WHO methods for estimates of physical activity in adolescents aged 11-17 years and over 2010-2025

Background document

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CONTENTS

1. Introduction

The World Health Organization (WHO) is currently updating country, regional and global estimates of physical activity in adolescents aged 11-17 years.

WHO's recommendation on adolescent physical activity changed in 2020 (1). Prior to 2020, the recommendation was for adolescents to undertake at least 60 minutes of moderate-to-vigorous physical activity (MVPA) on *every* day of the week. The 2020 update stated that adolescents should undertake *an average* of 60 minutes of MVPA per day (1). Globally, most survey data on adolescent physical activity ask adolescents to report the number of days in the past week that they undertook at least 60 minutes of MVPA. WHO has previously used these data to estimate trends in the percentage of adolescents not meeting the previous guideline, *i.e.*, reporting fewer than 7 days of 60 minutes of MVPA per week (2). The available surveillance data cannot be used to directly assess whether adolescents meet the new recommendation of *an average* of 60 minutes per day. However, these data can be used to describe the distribution of activity across days and to assess trends over time. In its current update, WHO has estimated trends in the number of days (0 to 7) of at least 60 minutes of MVPA per week, by country. These estimates will serve to provide an update on adolescent activity levels and trends until surveillance data that can monitor whether adolescents meet WHO's current guidelines are widely collected. These new estimates will be published in WHO information products, such as the WHO NCD Portal (ncdportal.org).

WHO has estimated trends between 2010 and 2025 of the distribution of the number of days per week on which adolescents aged 11-17 report doing at least 60 minutes of MVPA in 195 countries and territories. The analysis included two steps:

1) Identifying data sources; accessing and extracting data; and systematically assessing data against inclusion criteria;
2) Applying a statistical model to estimate the distribution of the number of days per week of at least 60 minutes of MVPA and its uncertainty by sex, age, country, and year for adolescents aged 11-17 years.

In this analysis, levels of physical activity are based on self-report data assessing physical activity undertaken at school, for leisure, or for transportation. Estimates were made for all countries, including those for which no data were included.

2. Data identification, access and inclusion

Our data search and access strategy was designed to obtain as many sources as possible while ensuring that the sources were representative of the population at the national level or at least covered three areas within

the country. We accessed data in two forms: 1) anonymised individual-level self-report data when available, and 2) summary statistics, namely percentage of adolescents by days of activity reported, age in years, and sex.

2.1 Data inclusion criteria

All data sources were population-based surveys of adolescents. We included data sources if:

- A question on the number of days per week of at least 60 minutes of MVPA was asked. Acceptable response options include: 0 days, 1 day, . . ., 7 days; or tick boxes for Monday through Sunday (see example in Box). Recall periods of past 7 days or typical/usual week were included;

Box. Example of single-item question used in the Global school-based student health survey (GSHS).

Physical activity is any activity that increases your heart rate and makes you breathe hard. Physical activity can be done in sports, playing with friends, walking to school, or in physical education class. Some examples of physical activity are running, biking, dancing, and football.

1. During the past 7 days, on how many days were you physically active for a total of at least 60 minutes <u>per day</u>? ADD UP ALL THE TIME YOU SPENT IN ANY KIND OF PHYSICAL ACTIVITY EACH DAY.

   A. 0 days
   B. 1 day
   C. 2 days
   D. 3 days
   E. 4 days
   F. 5 days
   G. 6 days
   H. 7 days

- Total MVPA must include activity at school, active travel, and active leisure/play. These domains may be explicit or implicit in the question preamble or examples given (see example in Box);
- Data were collected from the general or school-going adolescent populations through probabilistic sampling using a defined sampling frame, and are representative of a national or defined subnational population covering at least three regions within a country;[1]
- data were collected from the general population aged 11-17 years, or at least 3 years of this age group (e.g., 13-15-year-olds);
- statistics by single day of reported activity (0 days, 1 day . . . 7 days), by single year of age and by sex were reported or could be calculated from individual record data;
- data were collected in or after 2008;

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[1] Data sources covering one or two areas that includes at least 75% of the country's population or a UK home nation (e.g., Scotland) were also included.

- data were from a WHO member state or one of three included territories; and
- total survey sample size was at least n=100.

We excluded data sources with the following characteristics:
- the average daily minutes of MVPA were collected (this includes questionnaires designed for adults such as IPAQ or GPAQ or domain-specific questions that must be aggregated to obtain total MVPA),
- activity was measured using a device such as an accelerometer, or
- data sources that excluded migrants when collected in countries where migrants comprised more than 40% of the youth population (Kuwait, Qatar, United Arab Emirates).

Our last data update was in November, 2025.

2.2 Data identification

We used several strategies to identify data for inclusion, including:
- data from previous WHO estimates (2);
- data from the Global school-based student health surveys (GSHS);
- data from the Health Behaviour in School-Aged Children (HBSC) study;
- surveys provided in the 2023 WHO Country Capacity Survey (3) in response to a query about the latest nationally representative source of adolescent physical activity data;
- surveys cited in the Active Healthy Kids Report Cards (4);
- surveys identified by a targeted online Google search using each country name, terms for physical activity and national survey (translated as appropriate) checking the first page of hits; and
- other data shared with WHO, including during previous consultations with countries.

We aim to include data sources shared by countries during the present country consultation, provided they meet the inclusion criteria listed in section 2.1.

2.3 Data access and processing

Once a survey was identified for inclusion, we obtained individual-level data or summary statistics. For each data source accessed as individual-level data, we computed the percentage of students reporting 0-7 days of at least 60 minutes of MVPA, by number of days reported, single year of age and sex, applying sample weights if available. School-based surveys may include adolescents outside of the intended age range because sampling occurs at the class level, and classes include adolescents of different ages. We included data reported by students within the intended age range. In addition, we included data on younger or older students if the number of students included was at least 50% the average sample size of the ages included by design. We applied two additional quality criteria to data accessed at the individual-level: we excluded

the data if age or sex were missing for more than 20% of observations, and if physical activity data were missing for more than 20% of observations. Finally, we combined data accessed as summary statistics and data accessed at the individual level into a single database.

3. Bayesian hierarchical ordinal regression

Our aim was to estimate the distribution of the number of days per week on which adolescents report doing at least 60 minutes of MVPA for every country, year (2010-2025), and single year of age (11-17 years), and for males and females. All analyses were done separately for males and females.

We used Bayesian hierarchical ordinal regressions, which use all available data to make estimates for each country-year-age-day unit. The ordinal regression, implemented as a cumulative logit (ordered logistic) model (in brms notation, we used the cumulative family with flexible thresholds (5)), estimates the distribution of days adolescents report doing at least 60 minutes of activity; the overall shape of the distribution is fitted separately for each analysis region. In addition, the percentage of adolescents reporting 0 or 7 days is fitted separately using country random-effects, allowing for country-specific inflation/deflation of these key indicators. The mean number of days per week (the predictor in the ordinal regression) was specified as a function of country, region, age, and year. Country estimates were nested hierarchically within analysis regions, meaning that estimates for each country were informed by data from that country, if available, and by data from other countries, especially those in the same region with data in similar time periods. The hierarchical model shares information to a greater degree where data are nonexistent or weakly informative (i.e., have large uncertainty), and a lesser degree in data-rich countries and regions. Trends over time were also modelled hierarchically for each country, nested within its analysis region. Age patterns were modelled as a linear function that varied by region. In addition, we included global age and year trends. The model included a variance term that accounted for unobserved design factors (sample design, season, etc.) that lead to additional variability in the data beyond that expected due to sample size. We fit the models (one for males and one for females) using custom stan code (6) based on the brms package in R (5).

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