



Review Article

Global participation in sport and leisure-time physical activities: A systematic review and meta-analysis



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ABSTRACT

This review aimed to determine the most popular physical activities performed by children, adolescents, and adults globally. Statistic bureau websites and article databases Scopus, ProQuest, SPORTDiscus, and Science Direct were searched between November 17th, 2014 and April 31st, 2015. Eligible studies were published in the last 10 years with participation rates for specific physical activities among individuals five years or older. Data extraction for included articles ($n = 64$) was assessed independently and agreed upon by two authors. A random-effects model was used to calculate participation rates in specific activities for each age group and region. In total 73,304 articles were retrieved and 64 articles representing 47 countries were included in the final meta-analysis. Among adults, walking was the most popular activity in the Americas (18.9%; 95% CI 10.2 to 32.5), Eastern Mediterranean (15.0%; 95% CI 5.8 to 33.6), Southeast Asia (39.3%; 95% CI 0.9 to 98.0) and Western Pacific (41.8%; 95% CI 25.2 to 60.6). In Europe and Africa, soccer (10.0%; 95% CI 6.5 to 15.1) and running (9.3%; 95% CI 0.9 to 53.9), respectively, were top activities. Child and adolescent participation results were highly dependent upon region. American youth team sport participation was high, while youth from the Eastern Mediterranean and Western Pacific were more likely to report participation in lifelong physical activities. Global data for adults reflects a consistent pattern of participation in running and walking. Among all age groups and regions soccer was popular. In children and adolescents, preferences were variable between regions.

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1. Introduction

Attaining recommended amounts of physical activity for health benefits (physical, mental, emotional, social) is imperative for overall well-being for adults, adolescents, and children (Eime et al., 2013a; Janssen and Leblanc, 2010; Warburton et al., 2006; Taylor et al., 2004; Penedo and Dahn, 2005; Booth et al., 2012). Yet, large proportions of adults (31%) and adolescents (80%) are currently classified as insufficiently active (Hallal et al., 2012). Inactive individuals are prone to an increased risk of obesity, cancer, diabetes, and heart disease, as well as psychological and emotional distress (Hamer et al., 2009; Kohl et al., 2012; Lee et al., 2012).

Previous studies have typically focused on *how much* leisure-time physical activity people accumulate (Collings et al., 2014; Cooper et al., 2015; Nader et al., 2008), including a recent global review of physical activity rates and active transportation (Hallal et al., 2012). The authors of the review described physical inactivity as a global health pandemic and reported that large numbers of adults are not meeting physical activity guidelines (range: 17.0% in Southeast Asia to 43.3% in the Americas). Rates of active transportation were also low and at the highest end, no more than a third of individuals reported utilizing active transportation (Hallal et al., 2012). What remains less clear is an understanding of *what types* of physical activities individuals choose to perform in their leisure-time (separate from active transportation), at different life stages and across different regions of the world. This is a notable gap in the epidemiological literature, as different regions may perform different physical activities, and this may have implications for related health outcomes (Oja et al., 2015). Improving our understanding of the different types of leisure-time physical activities performed may provide insight into the disparities in global physical activity participation.

Physical activity choices may vary due to the age-related motivations for participation. For example, children often cite ‘fun’ and ‘enjoyment’ as the main reasons why they participate in physical activity (Humbert et al., 2006; Tannehill et al., 2013), while adolescents and adults are more likely to be motivated by the health and fitness benefits of physical activity (Allender et al., 2006; Costello et al., 2011). As motivation for physical activity changes over time, so too will the types of leisure-time physical activities selected by individuals. For example, during adolescence an individual might choose to participate in team sports (e.g., volleyball) to enhance their connectedness with friends, but as an adult, maintaining a healthy weight might become the primary motivation for staying active, thus time-efficient activities such as running might become the preferred option.

Leisure-time physical activity may be influenced by socio-demographic barriers including geographic location and socioeconomic status (Bauman et al., 2012; Humpel et al., 2002). For example, individuals who live in cold weather climates (e.g. Canada, Norway), as opposed to

warmer climate areas (e.g. Mexico, Australia) are more likely to participate in snow sports, such as skiing and snowboarding. Additionally, safety concerns, environmental factors (i.e., aesthetics), and access to facilities (e.g. parks) may inhibit or facilitate participation in physical activity (Humpel et al., 2002; Ball, 2015; Eime et al., 2013b; Kurka et al., 2015). Socioeconomic factors (e.g., cost, quality and availability) may also influence physical activity choices, as costs incurred through memberships (e.g., health/fitness clubs), registrations fees, equipment, and transportation can limit activity options for economically disadvantaged individuals (Costello et al., 2011; Eime et al., 2013b; Boone-Heinonen et al., 2011).

A more complete picture of physical activity preferences across the globe and at various life stages, will arm policy makers and interventionists with useful information to aid physical activity promotion efforts. To date, no global synthesis of the specific physical activities individuals perform has yet been conducted. The purpose of this review is to determine the most commonly performed physical activities by children, adolescents, and adults globally.

2. Methods

2.1. Search strategy

This systematic review and meta-analysis was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines (Liberati et al., 2009). The PRISMA checklist has been provided in the supplemental materials (Supplemental Table A.1). The literature search was conducted in two phases between November 17th, 2014 and April 31st, 2015. First, geohive.com, a database listing 207 independent nations (i.e., excluding territories/enclaves e.g., U.S. Virgin Islands, Puerto Rico, Cayman Islands) with links to each individual nation’s central statistics bureau (or similar organization) was searched from November 17th 2014 to January 29th, 2015. The following search terms were used in the search bar of each webpage: ‘sport’, ‘sport participation’, ‘physical activity’. If no search bar was present, webpages were navigated for relevant information under tabs including: ‘Health’, ‘Lifestyle’, ‘Recreation’, ‘Culture’ or other applicable sections. If multiple documents reporting participation data were found, only the most recent article was retrieved.

Phase two of the literature search included a systematic review of databases (Proquest, Science Direct, Scopus, SPORTDiscus), which took place from January 29th, 2015 to March 16th, 2015. Publication date was limited to the past 10 years from the date of the search. As documents may have been published in various languages, data were not restricted to those reported in English. An online translation engine (Google Translator) was used to read and interpret the literature (15 of 122 studies fitting inclusion criteria). Searches were performed using the following search strategy: [country name] AND ‘sport’ OR

'sport participation' OR 'physical activity'. Alterations to country names were included (e.g., United States, America, American). See Supplemental Table A.2 for in-depth search strategy.

Articles identified by the search engines were assessed by title and abstract. Full text articles identified as appropriate based on title and abstract were retrieved and assessed for eligibility. Literature search results can be found in Fig. 1.

2.2. Inclusion criteria

Studies were eligible if they met the following criteria: a) reported participation rates as a percentage participating in either sport (i.e., organized, competitive physical activity performed individually [e.g. golf] or as a team [e.g. soccer]) and/or leisure-time physical activities (physical activities performed during free time and often for pleasure, typically with less rules and regulations than organized sport, such as yoga or surfing); and b) participants were children (ages 5–12), adolescents (ages 13–17) or adults (18+ years), excluding special populations (e.g. persons with Cerebral Palsy) c) data were published in the last ten years from the date in which the first search took place; d) activities reported were not explicitly for purposes of transportation (e.g., cycling to work). In cases where more than one data set existed for a given age group and country, only the most representative study was included as determined by the following criteria: level 1) representative of national population (e.g., National Census Bureau data); level 2) large state/provincial level survey (e.g., New South Wales Schools Physical Activity and Nutrition Survey); level 3) large study but not necessary state/province wide (e.g., includes two sites or >250 participants); level 4) from one town or small region, not representative.

2.3. Data extraction

Sport and leisure-time activity participation data were extracted and broken down into three age groups: children (5–12 years), adolescents (13–17 years), and adults (18+ years). Data were organized by age group within one of six World Health Organization (WHO) regions (Africa, Americas, Eastern Mediterranean, Europe, Southeast Asia, Western Pacific). The division of data by region was consistent with Hallal and colleagues' global review (Hallal et al., 2012). To aid interpretation, types of activities reported by included studies were classified into the following: a) lifelong physical activities, previously defined as individual or small group activities (four people or less) involving little equipment and structure, low levels of physical contact, and performed with varying levels of intensity and competitiveness (e.g., swimming, running, walking) (Hulteen et al., 2015); b) team sports (e.g., basketball); and c) activities not otherwise defined, (e.g., gymnastics, athletics; do not fit the definition of either a lifelong physical activity or team sport).

2.4. Risk of bias

A six-item risk of bias template (see Table 1) was developed and coded as: reported (+), not reported (–), partially reported (+/–; where relevant) or data representativeness (value one to four). The risk of bias criteria included: a) level of representativeness of the data according to criteria previously described; b) participant consent rate; c) complete description of recruitment methods (setting, location, date of data collection); d) survey results reported separately by age (where applicable); e) survey results reported separately by sex (where applicable); and f) test-retest reliability of the measures used to collect data. Two raters independently assessed and agreed upon all items.

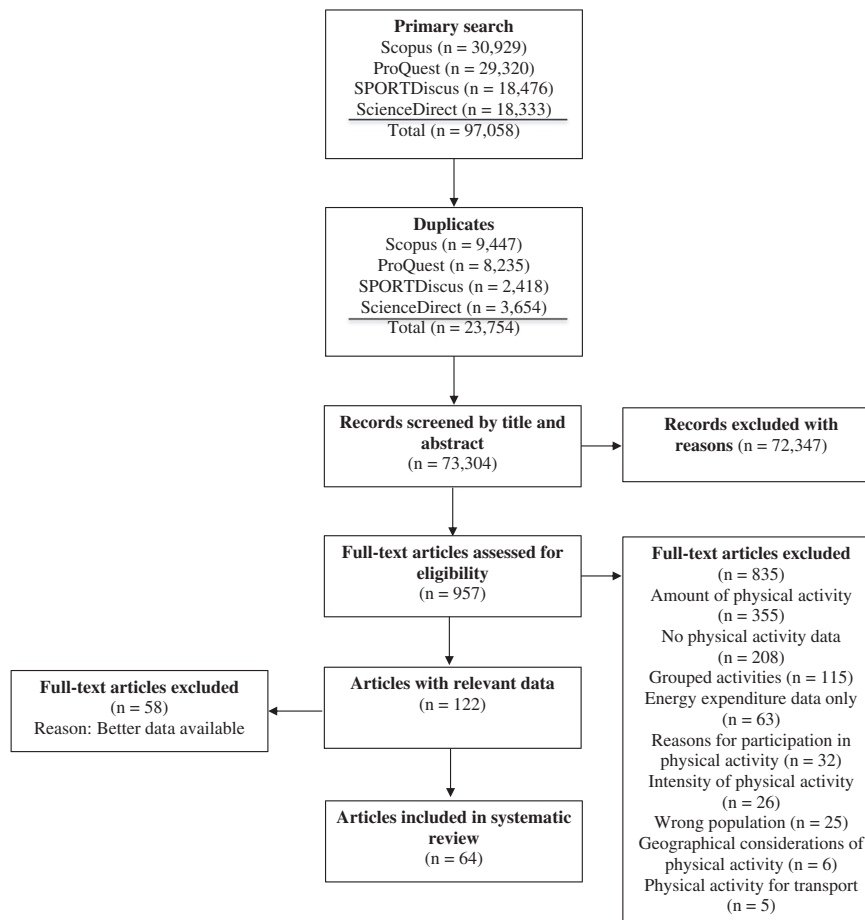


Fig. 1. Results of systematic literature search.

Table 1
Risk of bias for studies included in systematic review and meta-analysis.

Author	Country	Age group	Representativeness	Consent rate (%)	Recruitment methods	Data by age	Data by sex	Test-retest reliability
Africa								
(Sport and Recreation South Africa, 2005)	South Africa	Adolescent, adult	1	+	+	–	–	–
(Kirui et al., 2013)	Kenya	Adolescent	3	–	–	–	–	–
(Nannyonjo et al., 2013)	Uganda	Adult	4	+	–	–	n/a	–
(Ndlangamandla et al., 2012)	Swaziland	Adolescent	1	+	–	–	+	–
(Omondi et al., 2007)	Kenya	Adult	4	–	–	–	–	–
Americas								
(Canadian Heritage, 2013)	Canada	Child, adult	1	+	+	+/-	+	–
(Dumith et al., 2012)	Brazil	Child, adolescent	3	+	+	+	+	+
(Garriguet and Colley, 2014)	Canada	Adolescent	1	+	+	+	–	–
(Lobo et al., 2013)	Argentina	Adult	4	–	+	–	+	–
(Malete et al., 2008)	Jamaica	Adolescent	3	–	–	–	–	–
(Oguntibeju et al., 2010)	St Lucia	Adult	4	+	–	–	–	–
(Sá Silva et al., 2011)	Brazil	Adult	3	+	+	–	+	+/-
(United States Census Bureau, 2012)	United States	All	1	+	+	+	+	–
Eastern Mediterranean								
(Amin et al., 2012)	Saudi Arabia	Adult	4	+	–	–	+	–
(Muttappallymyalil et al., 2010)	United Arab Emirates	Adult	4	+	+	–	–	–
(Nazuk et al., 2011)	Pakistan	Adult	3	±	–	–	–	–
(Salam et al., 2012)	Libya	Adult	4	–	+	–	–	–
(The State Statistical Committee of the Republic of Azerbaijan, 2015)	Azerbaijan	Adult	1	–	–	–	–	–
(Taha, 2008)	Saudi Arabia	Adolescent, adult	3	+	+	–	+	+
(Youssef et al., 2013)	Oman	Adolescent	3	–	+	–	+	–
Europe								
(Akman et al., 2012)	Turkey	Adolescent	3	+	–	–	–	–
(Andreassen et al., 2007)	Norway	Adult	1	+	+	–	+	–
(Andrijasevic et al., 2005)	Croatia	Adult	4	–	–	–	+	–
(Asztalos et al., 2012)	Belgium	Adult	2	+	–	–	+	+
(Bergier et al., 2012)	Lithuania	Adolescent	4	–	+	n/a	+	–
(Bognar et al., 2010)	Hungary	Adult	4	–	–	–	–	–
(Breur et al., 2011)	Germany	All	1	–	+	–	–	–
(Central Statistics Office Ireland, 2015)	Ireland	Adult	1	–	+	+	+	–
(Central Statistical Office, 2014)	Poland	Adolescent, adult	1	–	–	–	–	–
(Department for Culture Media and Sport, 2013)	England	Child, adolescent	1	–	+	+	+	–
(Dlouhy et al., 2013)	Czech Republic	Adolescent	4	–	–	–	–	–
(Gracia-Marco et al., 2010)	Spain	Adolescent	1	–	+	–	+	±
(Gurbuz et al., 2010)	Turkey	Adult	4	–	–	–	–	–
(Jones et al., 2011)	England	Adult	1	–	+	+	+	–
(Karaca, 2011)	Turkey	Adult	3	–	–	–	+	–
(Lamprecht et al., 2014)	Switzerland	Adolescent, adult	1	+	+	–	+	–
(La Torre et al., 2006)	Italy	Child, adolescent	2	+	–	–	–	–
(Laub and Pilgaard, 2013)	Denmark	All	1	+	+	+	+	–
(Molinero et al., 2010)	Spain	Child	4	+	–	–	n/a	–
(Muller, 2005)	France	Adolescent, adult	3	–	+	+	+	–
(Nilsson et al., 2009)	Sweden	Adult	3	+	–	–	n/a	–
(Population and Social Statistics Unit, 2005)	Malta	All	1	–	–	–	+	–
(Rodríguez et al., 2010)	Spain	Adult	3	–	+	–	+	–
(Sport Scotland, 2010)	Scotland	All	1	–	–	+	+	–
(Sport Wales, 2012)	Wales	Adult	1	+	+	–	+	–

(continued on next page)

Table 1 (continued)

Author	Country	Age group	Representativeness	Consent rate (%)	Recruitment methods	Data by age	Data by sex	Test-retest reliability
(Sport Wales. School Sport Survey, 2013)	Wales	Child, adolescent	1	–	–	+	+	–
(Statistics Portugal, 2008)	Portugal	All	1	–	–	–	–	–
(Tiessen-Raaphorst and van den Dook, 2015)	Netherlands	Adult	1	+	+	+	+	–
				(40–65)				
(Toselli et al., 2014)	Italy	Child	3	–	+	–	+	–
(Wichstrøm and Wichstrøm, 2009)	Norway	Adolescent	1	+	–	–	–	–
				(97)				
(Woods et al., 2010)	Ireland	Child, adolescent	1	±	+	+	+	–
(Zimmermann-Sloutskis et al., 2009)	Switzerland	Child	1	–	+	+	+	–
Southeast Asia								
(Anjana et al., 2015)	India	Adult	4	–	–	–	–	–
(Molanorouzi et al., 2015)	Malaysia	Adult	3	–	+	–	–	–
Western Pacific								
(Australian Bureau of Statistics, 2015)	Australia	Adolescent, adult	1	+	+	–	+	–
				(76.8)				
(Chen et al., 2013)	China	Adult	4	+	+	–	–	–
				(87)				
(Gonzalez-Suarez and Grimmer-Somers, 2009)	Philippines	Child	3	+	–	+	+	–
				(62)				
(Hu et al., 2013)	Taiwan	Adolescent, adult	3	+	+	–	–	–
				(50)				
(Hui et al., 2009)	Hong Kong	All	1	+	+	+	+	–
				(70)				
(Keating et al., 2006)	China	Adult	3	+	+	–	+	–
				(96)				
(Sport New Zealand, 2012)	New Zealand	Child, adolescent	1	+	+	+	+	–
				(75)				
(Sport New Zealand, 2015)	New Zealand	Adult	1	+	+	+	+	–
				(61)				
(Statistics Bureau of Japan, 2012)	Japan	All	1	–	+	+	+	–
(Telford et al., 2005)	Australia	Child	3	+	+	+	+	±
				(38)				

+ = fully reported.

– = not reported.

+/- = not fully reported.

n/a = not applicable.

* = previously established in another study.

k = kappa coefficient.

ICC = intraclass correlation coefficient.

1 = national; 2 = state/provincial; 3 = two sites or >250 participants; 4 = not representative.

2.5. Meta-analyses

Meta-analyses results were conducted using Comprehensive Meta-Analysis, Version 2 (Englewood, NJ, USA). Event rates presented indicate the percentage of people in each of the six WHO regions who participate in a specific physical activity. Due to the variability between data sets in regards to sample size, a random effects model was selected. In calculating the random effects model, all studies reporting an activity were weighted equally, so results weren't skewed towards studies with large sample sizes. Analysis was performed for all activities extracted from included studies and the top ten activities according to participation rate are reported by age group and WHO region. If there was an overlap in age groups in two studies reporting data for the same country, then only the most representative data, according to the best level (described above) was used in the analysis. If there were two studies for the same country, but no overlap in age then both were included in the analysis. For example, if two studies for adults in the same country covered different ages (e.g., study one covers ages 20–40 and study two covers ages 45–80) then both were used to depict the full range of activities adults performed. Studies where participant ages spanned two different age categorizations (e.g. participants 15–35 years; adolescence and adults), assuming two years were represented in an age group, the study was included in the analysis of both age groups (n = 7).

3. Results

In total, 73,304 articles were identified by the search and 957 underwent full-text review. One-hundred and twenty-two articles met the inclusion criteria. However, following the exclusion of the least representative studies, where multiple studies for a single country and age category were provided, 64 articles were included in the final meta-analysis. Results reported show the top ten activities for each WHO region and corresponding age group.

3.1. Risk of bias

Out of 64 studies, 45% were classified as level one (data representative of entire country), 3% were classified as level two (state/province level data), 28% were classified as level three (multiple sites or >250 participants), and 23% were classified as level 4 (not representative). Consent rate (range: 28–100%) and recruitment methods were fully reported in more than half of all studies (n = 37). Results were reported by sex (n = 39) and by categories with age groups (n = 19). Further, 18 studies reported results by both sex and age categories. Results have not been presented by sex because variability in representativeness of studies reporting data by sex, as well as too few studies meant that it was not possible/appropriate to report in this review. Test-retest reliability of the physical activity measure was fully reported in only three studies.

Table 2
Adult sport and leisure-time physical activity participation with top 5 highlighted.

Activity	Event rate (%)	Lower rate (CI)	Upper rate (CI)	Activity	Event rate (%)	Lower rate (CI)	Upper rate (CI)
Africa (3 studies, n = 5,907)				Americas (5 studies, n = 242,420)			
Running	9.3	0.9	53.9	Walking	18.9	10.2	32.5
Netball	5.1	0.9	23.4	Cycling	14.3	8.1	24.0
Tennis	2.8	0.2	26.4	Running	8.5	2.4	26.0
Cycling	2.2	0.3	14.6	Soccer	5.7	1.7	17.0
Stair climbing	2.0	0.0	99.0	Resistance training	5.2	1.3	18.7
Swimming	1.7	0.6	4.9	Basketball	5.2	4.0	6.8
Soccer	1.6	0.1	25.4	Golfing	4.6	2.0	10.2
Golfing	1.3	0.8	2.1	Swimming	4.5	2.0	9.8
Rugby	1.2	0.3	4.8	Baseball	4.1	2.1	7.7
Field hockey	1.2	1.0	1.5	Tennis	3.9	3.1	4.8
Gymnastics	1.2	0.3	4.8				
Cricket	1.2	1.0	1.5				
Athletics	1.2	1.0	1.5				
Dancing	1.0	0.0	89.9				
Eastern Mediterranean (6 studies, n = 427,024)				Europe (20 studies, n = 1,560,602)			
Walking	15.0	5.8	33.6	Soccer	10.0	6.5	15.1
Soccer	14.8	5.3	35.1	Running	7.9	5.7	10.7
Running	11.9	4.1	29.5	Swimming	7.8	4.8	12.4
Volleyball	7.1	4.3	11.4	Resistance training	6.6	4.8	9.0
Swimming	6.4	0.8	35.0	Cycling	4.9	2.6	9.3
Basketball	2.3	1.0	5.5	Tennis	2.4	1.8	3.2
Resistance training	1.5	0.4	5.7	Martial arts	1.9	1.5	2.4
Martial arts	1.5	0.7	3.6	Gymnastics	1.9	1.2	2.9
Table tennis	1.0	0.4	2.2	Basketball	1.6	1.0	2.4
Dancing	0.6	0.1	3.7	Athletics	1.6	1.2	2.0
Southeast Asia (2 studies, n = 2,641)				Western Pacific (7 studies, n = 203,290)			
Walking	39.3	0.9	98.0	Walking	41.8	25.2	60.6
Running	11.1	7.6	15.8	Running	13.3	8.9	19.3
Cycling	5.6	1.5	18.5	Cycling	7.1	4.3	11.4
Yoga	1.2	0.0	89.1	Resistance training	5.0	3.0	8.4
Soccer	1.1	0.0	83.8	Swimming	4.4	2.1	9.1
Badminton	0.8	0.0	71.8	Soccer	4.0	2.5	6.4
Martial arts	0.7	0.0	61.1	Golfing	3.5	2.2	5.7
Basketball	0.6	0.0	42.1	Hiking	2.8	1.5	5.1
Resistance training	0.6	0.0	40.6	Basketball	2.1	0.8	5.7
Swimming	0.6	0.0	40.0	Tennis	2.1	1.3	3.4
Table tennis	0.6	0.0	48.0				
Tai chi	0.6	0.0	52.0				

^a Shaded boxes represent top five activities in a region based on event rate

^b CI = 95% confidence interval

3.2. Adults

Data were reported from 43 studies representing 40 countries in the following regions: Africa (n = 3), Americas (n = 5), Europe (n = 19), Eastern Mediterranean (n = 5), Southeast Asia (n = 2), and Western Pacific (n = 6). Adult participation rates for individual activities with 95% confidence intervals are presented in Table 2.

3.2.1. Activities selected by adults

Regardless of region, lifelong physical activities were more commonly reported in all of the top five activities participated in by adults compared to team sports. Lifelong physical activities were reported in

at least half of the regions and the top five included: running (range: 7.9%–13.3%, all regions), walking (range: 15.0% to 41.8%; Americas, Eastern Mediterranean, Southeast Asia, Western Pacific), cycling (range: 2.2% to 14.3%; Africa, Americas, Europe, Southeast Asia, Western Pacific), swimming (range: 4.4% to 7.8%; Eastern Mediterranean, Europe, Western Pacific), and resistance training (range: 5.0% to 6.6%; Americas, Europe, Western Pacific). Team sport participation rates were low among adults. Indeed, only one team sport (soccer) was consistently mentioned in the top five activities (range: 1.1% to 14.8% Americas, Eastern Mediterranean, Europe, Southeast Asia). Beyond the top five activities for each region, participation rates regardless of classification (e.g., lifelong, team) had participation rates below 5%.

3.2.2. Adult regional differences

Walking was the top ranked activity in four of six regions (range: 15.0% to 41.8%). Soccer was the top activity in Europe (10.0%) and running (9.3%) was the most popular activity in Africa. Lifelong physical activities unique to a region's top five (i.e., didn't appear in top five in any other region) included: tennis (2.8%) in Africa and yoga (1.2%) in Southeast Asia. Furthermore, team sports unique to a region's top five activities included netball (5.1%) in Africa, volleyball (7.1%) in the Eastern Mediterranean, and basketball (5.2%) in the Americas.

3.3. Adolescents

Adolescent data were provided for 31 countries in the following regions: Africa (n = 3), Americas (n = 4), Eastern Mediterranean (n = 2), Europe (n = 17), and Western Pacific (n = 5). No data were found for Southeast Asia. Every region had less data for adolescents (i.e., number of countries representing a region) compared with adults except Africa, where the same number of countries were represented (n = 3).

Participation rates with 95% confidence intervals for activities performed by adolescents can be found in Table 3.

3.3.1. Activities selected by adolescents

Two lifelong physical activities, swimming (range: 6.2% to 32.0%; Africa, Americas, Eastern Mediterranean, Europe, Western Pacific) and running (range: 8.4% to 39.9%; Eastern Mediterranean, Europe, Western Pacific), were classified as a top five activity in more than half of regions providing adolescent data. Swimming was the only lifelong physical activity mentioned in all regions even when accounting for all activities in the top ten for adolescents. Similar to adults, soccer was the only team sport in the top five across multiple regions (range: 3.3% to 30.6%; Africa, Americas, Eastern Mediterranean, Europe). Activities ranked six through ten were performed by <8% of individuals, except in the Americas where basketball, skating, fishing, cycling and snow sports were performed by 10–14% of adolescents.

Table 3

Adolescent sport and leisure-time physical activity participation with top 5 highlighted.

Activity	Event rate (%)	Lower rate (CI)	Upper rate (CI)	Activity	Event rate (%)	Lower rate (CI)	Upper rate (CI)
Africa (3 studies, n = 23,801)				Americas (4 studies, n = 37,385)			
Athletics	20.9	4.9	57.7	Soccer	30.6	12.8	57.1
Soccer	9.8	3.8	22.8	Bowling	23.0	19.1	27.4
Swimming	6.2	0.4	52.7	Baseball	16.9	13.5	21.0
Netball	2.3	0.5	10.0	Swimming	14.9	6.6	30.1
Rugby	1.5	0.8	2.8	Volleyball	14.4	6.8	28.0
Running	1.2	0.0	31.0	Basketball	13.9	6.7	26.7
Tennis	0.4	0.1	1.3	Skating ^b	13.7	9.4	19.4
Resistance training	0.3	0.0	94.7	Fishing	11.4	8.7	14.8
Field Events	0.3	0.0	93.0	Cycling	10.3	3.8	25.1
Dance	0.2	0.0	90.5	Snow sports ^c	10.2	7.8	13.6
Eastern Mediterranean (2 studies, n = 3,010)				Europe (17 studies, n = 1,276,038)			
Walking	56.0	38.1	72.4	Soccer	29.0	23.6	35.1
Running	39.9	19.6	64.4	Swimming	9.0	4.8	16.2
Swimming	32.0	23.3	42.1	Running	8.4	6.1	11.5
Resistance training	12.4	3.2	37.9	Basketball	6.6	4.2	10.2
Soccer	3.3	0.0	95.2	Cycling	5.2	2.2	11.9
Stair climbing	2.5	0.0	99.6	Gymnastics	4.9	3.1	7.6
Volleyball	1.4	0.0	55.0	Tennis	4.1	2.3	7.3
Basketball	1.4	0.0	58.1	Martial arts	4.0	3.3	4.8
Cycling	1.3	0.0	97.4	Volleyball	3.8	2.9	5.0
Aerobics	1.0	0.0	94.9	Resistance training	3.4	2.3	5.0
Western Pacific (5 studies, n = 48,594)							
Running	21.0	5.6	54.4				
Swimming	17.7	4.7	48.3				
Walking	10.8	4.5	23.5				
Cycling	9.1	2.3	30.2				
Basketball	8.8	2.2	29.3				
Soccer	8.4	2.2	27.4				
Resistance training	6.3	4.0	9.9				
Badminton	5.7	1.8	16.3				
Baseball	4.3	2.3	7.8				
Tennis	3.6	1.0	11.8				

^a Shaded boxes represent top five activities in a region based on event rate

^b Rollerskating only

^c Includes skiing and snowboarding

^d CI = 95% confidence interval

3.3.2. Adolescent regional differences

Four different activities, soccer (Americas, Europe), walking (Eastern Mediterranean), running (Western Pacific), and athletics (Africa) were identified as a top activity for adolescents. There were considerable differences among top five team sports in the five regions providing adolescent data. For example, netball (2.3%) and rugby (1.5%) were the most popular in Africa, while in the Americas, baseball (16.9%) and volleyball (14.4%) were the most prevalent. Only one team sport was reported in the top five for the Western Pacific (basketball, 8.8%) and Eastern Mediterranean (soccer, 3.3%) regions. Rather, lifelong physical activities in the top five for the Western Pacific and Eastern Mediterranean included: walking, running, swimming, resistance training, and cycling.

3.4. Children

Children from 19 countries across three regions were represented: Americas (n = 3), Europe (n = 11), and the Western Pacific (n = 5). No data were available for Africa, Eastern Mediterranean, or Southeast Asia. The child age group had the least available data meeting inclusion criteria. Findings for children can be viewed in Table 4.

3.4.1. Activities selected by children

The Americas had more team sports (soccer, basketball, volleyball, baseball), compared to lifelong physical activities (only swimming) in the top five. Children in the Western Pacific favored lifelong physical activities (running, swimming, walking, cycling) over team sports (only basketball). Europe had equal numbers of team sports and lifelong activities within the top five. Swimming (range: 10.3% to 33.9%) and basketball (range: 5.0% to 24.5%) were the only top five activities common among all regions. Activities ranked in positions six through ten in all regions were performed by <8% of individuals, except some activities in the Western Pacific (soccer, badminton, dance, and baseball; range: 12.1%–18.1%).

Table 4
Child sport and leisure-time physical activity participation with the top 5 highlighted.

Activity	Event rate (%)	Lower rate (CI)	Upper rate (CI)
Americas (3 studies, n = 25,013)			
Soccer	39.0	22.1	59.0
Swimming	15.7	3.4	49.9
Basketball	15.4	7.5	29.1
Volleyball	13.5	3.0	44.2
Baseball	10.8	4.3	24.6
Martial arts	3.2	1.4	6.7
Snow sports ^b	3.1	0.3	28.8
Ice hockey	2.0	0.3	13.2
Tennis	1.7	0.4	7.0
Gymnastics	1.2	0.3	5.0
Europe (12 studies, n = 690,476)			
Soccer	28.5	20.9	37.7
Swimming	10.3	2.3	35.8
Gymnastics	8.1	3.7	16.5
Dancing	7.1	3.9	12.6
Basketball	5.0	2.8	8.5
Tennis	4.3	1.6	11.2
Martial arts	4.1	2.5	6.5
Running	3.1	1.9	4.9
Volleyball	2.4	1.8	3.2
Cycling	2.4	0.6	9.3
Western Pacific (5 studies, n = 24,469)			
Running	38.1	15.3	67.6
Swimming	33.9	5.4	82.1
Walking	31.1	26.5	36.1
Basketball	24.5	12.0	43.4
Cycling	23.5	6.6	16.3
Soccer	18.1	7.1	39.1
Badminton	17.2	13.7	21.4
Dance	15.9	9.4	25.7
Baseball	12.1	6.7	21.0
Fishing	7.8	3.5	16.3

^a Shaded boxes represent top five activities in a region based on event rate
^b Includes skiing and snowboarding
^c CI = 95% confidence interval

3.4.2. Child regional differences

The most popular activity among children was soccer (Americas, Europe) or running (Western Pacific). Lifelong physical activities unique to the child top five included: dancing (Europe; 7.1%) and walking (31.1%), running (38.1%), and cycling (23.5%) in the Western Pacific. Soccer (18.1%), badminton (17.2%), dancing (15.9%), and baseball (12.1%) had participation rates above 10% in the Western Pacific, but weren't included in the top five. Volleyball (13.5%) and baseball (10.8%) were two team sports unique to the Americas top five.

4. Discussion

The purpose of this systematic review and meta-analysis was to determine the physical activities most commonly participated in by children, adolescents and adults globally. Sixty-four studies representing 47 countries across six regions were included. Global participation rates reflected a consistent pattern of participation in lifelong physical activities (e.g., swimming, running, walking) and soccer among adults. Alternatively, there was considerable variability in adolescent and child leisure-time physical activity patterns.

4.1. Risk of bias

Studies in this review and meta-analysis had a high risk of bias. A high proportion of studies (52%) were classified as a level three or level four study, thus generalizability of findings may be limited. Data were less commonly reported by age categories.

4.2. Representativeness of data

Forty adult studies from six regions were included in the review, while fewer studies focused on adolescents (n = 31; five regions) and children (n = 19; three regions). The larger number of adult studies could be explained by the large span of ages that constitute this age group.

4.3. Sport and leisure-time participation among adults

Lifelong physical activities were more commonly identified within the top five within different regions, compared to team sports. Soccer, was the one exception to popular top five activities. Walking and running were ranked in the top three for all regions. However, walking was not in the top ten for Europe and Africa. Promoting walking has been identified as a viable public health strategy due to its popularity (Ham et al., 2009). and associated health benefits, which include weight loss (Richardson et al., 2008) decreased blood pressure (Bravata et al., 2007), and improved serum lipids (Sugiura et al., 2002). Of note, walking may not have been included as a top ten activity in Europe and Africa because walking, much like cycling, can be classified as both for 'leisure' and 'transportation', thus causing conceptual confusion when classifying these activities. As this review was only concerned with identifying sport and leisure-time physical activities, activities reported as active transport were not included in the analysis.

Soccer was the one team sport that defied the trend of lifelong physical activities being most popular among adults. The continued popularity of soccer could in part be attributed to the fact that this sport is a social norm in many countries. Soccer is often characterized as the 'world game' and global competitions such as the football world cup might reinforce participation. Considering the high rates of participation in soccer among youth, it may be that prior experiences during childhood and adolescence translate to increased odds of participation in adulthood. Early experiences may support long-term interest in the sport, and likely help to develop the movement skills (e.g., kicking) required for individuals to feel competent. In addition, the long-term popularity of soccer in many countries might have led to the provision of facilities (e.g., playing fields and indoor or covered playing areas) that

also support population-level uptake of this activity. Of note, soccer may provide more substantial health benefits compared to many other physical activities. Specifically, a systematic review and meta-analysis reported moderate to strong evidence in support of improvements to aerobic fitness, cardiovascular function, metabolic fitness and reduced adiposity for soccer participants (Oja et al., 2015). Out of the 26 sport disciplines, soccer and running had the strongest evidence for health benefits, followed by slightly weaker evidence for cycling, gymnastics and swimming. All other activities had inconclusive evidence in support of health benefits (Oja et al., 2015).

Other popular activities among adults included swimming, although participation rates (range: 1%–8%) were lower than walking (range: 15.0%–41.8%) and running (range: 7.9%–13.3%). Swimming has characteristics (can be performed individually), much like running and walking, that are appealing. But swimming has additional barriers (e.g., access to facilities/pool) such as, cost, whether they have been taught to swim, and weather conditions/time of year.

Another commonly cited activity was resistance training. One barrier to participation in resistance training is the misconception that participation requires membership to a health club or specialized equipment, which is associated with monetary cost (Costello et al., 2011; Eime et al., 2013b; Boone-Heinonen et al., 2011). However, there are many ways resistance training can be done without a health club (e.g., bodyweight exercises, resistance bands). Adult data seems to show that despite geographic location, top choices for physical activity are relatively consistent, specifically running (all regions), cycling (Africa, Americas, Europe, Southeast Asia, and Western Pacific), walking (Western Pacific, Southeast Asia, Eastern Mediterranean, and Americas) as well as soccer (Americas, Eastern Mediterranean, Europe, Southeast Asia).

4.4. Sport and leisure-time participation among children and adolescents

Unlike adults, there was less consistency across regions for children and adolescents in choice of activity. Among regions where both child and adolescent data were available (Americas, Europe, Western Pacific) there was a tendency for young people from the Americas (Canada, Jamaica, United States, Brazil), to prefer team sports, while those from the Western Pacific (Australia, China, Hong Kong, Japan, New Zealand, Philippines) were more likely to participate in lifelong physical activities. No clear patterns emerged among European children and adolescents. Financial barriers and/or widespread availability of sporting infrastructure may explain the patterns in physical activity participation (Holt et al., 2011). A stark contrast is apparent in rates of participation for the Americas compared to Europe and Africa (Uganda, South Africa, Kenya). Only one activity in Europe (soccer) and Africa (athletics) had participation rates above 10%. Conversely, the lowest percentage for any activity in the top ten in the Americas was 10.2% (snow sports), whereas in Africa, the lowest was 0.2% (dance). Limited data could be another reason why Africa shows extremely low rates (9.8% or lower for adolescent data) of participation for any activity.

Swimming was a top two activity (10.3% to 33.9% participation rates) for all child data regions and was also a top five activity in all five adolescent regions. Learning to swim is important for water safety (Sanders, 2007). Water safety is a high priority in many countries, as drowning is a serious issue. Drowning for individuals between the ages of one and 14 years is the second leading cause of death from unintentional injury (World Health Organization, 2014). Thus, parents may consider it important for their children to learn to swim from a young age.

4.5. Implications

Previous studies have focused on how much activity individuals obtain. This review extends the field by describing patterns of participation in specific leisure-time physical activities. Of interest, activity choices

were associated with the percentage of individuals meeting physical activity guidelines. For example, adults in the Americas (43.3%) and the Eastern Mediterranean (43.2%), which had the highest rates of physical inactivity according to Hallal et al. (2012), were the only two adult regions to have two team sports reported in the top five. It's unlikely that an adult will meet physical activity recommendations through sport participation alone. Team sports, often played at a scheduled time, are difficult to fit into one's daily schedule and rotating in and out of games may limit time spent being active. Due to sport demand, different levels of aerobic activity are performed (e.g., soccer versus volleyball or baseball). However, across all adult regions, where activities such as walking, running, cycling, swimming and resistance training were commonly in the top five, 31.1% of individuals didn't meet guidelines.

Other factors also contribute to meeting or not meeting guidelines (e.g., motivation, social support, access). However, understanding the relationship between activity choice and meeting guidelines may indicate that one type of activity alone may not be sufficient for physical activity. Rather, physical activity experiences should encompass a broad range of skills and activities (i.e., team sports, lifelong activities, gymnastics, fundamental movement skills) to be taught to prepare individuals for a lifetime of activity (Fairclough et al., 2002; Hills et al., 2015). For children and adolescents, schools, through physical education, are a key institution to learn and practice movement and physical activity behavioral skills through participating in games and activities (Fairclough et al., 2002; Green, 2002; Kirk, 2005). In many countries around the globe, however, much of the curriculum focuses on developing skills in team sports rather than those needed for individual/small group activities, such as running, swimming, or cycling (Coulter and Ní Chróinín, 2013; Harvey and O'Donovan, 2013). Overemphasis on team sports may cause unintended side effects for individuals, including discouragement and disengagement for the least skilled individuals (Vandorpe et al., 2012). Thus, our findings provide a strong rationale for promoting participation in lifelong physical activities in schools and ensuring that young people achieve mastery in a wide range of movement skills (e.g., resistance training skills, yoga and Pilates).

This review highlights the need for more surveillance work to improve understanding of participation in specific physical activities. Child data are lacking with only three regions represented. This may be due to lack of surveillance and/or peer-reviewed research on the topic, but should be a priority in future studies. By better understanding child sport and leisure-time participation data we may be able to draw more definitive conclusions on the relationship between types of activities and physical activity levels. Further, this may help to explain geographic and/or country differences in physical inactivity and obesity levels. In both adolescent and adult populations, data is needed in South America, Africa, the Eastern Mediterranean, and Southeast Asia.

4.6. Strengths and limitations

Strengths of this review include that it was conducted and reported in accordance with the PRISMA statement (Liberati et al., 2009), included both peer reviewed and governmental papers, and reported leisure-time physical activity for multiple age groups. While the primary aim of each included article may not have been to report the prevalence of participation in specific leisure-time physical activities, the data were available and extracted as long as the article satisfied all inclusion criteria. This review didn't include studies that reported activities as means of transportation (e.g., cycling, running or walking). In particular, whether walking was performed for transport or as a leisure activity can be difficult to determine. Further, there remain substantial gaps in surveillance, especially from Africa, Southeast Asia, and the Eastern Mediterranean. Sometimes the lack of available data meant that only one or two countries was used to generalize findings to an entire region (e.g. Eastern Mediterranean, Southeast Asia). Additionally, this review is limited by the quality of self-report methods utilized and the extensiveness of activities provided in each study. Methodologies differed between studies

in classifying participation and frequency of participation, which weren't accounted for.

5. Conclusions

This is the first review and meta-analysis that has synthesized on a global scale specific sport and leisure-time physical activities. It is important to note that this review is a first step in understanding global participation rates, with room for improvement in strengthening the methodologies used to collect this data. Nevertheless, for a global review, it is important to include data as it currently stands, especially from developing countries with less opportunity to be able to conduct rigorous research. Results should be interpreted with caution, as some studies have a high risk of bias and may not necessarily be representative of the population for a given region. Data from 64 studies, constituting 47 different countries was found. Results show that among individuals of all ages walking, running, and soccer are some of the most commonly performed activities regardless of geographic region. From a public health perspective, popular activities, such as walking, running, and swimming may be beneficial to promote from a young age as these activities are easier to access and have lower associated costs than traditional team sports.

Contributors

Author RMH was responsible for conception and design of the work, data acquisition and analysis, interpretation of results, drafting the manuscript, and final approval of manuscript. Authors JJS, PJM, LMB, PCH, and DRL were responsible for the conception and design of the work, interpretation of results, critical revisions of the manuscript and final approval. Author KC was responsible for data analysis, interpretation of results, critical revisions, and final approval. All authors agree to be held accountable for all work as it relates to accuracy and integrity.

Competing interests

None.

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Appendix A. Supplementary data

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