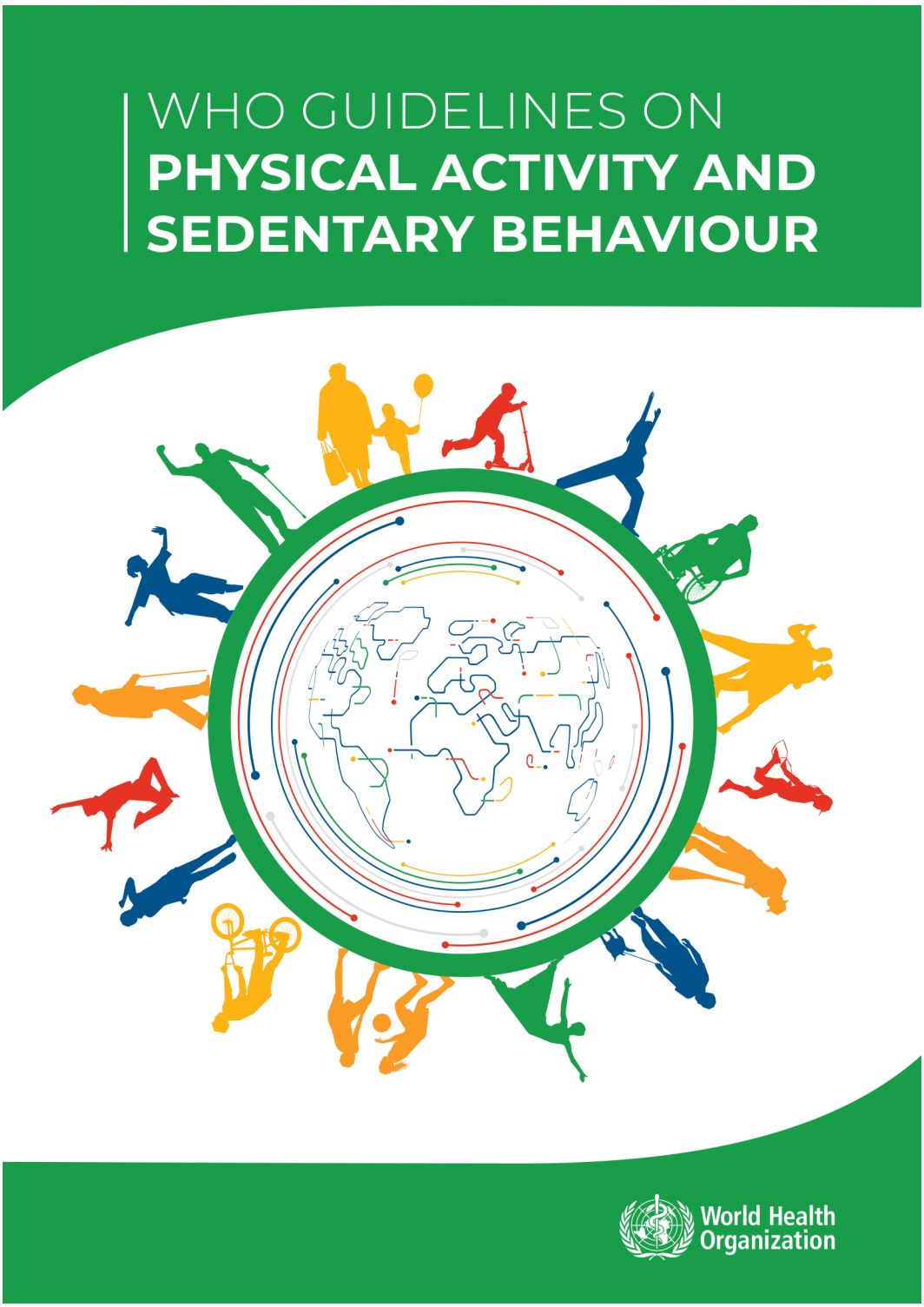
WHO 2020 Guidelines on Physical Activity and Sedentary Behaviour

Comprehensive Physical Activity Study Guide



WHO 2020 Physical Activity Guidelines

CardioDetect Clinical Advisor Module

December 2024

Quick Reference Cheat Sheet

CLINICAL DECISION SUPPORT: Physical activity targets across the lifespan.

1. Weekly Activity Targets

Population	Aerobic Target	Strength Target
Children (5-17)	60 min/day (Mod-Vigorous)	3 days/week
Adults (18-64)	150-300 min (Mod) OR 75-150 min (Vig)	2 days/week
Older Adults (65+)	Same as Adults + Balance Training	2 days/week (+ Balance 3d/wk)
Chronic Conditions	As tolerated (avoid inactivity)	2 days/week

Executive Summary

The WHO 2020 Guidelines provide evidence-based recommendations on physical activity for health benefits.

WHO GUIDELINES ON **PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOUR**

World Health Organization

WHO guidelines on physical activity and sedentary behaviour

ISBN 978-92-4-001512-8 (electronic version)
ISBN 978-92-4-001513-5 (print edition)

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Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps.who.int/iris.

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Design: Eddy Hill Design

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ACKNOWLEDGEMENTS

The World Health Organization (WHO) gratefully acknowledges the contribution to and support of the following individuals and organizations in the development of these guidelines:

Fiona Bull and Juana Willumsen led the process of developing these guidelines. Valentina Baltag, Maurice Bucagu, Alex Butchart, Neerja Chowdhary, Regina Guthold, Riitta-Maija Hämäläinen, Andre Ilbawi, Wasiq Khan, Lindsay Lee, Alana Officer, Leanne Riley and Gojka Roglic were members of the WHO Steering Group that managed the guideline development process.

The members of the Guideline Development Group (GDG) included Salih Saad Al-Ansari, Stuart Biddle, Katja Borodulin, Matthew Buman, Greet Cardon (co-chair), Catherine Carty, Jean-Philippe Chaput, Sebastien Chastin, Paddy Dempsey, Loretta DiPietro, Ulf Ekelund, Joseph Firth, Christine Friedenreich, Leandro Garcia, Muthoni Gichu, Russ Jago, Peter Katzmarzyk, Estelle V. Lambert, Michael Leitzmann, Karen Milton, Francisco B. Ortega, Chathuranga Ranasinghe, Emmanuel Stamatakis (co-chair), Anne Tiedemann, Richard Troiano, Hidde van der Ploeg, Vicky Wari. Roger Chou served as GRADE methodologist. The external review group included Kingsley Akinroye, Huda Alsiyabi, Alberto Flórez-Pregonero, Shigeru Inoue, Agus Mahendra, Deborah Salvo and Jasper Schipperijn.

Systematic reviews of evidence prepared for *2018 US Physical Activity Guidelines Advisory Committee Scientific Report to the Secretary of Health and Human Services* were updated thanks to additional literature searches conducted by Kyle Sprow (National Cancer Institutes, National Institutes of Health, Maryland, USA). Additional support to review papers identified was provided by Elif Eroglu (University of Sydney), Andrea Hillreiner (University of Regensburg), Bo-Huei Huang (University of Sydney), Carmen Jochem (University of Regensburg), Jairo H. Migueles (University of Granada), Chelsea Stone (University of Calgary) and Léonie Uijtdewilligen (Amsterdam UMC).

Summaries of evidence and GRADE tables were prepared by Carrie Patnode and Michelle Henninger (The Kaiser Foundation Hospitals, Center for Health Research, Portland, Oregon, USA).

Additional reviews of evidence were conducted by N Fairhall, J Oliveira, M Pinheiro, and C Sherrington (Institute for Musculoskeletal Health, School of Public Health, The University of Sydney, Sydney, Australia) and A Bauman (Prevention Research Collaboration, School of Public Health, The University of Sydney, Sydney, Australia; and WHO Collaborating Centre for Physical Activity, Nutrition and Obesity); S Mabweazara, M-J Laguette, K Larmuth, F Odunitan-Wayas (Research Centre for Health through Physical Activity, Lifestyle and Sports Medicine, Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa), L Leach, S Onagbiye (Department of Sport, Recreation and Exercise Science, Faculty of Health Sciences, University of the Western Cape, Cape Town, South Africa), M Mthethwa (Chronic Disease Initiative for Africa, University of Cape Town, Cape Town, South Africa), P Smith (The Desmond Tutu HIV Centre, Institute for Infectious Disease and Molecular Medicine, Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa) and F Mashili (Department of Physiology, Muhimbili University of Allied Sciences, Dar Es Salaam, United Republic of Tanzania); B Cillekens, M Lang, W van Mechelen, E Verhagen, M Huysmans, A van der Beek, P Coenen (Department of Public and Occupational Health at Amsterdam University Medical Centre, Amsterdam, Netherlands).

The Public Health Agency of Canada and the Government of Norway provided financial support, without which this work could not have been completed.

ABBREVIATIONS AND ACRONYMS

ADHD	attention deficit hyperactive disorder
AOR	adjusted odds ratio
BMI	body mass index
CI	confidence interval
CVD	cardiovascular disease
DBP	diastolic blood pressure
EtD	Evidence to Decisions
GDG	Guideline Development Group
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HR	hazards ratio
MET	Metabolic Equivalent of Task
MD	mean difference
MICT	moderate intensity continuous training
NCD	noncommunicable disease
OR	odds ratio
PA	physical activity
PAGAC	United States Physical Activity Guidelines Advisory Committee
PI/ECO	Population, Intervention/Exposure, Comparison, Outcome
RaR	Relative attributable risk
RCT	randomized control trial
RR	relative risk
SBP	systolic blood pressure
SMD	standardized mean difference
SPPB	short physical performance battery
TV	television
WHA	World Health Assembly
WHO	World Health Organization

GLOSSARY OF TERMS

Term	Definition
Aerobic physical activity	Activity in which the body's large muscles move in a rhythmic manner for a sustained period of time. Aerobic activity – also called endurance activity – improves cardiorespiratory fitness. Examples include walking, running, swimming, and bicycling.
Anaerobic physical activity	Anaerobic physical activity consists of brief intense bursts of exercise, such as weightlifting and sprints, where oxygen demand surpasses oxygen supply.
Balance training	Static and dynamic exercises that are designed to improve an individual's ability to withstand challenges from postural sway or destabilizing stimuli caused by self-motion, the environment, or other objects.
Body mass index (BMI)	Weight (kg) / height $(m)^2$
BMI-for-age or BMI z-score	BMI adjusted for age, standardized for children. BMI standard deviation scores are measures of relative weight adjusted for child age and sex. Given a child's age, sex, BMI, and an appropriate reference standard, a BMI z-score (or its equivalent BMI-for-age percentile) can be determined.
Bone-strengthening activity	Physical activity primarily designed to increase the strength of specific sites in bones that make up the skeletal system. Bone-strengthening activities produce an impact or tension force on the bones that promotes bone growth and strength. Running, jumping rope, and lifting weights are examples of bone-strengthening activities.
Cardiometabolic health	The interplay of blood pressure, blood lipids, blood glucose and insulin on health.
Cardiorespiratory fitness (endurance)	A health-related component of physical fitness. The ability of the circulatory and respiratory systems to supply oxygen during sustained physical activity. Usually expressed as measured or estimated maximal oxygen uptake (VO_2 max).
Cognitive function	Cerebral activities, i.e. reasoning, memory, attention, and language that lead to the attainment of information and knowledge. This can also include learning.
Disability	From the International Classification of Functioning, Disability and Health, an umbrella term for impairments, activity limitations, and participation restrictions, denoting the negative aspects of the interaction between an individual (with a health condition) and that individual's contextual factors (environmental and personal factors).
Domains of physical activity	Physical activity levels can be assessed in various domains, including one of more of the following: leisure-time, occupation, education, household and/or transportation.
Exercise	A subcategory of physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective. "Exercise" and "exercise training" frequently are used interchangeably and generally refer to physical activity performed during leisure time with the primary purpose of improving or maintaining physical fitness, physical performance, or health.
Executive function	Includes constructs such as: working memory, cognitive flexibility (also called flexible thinking) and inhibitory control (which includes self-control).
Fitness	A measure of the body's ability to function efficiently and effectively in work and leisure activities, and includes, for example, physical fitness and cardiorespiratory fitness.
Flexibility	A health- and performance-related component of physical fitness that is the range of motion possible at a joint. Flexibility is specific to each joint and depends on a number of specific variables including, but not limited to, the tightness of specific ligaments and tendons. Flexibility exercises enhance the ability of a joint to move through its full range of motion.
Functional exercises	Exercises that can be embedded into everyday tasks to improve lower-body strength, balance, and motor performance. Examples include tandem and one-leg stands, squatting, chair stands, toe raises, and stepping over obstacles.
Household domain physical activity	Physical activity undertaken in the home for domestic duties (such as cleaning, caring for children, gardening etc.).
Leisure-domain physical activity	Physical activity performed by an individual that is not required as an essential activity of daily living and is performed at the discretion of the individual. Such activities include sports participation, exercise conditioning or training, and recreational activities such as going for a walk, dancing, and gardening.

Term	Definition
Light-intensity physical activity	Light-intensity physical activity is between 1.5 and 3 METs, i.e. activities with energy cost less than 3 times the energy expenditure at rest for that person. This can include slow walking, bathing, or other incidental activities that do not result in a substantial increase in heart rate or breathing rate.
Major muscle groups	Major muscle groups include the legs, back, abdomen, chest, shoulders and arms.
Metabolic equivalent of task (MET)	The metabolic equivalent of task, or simply metabolic equivalent, is a physiological measure expressing the intensity of physical activities. One MET is the energy equivalent expended by an individual while seated at rest.
Moderate-intensity physical activity	On an absolute scale, moderate-intensity refers to the physical activity that is performed between 3 and less than 6 times the intensity of rest. On a scale relative to an individual's personal capacity, moderate-intensity physical activity is usually a 5 or 6 on a scale of 0–10.
Muscle-strengthening activity	Physical activity and exercise that increase skeletal muscle strength, power, endurance, and mass (e.g. strength training, resistance training, or muscular strength and endurance exercises).
Multicomponent physical activity	For older adults, multicomponent physical activity is important to improve physical function and decrease the risk of falls or injury from a fall. These activities can be done at home or in a structured group setting. Many studied interventions combine all types of exercise (aerobic, muscle strengthening, and balance training) into a session, and this has been shown to be effective. An example of a multicomponent physical activity programme could include walking (aerobic activity), lifting weights (muscle strengthening), and incorporates balance training. Examples of balance training can include walking backwards or sideways or standing on one foot while doing an upper body muscle-strengthening activity, such as bicep curls. Dancing also combines aerobic and balance components.
Occupation domain physical activity	See work domain physical activity.
Physical activity	Any bodily movement produced by skeletal muscles that requires energy expenditure.
Physical inactivity	An insufficient physical activity level to meet present physical activity recommendations.
Psychosocial health	Include mental, emotional and social dimensions of health.
Recreational screen time	Time spent watching screens (television (TV), computer, mobile devices) for purposes other than those related to education/study or work.
Sedentary screen time	Time spent watching screen-based entertainment (TV, computer, mobile devices). Does not include active screen-based games where physical activity or movement is required.
Sedentary behaviour	Any waking behaviour characterized by an energy expenditure of 1.5 METS or lower while sitting, reclining, or lying. Most desk-based office work, driving a car, and watching television are examples of sedentary behaviours; these can also apply to those unable to stand, such as wheelchair users. The guidelines operationalize the definition of sedentary behaviour to include self-reported low movement sitting (leisure time, occupational, and total), television (TV viewing or screen time, and low levels of movement measured by devices that assess movement or posture).
Sport	Sport covers a range of activities performed within a set of rules and undertaken as part of leisure or competition. Sporting activities involve physical activity carried out by teams or individuals and may be supported by an institutional framework, such as a sporting agency.
Transport domain physical activity	Physical activity performed for the purpose of getting to and from places, and refers to walking, cycling and wheeling (the use of non-motorized means of locomotion with wheels, such as scooters, rollerblades, manual wheelchair etc.).
Vigorous-intensity physical activity	On an absolute scale, vigorous-intensity refers to physical activity that is performed at 6.0 or more METS. On a scale relative to an individual's personal capacity, vigorous-intensity physical activity is usually a 7 or 8 on a scale of 0–10.
Work domain physical activity	Physical activity undertaken during paid or voluntary work.

EXECUTIVE SUMMARY

The *WHO Guidelines on physical activity and sedentary behaviour* provide evidence-based public health recommendations for children, adolescents, adults and older adults on the amount of physical activity (frequency, intensity and duration) required to offer significant health benefits and mitigate health risks. For the first time, recommendations are provided on the associations between sedentary behaviour and health outcomes, as well as for subpopulations, such as pregnant and postpartum women, and people living with chronic conditions or disability.

The guidelines are intended for policy-makers in high-, middle-, and low-income countries in ministries of health, education, youth, sport and/or social or family welfare; government officials responsible for developing national, sub regional or municipal plans to increase physical activity and reduce sedentary behaviour in population groups through guidance documents; people working in nongovernmental organizations, the education sector, private sector, research; and health-care providers.

The guidelines were prepared in accordance with the *WHO handbook for guideline development*. Systematic reviews of evidence were conducted for the critical and important outcomes, and recommendations were developed after consideration of the benefits and harms, values, preferences, feasibility and acceptability, and the implications for equity and resources.

The final public health recommendations presented are for all populations and age groups ranging from 5 years to 65 years and older, irrespective of gender, cultural background or socioeconomic status, and are relevant for people of all abilities. Those with chronic medical conditions and/or disability and pregnant and postpartum women should try to meet the recommendations where possible and as able.

The development of these guidelines provide a set of evidence-based recommendations that governments can adopt as part of their national policy frameworks to support comprehensive approaches to increasing population levels of physical activity. Within the adoption process, consideration should be given to the need to contextualize the guidelines. Practical tools to support adoption, dissemination, communication campaigns and implementation of the guidelines will support governments and stakeholders work together to increase physical activity and reduce sedentary behaviours across the life course. These supporting resources will be available through the WHO website following publication of the guidelines

Despite the large quantity of supporting data relating physical activity and, increasingly, sedentary behaviours to health outcomes across the life-span, important evidence gaps remain. In particular, there is less evidence from low- and middle-income countries and economically disadvantaged or underserved communities, and a dearth of evidence from subpopulations including people living with disabilities. Investment in more research is needed to build evidence particularly in these areas. In addition, the changes introduced to these recommendations will have some implications for surveillance systems and assessment instruments currently used to monitor national levels of physical activity. Existing global and national instruments should be reviewed, and reporting protocols updated, to inform future reporting against the new guidelines.

The *Global action plan on physical activity 2018–2030* set a target to reduce physical inactivity by 15% by 2030, and outlined 20 recommended policy actions and interventions. These guidelines support all countries to implement the GAPPA recommendations and "ACTIVE", the technical package of toolkits that provides guidance on how to promote physical activity across the life course and through multiple settings.

CHILDREN AND ADOLESCENTS
(aged 5–17 years)

In children and adolescents, physical activity confers benefits for the following health outcomes: improved physical fitness (cardiorespiratory and muscular fitness), cardiometabolic health (blood pressure, dyslipidaemia, glucose, and insulin resistance), bone health, cognitive outcomes (academic performance, executive function), mental health (reduced symptoms of depression); and reduced adiposity.

At least 60 minutes a day

moderate- to vigorous-intensity physical activity across the week; most of this physical activity should be aerobic.

It is recommended that:

> **Children and adolescents should do at least an average of 60 minutes per day of moderate- to vigorous-intensity, mostly aerobic, physical activity, across the week.**

Strong recommendation, moderate certainty evidence

On at least 3 days a week

vigorous-intensity aerobic activities, as well as those that **strengthen muscle and bone** should be incorporated.

> **Vigorous-intensity aerobic activities, as well as those that strengthen muscle and bone, should be incorporated at least 3 days a week.**

Strong recommendation, moderate certainty evidence

GOOD PRACTICE STATEMENTS

- Doing some physical activity is better than doing none.
- If children and adolescents are not meeting the recommendations, doing some physical activity will benefit their health.
- Children and adolescents should start by doing small amounts of physical activity, and gradually increase the frequency, intensity and duration over time.
- It is important to provide all children and adolescents with safe and equitable opportunities, and encouragement, to participate in physical activities that are enjoyable, offer variety, and are appropriate for their age and ability.

In children and adolescents, higher amounts of sedentary behaviour are associated with the following poor health outcomes: increased adiposity; poorer cardiometabolic health, fitness, behavioural conduct/pro-social behaviour; and reduced sleep duration.

It is recommended that:

> **Children and adolescents should limit the amount of time spent being sedentary, particularly the amount of recreational screen time.**

Strong recommendation, low certainty evidence

LIMIT

the amount of time spent being sedentary, particularly recreational screen time.

ADULTS
(aged 18–64 years)

In adults, physical activity confers benefits for the following health outcomes: improved all-cause mortality, cardiovascular disease mortality, incident hypertension, incident site-specific cancers,[1] incident type-2 diabetes, mental health (reduced symptoms of anxiety and depression); cognitive health, and sleep; measures of adiposity may also improve.

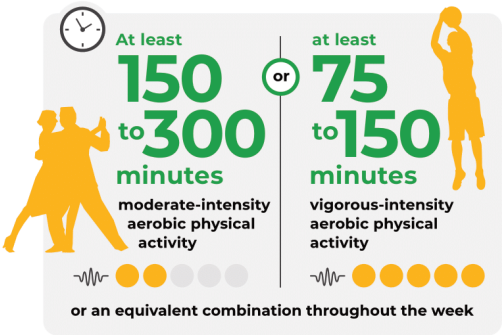
It is recommended that:

› **All adults should undertake regular physical activity.**

Strong recommendation, moderate certainty evidence

› **Adults should do at least 150–300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week, for substantial health benefits.**

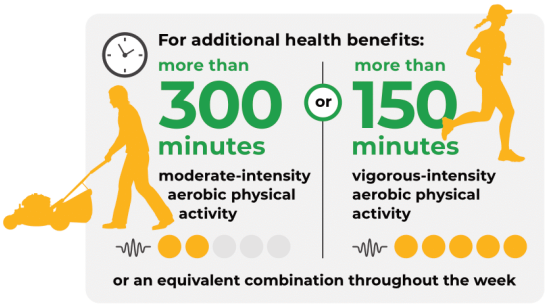
Strong recommendation, moderate certainty evidence



› **Adults should also do muscle-strengthening activities at moderate or greater intensity that involve all major muscle groups on 2 or more days a week, as these provide additional health benefits.**

Strong recommendation, moderate certainty evidence

[1] *Site-specific cancers of: bladder, breast, colon, endometrial, oesophageal adenocarcinoma, gastric, and renal.*



› **Adults may increase moderate-intensity aerobic physical activity to more than 300 minutes; or do more than 150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week for additional health benefits.**

Conditional recommendation, moderate certainty evidence

GOOD PRACTICE STATEMENTS

- Doing some physical activity is better than doing none.
- If adults are not meeting these recommendations, doing some physical activity will benefit their health.
- Adults should start by doing small amounts of physical activity, and gradually increase the frequency, intensity and duration over time.

In adults, higher amounts of sedentary behaviour are associated with the following poor health outcomes: all-cause mortality, cardiovascular disease mortality and cancer mortality and incidence of cardiovascular disease, cancer and type-2 diabetes.

It is recommended that:

› **Adults should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.**

Strong recommendation, moderate certainty evidence

› **To help reduce the detrimental effects of high levels of sedentary behaviour on health, adults should aim to do more than the recommended levels of moderate- to vigorous-intensity physical activity.**

Strong recommendation, moderate certainty evidence

OLDER ADULTS
(aged 65 years and older)

In older adults, physical activity confers benefits for the following health outcomes: improved all-cause mortality, cardiovascular disease mortality, incident hypertension, incident site-specific cancers, incident type-2 diabetes, mental health (reduced symptoms of anxiety and depression), cognitive health, and sleep; measures of adiposity may also improve. In older adults, physical activity helps prevent falls and falls-related injuries and declines in bone health and functional ability.

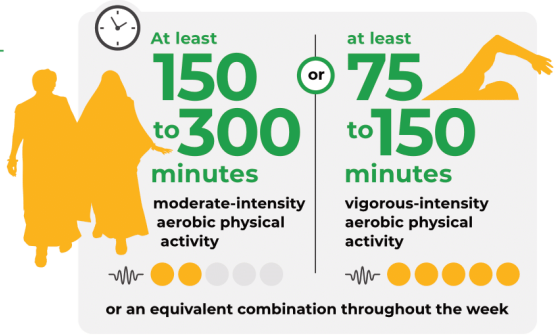
It is recommended that:

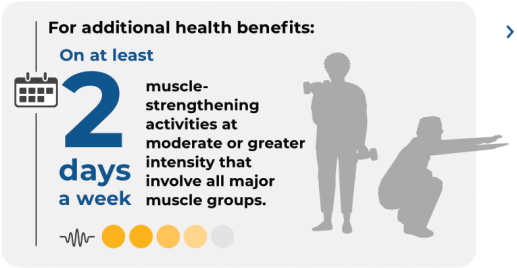
› **All older adults should undertake regular physical activity.**

Strong recommendation, moderate certainty evidence

› **Older adults should do at least 150–300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week, for substantial health benefits.**

Strong recommendation, moderate certainty evidence



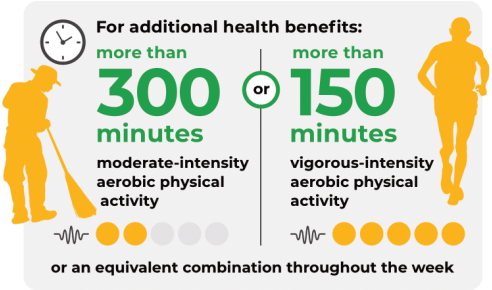


› **Older adults should also do muscle-strengthening activities at moderate or greater intensity that involve all major muscle groups on 2 or more days a week, as these provide additional health benefits.**

Strong recommendation, moderate certainty evidence

› **As part of their weekly physical activity, older adults should do varied multicomponent physical activity that emphasizes functional balance and strength training at moderate or greater intensity, on 3 or more days a week, to enhance functional capacity and to prevent falls.**

Strong recommendation, moderate certainty evidence



› **Older adults may increase moderate-intensity aerobic physical activity to more than 300 minutes; or do more than 150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week, for additional health benefits.**

Conditional recommendation, moderate certainty evidence

GOOD PRACTICE STATEMENTS

- Doing some physical activity is better than doing none.
- If older adults are not meeting the recommendations, doing some physical activity will bring benefits to health.
- Older adults should start by doing small amounts of physical activity, and gradually increase the frequency, intensity and duration over time.
- Older adults should be as physically active as their functional ability allows, and adjust their level of effort for physical activity relative to their level of fitness.

In older adults, higher amounts of sedentary behaviour are associated with the following poor health outcomes: all-cause mortality, cardiovascular disease mortality and cancer mortality, and incidence of cardiovascular disease, cancer and incidence of type-2 diabetes.

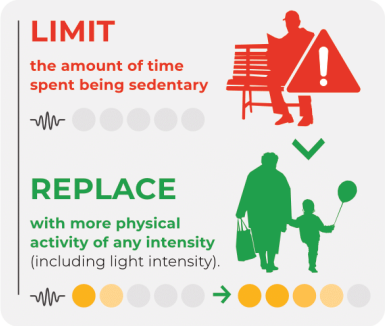
It is recommended that:

› **Older adults should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.**

Strong recommendation, moderate certainty evidence

› **To help reduce the detrimental effects of high levels of sedentary behaviour on health, older adults should aim to do more than the recommended levels of moderate- to vigorous-intensity physical activity.**

Strong recommendation, moderate certainty evidence



PREGNANT AND POSTPARTUM WOMEN

In pregnant and postpartum women, physical activity during pregnancy and postpartum confers benefits on the following maternal and fetal health benefits: decreased risk of pre-eclampsia, gestational hypertension, gestational diabetes, excessive gestational weight gain, delivery complications and postpartum depression, and fewer newborn complications, no adverse effects on birthweight; and no increase in risk of stillbirth.

It is recommended that all pregnant and postpartum women without contraindication should:

› **Undertake regular physical activity throughout pregnancy and postpartum.**

Strong recommendation, moderate certainty evidence

› **Do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week for substantial health benefits.**

Strong recommendation, moderate certainty evidence

› **Incorporate a variety of aerobic and muscle-strengthening activities. Adding gentle stretching may also be beneficial.**

Strong recommendation, moderate certainty evidence

In addition:

› **Women who, before pregnancy, habitually engaged in vigorous-intensity aerobic activity, or who were physically active, can continue these activities during pregnancy and the postpartum period.**

Strong recommendation, moderate certainty evidence

GOOD PRACTICE STATEMENTS

- Doing some physical activity is better than doing none.
- If pregnant and postpartum women are not meeting the recommendations, doing some physical activity will benefit their health.
- Pregnant and postpartum women should start by doing small amounts of physical activity, and gradually increase frequency, intensity and duration over time.
- Pelvic floor muscle training may be performed on a daily basis to reduce the risk of urinary incontinence.

Additional safety considerations for pregnant women when undertaking physical activity are:

- Avoid physical activity during excessive heat, especially with high humidity.
- Stay hydrated by drinking water before, during, and after physical activity.
- Avoid participating in activities which involve physical contact; pose a high risk of falling; or might limit oxygenation (such as activities at high altitude, when not normally living at high altitude).
- Avoid activities in supine position after the first trimester of pregnancy.
- When considering athletic competition, or exercising significantly above the recommended guidelines pregnant women should seek supervision from a specialist health-care provider.
- Pregnant women should be informed by their health-care provider of the danger signs alerting them as to when to stop; or to limit physical activity and consult a qualified health-care provider immediately should they occur.
- Return to physical activity gradually after delivery, and in consultation with a health-care provider, in the case of delivery by Caesarean section.

In pregnant and postpartum women, as in all adults, higher amounts of sedentary behaviour are associated with the following poor health outcomes: all-cause mortality, cardiovascular disease mortality and cancer mortality and incidence of cardiovascular disease, cancer and incidence of type-2 diabetes.

LIMIT

the amount of time spent being sedentary

REPLACE

with physical activity of any intensity
(including light intensity).

It is recommended that:

> **Pregnant and postpartum women should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.**

Strong recommendation, low certainty evidence

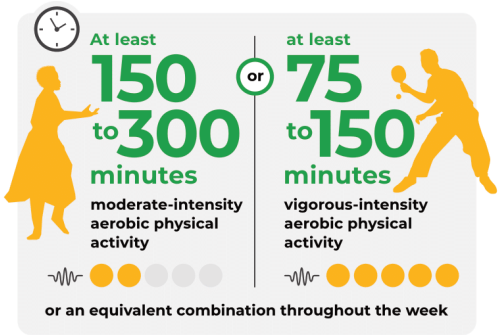
Doing some physical activity is better than doing none.

ADULTS AND OLDER ADULTS WITH CHRONIC CONDITIONS (aged 18 years and older)

Physical activity can confer health benefits for adults and older adults living with the following chronic conditions: **for cancer survivors** – physical activity improves all-cause mortality, cancer-specific mortality, and risk of cancer recurrence or second primary cancer; **for people living with hypertension** – physical activity improves cardiovascular disease mortality, disease progression, physical function, health-related quality of life; **for people living with type-2 diabetes** – physical activity reduces rates of mortality from cardiovascular disease and indicators disease progression; and **for people living with HIV** – physical activity can improve physical fitness and mental health (reduced symptoms of anxiety and depression), and does not adversely affect disease progression (CD4 count and viral load) or body composition.

It is recommended that:

› **All adults and older adults with the above chronic conditions should undertake regular physical activity.** *Strong recommendation, moderate certainty evidence*

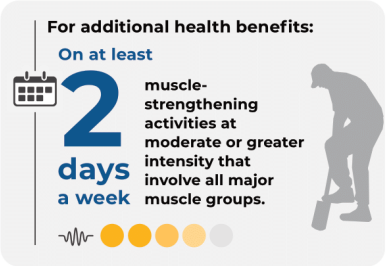


› **Adults and older adults with these chronic conditions should do at least 150–300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week for substantial health benefits.**

Strong recommendation, moderate certainty evidence

› **Adults and older adults with these chronic conditions should also do muscle-strengthening activities at moderate or greater intensity that involve all major muscle groups on 2 or more days a week, as these provide additional benefits.**

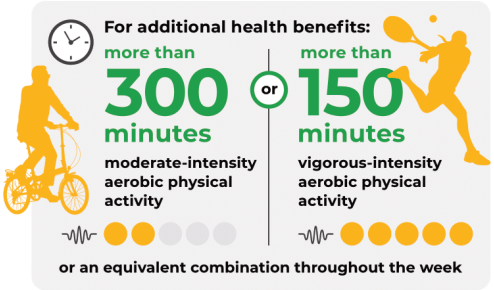
Strong recommendation, moderate certainty evidence



› **As part of their weekly physical activity, older adults with these chronic conditions should do varied multicomponent physical activity that emphasizes functional balance and strength training at moderate or greater intensity on 3 or more days a week, to enhance functional capacity and prevent falls.**

Strong recommendation, moderate certainty evidence

ADULTS AND OLDER ADULTS WITH CHRONIC CONDITIONS
(aged 18 years and older)



› **When not contraindicated, adults and older adults with these chronic conditions may increase moderate-intensity aerobic physical activity to more than 300 minutes; or do more than 150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week for additional health benefits.**

Conditional recommendation, moderate certainty evidence

GOOD PRACTICE STATEMENTS

- When not able to meet the above recommendations, adults with these chronic conditions should aim to engage in physical activity according to their abilities.
- Adults with these chronic conditions should start by doing small amounts of physical activity and gradually increase the frequency, intensity and duration over time.
- Adults with these chronic conditions may wish to consult with a physical activity specialist or health-care professional for advice on the types and amounts of activity appropriate for their individual needs, abilities, functional limitations/complications, medications, and overall treatment plan.
- Pre-exercise medical clearance is generally unnecessary for individuals without contraindications prior to beginning light- or moderate-intensity physical activity not exceeding the demands of brisk walking or everyday living.

In adults, including cancer survivors and people living with hypertension, type-2 diabetes and HIV, higher amounts of sedentary behaviour are associated with the following poor health outcomes: all-cause mortality, cardiovascular disease mortality and cancer mortality, and incidence of cardiovascular disease, cancer and incidence of type-2 diabetes.

For cancer survivors, and adults living with hypertension, type-2 diabetes and HIV, it is recommended that:

› **Adults and older adults with chronic conditions should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.**

Strong recommendation, low certainty evidence

› **To help reduce the detrimental effects of high levels of sedentary behaviour on health, adults and older adults with chronic conditions should aim to do more than the recommended levels of moderate- to vigorous-intensity physical activity.**

Strong recommendation, low certainty evidence

CHILDREN AND ADOLESCENTS (aged 5–17 years) LIVING WITH DISABILITY

Many of the health benefits of physical activity for children and adolescents, as set out in the section above, also relate to those children and adolescents living with disability. Additional benefits of physical activity to health outcomes for those living with disability include: improved cognition in individuals with diseases or disorders that impair cognitive function, including attention-deficit/hyperactivity disorder (ADHD); improvements in physical function may occur in children with intellectual disability.

It is recommended that:

› **Children and adolescents living with disability should do at least an average of 60 minutes per day of moderate- to vigorous-intensity, mostly aerobic, physical activity, across the week.**

Strong recommendation, moderate certainty evidence

› **Vigorous-intensity aerobic activities, as well as those that strengthen muscle and bone should be incorporated at least 3 days a week.**

Strong recommendation, moderate certainty evidence

Doing some physical activity is better than doing none.

GOOD PRACTICE STATEMENTS

- Doing some physical activity is better than doing none.
- If children and adolescents living with disability are not meeting these recommendations, doing some physical activity will bring benefits to health.
- Children and adolescents living with disability should start by doing small amounts of physical activity and gradually increase the frequency, intensity and duration over time.
- There are no major risks for children and adolescents living with disability engaging in physical activity when it is appropriate to an individual's current activity level, health status and physical function; and the health benefits accrued outweigh the risks.
- Children and adolescents living with disability may need to consult a health-care professional or other physical activity and disability specialist to help determine the type and amount of activity appropriate for them.

In children and adolescents, higher amounts of sedentary behaviour are associated with the following poor health outcomes: increased adiposity; poorer cardiometabolic health, fitness, and behavioural conduct/pro-social behaviour; and reduced sleep duration.

It is recommended that:

› **Children and adolescents living with disability should limit the amount of time spent being sedentary, particularly the amount of recreational screen time.**

Strong recommendation, low certainty evidence

LIMIT

the amount of time spent being sedentary, particularly recreational screen time.

Start by doing small amounts of physical activity.

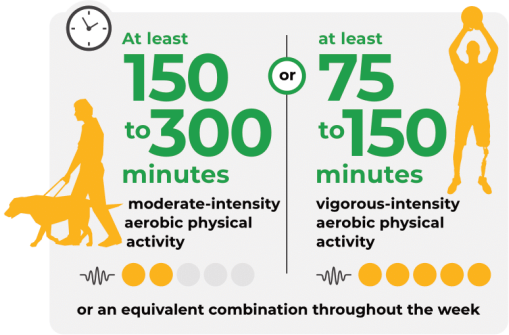
ADULTS (aged 18 years and older) LIVING WITH DISABILITY

Many of the health benefits of physical activity for adults, as set out in the section above, also relate to adults living with disability. Additional benefits of physical activity to health outcomes for those living with disability include the following: **for adults with multiple sclerosis** – improved physical function, and physical, mental, and social domains of health-related quality of life; **for individuals with spinal cord injury** – improved walking function, muscular strength, and upper extremity function; and enhanced health-related quality of life; **for individuals with diseases or disorders that impair cognitive function** – improved physical function and cognition (in individuals with Parkinson's disease and those with a history of stroke); beneficial effects on cognition; and may improve quality of life (in adults with schizophrenia); and may improve physical function (in adults with intellectual disability); and improves quality of life (in adults with major clinical depression).

It is recommended that:

› **All adults living with disability should undertake regular physical activity.**

Strong recommendation, moderate certainty evidence



› **Adults living with disability should do at least 150–300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week for substantial health benefits.**

Strong recommendation, moderate certainty evidence

› **Adults living with disability should also do muscle-strengthening activities at moderate or greater intensity that involve all major muscle groups on 2 or more days a week, as these provide additional health benefits.**

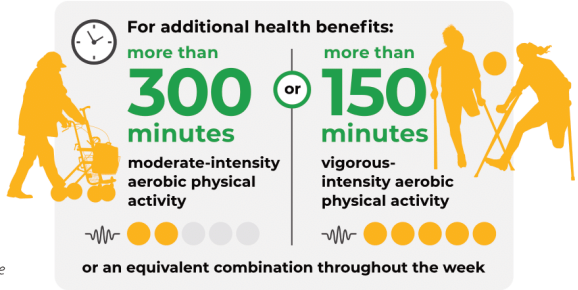
Strong recommendation, moderate certainty evidence

› As part of their weekly physical activity, older adults living with disability should do varied multicomponent physical activity that emphasizes functional balance and strength training at moderate or greater intensity on 3 or more days a week, to enhance functional capacity and prevent falls.

Strong recommendation, moderate certainty evidence

› Adults living with disability may increase moderate-intensity aerobic physical activity to more than 300 minutes; or do more than 150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week for additional health benefits.

Conditional recommendation, moderate certainty evidence



GOOD PRACTICE STATEMENTS

- Doing some physical activity is better than doing none.
- If adults living with disability are not meeting these recommendations, doing some physical activity will bring benefits to health.
- Adults living with disability should start by doing small amounts of physical activity, and gradually increase the frequency, intensity and duration over time.
- There are no major risks to adults living with disability engaging in physical activity when it is appropriate to the individual's current activity level, health status and physical function; and when the health benefits accrued outweigh the risks.
- Adults living with disability may need to consult a health-care professional or other physical activity and disability specialist to help determine the type and amount of activity appropriate for them.

In adults, higher amounts of sedentary behaviour are associated with the following poor health outcomes: all-cause mortality, cardiovascular disease mortality and cancer mortality and incidence of cardiovascular disease, cancer and type-2 diabetes.

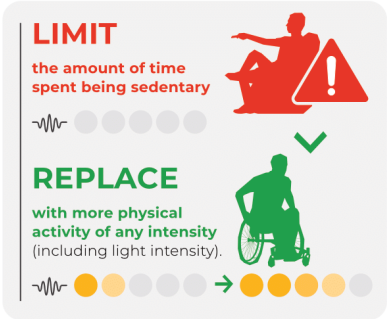
It is recommended that:

› Adults living with disability should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.

Strong recommendation, low certainty evidence

› To help reduce the detrimental effects of high levels of sedentary behaviour on health, adults living with disability should aim to do more than the recommended levels of moderate- to vigorous-intensity physical activity.

Strong recommendation, low certainty evidence



BACKGROUND

Regular physical activity is a known protective factor for the prevention and management of noncommunicable diseases such as cardiovascular disease, type-2 diabetes, breast and colon cancer *(1–3)*. Physical activity also has benefits for mental health *(4)*, delays the onset of dementia *(5)*, and can contribute to the maintenance of healthy weight *(1)* and general well-being *(6)*.

Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure *(1)* and can be performed at a variety of intensities, as part of work, domestic chores, transportation or during leisure time, or when participating in exercise or sports activities. At the low end of the intensity range, sedentary behaviour is defined as any waking behaviour while in a sitting, reclining or lying posture with low energy expenditure *(7)*. Emerging new evidence indicates that high levels of sedentary behaviour are associated with cardiovascular disease and type-2 diabetes as well as cardiovascular, cancer and all-cause mortality *(8–10)*.

Physical inactivity is defined as not meeting the 2010 *Global recommendations on physical activity for health (1)* and is a leading contributor to global mortality. It is estimated that between four and five million deaths per year could be averted if the global population was more active *(2, 11)*. Global estimates of physical inactivity indicate that in 2016, 27.5% of adults *(12)* and 81% of adolescents *(13)* did not meet the 2010 WHO recommendations *(1)*, and trend data show limited global improvement during the past decade. The data also highlight that women are less active than men in most countries and that there are significant differences in levels of physical activity within and between countries and regions. These differences can be explained by inequities in access to opportunities to be physically active, further amplifying inequalities in health.

Currently, there are no global estimates of sedentary behaviour, but technological innovation and the transition towards more sedentary occupations and recreation, and the increasing use of personal motorized transportation are contributing to changing patterns of physical activity and increased sedentary behaviour across the world. The *Global action plan on physical activity 2018–2030 (14)* sets out 4 strategic objectives and 20 policy actions to achieve a 15% relative reduction in the global prevalence of physical inactivity in adults and adolescents by 2030.

In 2010, WHO published the *Global recommendations on physical activity for health (1)*, the first population-based public health guidelines for children and adolescents, adults and older adults. In 2018, the World Health Assembly, in resolution WHA71.6,[1] called for WHO to update the 2010 recommendations.

In 2019, WHO published *Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age (15)*. The guidelines were called for by the Commission on Ending Childhood Obesity (recommendation 4.12) *(16)*, and address the omission of this younger age group in the 2010 *Global recommendations on physical activity for health (1)*.

The 2020 WHO *Guidelines on physical activity and sedentary behaviour*, replace the 2010 guidelines and are based on the most recent advances in the evidence for the selected behaviours and associated health consequences. They will form part of the overall set of global recommendations on physical activity and sedentary behaviour.

[1] *WHA71.6 WHO Global Action Plan on Physical Activity 2018–2030.*

OTHER KEY WHO GUIDELINES

The importance of physical activity for health is recognized in other WHO guidelines. The *WHO Package of essential noncommunicable disease interventions for primary health care in low-resource settings (17)* provides a protocol for the clinical management of hypertension, type-2 diabetes, raised cardiovascular risk, asthma, and chronic obstructive pulmonary disease, and includes counselling to progressively increase physical activity to moderate levels (such as brisk walking) and at least 150 minutes per week, in line with the 2010 global recommendations. Recent WHO guidance in *Risk reduction of cognitive decline and dementia (18)* states that physical activity should be recommended to adults with normal cognition (strong recommendation) and those with mild cognitive impairment (conditional recommendation) to reduce the risk of cognitive decline. WHO *Integrated care for older people: guidelines on community-level interventions to manage declines in intrinsic capacity (19)* recommend multimodal exercises to prevent falls, and exercises for older adults with declining mobility. *WHO recommendations on antenatal care for a positive pregnancy experience (20)* recommend counselling on healthy eating and being physically active during pregnancy to stay healthy and to prevent excessive weight gain, but do not address the wider health benefits of physical activity during pregnancy and the postpartum period.

The existing WHO guidelines, combined with these updated guidelines, provide an increasingly comprehensive set of global guidance on the contribution of physical activity and sedentary behaviours to the prevention and management of key diseases and to the promotion of health and well-being across the life course.

RATIONALE AND PURPOSE

The past 10 years has seen a significant increase in the body of evidence on the health impact of different types, amounts and durations of physical activity, as well as on the impact of sedentary behaviours and its interrelationship with levels of physical activity and health. In addition, the evidence base for physical activity in subpopulations, such as pregnant women and those living with chronic conditions and/or disability now permits the examination of the relationship between physical activity and health outcomes in these groups.

In the *Global action plan on physical activity 2018–2030 (14)*, action 4.1 calls for WHO to develop and disseminate global recommendations for physical activity and sedentary behaviours in children under 5 years of age, young people, adults, older adults and specific subpopulations, such as pregnant women, people living with chronic conditions and disability. Updating and broadening the scope of the guidelines, as requested by the World Health Assembly, ensures that population groups not included in the 2010 recommendations are provided with specific recommendations for physical activity. This aligns with the key principles and goals of the global action plan on physical activity, namely to reduce inequalities and to support all people to be more physically active every day.

The overarching purpose of these guidelines is to provide evidence-based public health recommendations on how much and what type of physical activity children and adolescents, adults, older adults and subpopulations such as pregnant women and those living with chronic conditions or disability, should do for significant health benefits and mitigation of health risks. The guidelines also provide evidence-based recommendations on the associations between sedentary behaviour and health outcomes.

The guidelines have been developed for children and adolescents (aged 5–17 years), adults (aged 18–64 years), older adults (aged 65 years and above), and include for the first time specific recommendations on physical activity for subpopulations such as pregnant women and those living with chronic conditions or disability. Recommendations are made for each specific age group and subpopulation, to provide those working with particular communities easy access to the relevant information. Providing separate recommendations for subpopulations, especially people living with chronic conditions or with disability, highlights the importance of including these subpopulations in policy and planning of physical activity and sedentary behaviour interventions.

These guidelines do not address sleep as a behaviour. Sleep is an important health-related issue and an emerging topic within population health science. However, it was deemed beyond the scope of the mandate to include sleep in the updated recommendations. Nonetheless, the importance of sleep is recognized and was included as an important health *outcome* when considering the impact of physical activity and sedentary behaviour.

TARGET AUDIENCE

This document reports the process and summarizes the evidence-base reviewed to develop the recommendations. **The primary audiences are:**

1. Policy-makers in ministries of health, education, youth, sport and/or social or family welfare, working in high as well as low- and middle-income countries, who formulate country-specific guidelines, and who plan health, education, workplace, residential or community-based intervention programmes across the life course.
2. Government officials who develop national, subregional or municipal plans to increase physical activity and reduce sedentary behaviours in population groups through guidance documents.
3. Persons working in nongovernmental organizations, education and workplace organizations or research.
4. Persons working in health services and those providing advice and guidance, such as community, family, primary or tertiary nurses or doctors, or allied health and exercise professionals working beyond the health sector. These guidelines can inform the content of their advice on these topics, if national guidance is not available.

The recommendations on physical activity and sedentary behaviour contained within the guidelines should be used to inform pre-service training and professional development courses for health-care workers, physical activity specialists and education professionals.

Derivative products are needed that convey these guidelines to specific end-users, stakeholders in sectors outside of health, and the wider community, that use tailored communications to meet the specific needs of each audience.

METHODS

These guidelines were developed in accordance with the *WHO Handbook for guideline development* (2nd edition) *(21)*. A WHO Steering Group, led by the Department of Health Promotion, was established, with representation from WHO regional offices and relevant WHO departments. A Guideline Development Group (GDG) was formed, consisting of 27 experts and stakeholders, taking into account gender balance and geographical diversity. The draft guidelines were externally reviewed by seven independent reviewers, who provided feedback on the scientific evidence, its interpretation and content. In addition, an online public consultation was conducted on the draft guidelines, and feedback was received from over 400 contributors. These inputs from scientists, practitioners and the general public were collated and used by the GDG to finalize the guidelines. Full details of the management of the guideline development process are available in Annex 1.

SCOPE OF GUIDELINES AND QUESTIONS OF INTEREST

The GDG reviewed the scope of the guidelines and, at their first meeting, agreed on the most relevant PI/ECO (**P**opulation, **I**ntervention/**E**xposure, **C**omparison, **O**utcome) questions. The key questions addressed for each subpopulation are summarized as follows:

For physical activity:

a. What is the association between physical activity and health-related outcomes?

b. Is there a dose-response association (volume, duration, frequency, intensity)?

c. Does the association vary by type or domain of physical activity?

For sedentary behaviour:

a. What is the association between sedentary behaviour and health-related outcomes?

b. Is there a dose-response association (total volume, frequency, duration and intensity of interruption)?

c. Does the association vary by type and domain of sedentary behaviour?

d. In adults only: Does physical activity modify the effect of sedentary behaviour on mortality?

For each population (P), the exposure (E) was greater volume, duration, frequency or intensity of physical activity; for, as comparison (C) no physical activity or lesser volume, frequency, intensity or duration of physical activity. The critical and important outcomes for each population are summarized in Table 1 and the details of each PI/ECO question in the relevant section of the Web Annex: Evidence profiles.

Available online at https://apps.who.int/iris/bitstream/handle/10665/336657/9789240015111-eng.pdf

Table 1: ***Summary of critical and important* health outcomes addressed by population groups***

Outcomes (in alphabetical order)	Children and adolescents aged 5–17 years: PA and sedentary	Adults aged 18–64 years: PA	Adults aged over 18 years: sedentary	Adults aged over 65 years: PA[a]	Pregnancy and postpartum	Chronic conditions[b]	Children and adults with disability[c]
Adiposity (weight gain, weight change, weight control, weight stability, weight status and weight maintenance)	Critical	Critical	Critical	Critical[a]	Critical	Critical – HIV	–
Adverse events	Critical	Critical	–	Critical[a]	Critical (fetal outcomes)	–	–
All-cause and cause-specific mortality	–	Critical (cancer and CVD specific)	Critical	Critical[a]	–	Critical	–
Bone health	Critical	–	Important	–	–	–	–
Cardiometabolic health	Critical	–	–	–	–	–	–
Cognitive outcomes	Critical	Critical	Important	Critical[a]	–	–	Critical – MS, PD, Stk, Sch, ADHD
Delivery complications	–	–	–	–	Important	–	–
Disease progression	–	–	–	–	–	Critical – HT, T2D, HIV, Critical – cancer recurrence	–
Falls and fall-related injuries	–	–	–	Critical	–	–	–
Fetal outcomes (birthweight, preterm birth)	–	–	–	–	Critical	–	–
Functional ability	–	–	–	Critical	–	–	–
Gestational diabetes mellitus	–	–	–	–	Critical	–	–
Gestational hypertension/ preeclampsia	–	–	–	–	Critical	–	–
Health-related quality of life	–	Important	Important	Important[a]	–	Critical – HT, T2D, HIV	Critical – MS, SCI, ID, MCD, Sch
Incidence of cancer	–	Critical	Critical	Critical[a]	–	–	–
Incidence of CVD	–	Critical	Critical	Critical[a]	–	–	–
Incidence of hypertension	–	Important		Important[a]	–	–	–
Incidence of type-2 diabetes	–	Critical	Critical	Critical[a]	–	–	–
Mental health (symptoms of anxiety and depression)	Critical	Critical	Important	Critical[a]	Critical	–	–
Osteoporosis	–	–	–	Critical	–	–	–
Physical fitness	Critical	–	Important	–	–	–	–
Physical function	–	–	Important	–	–	Critical – HT, T2D, HIV	Critical – MS, SCI, ID, PD, Stk
Pro-social behaviour	Important	–	–	–	–	–	–
Psychosocial outcomes	–	–	–	Important	–	–	–
Risk of co-morbid conditions	–	–	–	–	–	Critical – HT, T2D, HIV	Critical – MS, SCI, ID
Sleep	Important	Important	Important	Important[a]	–	–	–

* Critical outcome: an outcome that is critical to decision-making; Important outcome: an outcome that is important, but not critical to decision-making.

[a] The critical and important outcomes considered for the adult population, including older adults.

[b] Outcomes are for subpopulation condition as listed: Cancer – cancer survivors; HT – hypertension; T2D – type-2 diabetes; HIV.

[c] Outcomes are for subpopulation condition as listed: MS – muscular sclerosis; SCI – spinal cord injury; ID – intellectual disability; PD – Parkinson's disease; Stk – in stroke survivors; Sch – schizophrenia; ADHD – attention deficit/hyperactivity disorder. Critical and important outcomes for the age-specific population were considered and extrapolated.

THE EVIDENCE

The revision of the 2010 WHO recommendations on physical activity was conducted by identifying, and then updating, the most recent, relevant umbrella reviews related to the scope of these guidelines.

This approach was adopted due to an extensive body of recent systematic reviews which were conducted to inform the development of several national physical activity guidelines. The additional updating was undertaken to ensure the new WHO guidelines reflect the most recent available data in a rapidly developing field of public health.

Umbrella reviews were selected if they met the following three criteria: **i)** the evidence reviews had been conducted according to standard systematic processes that were well documented; **ii)** the assessment of the certainty of the evidence used the Grading of Recommendations Assessment, Development and Evaluation (GRADE) method or an equivalent methodology that was clearly described and documented; and **iii)** the evidence reviews addressed the populations of interest with no restrictions to country or country income level.

The PI/ECO questions and the critical and important health outcomes were mapped against existing evidence reviews and, where needed, additional new reviews were commissioned to address gaps. The GDG requested that the evidence reviews be updated, using the same search terms, search languages, and databases as the original reviews.

The following evidence reviews were identified as meeting the above three criteria and were chosen for recency and comprehensiveness:

- A systematic review of the literature conducted by Poitras et al. (2016) on the association between physical activity and health indicators in school-aged children and youth *(22)* as part of the process for developing the *Canadian 24-hour movement guidelines for children and youth (23)*. This review focused solely on studies that used objective measurements of physical activity. A total of 162 studies were included, representing 204 171 participants from 31 countries.
- A systematic review of the literature of the association between sedentary behaviour and health indicators in school-aged children conducted by Carson et al. (2016) *(24)*, as part of the process for developing the *Canadian 24-hour movement guidelines for children and youth (23)*. A total of 235 studies (194 unique samples) were included representing 1 657 064 unique participants from 71 countries.
- A systematic review conducted by Okely et al. (2019) *(25)* undertaken to update Poitras et al. (2016) *(22)* and Carson et al. (2018) *(24)* as part of the development of the 2019 *Australian 24-hour movement guidelines for children and young people* (aged 5–17 years) *(26)*. This report identified an additional 42 studies on physical activity, and 32 on sedentary behaviour, published through to July 2918 *(25)*. The GRADE tables developed by Okely et al. were used as the basis for the commissioned update conducted for WHO. The GRADE tables along with the evidence profiles are presented in the Web Annex: Evidence profiles.
- The 12 systematic reviews conducted and synthesized as part of the development of the *2019 Canadian guideline for physical activity throughout pregnancy (27)*. These 12 reviews assessed over 25 000 related studies in English, Spanish and French language on maternal physical activity during pregnancy that reported on maternal, fetal, or neonatal morbidity, or fetal mortality outcomes. Seven of these systematic reviews addressed outcomes deemed critical and important by the GDG *(28–34)* The GRADE tables from these evidence reviews were used as the basis for the literature search conducted to update and inform the development of WHO recommendations. The updated evidence profiles are presented in the Web Annex: Evidence profiles.
- The scientific report of the Physical Activity Guidelines Advisory Group (PAGAC) *(35)* which provides a systematic update of evidence on physical activity and sedentary behaviours and health outcomes published 2008–2016 as part of the development of the 2018 *Physical activity guidelines for Americans, 2nd Edition (36)*. The evidence summarized addressed a total of 38 main research questions and 104 subquestions selected for their public health relevance. The evidence comprised results from systematic reviews which consisted of a total of 1130 articles, each abstracted to answer the 38 research questions *(35)*. The protocols used a modified version of "A Measurement Tool to Assess Systematic Reviews" (AMSTARExBP) to assess the methodological quality of systematic reviews and meta-analyses. Risk of bias, or internal validity, was assessed for each original study using an adapted version of the USDA NEL Bias Assessment Tool (BAT) *(37)*. The new evidence identified in the updated searches conducted for these WHO guidelines is presented in the evidence profiles in the Web Annex: Evidence profiles; links are provided to the report and supplementary materials of PAGAC *(35)*.

Available online at https://apps.who.int/iris/bitstream/handle/10665/336657/9789240015111-eng.pdf

Methods for updating the evidence and data extraction

A search for systematic reviews and pooled analyses of cohort studies was conducted for studies published from the date of the last searches carried out for each of the included reviews (listed above) to September 2019; standardized data extraction protocols were developed and employed.

To update the searches conducted by Poitras et al. (2016) *(22)*, Carson et al. (2016) *(24)*, and Okely et al. (2019) *(25)*, the databases MEDLINE, EMBASE, PsycINFO, and SportDiscus were searched to identify reviews that were peer-reviewed, written in English or French. To update the searches conducted by PAGAC *(35)*, PubMed, CINAHL and Cochrane databases were searched to identify reviews that were peer-reviewed, written in English. A de novo search for important outcomes, where these were not included by PAGAC *(35)*, was not conducted due to resource constraints.

Searches were performed with no restriction by country or country income status, and inclusive of reviews addressing any subjectively or objectively measured physical activity or sedentary behaviour. It was decided not to conduct searches in languages other than those of the original searches, due to resource constraints and previous experience in the field indicating that such searches yielded very few, if any, additional reviews. Reviews were considered that examined an association between physical activity or sedentary behaviour and health-related outcomes (based on levels above or below a threshold of physical activity or sedentary behaviour), and that explored the dose-response relationship between these and health-related outcomes.

An external team of reviewers used the AMSTAR 2 (Assessment of Multiple Systematic Reviews) instrument to rate the credibility of the systematic reviews under consideration for inclusion *(38)*. The AMSTAR 2 tool contains 16 items that relate to the planning and conduct of the review. The overall confidence in the results of each review was rated according to published guidance: a rating of "high" reflects that the review had zero or one noncritical weakness; "moderate" indicates the review was judged to have more than one noncritical weakness; "low" means the review was judged to have one critical flaw with or without noncritical weaknesses, or multiple noncritical weaknesses; and "critically low" signifies that more than one critical flaw was present. One reviewer completed the AMSTAR 2 tool for all provisionally included reviews. Reviews that were rated critically low by one reviewer were reviewed by a second reviewer using the same tool. Reviews ultimately rated as critically low were excluded because they were judged to be too unreliable to provide an accurate and comprehensive summary of the available evidence, unless it was the only review available for a particular outcome.

This body of evidence also included pooled cohort studies. An external team of reviewers used the Newcastle-Ottawa Scale to assess the quality of the studies *(39)*. Each study was given a quality rating of "good", "fair", or "poor". In general, a good-quality study met all criteria on the Newcastle-Ottawa scale. A fair-quality study did not meet, or it was unclear whether it met, at least one criterion, but also had no known important limitations that could invalidate its results. A poor-quality study had a single fatal flaw, or multiple important limitations. Poor-quality studies were excluded.

There was an assessment for overlap, recognizing potential for duplication of studies in multiple reviews. Reviews containing redundant bodies of evidence, overviews of reviews, and some pooled cohort studies were excluded, where other more comprehensive and/or recent reviews were identified.

Methods for new reviews

Where gaps in existing evidence were identified, new umbrella reviews were commissioned to examine:

1. the relationship between occupational (i.e. work-related) physical activity and health-related outcomes *(40);* and
2. the association between leisure-domain physical activity and adverse health outcomes *(41)*.

(For numbers 1 and 2 above, searches were undertaken using PubMed, SportDiscus and EMBASE for reviews published from 2009 to December 2019.)

3. the association between physical activity and falls prevention; the 2019 Cochrane Collaboration Systematic Review by Sherrington et al. *(42)* was used, and updated with evidence published from the end search date of their original review, through to November 2019.
4. the association between physical activity and osteoporosis and sarcopenia. The search for existing systematic reviews on osteoporosis and sarcopenia, conducted in PubMed for reviews published from 2008 up to November 2019, identified no new reviews and eight new primary studies.
5. the evidence on associations between physical activity and health outcomes in people living with HIV. A scoping review ascertained the availability of

evidence on physical activity and health-related outcomes among people living with HIV to support conducting an umbrella review which was conducted for evidence published up to October 2019 with no start date limitation using PubMed, CINAHL and Web of Science.

Summary of characteristics of the evidence and assessment methods of physical activity and sedentary behaviour

Until recently, the primary methods for measuring physical activity and sedentary behaviours in adults has been by self-report (i.e. survey) and, for children, either self-report or parental recall. Although these methods have well-established strengths, limitations include being prone to reporting bias and measurement error *(43)*. In recent years, with digital technology rapidly growing in this area, there has been an increase in the use of device-based measures for assessing physical activity and sedentary time and their associations with health outcomes. However, challenges remain in comparing results between studies due to differences between the technical features and placement of different devices (accelerometers), and differences in the analyses and reporting of the data. For example, when measuring sedentary time with device-based measures, miscalculation may occur as many of the devices do not currently distinguish between positions (e.g. lying, sitting and standing still). Difficulties also exist when comparing findings from studies using device-based measures with those reporting results from self-report measures.

Self-report instruments vary in content, in the examples of physical activity, response options and domains covered. Until recently, studies focused primarily on assessing either total physical activity, or physical activity in the leisure/recreation domain only, but now increasingly include other domains such as physical activity for transport (e.g. walking and cycling), at work, and in the household. The majority of evidence reports on associations between aerobic physical activity and health outcomes, however studies are now assessing the benefits of muscle-strengthening exercise, as well as combinations of different types of activity and other domains.

Results on the association between physical activity levels and health outcomes are reported and compared in different ways. Many studies report comparisons between quartiles or quintiles of physical activity, other studies compare those "meeting" versus "not meeting" national guidelines. Calculation of total physical activity, when reported, is usually estimated in MET-hours per week and some studies compare "highest" versus "lowest", although categories also vary across studies. The literature frequently reports results from analyses that apply data cut points based on an existing guideline, or the current WHO Global recommendation, or metrics from previous research (for example the cut points of 60 minutes per day in research on youth populations, or the frequency of 2–3 times per week for strength training intervention). When such cut points become commonplace the building of evidence on the associations of higher or lower levels of physical activity exposure on health outcomes can be limited.

Most of the evidence assessing the associations between sedentary behaviours and health outcomes for children and adolescents is cross-sectional in nature, and a majority of studies rely on self- or parent-reported measures of sedentary time that are subject to measurement errors and recall biases.

Evidence from longitudinal observational studies and intervention trials was prioritized, and reviews that solely or primarily synthesized cross-sectional evidence were not considered. Greater emphasis was given to evidence provided by reviews graded moderate certainty and above, and to those providing evidence from studies using device-based measures of exposure.

Grading the body of evidence

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) method was used to rate the certainty of the evidence for each PI/ECO *(44)*, based on the underlying evidence in the reviews. When available, the GRADE "Evidence Profiles" or "Summary of Findings" tables from each review, were used as a starting point. If no table was available within the existing systematic reviews, "Evidence Profile" tables for each population and outcome of interest were constructed.

The GRADE method was used to rate the certainty of the evidence for each PI/ECO *(44)* with the following criteria considered: study design; risk of bias; consistency of effect; indirectness; precision of effect; and other limitations, including publication bias and factors for upgrading observational evidence (magnitude of effect, dose-response, and effects of confounders). Observational evidence from well-conducted longitudinal studies was also upgraded to reflect more appropriately the increased certainty in findings regarding associations between physical

activity or sedentary behaviour and outcomes from such studies. Studies that evaluated intermediate/indirect outcomes were not necessarily downgraded, as the outcomes (including intermediate outcomes) were prioritized by the GDG; the GRADE rating reflects the certainty in effects on those outcomes. In some cases, the GRADE ratings from existing reviews were modified to ensure consistency in application of GRADE methods. The certainty in the body of evidence for each outcome was assigned based on the following guidance *(45):*

High	Very confident that the true effect lies close to that of the estimate of the effect.
Moderate	Moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low	Confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect.
Very low	Very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect.

Going from evidence to recommendations

The GDG employed the GRADE Evidence to Decisions (EtD) framework for generating question-specific recommendations. The EtD framework is a systematic, structured and transparent approach to decision-making. The framework uses explicit criteria for generating guideline recommendations considering research evidence, certainty of evidence and, where required, expert opinion and topical knowledge from the perspective of the target audience. The criteria elicit judgments about the balance between the observed evidence of desirable and undesirable outcomes, overall certainty of evidence, relative values of patients for desirable and undesirable outcomes, resource use (cost considerations) where applicable, potential impact on inequities in health, acceptability and feasibility of recommendations.

The GDG considered the body of evidence in totality for each recommendation for all critical outcomes, and all available important outcomes. For a particular exposure/intervention and outcome link, studies differed widely in the specific exposure/intervention assessed, outcomes assessed, study design, and analytic methods, resulting in heterogeneity in the available evidence. Therefore, it was not possible to apply the classic GRADE approach to each specific exposure/intervention and outcome link; rather, GRADE was applied for the overall body of evidence addressing each exposure/intervention and outcome link, across study design types and variations in exposure/intervention measurements and analyses. When these factors resulted in concerns regarding the coherence of the evidence (i.e. that the evidence for a particular exposure/intervention and outcome link did not correspond when looked at in different ways), the panel downgraded the certainty of evidence *(21)*.

The GDG prioritized the following health outcomes to consider the effects of physical activity and sedentary behaviour: reduced all-cause and cause-specific mortality (cardiovascular disease and cancer); reduced incidence of cardiovascular disease; cancer (site-specific); type-2 diabetes; improved physical fitness (e.g. cardiorespiratory, motor development, muscular fitness); improved cardiometabolic health (e.g. blood pressure, dyslipidaemia, glucose, insulin resistance); bone health; mental health (e.g. reduction in depressive symptoms, self-esteem, anxiety symptoms, ADHD); and improved cognitive outcomes (e.g. academic performance, executive function); and reduced adiposity. Adverse effects (e.g. injuries and harms) were also considered.

Additional considerations

For each population and all PI/ECO questions, the GDG also considered values and preferences of those affected by the guidelines; the resource implications of the recommendations; the impact on health equity; and the acceptability and feasibility of the recommendations. As there was considerable duplication in these considerations, and in the GDG's assessment, for each population group, a summary of the discussions regarding assessments for these elements are described in the "Evidence to recommendations" section.

RECOMMENDATIONS

The public health recommendations presented in the *WHO Guidelines on physical activity and sedentary behaviour* are for all populations and age groups ranging from 5 years to 65 years and older, irrespective of gender, cultural background or socioeconomic status, and are relevant for people of all abilities.

The new guidelines are presented by age group and behaviour (physical activity and sedentary). For each set of recommendations, an introductory statement summarizes the health outcomes associated with physical activity and sedentary behaviour respectively; the recommendations then follow. A set of good practice statements is provided to further clarify how the recommendation can be met safely by the target population. These good practice statements are not "graded recommendations" per se, but are derived from scientific evidence and from practical considerations reviewed and recommended by the GDG.

For each set of recommendations, a summary of the supporting scientific evidence is provided, structured by the three PI/ECO questions; presenting first the evidence on the associations with the critical health outcomes, followed by a summary of evidence on dose response. Finally, a summary of evidence on the relationships between different types or domains of exposure and health outcomes is presented, where this exists.

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CHILDREN AND ADOLESCENTS
(aged 5–17 years)

PHYSICAL ACTIVITY RECOMMENDATION

For children and adolescents, physical activity can be undertaken as part of recreation and leisure (play, games, sports or planned exercise), physical education, transportation (wheeling, walking and cycling) or household chores, in the context of educational, home, and community settings.

In children and adolescents, physical activity confers benefits for the following health outcomes: improved physical fitness (cardiorespiratory and muscular fitness), cardiometabolic health (blood pressure, dyslipidaemia, glucose, and insulin resistance), bone health, cognitive outcomes (academic performance, executive function), mental health (reduced symptoms of depression); and reduced adiposity.

It is recommended that:

- **Children and adolescents should do at least an average of 60 minutes per day of moderate- to vigorous-intensity, mostly aerobic, physical activity, across the week.**
  Strong recommendation, moderate certainty evidence
- **Vigorous-intensity aerobic activities, as well as those that strengthen muscle and bone, should be incorporated at least 3 days a week.**
  Strong recommendation, moderate certainty evidence

GOOD PRACTICE STATEMENTS

- Doing some physical activity is better than doing none.
- If children and adolescents are not meeting the recommendations, doing some physical activity will benefit their health.
- Children and adolescents should start by doing small amounts of physical activity, and gradually increase the frequency, intensity and duration over time.
- It is important to provide all children and adolescents with safe and equitable opportunities, and encouragement, to participate in physical activities that are enjoyable, offer variety, and are appropriate for their age and ability.

Supporting evidence and rationale

For these guidelines for children and adolescents, systematic reviews *(22, 25, 35)* were used and updated with 16 new reviews identified that met inclusion criteria. Full details of the methods, data extraction and evidence profiles can be found in the Web Annex: Evidence profiles.

Available online at https://apps.who.int/iris/bitstream/handle/10665/336657/9789240015111-eng.pdf

In children and adolescents (aged 5–17 years), what is the association between physical activity and health-related outcomes?

A large body of evidence previously established that greater amounts and higher intensities of physical activity in children and adolescents are associated with multiple beneficial health outcomes *(1)*. Recent evidence reaffirms that increased physical activity improves **cardiorespiratory fitness** and **musculoskeletal fitness** in children and adolescents *(22, 35)*. For example, positive impacts are obtained when participating in moderate- to vigorous-intensity physical activity for 3 or more days per week, for 30 to 60 minutes *(22, 35)*.

Regular physical activity, largely aerobic, in children and adolescents is positively associated with beneficial **cardiometabolic health** outcomes, including improved blood pressure, lipid profile, glucose control and insulin resistance *(35)*. Recent reviews examined the effectiveness of school-based physical activity programmes *(46)*, high-intensity interval training *(47)* and resistance training *(48)*, versus no intervention on measures of cardiometabolic health. Within all 3 reviews, there was consistent evidence that interventions were associated with better cardiometabolic outcome measures, although there was varied precision in effect sizes and few individual trials found statistically significant benefits of physical activity across all cardiometabolic outcomes. One review of 19 RCTs (n= 11 988) *(46)* reported that school-based physical activity programmes were associated with statistically significant improvements in diastolic blood pressure (ES= 0.21 [95% CI: 0.42 to 0.01]; p= 0.04) and fasting insulin (ES= 0.12 [95% CI: 0.42 to 0.04]; p= 0.03) compared with no physical activity interventions.

Physical activity has been reported to be favourably associated with **adiposity**, and higher levels of activity may be associated with healthy weight status in children and adolescents *(22, 35)*. The results are generally strongest in cross-sectional studies, while the results are more mixed from prospective observational studies, which limits understanding of the directionality of the reported associations. More recent reviews of physical activity interventions trials (laboratory-based high-intensity interval training [HIIT], classroom-based active learning, resistance training) reported inconsistent results with the majority of the studies included in the reviews not reporting an effect *(47, 49, 50)*. However, a review of longitudinal and cross-sectional studies reported a negative relationship between pedometer-measured physical activity and measures of adiposity, BMI or waist circumference *(51)*. Overall there is low certainty evidence that physical activity is associated with the management of a healthy weight status and more research is needed to determine directionality and strength of association.

There is less evidence examining the association between physical activity and **motor skill development** in children and adolescents, with current reviews demonstrating null findings *(22)*. More research is needed with motor development as an outcome to inform future guidelines.

For children and adolescents, bone-loading activities can be performed as part of playing games, running, turning, or jumping. Physical activity is positively associated with bone mass accrual and/or bone structure, and recent evidence supports that children and adolescents who are more physically active than their peers have greater bone mass, higher bone mineral content or density, and greater bone strength *(35)*. Maximizing **bone health** in childhood and adolescence can help protect from osteoporosis and related fractures later in life.

Developing and maintaining cognitive function is essential across the entire lifespan. In children and adolescents, physical activity has positive effects on **cognitive function** and **academic outcomes** (e.g. school performance, memory and executive function) *(22, 35)*. One recent review (19 RCTs; n= 5038) demonstrated that exercise interventions with multiple sessions per week, for 6 weeks or longer, were associated with greater change in measures of cognitive function such as inhibitory control (SMD 0.26 [95% CI: 0.08 to 0.45], p= < 0.01); working memory (SMD 0.10 [95% CI: -0.05 to 0.25], p= < 0.02), and cognitive flexibility (SMD 0.14 [95% CI: -0.03 to 0.31], p= < 0.04) compared with no exercise interventions *(52)*. Physical activity also reduces the risk of experiencing depression and depressive symptoms in children and adolescents with and without major **depression** *(35)*, and may be comparable to psychological and pharmaceutical therapies in reducing symptoms.

Although all physical activity comes with some **risk of adverse event** *(53)* there is limited evidence reporting harms associated with physical activity levels recommended for health benefit *(35)*. Based on available evidence and expert opinion, the potential risks associated with the amounts and types of physical activity recommended for children and adolescents

were considered to be low *(35)* and can be reduced by a progressive increase in the activity level and intensity, especially in children and adolescents who are inactive. It is known that participation in some sports increases the risk of injury, as does increasing exercise intensity *(53)*. More research is needed to strengthen the knowledge base in this area.

The GDG concluded that:

- There is moderate certainty evidence that greater amounts of moderate- and vigorous-intensity physical activity are associated with improved cardiorespiratory fitness and muscular fitness, cardiometabolic health and bone health in children and adolescents.
- There is moderate certainty evidence that both short- and long-term moderate- to vigorous-intensity physical activity have positive effects on cognitive function, academic outcomes and mental health.
- There is low certainty evidence that physical activity is favourably associated with the management of healthy weight status in children and adolescents.
- There is low-certainty evidence that the risks for the amounts and types of physical activity recommended for children and adolescents are low and are outweighed by the benefits.

Is there a dose-response association (volume, duration, frequency, intensity)?

Although there is a substantial body of evidence demonstrating a positive association between physical activity and health outcomes in children and adolescents, very few studies have addressed the issue of dose-response. Therefore, the exact shape of the dose-response curve and/or the presence of threshold values (that differentiate lower versus higher risk) for physical activity and specific health outcomes is less well understood in children and adolescents compared with adult populations. Nonetheless, a substantial body of evidence shows that many of the health benefits occur with 60 minutes of physical activity daily *(22, 35)*, and given no contradictory evidence, it was concluded that the updated evidence reaffirms the current WHO recommendation for 60 minutes of moderate- to vigorous-intensity physical activity per day *(1)*.

However, the review of all evidence, including recent results from studies using device-based measures of physical activity, did not support retaining the specification of a "minimum" daily threshold of 60 minutes of moderate- to vigorous-intensity physical activity for health benefits, given that studies broadly used "an average" threshold of 60 minutes per day, not a *minimum* daily threshold of 60 minutes, to assess the benefits of physical activity on health outcomes. The review concluded that the new guideline should be amended to more closely reflect this evidence.

The benefits of regular vigorous-intensity activity on cardiometabolic health outcomes has been previously established *(1)* and recent reviews provided further supporting evidence *(35)*. For example, a recent review *(54)* showed that high-intensity interval training, compared with moderate-intensity continuous training, had a moderate beneficial effect on cardiorespiratory fitness (SMD= 0.51 [95% CI: 0.33 to 0.69], $p = < 0.01$; $I^2 = 0\%$). There was no evidence that intervention duration, exercise modality, exercise and rest ratio, and total bouts modified the effect on cardiorespiratory fitness. These results were consistent overall with other recent reviews *(22, 35, 47)* and provide support to retaining the recommendation that youth and adolescents should do regular vigorous-intensity activity to improve cardiorespiratory fitness.

The GDG concluded that:

- Evidence affirms the previous WHO recommendation for 60 minutes of moderate- to vigorous-intensity physical activity per day.
- Evidence supports amending the previous specification of a minimum daily threshold of 60 minutes of physical activity to an average of 60 minutes per day per week, which more closely reflects the evidence.
- There is moderate certainty evidence that greater amounts of vigorous-intensity physical activity are associated with improved cardiorespiratory fitness.

Does the association vary by type or domain of physical activity?

For children and adolescents, physical activity includes play, games, sports, transportation, recreation, physical education or planned exercise, in the context of family, school, and community activities. However, few studies have directly compared different types or domains of physical activity in children and adolescents and thus there is insufficient evidence to determine if the association between physical activity and health outcomes varies by type of activity (e.g. aerobic versus muscle-strengthening exercise) or domain of physical activity (e.g. active transport (walking and cycling) versus physical education, versus sports/recreation).

There is evidence showing that both increased levels of aerobic moderate- to vigorous-intensity physical activity are associated with increased cardiorespiratory fitness, and that increased muscle-strengthening activity increases muscular fitness in children and adolescents. This evidence informed the 2010 WHO *Global recommendations on physical activity for health (1)* which recommended incorporating activities that strengthen muscles and bones at least 3 days per week. Updated evidence reaffirmed that regular muscle-strengthening activity 3 times per week was effective for improving indicators of muscular fitness; however, there is insufficient evidence to state specific details of session duration and intensity, largely due to the heterogeneity of exposures assessed in the literature *(22, 35)*. There is less evidence for a protective effect of resistance training on cardiometabolic health. Given the absence of new evidence on characteristics other than the frequency of muscle strengthening activities for children and adolescents, such as duration, it was not possible to specify any further details. Future research should address the health benefits of specific types and domains of physical activity in order to provide more specificity to this component of the guidelines.

The GDG concluded that:

- There is moderate certainty evidence that muscle-strengthening activities should be incorporated at least 3 days a week.

SEDENTARY BEHAVIOUR RECOMMENDATION

Sedentary behaviour is defined as time spent sitting or lying with low energy expenditure, while awake, in the context of educational, home, and community settings and transportation.

In children and adolescents, higher amounts of sedentary behaviour are associated with the following poor health outcomes: increased adiposity; poorer cardiometabolic health, fitness, behavioural conduct/pro-social behaviour; and reduced sleep duration.

It is recommended that:

› **Children and adolescents should limit the amount of time spent being sedentary, particularly the amount of recreational screen time.**

Strong recommendation, low certainty evidence

Supporting evidence and rationale

Sedentary behaviour was not included in the WHO 2010 recommendations, yet during the past decade, there has been a growing body of research examining the health outcomes associated with different measures and types of sedentary behaviours. Technology and digital communications have influenced how people work, study, travel and spend leisure-time. In most countries, children and adolescents are spending greater time engaged in sedentary behaviours, particularly for recreation, such as screen-based entertainment (television and computers) and digital communications, such as mobile phones.

For these guidelines for children and adolescents, systematic reviews *(24, 25)* were used and updated with seven new reviews identified that met inclusion criteria. Full details of the methods, data extraction and evidence profiles can be found in the Web Annex: Evidence profiles.

Available online at https://apps.who.int/iris/bitstream/handle/10665/336657/9789240015111-eng.pdf

In children and adolescents (aged 5–17 years), what is the association between sedentary behaviour and health-related outcomes?

Evidence indicates that greater time spent in sedentary behaviour, especially recreational screen time, is related to poorer health outcomes *(24, 35)*. For example, higher duration of screen time (including television viewing) is associated with poorer **fitness** and **cardiometabolic health** *(24, 25)* in children and adolescents. Evidence from device-based assessment of association with sedentary behaviour and interventions studies showed modest effects, although stronger effects for those already living with obesity *(55)*. There is limited evidence suggesting that sedentary behaviour is not related to bone health in children and adolescents.

Despite more mixed results, evidence also suggests that sedentary behaviour may be associated with unfavourable measures of **adiposity** *(24, 25)*. One review of largely cross-sectional studies, reported that sedentary behaviour (measured as total screen time) of more than 2 hours per day was positively associated with childhood overweight/obesity compared with lower levels (< 2 hours/day) *(56)*. However, another review of 20 cross-sectional studies *(57)* found no statistically significant association between sedentary video gaming and body mass index among children or adolescents. A large review of 29 systematic reviews concluded that many studies report unfavourable associations between sedentary behaviour and markers of adiposity in young people when the behaviour is self-reported as some form of screen time *(55)*. However, the review noted that the magnitude of such associations was small and, for studies using device-based assessment of sedentary time, largely zero *(55)*. Intervention studies showed modest effects, although stronger effects for those already living with obesity *(55)*. Further research is needed to inform the association between sedentary behaviours and measures of adiposity.

Although still an emerging area of research, some evidence shows that there may be a negative association between sedentary behaviour and **well-being and quality of life**, as well as an unfavourable relationship between **depression** and leisure screen time in children and adolescents *(58, 59)*. For example, higher durations of sedentary behaviour, assessed as screen time, and some aspects of computer use, can be associated with poorer mental health *(24)*. In another recent review, an association between sedentary behaviour and anxiety symptoms was found in 5 of 8 studies, although results were inconsistent across different measures of sedentary behaviour within studies *(60)*. Other evidence demonstrates that higher durations of television viewing and video game use were significantly associated with unfavourable measures of **behavioural conduct/pro-social behaviour** *(24)*; and more screen time and television viewing is associated with shorter **sleep** duration, although there was no association between computer use/gaming and sleep duration *(61)*. Investigations into the relationship between sedentary behaviours and mental health is a rapidly developing field with many unknowns, and reverse causality is likely to be in evidence. Further research is needed to inform on the direction and strength of this association.

The GDG concluded that:

- There is low certainty evidence that higher duration of sedentary behaviour (screen time) is significantly associated with lower physical fitness and cardiometabolic health in children and adolescents.
- There is very low to moderate certainty evidence that higher durations of sedentary behaviour (screen time, television viewing and video game use) are significantly associated with unfavourable measures of mental health and behavioural conduct/pro-social behaviour in children and adolescents.
- There is low certainty evidence that greater time spent in sedentary behaviour (screen time and television viewing) is associated with detrimental effects on sleep duration in children and adolescents.
- The benefits of limiting the amount of sedentary behaviour for children and adolescents outweigh the harms.

Is there a dose-response association (total volume, duration, frequency, intensity of interruption)?

There is insufficient evidence available to determine whether a dose-response relationship exists between sedentary time (including recreational screen time) and health outcomes in children and adolescents. Most of the evidence assessing the associations between sedentary behaviours and health outcomes in children and adolescents is cross-sectional in nature, with low certainty evidence according to GRADE, and a majority of studies relied on self- or parent-reported measures of sedentary time that are subject to measurement errors and recall biases. There is, however, evidence that less time spent in sedentary behaviours appears to be

better for health outcomes, and the association between sedentary behaviour and adverse health outcomes is generally stronger for sedentary behaviour when assessed as television viewing or recreational screen time as the exposure variable, than for total sedentary time. However, overall the evidence was considered insufficient to support specifying time limits.

Evidence that sedentary behaviours are linked to adverse health outcomes could be the result of either direct effects of the sedentary behaviours, displacement of time spent in more physically active behaviours, or both. Although there are studies that have reported associations between screen time and adverse health outcomes in children and adolescents, total sedentary time (as assessed in studies using device-based measurements of sedentary behaviour) has consistently not been associated with health outcomes when time in moderate- to vigorous-intensity physical activity is taken into account *(62)*. Conversely, the evidence linking moderate- to vigorous-intensity physical activity to positive health outcomes is strong and well documented across diverse settings; replacing some sedentary behaviour with physical activity (especially moderate- to vigorous-intensity physical activity) may improve health outcomes.

Research investigating the associations and interplay between sedentary behaviour, physical activity and health outcomes is rapidly growing, and evidence from device-based measures of sedentary behaviour and cardiometabolic health show the association is attenuated when moderate- to vigorous-intensity physical activity is taken into account (i.e. statistically adjusted for) *(62–64)*. There is therefore a need for further prospective studies using device-based measures of exposure, to advance knowledge of these associations and inform future recommendations.

The GDG concluded that:

- There is low certainty evidence that greater time spent in sedentary behaviour is related to poorer health outcomes.
- There is insufficient evidence to specify time limits on sedentary behaviour.
- Replacing sedentary time with moderate- to vigorous-intensity physical activity may provide health benefits.

Does the association vary by type or domain of sedentary behaviour?

The study of health effects of sedentary behaviour is a relatively new field of research. As such the findings are from studies using different instruments and measures of exposure. Exposure assessed as "total time spent doing sedentary behaviours" is frequently used, as is sedentary time spent using "screens" or "television viewing". Available evidence suggests that the association between sedentary behaviour and adverse health outcomes is generally stronger for television viewing or recreational screen time than for total sedentary time *(24, 35)*. The increased use of device-based assessment of sedentary behaviour in the more recent research is advancing knowledge, and when combined with standardized reporting will help inform future guidelines.

It is acknowledged that not all sedentary behaviour is harmful. Evidence suggests certain types of sedentary behaviour, such as reading and doing homework outside of school, are associated with higher academic achievement, indicating that there are differences in outcome depending on the activity *(24, 25)*. Sedentary behaviour may include time spent engaged in educational pursuits/study or quiet play, or social interaction without electronic media. These pursuits (e.g. reading, doing puzzles, drawing, crafting, singing, music) are important for child development and have cognitive as well as other benefits.

The GDG acknowledged that:

- Some sedentary activities confer benefits for cognitive function and social interaction in children and adolescents.
- Evidence on the adverse health effects of sedentary behaviour is generally stronger for television viewing or recreational screen time than for total sedentary time.

ADULTS
(aged 18–64 years)

PHYSICAL ACTIVITY RECOMMENDATION

For adults, physical activity can be undertaken as part of recreation and leisure (play, games, sports or planned exercise), transportation (wheeling, walking and cycling), work or household chores, in the context of daily occupational, educational, home and community settings.

In adults, physical activity confers benefits for the following health outcomes: improved all-cause mortality, cardiovascular disease mortality, incident hypertension, incident site-specific cancers,[1] incident type-2 diabetes, mental health (reduced symptoms of anxiety and depression); cognitive health, and sleep; measures of adiposity may also improve.

It is recommended that:

- **All adults should undertake regular physical activity.**
  Strong recommendation, moderate certainty evidence
- **Adults should do at least 150–300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week, for substantial health benefits.**
  Strong recommendation, moderate certainty evidence
- **Adults should also do muscle-strengthening activities at moderate or greater intensity that involve all major muscle groups on 2 or more days a week, as these provide additional health benefits.**
  Strong recommendation, moderate certainty evidence
- **Adults may increase moderate-intensity aerobic physical activity to more than 300 minutes; or do more than 150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week for additional health benefits.**
  Conditional recommendation, moderate certainty evidence

GOOD PRACTICE STATEMENTS

- Doing some physical activity is better than doing none.
- If adults are not meeting these recommendations, doing some physical activity will benefit their health.
- Adults should start by doing small amounts of physical activity, and gradually increase the frequency, intensity and duration over time.

[1] *Site-specific cancers of: bladder, breast, colon, endometrial, oesophageal adenocarcinoma, gastric, and renal.*

Supporting evidence and rationale

For these guidelines, the synthesis of evidence undertaken by the United States Physical Activity Guidelines Advisory Committee (PAGAC) *(35)* was used and updated.

The GDG considered the entire body of evidence, including both the findings reported by PAGAC and the 28 reviews and 3 pooled cohort studies, published from 2017 through to November 2019, that met inclusion criteria, and contributed evidence on the association between physical activity and health-related outcomes in adults. In addition, two umbrella reviews were commissioned to address evidence gaps and examine **i)** the relationship between occupational (i.e. work-related) physical activity and health-related outcomes *(40)*; and **ii)** the association between leisure-domain physical activity and adverse health outcomes *(41)*. The umbrella reviews identified 36 and 15 systematic reviews respectively. Evidence from longitudinal observational studies and intervention trials was prioritized, and reviews that solely, or primarily, synthesized cross-sectional evidence were not considered. Greater emphasis was given to evidence provided by reviews graded moderate certainty and above, and to those providing evidence from studies using device-based measures of exposure.

Full details of the methods, data extraction and evidence profiles can be found in the Web Annex: Evidence profiles.

In adults (aged 18–64 years), what is the association between physical activity and health-related outcomes?

The association between physical activity and **all-cause mortality and cardiovascular disease mortality** in adults is already well-established *(1)*. Findings from recent reviews reaffirmed that compared with the lowest levels of physical activity, higher levels of physical activity were associated with a lower risk of mortality. New evidence from studies using device-based measures of physical activity reaffirmed and extended the evidence showing that compared with the lowest levels of physical activity, *any* level and *all intensities* (including light intensity) of physical activity, were associated with a lower risk of mortality *(65)*. For example, compared with the least active (referent, 1.00), adjusted HR for quartiles of total physical activity improved across quartiles of physical activity: 2nd quartile (0.48 [95% CI: 0.43 to 0.54]); 3rd quartile (0.34 [95% CI: 0.26 to 0.45]); and 4th quartile (0.27 [95% CI: 0.23 to 0.32]) *(65)*. New evidence also reaffirmed the well-established *(1)* inverse relationship between physical activity and **cardiovascular disease mortality** *(66)*.

The benefits of physical activity for reducing cardiovascular disease and hypertension incidence is well-documented *(1)*. Physical activity promotes many physiological responses that cause beneficial short- and long-term autonomic and haemodynamic adaptations, resulting in lowered risk of **hypertension**, which is a key risk factor for **cardiovascular disease**.

Evidence reaffirmed an inverse relationship between physical activity and incident hypertension among adults with normal blood pressure, and that physical activity reduces blood pressure among adults with prehypertension and normal blood pressure *(35)*.

The inverse association between physical activity and developing **type-2 diabetes** in adults is well-established *(1)*. Recent evidence reaffirmed an inverse curvilinear relationship between higher volumes of physical activity and incidence of type-2 diabetes *(35)*, with a decreasing slope at higher levels of physical activity. A new review found that this effect is consistent across individuals of different backgrounds with a reduced risk of developing type-2 diabetes in "highest" versus "lowest" levels of physical activity among non-Hispanic whites (RR= 0.71 [95% CI: 0.60 to 0.85]); Asians (RR= 0.76 [95% CI: 0.67 to 0.85]); Hispanics (RR = 0.74 [95% CI 0.64 to 0.84]); and American Indians (RR = 0.73 [95% CI: 0.60 to 0.88]), although the effect among non-Hispanic blacks was not significant (RR = 0.91 [95% CI: 0.76 to 1.08]) *(67)*. Evidence suggests there is no effect modification by weight status and that the inverse relationship between a higher volume of physical activity and lower incidence of type-2 diabetes exists for people who have normal weight, overweight or obesity *(35)*.

The associations between higher levels of physical activity and reduced risks of **colon cancer and breast cancer** have been well-established *(1)*. In previous reviews of the evidence, higher levels of physical activity have been found to be associated with a reduced risk of

Available online at https://apps.who.int/iris/bitstream/handle/10665/336657/9789240015111-eng.pdf

developing breast cancer and colon cancer *(1)*. Following an extensive increase in physical activity and cancer research, there is new evidence demonstrating higher levels of physical activity are also associated with reduced risk of developing bladder, endometrial, oesophageal adenocarcinoma, gastric and renal cancers, as well as reaffirming that physical activity is protective for breast cancer and colon cancer *(35)*. Higher levels of physical activity are associated with risk reductions ranging from approximately 10–20% *(35)*. For example, one review reported an inverse association with liver cancer risk when comparing high levels of physical activity to low levels of physical activity (HR= 0.75 [95% CI: 0.63 to 0.89]) *(68)*. There is insufficient evidence on the association between increased physical activity and decreased risks of hematologic, head and neck, ovary, pancreas, prostate, thyroid, rectal and brain cancer *(35)*. While evidence suggests a reduction in risk of lung cancer between the highest versus lowest levels of physical activity, these findings may be confounded by tobacco use and it was determined that overall there is insufficient evidence to establish an association.

The association between physical activity and **adiposity** in adult populations is less well established despite a large, but heterogenous, body of evidence assessing this relationship across various outcome measures (weight gain, weight change, weight control, weight stability, weight status and weight maintenance) *(35, 69, 70)*. Overall the evidence shows that higher levels of physical activity may be associated with more favourable measures of adiposity and attenuation of weight gain in adults *(35)*. Further research is needed to establish consistent results and strength of associations.

Research on physical activity and **mental health, cognition and sleep** has increased substantially since the development of the 2010 *Global recommendations on physical activity for health (1)*. At that time, there was sufficient evidence to conclude only that physical activity may reduce the risk of depression and cognitive decline in adults. New evidence reviewed for these guidelines showed that adults engaging in higher versus lower physical activity are at reduced risk of developing anxiety and depression. For example, adults with high, versus low, levels of physical activity were at reduced odds of developing anxiety (AOR= 0.81 [95% CI: 0.69 to 0.95]) *(71)* or depression (AOR= 0.78 [95% CI: 0.70 to 0.87) *(72)*. Greater amounts of moderate- to vigorous-intensity physical activity are associated with improvements in cognition (e.g. processing speed, memory, and executive function) *(35)*, brain function and structure, and a reduced risk of developing **cognitive impairment**, including Alzheimer's disease *(73–76)*. The evidence included several adult populations representing a gradient of normal to impaired cognitive health status and the beneficial effects of physical activity were reported across a variety of types, including aerobic activity, walking, muscle-strengthening activity, and yoga *(74)*. There is evidence that both acute bouts and regular physical activity improve **sleep and health-related quality of life** outcomes in adults *(35)*.

Evidence examining physical activity and **symptoms of depression, symptoms of anxiety, and the development of anxiety and depression** indicated that physical activity was associated with reduced symptoms of anxiety *(77, 78)* and reduced symptoms of depression *(77, 79)*.

All physical activity comes with some risk. Evidence from a commissioned review on the adverse effects, injuries and harms associated with leisure physical activity in adults *(41)* suggests an unfavourable association between levels of leisure-time physical activity and musculoskeletal injuries, and a favourable relationship between leisure-time physical activity and risk of fracture and onset of knee or hip osteoarthritis. Additional existing evidence *(35)* indicates sudden cardiac adverse events are rare and associated with acute sessions of relatively vigorous-intensity physical activity. Generally, the risks of adverse events are very low with moderate-intensity physical activity and when increases in physical activity frequency, intensity and duration are gradual *(35)*.

The GDG concluded that:

- There is high certainty evidence that any level and any intensity of physical activity is associated with lower risk of all-cause mortality and cardiovascular disease mortality, incidence of hypertension, cardiovascular disease and type-2 diabetes.
- There is moderate to high certainty evidence on the associations between higher levels of physical activity and lower risk of incidence of site-specific cancers.
- There is moderate certainty evidence supporting an association between physical activity and improvements in mental health, cognitive health and sleep outcomes.
- There is evidence of an association between higher levels of physical activity and more favourable measures of adiposity and attenuation of weight gain in adults.
- There is low certainty evidence that physical activity recommended for adults will not be harmful and that the health benefits from such activity outweigh the risks.