The 2018 Report Card addresses evidence gaps identified in 2016 using peer-reviewed and grey literature, as well as primary data obtained through key partners.

OBJECTIVES

The aims of the 2018 India Report Card on Physical Activity for Children and Youth are to:

1. Evaluate and translate the current state of active living
2. Identify critical gaps in research and policy
3. Serve as an advocacy tool for active living policies and programs

METHODS

REPORT CARD DEVELOPMENT

The 2018 India Report Card on Physical Activity for Children and Youth is part of Global Matrix 3.0, an international endeavour to evaluate various aspects of active living in 49 countries spread across six continents.[17] As part of this initiative, country-specific teams appraised current evidence using rigorous methods, and assigned standardized grades to previously developed indicators of active living.[18] The India Report Card is an independently developed, evidence-based scientific report that assesses physical activity, sedentary behaviour, and multiple contextual factors that impact these behaviours in Indian children and youth.

Photo credit: www.activehealthykids.org

The 2018 India Report Card Research Working Group (RWG) was comprised of seven experts in physical activity, child health, and health policy from five universities and institutions. The RWG appraised 10 previously developed core indicators of physical activity (Overall Physical Activity, Organized Sport Participation, Active Play, Active Transportation, Sedentary Behaviour, Physical Fitness, Family and Peers, School, Community and the Built Environment, Government Strategies, Policies and Investments).[18] Yoga was added as a new indicator specific to India.

Members of the RWG collated and evaluated available evidence on physical activity of children and youth in India. A systematic search of peer-reviewed and grey literature was conducted for 11 indicators of active living. This approach included a comprehensive search strategy that utilized separate search terms for each of the 11 indicators of active living. Peer-reviewed literature was identified through the PubMed database, and the grey literature search included tailored Google searches for each indicator. Specific searches of Government and Ministry websites, physical activity and health-focused non-profit organizations, school board websites, and national program websites were also conducted.

Data were appraised for the peer-reviewed portion of the literature search by two reviewers who screened titles and abstracts, selected relevant articles, and reached consensus on a final shortlist after reviewing full articles. Unpublished data were also obtained from key stakeholders and included in the final analysis. Peer-reviewed articles were appraised based on national representativeness, sample size, and data quality. Grey literature was appraised based on comprehensiveness, validity of the sources, and representativeness. Nationally representative peer-reviewed articles and primary data were given higher weightage, followed by non-nationally representative (state or city-level data) peer-reviewed articles and unpublished data, and grey literature. All indicators were assessed against parameters provided by Active Healthy Kids Global Alliance,[17,18] with the exception of yoga, which is an indicator introduced by the RWG to capture a key cultural component of physical activity in India.

GRADING RUBRIC

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

SUMMARY OF REPORT CARD INDICATORS AND GRADES

INDICATOR		GRADE
	**Overall Physical Activity** The proportion of children and youth who meet physical activity guidelines.	D
	**Organized Sport Participation** The proportion of children and youth who participate in organized sport and/or physical activity programs.	INC
	**Active Play** The proportion of children and youth who engage in unstructured or unorganized active play at any intensity for more than 2 hours per day. The proportion of children and youth who report being outdoors for more than 2 hours per day.	C-
	**Active Transportation** The proportion of children and youth who walk or bike to different destinations (e.g. home, school).	B-
	**Sedentary Behaviour** The proportion of children and youth who meet sedentary behaviour or screen-time guidelines.	C-
	**Family and Peers** The proportion of parents who facilitate physical activity and sport opportunities for children, meet physical activity guidelines for adults, and are physically active with their children. The proportion of children and youth with friends or peers who encourage and support them to be physically active.	D
	**School – Infrastructure, Policies and Programs** The proportion of schools with active school policies, daily physical activity and recess; providing access to physical activity opportunities at school in addition to physical education (PE) (e.g. outdoor time); providing regular access to facilities and equipment which support physical activity (i.e., gymnasium, playgrounds, sporting fields, bike racks, etc.). The proportion of schools where the majority (≥ 80%) of students are taught by a PE specialist and students are offered the mandated amount of PE (for the given state/territory/region/country).	INC
	**Community and the Built Environment** The proportion of children, youth, or parents who perceive their community as supportive for physical activity. The proportion of communities reporting physical activity policies and infrastructure (e.g. sidewalks, trails, bike lanes). The proportion of children and youth who report being outdoors for several hours daily, and reporting well-maintained facilities, parks, and playgrounds which are also safe.	D
	**Government – Strategies, Policies and Investments** Demonstrated leadership, investments, and evidence of implementation of physical activity strategies targeting children and youth (e.g. policy agenda, policy formation, policy implementation, policy evaluation and decisions about the future).	D
	**Physical Fitness** The proportion of children and youth performing well in several fitness tests and exercise regimens meant to test physical fitness, including: cardio respiratory endurance, muscular strength, muscular endurance, flexibility, explosive strength, and body composition.	F
	**Yoga** The proportion of children and youth who practice yoga daily.	INC

PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOUR GUIDELINES

Physical activity and sedentary behaviour guidelines provide recommendations for the amount of time that children and youth should spend daily in active and sedentary activities to improve health outcomes and reduce health risks.

PHYSICAL ACTIVITY GUIDELINES

Up to 5 Years

For infants (birth to one year) to have healthy growth and development, physical activity should be encouraged from birth. Among infants, physical activity includes supervised floor-based play in safe environments. Toddlers (1 to 3 years) and preschool-aged children (3 to 5 years) should accumulate at least three hours of physical activity per day.

5 to 17 Years

Children and youth aged 5 to 17 years should accumulate at least 60 minutes of moderate-to-vigorous-intensity physical activity daily. Moderate-to-vigorous physical activity encompasses a wide variety of activities that could range from a brisk walk to intensive exercise, such as running. Most of the daily physical activity should be aerobic. When possible, vigorous intensity activities should be incorporated, including activities that strengthen muscle and bone, at least 3 times per week.

These recommendations are relevant to all healthy children between 5 and 17 years, unless specific medical conditions indicate the contrary. The concept of accumulation refers to meeting the goal of 60 minutes per day by performing activities in multiple shorter bouts spread throughout the day (e.g. two bouts of 30 minutes), then adding together the time spent during each of these bouts. These recommendations are applicable to all children and youth irrespective of gender, race, ethnicity, or income level.

SEDENTARY BEHAVIOUR GUIDELINES

Sedentary behaviour refers to any waking activity characterized by an energy expenditure ≤ 1.5 metabolic equivalents and a sitting or reclining posture. Common sedentary behaviours include television viewing, playing video games, computer use (collectively termed "screen time"), driving automobiles, and reading.

Up to 5 Years

For those under 2 years of age, screen time (e.g., TV, computer, electronic games) is not recommended. For children between 2 to 4 years, screen time should be limited to under one hour per day.

5 to 17 Years

For children and youth aged 5 to 17 years, recreational screen time should be limited to no more than 2 hours per day. Sedentary transport, extended sitting time, and time spent indoors, should also be limited throughout the day, and regular breaks from sedentary behaviour are encouraged.

Note: the Guidelines currently provide a time limit recommendation for screen-related pursuits, but not for non-screen-related pursuits.

GRADE D

The grade of D indicates that approximately one-third of children and youth are meeting physical activity guidelines.

OVERALL PHYSICAL ACTIVITY

GRADING CRITERIA: The proportion of children and youth accumulating 60 minutes or more of moderate-to-vigorous physical activity daily.

Evidence from major urban centres in India (Bengaluru, Chennai, Mumbai, Hyderabad, Goa) and medium sized cities (Surat and Malwa) indicates that approximately a one-third of children and youth are accumulating the minimum recommendation of 60 minutes of MVPA per day.[10,19-26] It is expected that children and youth from rural areas accumulate greater MVPA, however data from these populations is sparse and difficult to align with MVPA guidelines.

The majority of studies among children and youth have been conducted in urban centres. Accelerometer-derived data from the International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE) based in the city of Bengaluru indicates that children aged between 9-11 years are accumulating approximately 49 minutes of MVPA/day on average.[19-21] However, another study in the city of Chennai that also derived data from accelerometers showed that children and youth are accumulating approximately 26 minutes of MVPA/day.[22] Results also indicated a significant difference in MVPA accumulation between boys (33.9 minutes/day) and girls (18.3 minutes/day).[22]

Data shows wide variation in physical activity among children and youth, and this could be attributed to disparity of data collection measures. Gregori et al (2014) showed that among 1680 children aged 3-11 years from 7 Indian cities (Bengaluru, Chennai, Hyderabad, Kolkata, Mumbai, New Delhi, and Surat), only 5% reported accumulating more than 7 hours of physical activity per week (i.e., >1hr/day).[23] It is important to note that parents reported children's physical activity data, and that this data does not differentiate between light and moderate-to-vigorous physical activity.[23] Another study by Contactor et al (2014) used pedometers to assess step counts in children aged 12-15 years, thus the evidence generated could not clearly ascertain MVPA accumulation.[24]

Several studies focused on rural populations, and while the evidence is relatively sparse for children and youth, there is some indication that children residing in rural areas accumulate greater MVPA than their urban counterparts. Shridhar et al (2016) showed that 79% of rural children aged 5 to 14 years (n = 564) in south India accumulated at least one hour of leisure time time physical activity (i.e., includes light physical activities).[25] Esht et al (2017) conducted a study among 234 rural children and youth in north India aged between 8-14 years to show that approximately 45% of children and youth met physical activity guidelines.[26] Another trend observed in this study was that MVPA accumulation was inversely proportional to the age of of the participants, i.e., as the age of the participants increased, their physical activity accumulation decreased.[26] One common pattern that emerged from both urban and rural data was that girls were significantly less active compared to boys.[22,26]

The data identified considerable variability in terms of quality and methods. Considering all sources of evidence, and providing appropriate weightage as explained in the methods section, a grade of D has been assigned as approximately one-third of children and youth appear to be meeting physical activity guidelines.

WHY IS OVERALL PHYSICAL ACTIVITY IMPORTANT?

Habits and behaviours developed in childhood persist into adulthood, thus children and youth who are active are more likely to become active adults. Regular physical activity can reduce the risk of numerous illnesses such as cardiovascular diseases, metabolic syndrome, colon and breast cancer, and depression.[7,8] Physical activity can also help control weight, improve mood, and increase life expectancy.[7,8]

GRADE **INC**

The grade of incomplete (INC) indicates that there was insufficient information available to assess this indicator.

ORGANIZED SPORT PARTICIPATION

GRADING CRITERIA: The proportion of children and youth involved in any organized sports programming provided through schools or communities.

Organized sports include physical activities that are structured, goal-oriented, competitive and contest-based. Organized sport participation includes involvement in any programming provided through schools or communities that enables children and youth to participate in sports.

WHY DOES ORGANIZED SPORT PARTICIPATION MATTER?

For many children and youth, organized sport participation is a fun way to be physically active with peers. While not all families may be able to afford extracurricular organized sports activities, programs offered through schools are more accessible to children and youth, and therefore an important part of overall physical activity accumulation.

This indicator receives an incomplete grade as there are not enough data available on Indian children and youth's participation in organized sports. The existing evidence has focused on overall physical activity and active transportation, with little to no mention of organized sport participation either inside or outside of school time. Thus, it is not possible to discern organized sport participation from existing physical activity studies.

GRADE C-

The grade C- indicates that less than half of children and youth engage in active play for more than 2 hours per day.

ACTIVE PLAY

GRADING CRITERIA: The proportion of children and youth engaged in unstructured, unorganized active play for several hours per day.

Active play refers to activities and games with or without clearly defined rules, which take place either indoors or outdoors. They may be social or independent, however to be considered active, play must result in activity that is above resting metabolic rate. Compared to other indicators, active play is difficult to measure as it often occurs spontaneously and with frequent rest periods.

Based on a representative urban study sample of 20,000 children and youth aged 6 to 19 years from both high and low socioeconomic status groups, 49% of participants spent at least 1 hour in active play.[27] However there were significant differences in active play between boys and girls. Approximately 60% of boys reported active play compared to only 35% of girls, with 45% of boys and 26% of girls playing for more than one hour daily.[27]

One study conducted in Wardha city in 31 schools with children and youth aged 10 to 16 years (n=2555) found that 83% of participants spent at least 30 minutes in active play.[28] Data from smaller study samples in Mysuru showed higher levels of active play on weekends compared to weekdays among various age groups.[29] Among 8-year-old children (n=404), 12% engaged in more than 2 hours of active play daily, including playing games outside of school hours.[29] Among 9-year-old children (n=500), 18.2% engaged in at least 2 hours of active play on weekdays, and 38.4% engaged in active play for more than 2 hours on weekends.[29] For youth aged 13 to 14 years (n=563), 28.4% and 68.2% engaged in active play for at least 2 hours on weekdays and weekends, respectively.[29] Other similar studies, including one by Mukherjee et al (2014) found that 3 to 5 year-olds (n=48) on average engaged in 2.5 hours of active play daily, and 5 to 11 year olds (n=61) on average engaged in approximately 1.5 hours of active play daily.[30]

Based on available evidence, approximately half of Indian children and youth engage in daily recommended levels of active play. There are clear inconsistencies in how the data are being collected, thus some studies which did not clearly define active play or measure frequency (i.e., only yes/no questions) had to be excluded. This grade is largely based on data from urban centres, as data from rural areas on active play is limited.

WHY IS ACTIVE PLAY IMPORTANT AMONG CHILDREN?

Active play is an important contributor to overall physical activity, especially among young children. Many children who do not participate in organized sports or structured activities, particularly infants and preschool-aged children, may engage in active play as their primary form of activity.[31,32] Research also suggests that children accumulate up to 50% more MVPA during unstructured play than they do during organized physical activities.[33-35]

For many young children, active play may be the primary form of physical activity accumulation. Unlike structured activities, active play encourages creativity, independence and social behaviour. It also improves one's ability for conflict resolution, problem solving, and motor skills—aspects that are important to children's social, emotional, and cognitive development.[31,32,35,36]

Photo credit: Sumita Roy Dutta, 2012

GRADE **B-**

The grade B- indicates well over half of children and youth use active transportation to travel to different destinations.

ACTIVE TRANSPORTATION

GRADING CRITERIA: The proportion of children and youth who walk or bike to different destinations (e.g. home, school, park).

Active transportation includes physical activity accumulated during transportation between different destinations, for example, between home and school, or between home and parks. Common modes of active transportation are walking, jogging, running; cycling; skateboarding; and non-mechanized wheelchairing.[37]

Tetali et al (2016) conducted a study in 48 Hyderabad schools among 13-year-old youth (n=5842) and found that 63% either walked or biked to and from school.[38] Similarly, a study by Dandona et al (2011) found that 61% of commute trips by children and youth aged 5 to 14 years (n=2856) in Hyderabad were on foot.[39]

A study in Chennai among 12-17-year-olds (n=325) found that 51.5% of youth walked or cycled at least 1 trip per week to school.[22] Another study in Chennai (n=1842) found that 65.4% of youth engaged in active transportation, with 43% walking and 22% cycling to school daily.[40] In a Mysuru study, approximately half of children and youth also engaged active transportation to and from school, with 46% of 8 year-olds (n=404), 44.4% of 9 year-olds (n=500), and 48.3% of 13 year-olds (n=563) either walking or biking to school.[29]

Nationally representative evidence from the Global School-Based Student Health Survey (n=6130) has shown that approximately 57% of youth aged 13 to 15 years participated in active transportation.[10] Approximately 61% of boys and 52% of girls engaged in active transportation in this sample.[10] Data from the ISCOLE studies has shown that only 5.2% of children aged 9 to 11 years participated in active transportation (n=546 and n=600).[41,42] However, these data are at a local level (city of Bengaluru), and younger children are less likely to accumulate physical activity via active transportation.[43]

After evaluating evidence from both published and unpublished data, a weighted average resulted in a B- grade for active transportation, with approximately 65% of children and youth participating in active transportation on a regular basis. Similar to other indicators, we expect that a higher proportion of children and youth in rural areas engage in active transportation, however the evidence for these populations is sparse.

WHY SHOULD WE FACILITATE ACTIVE TRANSPORTATION IN CHILDREN AND YOUTH?

Current evidence indicates that children and youth who use active transportation accumulate more physical activity and have better health outcomes in comparison with those who are passive during transportation (e.g. car/bus travel).[44-46] Moreover, the benefits of active transportation extend beyond physical health as it increases social interaction, reduces road congestion, saves money on gas and parking, and more importantly, can contribute towards reduction in greenhouse gas emissions.[41]

GRADE C-

The grade C- indicates that less than half of children and youth meet sedentary behaviour guidelines.

SEDENTARY BEHAVIOUR

GRADING CRITERIA: The proportion of children and youth who meet screen-time-based sedentary behaviour guidelines.

Less than half of Indian children and youth are meeting screen time-based sedentary behaviour guidelines. Many physical activity-focused studies have measured sedentary time, however these data could not be used because they were inconsistent with screen time guidelines. Nonetheless, data from several large urban centres showed consistently high screen time among children and youth, which exceeded recommended levels.

A study conducted in Mysuru showed that screen time accumulation increased with age among children and youth. Among 8-year-old children (n=404), 66% spent two hours or less watching television daily, whereas among 9- (n=500) and 13-year-old children (n=563), approximately 88% spent 2 hours or less watching television daily.[29] It must be noted that these data do not include screen time that could have been accumulated through other devices (e.g., computers, tablets, smartphones).

Another study by Rani et al (2013), showed that among 1842 children and youth in the city of Chennai, 30% watched more than 2 hours of television daily and 27.7% spent more than 2 hours on a computer daily.[40] Among a sample in Chennai (n=20,000) that is representative of urban children and youth in India, it was shown that 33.8% accumulated less than 1 hour of screen time/day, 28.7% accumulated 1-3 hours and 11.7% accumulated 4-6 hours of screen time/day.[27]

LeBlanc et al (2015) found that among a sample of 540 children aged 9-11 years, approximately 31.3% were not meeting sedentary behaviour guidelines.[47] Another study by Guthold et al (2010) showed that among children and youth aged 13-15 years (n=6130), 23.7% spent 3 hours or more pursuing sedentary activities that included watching television and playing video games, with boys accumulating more screen time than girls.[10]

Newer evidence on screen time has found significant differences in screen time accumulation between children and youth aged 10-15 years (n=268) belonging to high and low socioeconomic groups.[48] Screen time accumulation decreased with increasing wealth, with participants in low, medium, and high socioeconomic groups reporting 178, 154, and 119 minutes of screen time/day, respectively. Moreover, the average screen time for all groups (151 minutes/day) exceeded the daily recommendation of less than 2 hours of screen time/day.[48] Another study that focused predominantly on children (3-11 years) belonging to low socioeconomic groups showed that, on average, children aged 3-5 years accumulated 2.3 hours of screen time daily, and children aged 5-11 years accumulated 3.3 hours of screen time/day.[30] More importantly, it was reported that 100% of children watched more than 2 hours of television/day, with 71.3% of participants watching television while eating dinner, and 82% of households reporting having a television in the bedroom.[30]

The data tells a story of high levels of screen time across all age groups, with boys, and children and youth belonging to low socioeconomic groups, accumulating significantly more screen time than their counterparts. Based on evolving evidence, the grade for sedentary behaviour has been reduced to C- from C.[12] This change may be attributed to increasing dependence on technology, and the ubiquitous presence of screens and digital devices in daily lives of children and youth.

WHY SHOULD WE ENCOURAGE CHILDREN AND YOUTH TO BE LESS SEDENTARY?

Children can be highly active and highly sedentary on the same day! Irrespective of the amount of physical activity children accumulate, they could still spend a lot of time in sedentary pursuits such as watching television.[49] Taking this observation into consideration is important, because increasingly, evidence suggests that independent of physical activity levels, sedentary behaviours are associated with increased risk of both physiological and psychological problems.[50] Watching television for more than 2 hours per day has been associated with unhealthy body composition, decreased fitness, low self-esteem, and decreased academic achievement. Fortunately, evidence also suggests that decreasing any type of sedentary behaviour is associated with lower health risk in children and youth.[50] Moreover, with evidence now emerging that sedentary behaviour embedded in childhood can continue through adolescence into adulthood,[51] it is imperative to focus on curbing sedentary behaviour in children and youth.

GRADE **D**

The D grade indicates that one-third of children are adequately supported by their family and peers in active living.

FAMILY AND PEERS

GRADING CRITERIA: The proportion of parents who facilitate physical activity and sport opportunities for children, meet physical activity guidelines for adults, and are physically active with their children. The proportion of children and youth with friends or peers who encourage and support them to be physically active.

Family and peers play a critical role in facilitating active living among children and youth. They can provide physical resources, financial support, and emotional encouragement to be physically active, and can help create an environment conducive to active living. Family and peers can also impact habits, behaviours, and interests among children and youth.

Published evidence and unpublished primary data from large urban centres indicates that approximately 30% of family/peers participate in physical activity with children and provide support/transport/access to physical activities. Data from the ISCOLE study in Bengaluru found that 42% of parents provided "high support".[52] Another study in Bengaluru among 12 to 17 year olds (n=325) found that 47% of parents encouraged their children to do sports or to be physically active often or very often.[22] Approximately 22% of parents in this sample provided their children transportation to a place where they could be physically active either often or very often.[22] Only 15.8% of parents did physical activity or participated in sports with their children often or very often, however 48% of children reported having siblings or friends that they could play sports or be physically active with often or very often.[22] A study in Mysuru conducted with 8-year olds (n = 404) found that only 11% of children reported being active with their families.[29]

Vaz (2015) conducted focus groups with 14 to 15-year-old youth (n=36) which elucidated some of the cultural and environmental contexts responsible for some of the trends in family and peer support.[53] Vaz (2015) reported discouragement to be physically active from parents and teachers as a barrier to physical activity.

WHY ARE FAMILY AND PEERS IMPORTANT FOR PHYSICAL ACTIVITY?

Research has shown that family, particularly parents, have a large influence on children's physical activity. Children of physically active parents are more likely to be physically active themselves.[54-57] Sibling physical activity has also been shown to be related to child and youth activity levels.[56]

Photo credit: Brian Glanz, 2005

Youth importantly noted gender-specific barriers for girls compared to boys, including deterrence due to appearance, fewer options for girls to participate in sports, societal concerns about girls' reputation, parents' advice to avoid exercise during menstruation, other household responsibilities, and relatives' discouragement.[53] Interestingly, the perceived barriers varied by urban and rural residence, as well as socioeconomic status (SES), as Indian rural boys and girls from lower SES families noted different barriers than higher SES youth in urban areas.[53]

After averaging both family and peer environment and weighting the evidence, this indicator receives a D grade.

GRADE **INC**

The grade of INC indicates that there was insufficient information available to assess this indicator.

SCHOOL — INFRASTRUCTURE, POLICIES AND PROGRAMS

GRADING CRITERIA: The proportion of schools implementing active school policies, providing opportunities to be physically active at school, and enabling access to necessary facilities and equipment to support physical activity.

The school indicator refers to the implementation of active school policies, provision of physical activities at school, as well as access to necessary facilities and equipment to support physical activity.

For students in grades 1-10 (5 to 16 years), physical education class is mandated across all school boards for at least 45 minutes per day.[58] Currently, for grades 11-12 (16-18 years), only 90 to 120 minutes, or two class periods, of physical activity is mandated per week. However new Central Board of Secondary Education (CBSE) rules for 2018-2019 will require that all schools have one mandatory 60 minute physical education period.[59] CBSE schools can be found across India in every state, however each state also has its own additional school boards.

One study by Tarun et al (2017) conducted an audit of 16 schools in Delhi.[60] They found that 15 schools had playground equipment, and 9 had courts for outdoor sports.[60] The majority of schools did not have infrastructure to support physical activity, although there was indication of supports for active transportation (i.e., bike racks).[60] Only 25% (4 schools) had dedicated areas for sports, 31% (5 schools) had space for informal games (i.e., active play), and 37% (6 schools) had general play space.[60]

Many private schools across the country have physical activity infrastructure and equipment and enforce mandatory physical education classes. However, this spread is difficult to measure and would only reflect school environment available to higher SES families.

CSBE regulates approximately 19,000 schools across the country,[61] however there is limited evidence of physical activity policy implementation with respect to 1.2 million other schools across the country. Moreover, there are no nationally representative data on school infrastructure, access to facilities and equipment, school environment, and accountability for policy implementation to adequately grade this indicator.

HOW DO SCHOOLS CONTRIBUTE TO PHYSICAL ACTIVITY?

Schools are a critical venue for the accumulation of physical activity as children and youth spend a substantial amount of their waking hours at school. Schools can provide equipment and space to be physically active, as well as necessary programming and education to instill the importance of physical activity for overall health and fitness.

Photo credit: Atul Loke

GRADE **D**

A grade of D indicates that overall community and built environment is not promoting active living among children and youth, with a significantly high proportion of communities lacking active living policies or infrastructure.

COMMUNITY AND BUILT ENVIRONMENT

GRADING CRITERIA: The proportion of children or parents who perceive that their community/ municipality is doing a good job promoting physical activity. The proportion of communities/ municipalities that report they have policies and infrastructure (e.g., sidewalks, trails, paths, bike lanes) specifically geared toward promoting physical activity.

WHY SHOULD WE FOCUS ON THE BUILT ENVIRONMENT?

Evidence indicates that safety, access to recreational facilities and opportunities for active transportation increase physical activity levels in children and youth.[67-72] Recent evidence has revealed a more complex picture, where multilevel environmental determinants (urban design, neighbourhood built and social environment, school and home environment) have been shown to influence physical activity in children and youth.[73-75] In terms of urban design, it has been shown that more than one type of design can facilitate active living.[76]

The evidence includes results from a nationally representative audit and pedestrian survey which provides community members' perceptions (aged 15 to 50 years) to map walkability in six Indian cities.[62] These cities received low walkability ratings due to poor and unsafe infrastructure, and lack of sidewalks. Moreover, independent studies that captured parents' and children's perception of built environment showed that participants rated the following aspects poorly: urban infrastructure for walking and biking, access to physical activity spaces, safety from crime and traffic, pollution, aesthetics, and built environment around schools.[22,63]

Adlakha et al (2016) conducted a mixed-methods study among adults (n=370) in Chennai to show that although there is great density and diversity of destinations which could promote walkability, infrastructure for walking and biking was poor, with only 30% of participants reporting well-maintained pavements, 11% reporting bicycle lanes, and 26% reporting presence of pedestrian crosswalks.[63] Aesthetics were also rated poorly with only 19% reporting a neighbourhood that is free from garbage and litter, and 25% reporting attractive buildings.[63] Safety from traffic and crime also featured as one of the key issues for poor walkability, with 67% reporting feeling unsafe while walking, 71% reporting high levels of exhaust fumes, 43% reporting feeling unsafe walking during the day, and 58% reporting feeling unsafe walking during the night.[63]

Be Activ, a study conducted among children and youth in Chennai (n = 325) assessed perception of built environment, with a significant proportion of participants (>50%) reporting poor walkability due to pollution, and poor perception of safety, traffic, and general environment (i.e., presence of open drains, mosquitoes, garbage, stray dogs, unattended cattle, stagnant water etc.).[22]

The Clean Air Initiative for Asian Cities (2011) conducted a comprehensive study of walkability in Bhubaneshwar, Indore, Surat, Chennai, Pune, and Rajkot using a variety of methods, including field surveys, pedestrian interviews (n=1900), as well as policy and institutional assessments.[62] The study included a combination of small and large cities, which together are representative of cities across India. The main findings showed that although walking environment varied significantly between locations, overall, Indian cities had low walkability ratings due to poor and unsafe infrastructure, as well as lack of appropriate sidewalks.[62] Areas with large numbers of pedestrians (i.e., public transport terminals) received lower ratings than residential areas.[62]

A key determinant of walkability that is often not measured in Western countries is air pollution, which pedestrians identified as a barrier for walkability. This public perception is supported by the evidence that about 78% of 141 cities in India exceed the acceptable standard of particulate matter (PM2.5) exposure.[64] More importantly, 90 cities reported critical levels, and 26 reported levels of PM2.5 exceeding the acceptable standard by three times.[64] The policy and institutional assessments revealed that there is a lack of relevant policies, institutions, and political support for pedestrian needs. However, in 2018, the "Clean Air India Initiative" campaign was launched to curb air pollution in Indian cities by promoting partnerships between Indian start-ups and Dutch companies.[65,66] While there is now increased attention on reducing pollution, particularly in large urban centres, these efforts could take time to reverse existing conditions, which continue to impact population health and ability to be physically active in communities or outdoors.

The D grade is based on both published and unpublished primary data and includes a wide range of studies across India that capture perception of children, youth and adults.


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GRADE **D**

A grade of D indicates that overall there is a dearth of implementation of government policies, strategies and investments to promote active living among children and youth.

GOVERNMENT

GRADING CRITERIA: Demonstrated leadership, investments, and evidence of implementation of physical activity strategies targeting children and youth.

Although evidence shows investments towards physical activity programming, a major focus of government strategies has been competitive sports and development of elite athletes. There is no readily available evidence of strategies and investments that are being directed towards all children and youth with a purpose to increase active living among the entire population. While the need to embed physical activity into formal education was highlighted in the country's first 5 Year Plan in 1951, the focus over the next 70 years has shifted to promoting athletes, rather than investing in active living infrastructure for the benefit of all children and youth.[77]

In fact, the 2007 Comprehensive Sports Policy Report of the Ministry of Youth Affairs and Sports enumerates the 1998 Parliament Standing Committee on Human Resource Development findings that emphasized the need for integrating sports within the formal education system.[78] Even though there is evidence of investment to encourage schools to develop infrastructure, the area of concentration is again on the development of elite athletes. In terms of school strategies and investments, a policy is in place to mandate compulsory physical activity in schools regulated by the Central Board of Secondary Education, an autonomous organization under the Union Ministry of Human Resource Development, Government of India.[58] However, again, there is lack of evidence of actual implementation of these school-based policies. Finally, there is no evidence of a concerted national strategy or vision to address the physical inactivity epidemic through education of parents, teachers, or development of intersectoral policy interventions (i.e., urban/transportation planning).

WHAT IS THE ROLE OF GOVERNMENT POLICIES, STRATEGIES AND INVESTMENTS?

Government policies, strategies and investments play a critical role of setting a multi-jurisdictional (i.e., national, state, municipal) agenda that drives policies and programs at different levels of implementation, such as schools, built environment and urban design, and family, peers and educators (e.g. through awareness and education campaigns). Government also has a role to play in resource allocation towards active living research to address the lack of evidence, and towards evidence-based active living interventions to facilitate physical activity and discourage sedentary behaviour.

GRADE F

A grade of F indicates that very few children and youth meet the criteria for good physical fitness.

PHYSICAL FITNESS

GRADING CRITERIA: The proportion of children and youth that exhibit good performance on given physical tasks in a specified physical, social and psychological environment. This includes, but is not limited to, cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, and explosive strength.

Based on data from 3.8 million children and youth (grades 5-9) from 10,684 schools, approximately 15% of participants met recommended standards for minimum fitness.[79] This large sample of children from Kerala belonged to the Total Physical Fitness Program, where fitness was assessed using Health-Related Physical Fitness Test.[79]

The Total Physical Fitness Program included six measures of physical fitness: cardio respiratory endurance, muscular strength, muscular endurance, flexibility, explosive strength, and body composition (percentage of body fat). The fitness program was composed of a variety of tests and exercise regimens including: sit-ups (number per minute), sit and reach (centimetres), modified pull up (number completed), mile run (minute:second), 4x10 metre shuttle run test, standing vertical jump, standing broad jump, and height and weight (to calculate BMI).[79] Independent studies with much smaller samples (300 to 700 children/youth) utilized different fitness tests and found varied results.[80-82] In February 2017, a National Physical Fitness Programme was announced,[79] however it is unclear if the initiative has been launched as there is only evidence of implementation in Kerala.

A grade of F has been assigned based on the comprehensive data from the Total Physical Fitness Program which utilized a battery of comprehensive fitness tests to assess physical fitness of children and youth in a very large and representative sample.

WHY DOES PHYSICAL FITNESS MATTER?

Physical fitness provides an indication of a child's physical capabilities. Routine tests allow educators and parents to monitor physical fitness over time. Overall, physical fitness serves as a proxy measure for health status (e.g. cardiovascular health).

GRADE **INC**

The grade of INC indicates that there was insufficient information available to assess this indicator.

YOGA

GRADING CRITERIA: The proportion of children and youth who practice yoga daily.

There is no nationally representative data on the proportion of children and youth who practice yoga daily in India. In collaboration with one of our primary research partners, we conducted a cross-sectional survey among 12-15-year-old children and youth (n=500) in Chennai to assess levels of yoga practice. Approximately 60% of girls and 40% of boys reported practicing yoga regularly.[83]

The Government of India has driven promotion of yoga practice with approval from the National AYUSH Mission (Ministry of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy).[84] As a result, efforts have been made to create provisions such as co-location of AYUSH facilities at primary health centers, community health centers and district hospitals; and upgrading of exclusive state government AYUSH hospitals and dispensaries.[84] The Indian Prime Minister, Mr. Narendra Modi, proposed formal recognition of yoga on the summer solstice, and June 21 has been declared the International Day of Yoga by the United Nations General Assembly.

Specific to children and youth, the Government of India has mandated yoga to be a part of the school curriculum in institutions run by the central government.[84] These programs are a step in the right direction, however they could not be assessed under the "Government" indicator of Global Matrix 3.0, because yoga is not yet considered a sport or a physical activity.

WHY SHOULD WE ENCOURAGE CHILDREN AND YOUTH TO DO YOGA?

The ancient practice of Yoga has been a part of life in India over the past 2500 years. The combination of physical, mental, and spiritual aspects of the practice make it imperative to include yoga as part of a key indicator of physical activity and fitness in India, especially due to its cultural implications. Moreover, with the physical practice of yoga becoming popular in the west, it is time to recognize this practice as a way to improve physical activity and fitness among children.[85] Current evidence indicates a positive relationship between yoga practice, cognitive abilities, and mental health among Indian children and youth.[86-88] More importantly, growing evidence from across the globe suggests that yoga within school curricula may be an effective avenue to help students develop self-regulation and physical fitness.[89]

RECOMMENDATIONS

RECOMMENDATION 1: Investments in active living research and policy

The primary goal in improving physical activity among children and youth should be to develop an agenda for directing investments towards active living research and policy. The current approach of investing in sports and elite athletes needs to be expanded, and a mechanism for funding research and policy initiatives that benefit all children and youth should be given precedence. There is a critical need for multiple sectors (e.g. health, education, transportation, and urban planning) to work together in developing a funding agenda for active living research and policy implementation.

RECOMMENDATION 2: National strategy for physical activity for children and youth

To date, the majority of government-led strategies are focused on competitive sport and the development of elite national and international athletes. While there is some indication of school boards and private organizations implementing physical activity programs, a national-level strategy to promote physical activity among children and youth is missing. A national strategy would make physical activity a priority among schools, communities, cities and states, and will help guide investments, policies, and programs.

RECOMMENDATION 3: Minimizing gender-based inequities

Evidence indicates clear differences in physical activity opportunities and access between boys and girls. Many of these differences are rooted in cultural or societal expectations, and this is reflected in the activities children and youth participate in, as well as their overall physical activity levels. Both national and local policies or programs need to encourage equal participation from girls. This may include specific investment in female-focused activity initiatives and education campaigns to highlight the importance of physical activity for all children and youth.

RECOMMENDATION 4: Physical activity education and promotion campaigns to educate policymakers, educators, families, and children and youth

Health promotion campaigns are an important tool for public advocacy and education. Targeted physical activity campaigns will help educate the public about the benefits of activity for overall health, and may facilitate the creation of supportive social and physical environments. Increased interest from children and youth, families, and educators may also shift policymakers priorities to enable greater investments in research and infrastructure to support active living. Moreover, families and educators play an important role in providing children and youth opportunities to be physically active. Health promotion campaigns could benefit greatly if administered via social media and championed by well-known role models in sports, arts, and culture.

RECOMMENDATION 5: Adoption of active living policies in urban planning and development

There are numerous barriers to physical activity in the built environment, and a national survey identified Indian cities as having low walkability ratings. Evidence-based local urban planning policy is critical to facilitate active living and minimize existing barriers. These urban planning policies should fit into a wider strategy to curtail air pollution (a major barrier to active living), as Indian cities have some of the highest levels of air pollution in the world.

The recommendations for action are not mutually exclusive. If India is to make significant progress in active living among children and youth, the recommendations are to be implemented in concert, where there is interplay between multiple aspects of these action items.

REFERENCES

1. India. Encyclopaedia Britannica Web site. https://www.britannica.com/place/India Updated 2018. Accessed Sept 20, 2018.

2. Chapter 3: Size, growth rate and distribution of population. Census India, Government of India Web site. http://censusindia. gov.in/2011-prov-results/data_files/india/Final_PPT_2011_ chapter3.pdf Updated 2011. Accessed June 1, 2018.

3. Physiographic regions of India. Iasmania Web site. http://iasmania.com/physiographic-divisions-of-india/ Updated 2015. Accessed May 30, 2018.

4. Peel MC, Finlayson BL, McMahon TA. Updated world map of the Köppen–Geiger climate classification. Hydrol Earth Syst. Sci, 2007; 11: 1633–44.

5. Religions of India. Religions of India Website. https://www.mapsofindia.com/maps/india/religionsinindia.htm Updated 2018. Accessed May 30, 2018.

6. Data on language. Government of India, Ministry of Home Affairs. http://censusindia.gov.in/Census_Data_2001/Census_Data_Online/Language/gen_note.html Updated 2011. Accessed June 1, 2018.

7. Health topics: Physical activity. World Health Organization Web site. http://www.who.int/topics/physical_activity/en/ Updated 2018. Accessed June 1, 2018.

8. Physical activity and health: The benefits of physical activity. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (CDC) Web site. http://www. cdc.gov/physicalactivity/basics/pa-health/ Update 2018. Accessed June 1, 2018.

9. Global recommendations on physical activity for health. World Health Organization Web site. http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/ Published 2018. Accessed June 1, 2018.

10. Guthold R, Cowan MJ, Autenrieth CS, Kann L, Riley LM. Physical activity and sedentary behavior among schoolchildren: a 34-country comparison. J Pediatr, 2010; 157: 43-49.

11. Gulati A, Hochdorn A, Paramesh H, et al. Physical activity patterns among school children in India. Indian J Pediatr, 2014; 81 Suppl 1: 47-54.

12. Katapally TR, Goenka S, Bhawra J, Mani S, Krishnaveni GV, Kehoe SH, Lamkang AS, Raj M, McNutt K. (2016). India Report Card 2016 on Physical Activity for Children and Youth. Johnson Shoyama Graduate School of Public Policy; The University of Regina.

13. Sridhar GR, Kumar PS, Venkata P, et al. Built environment factors, psychosocial factors, and diabetes mellitus: a south Indian study. IJCM, 2010; 1: 15-22.

14. Millward Brown Study: Indian multiscreen users consume over six hours of screen media daily. Afaqs! Web site. http://www.afaqs.com/news/story/40768_Millward-Brown-Study-Indian-multiscreen-users-consume-over-six-hours-of-screen-media-daily Published May 7, 2014. Accessed June 1, 2018.

15. IRIS Knowledge Foundation. State of urban youth, India 2012. Mumbai: IRIS Knowledge Foundation; Available at http://www.esocialsciences.org/general/a201341118517_19.pdf Published 2013. Accessed May 30, 2018.

16. Oyelaran-Oyeyinka O. State of the urban youth 2012/2013. Nairobi: United National Human Settlements Programme. Published 2012. Accessed February 23, 2018.

17. Active healthy Kids Global Alliance. The global matrix 3.0 on physical activity for children and youth. Published 2018. Accessed Sept 1, 2018.

18. 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.

19. Katzmarzyk PT, Barreira TV, Broyles ST, Champagne CM, Chaput JP, Fogelholm M, et al. Physical activity, sedentary time, and obesity in an international sample of children. Med Sci Sports Exerc; 2015; 47(10):2062-69.

20. Silva DAS, Chaput JP, Katzmarzyk PT, Fogelholm M, Hu G, et al. Physical education classes, physical activity, and sedentary behavior in children. .Med Sci Sports Exerc, 2018;50(5):995-1004.

21. Sampasa-kanyinga H, Standage M, Tremblay MS, Sarmiento OL, Tudor-locke C, Chaput J. Associations between meeting combinations of 24-h movement guidelines and health-related quality of life in children from 12 countries. Public Health, 2017;153:16-24

22. Mohan A, Harish R, et al. 2018. Be Activ Chennai Study [Primary data].

23. Gregori D, Gulati A, Paramesh EC, Arockiacath P, Comoretto R, Paramesh H, et al. Cross-regional analysis of multiple factors associated with childhood obesity in India: a national or local challenge? Indian J Pediatr, 2014;8(S1):S5-S16.

24. Contractor A, Bhanushali A, Changrani J, Angadi S, Das BR. Pedometer assessed physical activity in urban pubertal children: first report from India. J Phys Act Health, 2014;11:1475-1481.

25. Shridhar K, Millett C, Laverty AA, Alam D, Dias A, Williams J, et al. Prevalence and correlates of achieving recommended physical activity levels among children living in rural south Asia – a multi-centre study. BMC Public Health, 2016;16:690.

26. Esht V, Midha D, Chatterjee S, Sharma S. A preliminary report on physical activity patterns among children aged 8-14 years to predict risk of cardiovascular diseases in Malwa region of Punjab. IHJ, 2018. Doi: https://doi.org/10.1016/j.ihj.2018.01.015

27. Mohan A, Harish R, et al. 2018. ORANGE Chennai Study [Primary data].

28. Bharati DR, Deshmukh PR, Garg BS. Correlates of overweight and obesity among school going children of Wardha city, central India. Indian J Med Res, 2008;127(6):539-543.

29. Ghattu KV, Kalyanaraman K, et al. 2018. Mysuru Study [Primary data].

30. Mukherjee SB, Gupta Y, Aneja S. Study of television viewing habits in children. Indian J Pediatr, 2014;81(11):1221-1224.

31. The biggest risk is keeping kids indoors. The 2015 ParticipACTION Report Card on Physical Activity for Children and Youth. ParticipACTION Web site. http://www.participaction.com/ sites/default/files/downloads/Participaction-2015ReportCard- FullReport_4.pdf Published 2015. Accessed June 1, 2018.

32. Tremblay M, Gray C, Babcock S, Barnes J, Bradstreet C, Carr D, et al. Position Statement on Active Outdoor Play. Int J Environ Res Public Health, 2015; 12(6):6475–505.

33. Dzewaltowski D. Physical activity levels among children attending after-school programs. Med Sci Sports Exerc, 2008; 40:622-629.

34. Maitland C, Stratton G, Foster S, Braham R, Rosenberg M. A place for play? The influence of the home physical environment on children's physical activity and sedentary behaviour. Int J Behav Nutr Phys Act, 2013; 10:99.

35. Burdette H, Whitaker R. Resurrecting free play in young children. Arch Paediatr Adolesc Med, 2005; 159: 46-50.

36. Ginsburg KR. The importance of play in promoting healthy child development and maintaining strong parent-child bonds. Pediatrics, 2007; 119 (1): 182-191.

37. What is active transportation? Public Health Agency of Canada Web site. http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/pa-ap/at-ta-eng.php Updated 2017. Accessed June 6, 2018.

38. Tetali S, Edwards P, Murthy GVS, Roberts M. How do children travel to school in urban India? A cross-sectional study of 5,842 children in Hyderabad. BMC Public Health, 2016;16:1099.

39. Dandona R, Kumar GA, Ameratunga S, Dandona L. Road use pattern and risk factors for non-fatal road traffic injuries among children in urban India. Injury, 2011;42(1):97-103.

40. Rani MA, Sathiyasekaran BWC. Behavioural determinants for obesity: a cross-sectional study among urban adolescents in India. J Prev Med Public Health, 2013;46:192-200.

41. Denstal KD, Broyles ST, Larouche R, et al. Active school transport and weekday physical activity in 9-11 year old children from 12 countries. Int J Obes Suppl, 2015; 5: S100-S106.

42. Larouche R, Sarmiento OL, Broyles ST, et al. Are the correlates of active school transport context-specific? Int J Obes Suppl, 2015; 5: 589-599.

43. Giles-Corti B, Kelty SF, Zubrick SR, Villanueva KP. Encouraging walking for transport and physical activity in children and adolescents. How important is built environment? Sports Med, 2009; 39(12): 995-1009.

44. Mendoza JA, Watson K, Nguyen N, Cerin E, Baranowski T, Nicklas TA. Active commuting to school and association with physical activity and adiposity among U.S. youth. J Phys Act Health, 2011; 8:488-95.

45. Ostergaard L, Kolle E, Steene-Johannessen J, Anderssen SA, Andersen LB. Cross-sectional analysis of the association between mode of school transportation and physical fitness in children and adolescents. Int J Behav Nutr Phys Act, 2013; 10:91.

46. Pizarro AN, Ribeiro JC, Marques EA, Mota J, Santos MP. Is walking to school associated with improved metabolic health? Int J Behav Nutr Phys Act, 2013; 10:12.

47. LeBlanc AG, Katzmarzyk PT, Barreria TV, Broyles ST, Chaput JP, et al. Correlates of total sedentary time and screen time in 9-11 year-old children around the world: the International Study of Childhood Obesity, Lifestyle, and the Environment. PLOS One, 2015. Doi: 10.1371/journal.pone.0129622

48. Bapat R. The class divide in urban Indian youths' lives; their time-use and adaptive functioning. J Child Family Studies, 2016; doi: 10.1007/s10826-016-0557-8.

49. Katapally TR, Muhajarine N. Capturing the interrelationship between objectively measured physical activity and sedentary behaviour in children in the context of diverse environmental exposures. Int J Environ Res Public Health, 2015; 12(9):10995-11011.

50. Tremblay MS, LeBlanc AG, Kho ME, et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth. Int J Behav Nutr Phys Act, 2011; 8: 98.

51. Biddle SJH, Pearson N, Ross GM, et al. Tracking of sedentary behaviours of young people: a systematic review. Prev Med, 2010; 51: 345-351.

52. Muthuri SK, Onywera VO, Tremblay MS, Broyles ST, Chaput JP, Fogelholm M, et al. Relationships between parental education and overweight with childhood overweight and physical activity in 9-11 year old children: results from a 12-country study. PLOS One, 2016. Doi: 10.1371/journal.pone.0147746

53. Vaz M, Swaminathan S, Rajaraman D, Kuriyan R, et al. Overweight and obesity in Asian Indian children in India and Canada: multi-level determinants, functional consequences and novel mechanisms. Report. 2015. Ref No. 58/4/2/ICMR-CIHR/2009/NCD-II (IRIS No: 2009-09540)

54. Davison KK, Cutting TM, Birch LL. Parents' activity-related parenting practices predict girls' physical activity. Med Sci Sports Exerc, 2003; 35:1589-95.

55. Moore LL, Lombardi DA, White MJ, Campbell JL, Oliveria SA, Ellison RC. Influence of parents' physical activity levels on activity levels of young children. J Pediatr, 1991;118:215-219.

56. Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. Med Sci Sports Exerc, 2000; 32:963-75.

57. Gustafson SL, Rhodes RE. Parental correlates of physical activity in children and early adolescents. Sports Med, 2006; 36(1):79- 97.

58. Central Board of Secondary Education. Circular No. 71, 2015. New Delhi: Government of India.

59. Times of India. CBSE makes health physical education a must for Std IX to XII. Web site. https://timesofindia.indiatimes.com/home/education/news/cbse-makes-health-physical-education-must-for-std-ix-to-xii/articleshow/63873756.cms 2018. Accessed June 6, 2018.

60. Tarun S, Arora M, Rawal T, Benjamin Neelon SE. An evaluation of outdoor school environments to promote physical activity in Delhi, India. BMC Pub Health, 2017;17:11.

61. Central Board of Secondary Education. Web page. http://cbse.nic.in/newsite/index.html Accessed June 6, 2018.

62. Clean Air Initiative for Asian Cities Center. Walkability in Indian cities. New Delhi: Clean Air Initiative for Asian Cities Center; Available at: http://cleanairasia.org/wp-content/uploads/portal/ files/Walkability-India_SEP.pdf Published March 2011. Accessed May 30, 2018.

63. Adlakha D, Hipp JA, Brownson RC. Adaptation and evaluation of the neighborhood eironment walkability scale in India (NEWS-India). Int J Environ Res Public Health, 2016;13:401. Doi: 10.3390/ijerph13040401

64. National ambient air quality status and trends-2012. Central Pollution Control Board Web site. http://www.cpcb.nic.in/ divisionsofheadoffice/pams/NAAQStatus_Trend_Report_2012. pdf Published 2014. Accessed May 30, 2018.

65. The Hindu. Clean Air India initiative launched. Web site. https://www.thehindu.com/news/national/clean-air-india-initiative-launched/article23980873.ece Accessed Sept 1, 2018.

66. Banerjee T, Kumar M, Mall RK, Singh RS. Airing 'clean air' in Clean India Mission. Environ Sci Pollut Res, 2017;24:6399-6413.

67. Timperio A, Crawford D, Telford A, Salmon J. Perceptions about the local neighborhood and walking and cycling among children. Preventive Medicine 2004; 38(1): 39-47.

68. Hume C, Salmon J, Ball K. Children's perceptions of their home and neighborhood environments, and their association with objectively measured physical activity: a qualitative and quantitative study. Health Education and Research 2005; 20(1): 1-13.

69. Evenson KR, Birnbaum AS, Bedimo-Rung AL, Sallis JF, Voorhees CC, Ring K, Elder JP. Girls' perception of physical environmental factors and transportation: reliability and association with physical activity and active transport to school. IJBNP, 2006; 3(28): 1-16.

70. Centers for Disease Control and Prevention. Physical activity levels among children aged 9 to 13 years. Morbidity & Mortality Weekly Report, 2003; 785-788.

71. Romero A J, Robinson TN, Kraemer HC, Erickson SJ, Haydel KF, Mendoza F, Killen JD. Are perceived neighborhood hazards a barrier to physical activity in children? Arch Pediatr Adolesc Med, 2001; 155(10): 1143-48.

72. Molnar BE, Gortmaker SL, Bull FC, Buka SL. Unsafe to play? Neighborhood disorder and lack of safety predict reduced physical activity among urban children and adolescents. AJHP, 2004; 18(5): 378-386.

73. Ding D, Sallis JF, Kerr J, Lee S, Rosenberg DE. Neighborhood environment and physical activity among youth: a review. Am J Prev Med, 2011; 41(4): 442–455.

74. Edwardson CL, Gorely T. Parental influences on different types and intensities of physical activity in youth: a systematic review. Psychol Sport Exerc, 2010; 11:522-35.

75. Craggs C, Corder K, van Sluijs EMF, Griffin SJ. Determinants of change in physical activity in children and adolescents: a systematic review. Am J Prev Med, 2011; 40(6): 645- 58.

76. Katapally TR, Rainham D, Muhajarine N. Factoring in weather variation to capture the influence of urban design and built environment on globally recommended levels of moderate to vigorous physical activity in children. BMJ Open, 2015;5:e009045.

77. Government of India. Chapter 2.7 Youth and Sports. Tenth 5-year plan 2002-2007.

78. Ministry of Youth Affairs and Sports. Comprehensive Sports Policy 2007. Report. Available at: https://yas.nic.in/sites/default/files/File371.pdf Accessed Sept 1, 2018.

79. Ministry of Youth Affairs and Sports. Exposure draft on national physical fitness programme for school children. New Delhi: Government of India; 2012. Available at: http://www.yas.nic.in/ sites/default/files/File1116.pdf Accessed June 6, 2018.

80. Sharma VK, Subramanian SK, Arunachalam V. Evaluation of body composition and its association with cardio respiratory fitness in south Indian adolescents. Indian J Physiol Pharmacol, 2013;57(4):399-405.

81. Karkera A, Swaminathan N, Pais SMJ, Vishal K, Rai SB. Physical fitness and activity levels among urban school children and their rural counterparts. Indian J Pediatr, 2014;81(4):356-361.

82. Deoke A, Hajare S, Saoji A. Prevalence of overweight in high school students with special reference to cardiovascular efficiency. Glob J Health Sci, 2012;4(2):147-152.

83. Mohan A, Harish R, et al. Yoga study. 2018. [Primary data]

84. Government of India. Government measures to promote yoga. AYUSH. Available at: http://pib.nic.in/newsite/mbErel.aspx?relid=124069 Accessed on Aug 30, 2018.

85. India Perspectives. Yoga in India. India Perspectives Wellness Special. Report. Available at: https://www.mea.gov.in/Uploads/PublicationDocs/24452_IP_Yoga_Digital_2.pdf Accessed Aug 30, 2018.

86. Chaya MS, Nagendra H, Selvan S, Kurpad A, Srinivasan K. Effect of yoga on cognitive abilities in schoolchildren from a socioeconomically disadvantaged background: a randomized controlled study. J Alt Complem Med, 2012;18(12):1161-1167.

87. Telles S, Singh N, Yadav A, Balkrishna A. Effect of yoga on different aspects of mental health. Indian J Physiol Pharmacol, 2012;56(3):245-54.

88. Nagendra H, Kumar V, Mukherjee S. Cognitive behavior evaluation based on physiological parameters among young healthy subjects with yoga as intervention. Comput Math Methods Med, 2015. Doi: 10.1155/2015/821061

89. Khalsa SB, Butzer B. Yoga in school settings: a research review. Ann N Y Acad Sci, 2016;1373(1):45-55.

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