

Compendium of WHO and other UN guidance on health and environment

2024 update



Compendium of WHO and other UN guidance on health and environment

2024 update



Compendium of WHO and other UN guidance in health and environment, 2024 update

ISBN 978-92-4-009538-0 (electronic version)
ISBN 978-92-4-009539-7 (print version)

© World Health Organization 2024

Some rights reserved. This work is available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; <https://creativecommons.org/licenses/by-nc-sa/3.0/igo>).

Under the terms of this licence, you may copy, redistribute and adapt the work for non-commercial purposes, provided the work is appropriately cited, as indicated below. In any use of this work, there should be no suggestion that WHO endorses any specific organization, products or services. The use of the WHO logo is not permitted. If you adapt the work, then you must license your work under the same or equivalent Creative Commons licence. If you create a translation of this work, you should add the following disclaimer along with the suggested citation: "This translation was not created by the World Health Organization (WHO). WHO is not responsible for the content or accuracy of this translation. The original English edition shall be the binding and authentic edition".

Any mediation relating to disputes arising under the licence shall be conducted in accordance with the mediation rules of the World Intellectual Property Organization (<http://www.wipo.int/amc/en/mediation/rules/>).

Suggested citation. Compendium of WHO and other UN guidance in health and environment, 2024 update. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at <https://iris.who.int/>.

Sales, rights and licensing. To purchase WHO publications, see <https://www.who.int/publications/book-orders>. To submit requests for commercial use and queries on rights and licensing, see <https://www.who.int/copyright>.

Third-party materials. If you wish to reuse material from this work that is attributed to a third party, such as tables, figures or images, it is your responsibility to determine whether permission is needed for that reuse and to obtain permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

General disclaimers. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by WHO in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by WHO to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall WHO be liable for damages arising from its use.

Design and layout by Lushomo.

Contents

Notes on the 2024 update	v
Preface.....	vi
Acknowledgements	vii
Abbreviations	viii
Executive summary	ix
1. Background	1
1.1 Target audience	2
1.2 Methods used for the development of the compendium.....	2
1.3 How to use this compendium	3
1.4 Links between diseases and environmental determinants of health	6
1.5 Links with social determinants of health	8
1.6 Governance.....	8
2. Air pollution	11
2.1 Introduction	11
2.2 Ambient air pollution.....	12
2.3 Indoor air pollution: household air pollution, second-hand tobacco smoke, dampness and mould	20
2.3.1 Particulate matter, carbon monoxide and other pollutants from incomplete combustion processes.....	21
2.3.2 Environmental impacts of tobacco: second-hand tobacco smoke and environmental pollution	27
2.3.3 Dampness and mould	33
3. WASH	40
3.1 Introduction	40
3.2 Water	41
3.2.1 Drinking-water.....	41
3.2.2 Recreational water.....	47
3.3 Sanitation	52
3.4 Personal hygiene.....	56
4. Solid waste	61
5. Chemicals	73
5.1 Introduction	73
5.2 Chemical safety	74
5.3 Chemical incidents.....	88

6. Radiation	99
6.1 UV radiation – natural and artificial	99
6.2 Electromagnetic fields	102
6.3 Radiation exposures in health care.....	103
6.4 Radon	104
6.5 Radioactivity in food and drinking-water.....	106
6.6 Radiological emergencies	107
7. Climate change	112
8. Nature and health	131
8.1 Protection of nature, biodiversity and ecosystems for health	131
8.2 Vector control	138
8.3 One Health.....	145
9. Safe environments and mobility	154
9.1 Introduction	154
9.2 Environments for safe and sustainable transport, active mobility and physical activity.....	155
9.3 Safe environments to prevent drownings, falls and burns.....	163
9.3.1 Drownings	163
9.3.2 Falls.....	165
9.3.3 Burns.....	168
10. Safe and healthy food	172
10.1 Food safety and the environment.....	172
10.2 Healthy diets and the environment.....	178
11. Environmental noise	182
12. Priority settings for action	188
12.1 Cities and other settlements	188
12.2 Housing.....	194
12.3 Workplaces	198
12.4 Health care facilities	205
13. Cross-cutting topics	229
13.1 Children's environmental health.....	229
13.2 Health in All Policies	230
13.3 Health Impact Assessment	231
Annex 1: Messages on health and environment for the general public	233

Notes on the 2024 update

The 2024 update of the *Compendium of WHO and other UN guidance on health and environment* includes new guidance based on guidelines, reports, technical documents and tools published since the first version of the Compendium.

This update adds new information about Governance ([Section 1.6 Governance](#)), One Health ([Section 8.3 One Health](#)) and a text box on the Human right to a clean, healthy and sustainable environment ([Chapter 1 Background](#)). The previous section on second-hand tobacco smoke has been expanded to include the environmental impact of tobacco.

The following chapters and sections have been updated:

- 1 Background;
- 2.3.2 Environmental impact of tobacco: second-hand tobacco smoke and environmental pollution (this section was previously called Second-hand tobacco smoke);
- 4. Solid waste;
- 5. Chemicals;
- 7. Climate change;
- 8. Nature and health;
- 9.2 Environments for safe and sustainable transport, active mobility and physical activity;
- 12.1 Cities and other settlements;
- 12.4 Health care facilities;
- Annex 1.

These chapters and sections have a footnote indicating that they were updated in 2024. The previous update was conducted in 2022, as indicated in the footnotes of corresponding chapters. The remaining parts of the Compendium will be updated during the next cycle. Chapters and sections that were updated for 2024 have some changes in the way information is presented, in addition to incorporating new evidence.

These changes include:

- an additional classifier in the Guidance tables for Category of evidence, classifying underlying evidence as: A – WHO guideline, B – WHO best practice or strategy, or C – other UN best practice or strategy;
- two tables after the Guidance table that replace the Selected tools table. The first is the Selected resources for the Guidance table, which lists about five key resources that informed the advice presented in the chapter or section (the remaining resources are listed in the References). The second is the Additional selected tools and further resources table, which lists supplementary material that was not cited in the Guidance table.

Preface

Environmental pollution and other environmental risks cause almost a quarter of the worldwide disease burden. To eliminate or at least substantially reduce this disease burden and to address the challenges in health, environment and climate change being faced, bold preventive action at national, regional, local and sector-specific level is needed. Policy-makers and other actors are increasingly prepared to take action on health and the environment, often as a result of requests by citizens and organizations, and need to be supported by adequate resources.

The World Health Organization (WHO) and various other United Nations (UN) organizations offer guidance on effective actions on health and the environment distributed over hundreds of different reports. This compendium consists of a systematic compilation of WHO and other UN guidance that addresses all major areas of health and the environment into one resource. Unlike regular reports, this compendium presents a database or repository extracting the relevant guidance for policy-makers and other key target audiences on health and the environment and refers to the original reports if more detail is needed.

This compendium supports the strategic objectives and their implementation at country-level of the WHO Global Strategy on Health, Environment and Climate Change to scale up action on health determinants in all policies and in all sectors for health protection and improvement. It further supports the implementation of the 2030 Agenda for Sustainable Development to address environmental risks through a shift towards primary preventive actions and the promotion of healthy choices.

In publishing this compendium, WHO seeks to assist policy-makers and other actors in countries to take actions to improve the health of people and the environment and reduce health inequities and provide assistance with implementation of norms and solutions. It does this by summarizing in one resource the most crucial policy recommendations to improve health and reduce the disease burden coming from environmental risks; it further provides guidance on the ways in which policy-makers and other actors can raise awareness of the risks being faced and the healthy practices people can take to reduce them.

Acknowledgements

The World Health Organization (WHO) thanks the many individuals who contributed to the development of this document and acknowledges the valuable input received from the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP) and the United Nations Children's Fund (UNICEF) during the review phase, and for joint coordinated action in view of implementation.

At the WHO Department of Environment, Climate Change and Health, Jennyfer Wolf, Alexandra Egorova, Cristina Vert and Anandita Pattnaik were part of the drafting team. Annette Prüss coordinated the project, and Maria Neira (Director of the Department) provided overall guidance.

WHO thanks the following WHO, UNDP, UNEP and UNICEF staff and consultants for their valuable input, information about key resources and revisions to chapters and sections: Heather Adair-Rohani (WHO, Department of Environment, Climate Change and Health), Marcel Alers (UNDP), Jacqueline Alvarez (UNEP), Amina Benyahia (WHO, One Health Initiative), Sophie Boisson (WHO, Department of Environment, Climate Change and Health), David Boyd (Office of the United Nations High Commissioner for Refugees), Francesco Branca (WHO, Department of Nutrition and Food Safety), Matthias Braubach (WHO Regional Office for Europe, European Centre for Environment and Health), Marie Noel Brune-Drisse (WHO, Department of Environment, Climate Change and Health), Valentina Buj (UNICEF), Fiona Bull (WHO, Department of Health Promotion), Diarmid Campbell-Lendrum (WHO, Department of Environment, Climate Change and Health), Shelly Chadha (WHO, Department of Noncommunicable Diseases), Andreia Costa Santos (WHO, Department of Health Promotion), Jennifer de France (WHO, Department of Environment, Climate Change and Health), Mandeep Dhaliwal (UNDP), Florence Fouque (WHO Special Programme for Research and Training in Tropical Diseases), Monica Gaba Kapadia (UNDP), Sabrina Gander (WHO, Department of Health Promotion), Bruce Gordon (WHO, Department of Environment, Climate Change and Health), Julia Gorman (WHO, Department of Environment, Climate Change and Health), Hebe Gouda (WHO, Department of Health Promotion), Sophie Gumy (WHO, Department of Environment, Climate Change and Health), Kersten Gutschmidt (WHO, Department of Environment, Climate Change and Health), Arabella Hayter (WHO, Department of Environment, Climate Change and Health), Thiago Herick de Sá (WHO, Department of Environment, Climate Change and Health), Sufi Huikuri (UNDP), Ivan Ivanov (WHO, Department of Environment, Climate Change and Health), Robert Jakob (WHO, Department of Data and Analytics), Richard Johnston (WHO, Department of Environment, Climate Change and Health), Kelvin Khow (WHO Framework Convention on Tobacco Control), Hyung-Tae Kim (WHO, Department of Social Determinants of Health), Marianne Kjellen (UNDP), Jan Kolaczinski (WHO, Global Malaria Programme), Nenad Kostanjsek (WHO, Department of Data and Analytics), Ramona Ludolph (WHO, Department of Environment, Climate Change and Health), Richard Madden (The University of Sydney), David Meddings (WHO, Department of Social Determinants of Health), Margaret Montgomery (WHO, Department of Environment, Climate Change and Health), Rory Moses McKeown (WHO, Department of Environment, Climate Change and Health), Pierpaolo Mudo (WHO, Department of Environment, Climate Change and Health), Dorothy Ngajilo (WHO, Department of Environment, Climate Change and Health), Sinaia Netanyahu (WHO Regional Office for Europe, European Centre for Environment and Health), Muhammed Omotola (UNEP), Lesley Onyon (WHO, Department of Environment, Climate Change and Health), Marine Perraudin (WHO, Department of Health Promotion), Vinayak Prasad (WHO, Department of Health Promotion), Pierre Quiblier (UNEP), Mashida Rashid (UNDP), Nicholas Rees (UNICEF), Ajiniyaz Reimov (UNDP), Angella Rinehold (WHO, Department of Environment, Climate Change and Health), Nathalie Roebbel (WHO, Department of Social Determinants of Health), Cristina Romanelli (WHO, Department of Environment, Climate Change and Health), Amy Savage (WHO, Department of Environment, Climate Change and Health), Kerstin Schotte (WHO, Department of Health Promotion), Erin Shutes (WHO, Global Malaria Programme), Soraya Smaoun (UNEP), Abheet Solomon (UNICEF), Jennifer Stevenson (WHO, Global Malaria Programme), Joanna Tempowski (WHO, Department of Environment, Climate Change and Health), Nhan Tran (WHO, Department of Social Determinants of Health), Nicole Valentine (WHO, Department of Social Determinants of Health), Emilie van Deventer (WHO, Department of Environment, Climate Change and Health), Raman Velayudhan (WHO, Department of Neglected Tropical Diseases), Carolyn Vickers (WHO, Department of Environment, Climate Change and Health), Elena Villalobos Prats (WHO, Department of Environment, Climate Change and Health), Joanne Adrienne Vincenten (UNICEF), Salvatore Vinci (WHO, Department of Environment, Climate Change and Health), Douglas Webb (UNDP), Xiaofang Zhou (UNDP) and Cristina Zucca (UNEP).

Acknowledgements are also due to the following external experts who reviewed chapter 4 – Solid waste: David Marquis (Resources and Waste Advisory (RWA) Group, Sofia, Bulgaria), Nicole Weber (Resources and Waste Advisory (RWA) Group, Sofia, Bulgaria) and Andrew Whiteman (Resources and Waste Advisory (RWA) Group, Sofia, Bulgaria). The three external experts declared no conflict of interest.

Abbreviations

AQG	air quality guideline (level)
CFU	colony-forming unit
CO	carbon monoxide
COP	Conference of the Parties
COPD	chronic obstructive pulmonary disease
COVID-19	coronavirus disease 2019
CPC	Central Product Classification
dB	decibel
e-waste	electrical and electronic waste
EMF	electromagnetic fields
EPR	extended producer responsibility
FAO	Food and Agriculture Organization of the United Nations
FCTC	Framework Convention on Tobacco Control
GDWQ	Guidelines for Drinking-Water Quality
GHG	greenhouse gas
HEAT	Health and Economic Assessment Tool
HHP	highly hazardous pesticide
HIA	Health Impact Assessment
HiAP	Health in All Policies
IAEA	International Atomic Energy Agency
ICD	International Statistical Classification of Diseases and Related Health Problems
ICHI	International Classification of Health Interventions
ICSCs	International Chemical Safety Cards
IHD	ischaemic heart disease
ILO	International Labour Organization
INCHEM	Internationally Peer Reviewed Chemical Safety Information
IOMC	Inter-Organization Programme for the Sound Management of Chemicals
IPC	infection prevention and control
ISIC	International Standard Industrial Classification of All Economic Activities
IVM	integrated vector management
MOOC	massive open online course
NBSAP	National Biodiversity Strategies and Action Plan
NCA	national competent authority
NCD	noncommunicable disease
NO₂	nitrogen dioxide
O₃	ozone
PBO	piperonyl butoxide
PM	particulate matter
PM_{2.5}	particles with an aerodynamic diameter equal to or less than 2.5 µm
PM₁₀	particles with an aerodynamic diameter equal to or less than 10 µm
PPE	personal protective equipment
SAICM	Strategic Approach to International Chemicals Management
SDG	Sustainable Development Goal
SI	sanitary inspection
SIDS	small island developing states
SO₂	sulfur dioxide
SOP	standard operating procedure
STEPS	STEPwise approach to NCD risk factor surveillance
UN	United Nations
UNDP	UN Development Programme
UNECE	UN Economic Commission for Europe
UNEP	UN Environment Programme
UNFCCC	UN Framework Convention on Climate Change
UNICEF	UN Children's Fund
UNIDO	UN Industrial Development Organization
UNITAR	UN Institute for Training and Research
UV	ultraviolet
WASH	water, sanitation and hygiene
WASH FIT	Water and Sanitation for Health Facility Improvement Tool
WHO	World Health Organization
WSP	water safety plan

Executive summary

The World Health Organization (WHO) and other United Nations (UN) organizations have published extensive guidance on a range of essential health topics over the years specifically addressing disease, environmental pollutants and children's health, among many other topics. To date, however, there has been no systematic compilation of this guidance for policy-makers and decision-makers, which makes it difficult to have an overview of the options and to determine where linkages exist between sectors and levels of government.

This Compendium seeks to address these gaps by providing a systematic compilation of published guidance from WHO and other UN organizations about all major areas that address health and the environment. The guidance in the Compendium also includes information about ways to raise awareness and advocacy among the public and policy-makers, in addition to information about interventions to build and enhance capacity among various stakeholders. Guidance referring to priority settings for action – such as in cities and other urban settlements, housing, workplaces and health care facilities – is also provided, as is guidance on cross-cutting topics, such as One Health, children's environmental health and Health in All Policies, which aims to enhance collaboration across sectors to systematically consider health in policy-making.

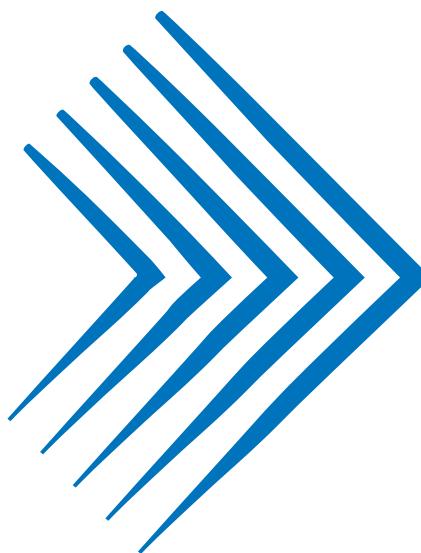
For greater practical relevance, each section of this guidance is classified according to the principally involved sectors, the level of implementation, the instruments for implementation and the category of evidence (the latter applies exclusively to the chapters and sections updated in the 2024 update).

The compilation of guidance for each area of health and the environment or priority settings for action is accompanied by information about the main reference sources, exposure assessments and guideline values, as available. Important further resources are presented alongside the guidance and include tools for assessments or implementing interventions.

This compilation of published guidance emphasizes that a large number of actions across major topics that address health and the environment can be undertaken to improve health and reduce environmental risks. Compiling these into one volume also shows how this guidance often involves multiple sectors and is applicable to various levels – local, regional and national. Where such interlinkages exist, these are indicated in the text.

This Compendium is intended to serve as a repository and easy-to-use resource for decision-makers and policy-makers working in the health and environmental sectors at various levels. It is regularly updated as new evidence and recommendations become available.

1. Background



As much as 24% of deaths are estimated to be attributable to environmental risks to health that are largely preventable (1). Acting on these environmental risks can be key to reducing many communicable and noncommunicable diseases and injuries. As much as 31% of deaths from ischaemic heart disease, 25% of strokes, 20% of lung cancers, 43% of acute respiratory infections and 33% of cases of chronic obstructive pulmonary disease (COPD) could be prevented by reducing air pollution. In addition, 69% of diarrhoeal diseases could be prevented through providing safer water, sanitation and hygiene (WASH); 40% of road traffic injuries could be reduced by changing the built environment and land use, and increasing occupational safety and traffic regulations; and 73% of unintentional poisonings could be prevented by improving the management of chemicals and restrictions regarding their use (1–3). Thus, taking preventive action by creating healthier environments should be an important component of most disease control strategies.

Essential to ensuring good health are clean indoor and outdoor air, a stable climate, adequate WASH facilities, the safe use of chemicals, protection from radiation, sound waste management, healthy and safe workplaces, health-supportive cities and built environments, sustainable and healthy diets, and the preservation of biodiversity and ecosystems. The coronavirus disease 2019 (COVID-19) pandemic was a reminder of the intrinsic linkages between human health and nature.

This Compendium presents key guidance to those wishing to minimize preventable deaths and disability, and improve health now and in the future. It summarizes and aims to facilitate access to guidance from the World Health Organization (WHO) and other United Nations (UN) agencies, and funds and programmes targeting the creation of healthier environments for healthier populations.



In this Compendium, **environment** refers to the following factors (4):

- air, water and soil pollution caused by chemical and biological agents, including environmental pollution from second-hand tobacco smoke;
- ultraviolet (UV) and ionizing radiation;
- electromagnetic fields (EMF);
- occupational risks;
- the built environment, including housing, workplaces, the provision of water for washing hands, and land use patterns and roads;
- climate and ecosystem changes;
- behaviour related to environmental factors, for example, hand-washing hygiene, physical activity fostered through improved urban design, and sustainable healthy diets.

The human right to a clean, healthy and sustainable environment

On 28 July 2022, the UN General Assembly adopted a historic resolution recognizing that everyone has the human right to a clean, healthy and sustainable environment (5). While recognized for the first time by the UN, more than 160 States had already enshrined this right in law through their constitutions, legislation or regional treaties (6).

Decades of experience confirm that the right to a clean, healthy and sustainable environment includes clean air; safe and sufficient water; healthy and sustainably produced food; non-toxic environments where people can safely live, work, learn and play; healthy ecosystems and biodiversity; and a safe climate (7–12). These substantive elements of the right to a healthy environment are supported by procedural rights of access to information, public participation in decision-making, access to justice with effective remedies, freedom of expression and freedom of association (13).

The implementation of the right to a healthy environment is guided by key principles, including non-discrimination, prevention, precaution and non-retrogression. Evidence proves that legal recognition of the right to a healthy environment is a catalyst for stronger environmental laws, improved enforcement of the relevant laws, enhanced accountability and, most importantly, improved environmental performance, such as improved air and water quality (14, 15).

Costa Rica, France and Slovenia are examples of states where constitutional recognition of the right to a healthy environment has spurred remarkable progress in addressing the climate crisis, loss of biodiversity and the effects of toxic pollution. Costa Rica generates 99% of its electricity from renewables and has doubled its forest cover since 1990, from 25% to more than 50%. France has banned the use of neonicotinoid pesticides and prohibits the export of pesticides that are not approved for use in the European Union. Slovenia has protected 40% of its land in national parks and ecological reserves, and is a world leader in recycling. Hundreds of good practices enacted as part of the implementation of the right to a clean, healthy and sustainable environment have been compiled by the UN Special Rapporteur on human rights and the environment (6).

1.1 Target audience

This Compendium aims to provide practitioners, policy makers and other professionals with a rapid overview of WHO- and other UN-recommended actions and tools to address various health risks. The particular practitioners targeted include key decision-makers at national, regional and municipal levels; other government officials; higher-level policy-makers; key actors, such as municipal staff, staff in relevant ministries (including those working with industry) and community health workers; country representatives and staff from WHO and UN partner agencies, funds and programmes; and nongovernmental organizations planning or performing work in countries.

1.2 Methods used for the development of the compendium

This Compendium was developed by systematically compiling published guidance from WHO and other UN organizations about health and the environment. Relevant WHO technical units were methodically consulted about its structure, content and resources. The units' input and subsequent reviews of sections and chapters were incorporated. Other UN organizations addressing health and the environment were also consulted.

Evidence and recommendations were included when they referred to protecting and promoting health by modifying the environment, safeguarding natural environments and the climate, reducing pollution, introducing personal protective measures and promoting healthy behaviours linked to environmental exposures. As put forward in the *WHO global strategy on health, environment and climate change* (16), the approaches included cover (i) implementing primary prevention that acts on determinants of health, (ii) taking cross-sectoral action to ensure that Health in All Policies effectively reach all environmental determinants of health, (iii) strengthening the health sector to build mechanisms for governance and political and social support, and (iv) developing effective communication about risks and solutions to guide choices and investments.

Collated guidance is grouped under the categories “policies and actions” and “awareness-raising and capacity-building”, if not under otherwise relevant categories. UN and World Bank guidance about interventions – such as disease control priorities for injury prevention and environmental health (17); *Healthy environments for healthy children: key messages for action*, from WHO and the United Nations Environment Programme (UNEP)

(18); and *Programme guidance for early life prevention of non-communicable diseases*, from the United Nations Children's Fund (UNICEF) (19) – was used to develop classifiers that serve as search tools, as well as to provide useful information for implementers and planners about the type of strategy or intervention. Classifiers include (i) the sectors principally involved in planning or implementation; (ii) the level of implementation; (iii) the type of instrument; and (iv) the category of evidence (see [Section 1.3 How to use this Compendium](#)).

A companion to the Compendium was published (20) that categorizes interventions according to the International Classification of Health Interventions (ICHI), which is a tool for reporting and analysing interventions for clinical and statistical purposes (21). The codes used to categorize interventions in the Compendium came from the ICHI system; the International Statistical Classification of Diseases and Related Health Problems, eleventh revision (known as the ICD-11) (22); and the International Standard Industrial Classification of All Economic Activities (ISIC) (23), where relevant, and these provide additional specificity when defining interventions.

The lists of guidance and classifiers are not comprehensive, and they are regularly updated as additional information becomes available.

1.3 How to use this compendium

There are many opportunities for interventions to be leveraged to create healthier environments. This Compendium provides an overview of guidance by environmental health topic and points to more detailed WHO and other UN guidance for further information. It also outlines actions that can be taken to create healthier environments and to guide and support the user in engaging in strategic discussions with other sectors and partners to effect these changes, when necessary.

The main part of each section compiles the guidance, and it also provides information about assessing the current situation in a country or area (e.g. using local data, conducting exposure modelling, using databases) and pollution sources, targets to achieve (e.g. guideline values) and selected tools and further resources, where relevant.

Not all of the guidance in this Compendium will apply to and work equally well in every context because there may be (i) differing exposures to the risk, (ii) differing underlying distribution of socioeconomic status and other health risks that influence the effectiveness of the guidance or (iii) differences in the resources available for implementation. Therefore, local circumstances and priorities should be considered before implementing any intervention, strategy or action.

Guidance in this Compendium can be searched using the following classifiers.

- **Sector principally involved in planning/implementation:**¹ These sectors include health, the environment, agriculture, transport, industry, food, water/sanitation, waste, energy, housing, construction, land use planning, education, labour, finance, social welfare and family, sports and leisure, civil defence or multiple sectors.
- **Level of implementation:** The levels are national, community, schools/childcare settings, health care and the workplace. The additional classifier "universal health coverage" has been added to guidance that directly contributes to achieving universal health coverage (often through prevention efforts provided by health workers in the community).
- **Instruments:** The instruments are governance; regulation; taxes and subsidies; infrastructure, technology and the built environment; other management and control; assessment and surveillance; information, education and communication; or other action.
- **Category of evidence:** This is included in the Guidance tables in the chapters updated for 2024. The categories are: A – WHO guideline, B – WHO best practice or strategy, or C – other UN best practice or strategy.

Although not systematically mentioned throughout the Compendium, most areas require adequate monitoring and evaluation, capacity-building and resource mobilization. In addition, all policies and plans should consider gender and equity when being established or implemented.

Messages for promoting health in the general population have been developed based on the guidance contained in this Compendium and can be used to more broadly promote health (see [Annex 1: Messages on health and environment for the general public](#)).

This Compendium is available in both print and online versions. References are included after each chapter.

¹ This classifier focuses on the main sectors responsible for planning and implementation. However, the early engagement of diverse sectors needs to take place to ensure active participation across sectors and effective implementation.

How to use the Compendium of WHO and other UN guidance on health and environment

Target audience

Practitioners and key decision-makers at national, regional and municipal levels

Environment

The environment in this compendium refers to the following environmental factors:

Air pollution



WASH



Solid waste



Chemicals



Radiation



Climate change



Nature and health



Safe environments and mobility



Safe and healthy food



Noise



Categories

Guidance was grouped under two categories:



Policies and actions

Awareness raising and capacity building

Classifiers

Guidance can be searched by the following classifiers:



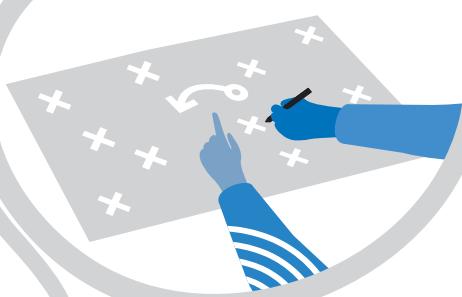
Sector principally involved in planning/implementation

- Health
- Environment
- Agriculture
- Transport
- Industry
- Food
- Water/
sanitation
- Waste
- Energy
- Housing
- Construction
- Land use
planning
- Education
- Labour
- Finance
- Social welfare
and family
- Sports and
leisure
- Civil defence
- Multiple sectors



Level of implementation

- National level
- Community
- Schools/
childcare
- Healthcare
- Workplace
- “Universal health
coverage”



Instruments

- Governance
- Regulation
- Taxes and
subsidies
- Infrastructure,
technology
- and built
environment
- Other
management
and control
- Assessment and
surveillance
- Information,
education and
communication
- Other action



Category of evidence

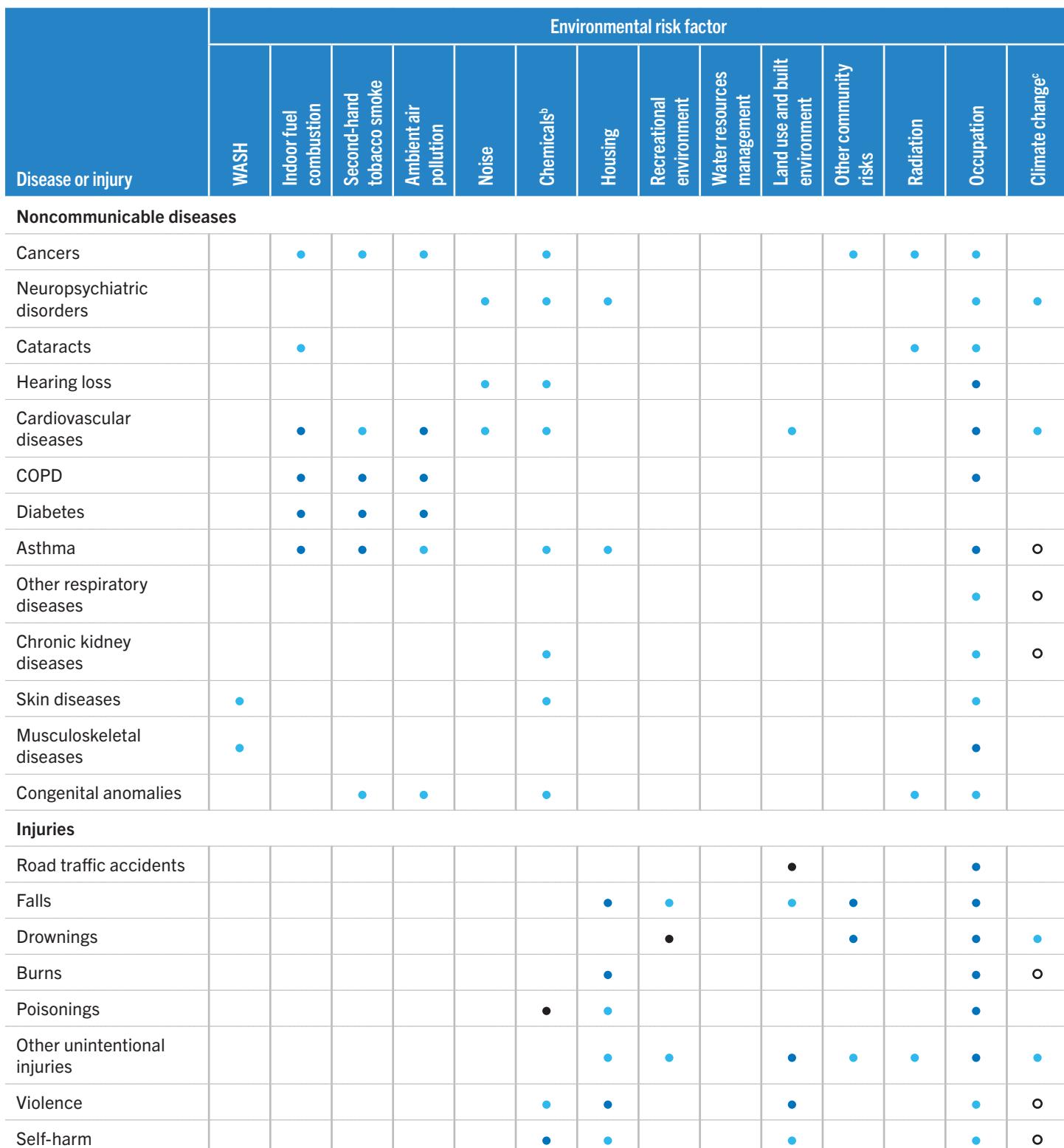
- A – WHO guideline
- B – WHO best practice or strategy
- C – Other UN best practice or strategy

1.4 Links between diseases and environmental determinants of health

To target specific diseases, the environmental determinants or risk factors of greatest relevance can be identified through the risk–disease links shown in Table 1.1. In this way, suitable preventive action can be selected and integrated into disease control programmes.

Table 1.1. Indicative linkages between an environmental risk factor and a disease or injury^a

Disease or injury	Environmental risk factor												
	WASH	Indoor fuel combustion	Second-hand tobacco smoke	Ambient air pollution	Noise	Chemicals ^b	Housing	Recreational environment	Water resources management	Land use and built environment	Other community risks	Radiation	Occupation
Infectious and parasitic diseases													
Respiratory infections	●	●	●	●			●						
Diarrhoeal diseases	●							●					●
Intestinal nematode infections	●											●	○
Malaria								●			●	●	●
Trachoma	●												○
Schistosomiasis	●							●				●	○
Chagas disease					●		●						○
Lymphatic filariasis	●								●			●	○
Onchocerciasis									●			●	○
Leishmaniasis						●						●	○
Dengue					●							●	●
Japanese encephalitis								●				●	○
HIV/AIDS												●	
STDs												●	
Hepatitis B and C												●	
Tuberculosis		●					●					●	
Other infectious diseases	●						●		●			●	
Neonatal and nutritional diseases													
Neonatal conditions	●	●	●	●	●							●	○
Protein–energy malnutrition ^d	●									●			●



COPD, chronic obstructive pulmonary disease; STDs, sexually transmitted diseases.

a Coloured dots represent attributable fractions; an attributable fraction is the proportional reduction in death or disease that would occur if exposure to a risk were removed or reduced to a minimum exposure distribution that is currently achieved in certain population groups. The ranges of the attributable fractions are:

● < 5%; ● 5–25%; ● > 25%; ○ influence likely but not yet quantifiable. The environmental attributable fractions are indicative values based on comparative risk assessments or expert opinion. They are discussed in further detail in reference (4).

b Chemicals in this table are limited to industrial and agricultural chemicals and chemicals involved in acute poisoning.

c Global climate change will increasingly influence all life on the planet. This table covers current risks to health. While hollow circles have been added to highlight likely future impacts of climate change on health, most future health impacts are not yet quantifiable.

d This includes malnutrition and its consequences.

Source: Adapted from reference (4).

1.5 Links with social determinants of health

Many diseases and adverse health conditions, such as malnutrition, are strongly related to social determinants of health – which are the conditions in which people are born, grow, work, live and age – and the wider set of forces and systems shaping the conditions of daily life. Some social determinants of health, such as housing and certain basic amenities, are closely linked with environmental factors and are, therefore, considered in this Compendium. Other crucial social determinants of health are income or socioeconomic position, education, employment status, job security, and social support and inclusion. These are important causes of disease and disability but are not within the scope of this Compendium (24).

1.6 Governance

The Compendium provides policy-makers and other actors in countries with a comprehensive set of resources and guidance to support the implementation of actions addressing the relationship between health and the environment. Nevertheless, the success of these actions critically depends on the good governance of countries, regions or cities.

Governance is the intricate process of decision-making and the implementation of decisions that occurs whenever groups or individuals collaborate to achieve a common goal. This concept builds on three key dimensions: authority (i.e. identifying decision-makers), decision-making (i.e. the methods employed in decision processes) and accountability (i.e. mainly involving being answerable for decisions and actions) (25). Good governance should be the ultimate goal of all policy-makers. It ensures that corruption is minimized and that minority groups and vulnerable people in society are considered when decisions are made. Good governance is participatory, consensus-oriented, accountable, transparent, responsive, effective and efficient, and equitable and inclusive, and it follows the rule of law (25, 26). Participation, partnership and community empowerment are critical elements of good governance (27).

Although good governance should be intrinsic to any political decision, industry, certain lobbyists and special interest groups, a weak and ineffective legal system, or political corruption itself, might have a damaging influence on governance and the consequent decisions. Such influences can distort policy-making processes and prioritize special interests over the public good. Certain decisions about the environment (e.g. reducing air pollution, protecting nature and biodiversity, promoting healthy urban planning or ensuring adequate waste management, among others described in the Compendium) have a significant impact on a population's health and well-being. Therefore, it is imperative to ensure that political decisions truly serve the interests of all people.

Important actions governments can take to improve governance include establishing a strong mandate, showing political will, addressing community needs, acknowledging health inequities, involving the community in planning, creating a transparent and accountable delivery system, collaborating with partners to develop and implement integrated solutions, and continually monitoring and improving performance (27). Moreover, it is fundamental to minimize the influence of vested interests that prioritize their own benefit (whether political, economic or personal) over the broader public interest during the decision-making process, potentially resulting in corruption, unfair advantages or decisions that do not reflect the needs and values of society. Transparency is key to minimizing or avoiding the influence of organizations or people with vested interests by ensuring the disclosure of any potential conflicts of interest or relationships with stakeholders who have questionable interests.

References

1. Prüss-Ustün A, Wolf J, Corvalán C, Bos R, Neira M. Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks. 2016 updated data in a spreadsheet. Geneva: World Health Organization; 2019 (<https://www.who.int/publications/i/item/9789241565196>, accessed 29 January 2024).
2. The public health impacts of chemicals: knowns and unknowns – data addendum for 2019. Geneva: World Health Organization; 2021 (<https://www.who.int/publications/i/item/WHO-HEP-ECH-EHD-21.01>, accessed 29 January 2024).
3. Air pollution data portal: Global Health Observatory [online database]. Geneva: World Health Organization; 2023 (<https://www.who.int/data/gho/data/themes/air-pollution>, accessed 29 January 2024).
4. Prüss-Ustün A, Wolf J, Corvalán C, Bos R, Neira M. Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks. Geneva: World Health Organization; 2016 (<https://iris.who.int/handle/10665/204585>, accessed 29 January 2024).
5. Resolution A/76/300: the human right to a clean, healthy and sustainable environment. In: Seventy-sixth session, United Nations General Assembly, 1 August 2022. New York: United Nations; 2022 (<https://digitallibrary.un.org/record/3983329>, accessed 29 January 2024).
6. Report A/HRC/43/53: Right to a healthy environment: good practices. Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment. In: Forty-third session, Human Rights Council, 24 February–20 March 2020. New York: United Nations; 2020 (<https://www.ohchr.org/en/documents/thematic-reports/ahrc4353-good-practices-right-safe-clean-healthy-and-sustainable>, accessed 29 January 2024).
7. Report A/HRC/46/28: Human rights and the global water crisis: water pollution, water scarcity and water-related disasters. Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment. In: Forty-sixth session, Human Rights Council, 22 February–19 March 2021. New York: United Nations; 2021 (<https://www.ohchr.org/en/documents/reports/ahrc4628-human-rights-and-global-water-crisis-water-pollution-water-scarcity-and>, accessed 29 January 2024).
8. Report A/HRC/40/55: Issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment. Report of the Special Rapporteur. In: Fortieth session, Human Rights Council, 25 February–22 March 2019. New York: United Nations; 2019 (<https://www.ohchr.org/en/documents/thematic-reports/ahrc4055-issue-human-rights-obligations-relating-enjoyment-safe-clean>, accessed 29 January 2024).
9. Report A/76/179: Human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment – note by the Secretary-General. In: Seventy-sixth session, United Nations General Assembly, 19 July 2021. New York: United Nations (<https://www.ohchr.org/en/documents/thematic-reports/a76179-human-rights-obligations-relating-enjoyment-safe-clean-healthy>, accessed 29 January 2024).
10. Report A/74/161: Safe climate: a report of the Special Rapporteur on Human Rights and the Environment. Nairobi: United Nations Environment Programme; 2019 (<https://www.ohchr.org/en/special-procedures/sr-environment/safe-climate-report>, accessed 29 January 2024).
11. Report A/HRC/49/53: The right to a clean, healthy and sustainable environment: non-toxic environment. Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment. In: Forty-ninth session, Human Rights Council, 28 February–1 April 2022. New York: United Nations; 2022 (<https://www.ohchr.org/en/documents/thematic-reports/ahrc4953-right-clean-healthy-and-sustainable-environment-non-toxic>, accessed 29 January 2024).
12. Report A/75/161: Healthy biosphere: report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment. Geneva: Office of the United Nations High Commissioner for Human Rights; 2020 (https://www.ohchr.org/Documents/Issues/Environment/SREnvironment/Healthy_Biosphere_A75161.pdf, accessed 29 January 2024).
13. Framework Principles on Human Rights and the Environment (2018). In: Office of the United Nations High Commissioner for Human Rights [website]. Geneva: Office of the United Nations High Commissioner for Human Rights; 2023 (<https://www.ohchr.org/en/special-procedures/sr-environment/framework-principles-human-rights-and-environment-2018>, accessed 29 January 2024).
14. Jeffords C, Minkler L. Do constitutions matter? The effects of constitutional environmental provisions on environmental outcomes. *Kyklos*. 2016;69:294–335.
15. Boyd DR. The environmental rights revolution: a global study of constitutions, human rights, and the environment. Vancouver: University of British Columbia Press; 2011 (<https://www.ubcpress.ca/the-environmental-rights-revolution>, accessed 29 January 2024).
16. WHO global strategy on health, environment and climate change: the transformation needed to improve lives and well-being sustainably through healthy environments. Geneva: World Health Organization; 2020 (<https://www.who.int/publications/i/item/9789240000377>, accessed 29 January 2024).
17. Disease control priorities, third edition. Volume 7: injury prevention and environmental health. Washington (DC): World Bank; 2017 (<http://hdl.handle.net/10986/28576>, accessed 29 January 2024).
18. Healthy environments for healthy children: key messages for action. Geneva: World Health Organization, United Nations Environment Programme; 2010 (<https://apps.who.int/iris/handle/10665/44381>, accessed 29 January 2024).
19. Programme guidance for early life prevention of non-communicable diseases. New York (NY): United Nations Children's Fund; 2019 (<https://www.unicef.org/media/61431/file>, accessed 29 January 2024).

20. Compendium of WHO and other UN guidance on health and environment: version with International Classification of Health Intervention (ICHI) codes. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/375800>, accessed 29 January 2024).
21. International Classification of Health Interventions (ICHI) [website]. Geneva: World Health Organization; 2024 (<https://www.who.int/standards/classifications/international-classification-of-health-interventions>, accessed 29 January 2024).
22. ICD-11: International Classification of Diseases 11th Revision [website]. Geneva: World Health Organization; 2024 (<https://icd.who.int/en>, accessed 29 January 2024).
23. International Standard Industrial Classification of All Economic Activities (ISIC), rev. 4. New York (NY): United Nations, Department of Economic and Social Affairs; 2008 (https://unstats.un.org/unsd/publication/seriesm/seriesm_4rev4e.pdf, accessed 29 January 2024).
24. Social determinants of health: overview [website]. Geneva: World Health Organization; 2024 (https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1, accessed 29 January 2024).
25. Guidance for health information system governance. Copenhagen: WHO Regional Office for Europe; 2021 (<https://apps.who.int/iris/handle/10665/342572>, accessed 29 January 2024).
26. What is good governance? Bangkok: United Nations Economic and Social Commission for Asia and the Pacific; 2009 (<https://www.unescap.org/resources/what-good-governance>, accessed 29 January 2024).
27. Healthy cities: good health is good politics. Toolkit for local governments to support healthy urban development. Manila: WHO Regional Office for the Western Pacific; 2015 (<https://iris.who.int/handle/10665/208242>, accessed 29 January 2024).

2. Air pollution



2.1 Introduction

The combined effects from ambient (outdoor) air pollution and indoor (household, in particular) air pollution cause approximately 7 million premature deaths every year, largely as a result of increased mortality from stroke, IHD, COPD, lung cancer and acute respiratory infections (1). Air pollution can occur in both the outdoor and indoor environments. Cook-stoves in homes, motor vehicles, industrial facilities and forest fires are common sources of air pollution. Air pollutants with the strongest evidence for adverse health outcomes include particulate matter (PM; both PM_{2.5} (i.e. particles with an aerodynamic diameter equal to or less than 2.5 µm) and PM₁₀ (i.e. particles with an aerodynamic diameter equal to or less than 10 µm), ozone (O₃), nitrogen dioxide (NO₂), sulfur dioxide (SO₂) and carbon monoxide (CO). Air pollution is however composed of many more pollutants (1).

2.2 Ambient air pollution



This section contains the guidance to improve air quality in a location or country, information on the context and additional tools. While in-depth local assessments are generally needed to identify the most appropriate and efficient solutions, some lines of action are fundamental to achieve cleaner air, such as clean energy generation and transport, sustainable consumption and sound agricultural and waste management practices.

As part of local air pollution originates from sources far from the local context, some of the required action will go beyond the scope of the local practitioner, and will require action at another level, such as through international activities not addressed here (2).

Many of the measures suggested also reduce those harmful emissions that lead to air pollution and climate change, and thereby create multiple benefits. Synergies between measures to reduce air pollution and those mitigating climate change should be actively sought when prioritizing action.



Overview

Air pollution originates from numerous sources of emission, both natural and anthropogenic, with the latter becoming globally dominant since the beginning of industrialization. The process of combustion is the greatest contributor to air pollution, in particular, combustion of fossil fuels and biomass to generate energy. Outdoor combustion sources include ground, air, and water transport; industry and power generation; and biomass burning, which includes controlled and uncontrolled forest and savannah fires and agricultural waste burning as well as waste burning in urban areas. Other sources and processes contributing to outdoor pollution are re-suspension of surface dust and construction activities. Long-range atmospheric transport of pollutants from distant sources contributes to local pollution, particularly urban air pollution (3).

Over 90% of people live in places where the air is unhealthy to breathe, resulting in 4.2 million deaths globally each year (2016 data). Of all deaths from ambient air pollution, 38% were due to IHD, 20% were due to stroke and 43% were due to COPD (4, 5).

Air pollution has an especially devastating impact on children's health and has been linked to respiratory infections, adverse birth outcomes, adverse impacts on brain development and lung function, obesity, asthma, otitis media, cancers and increased mortality (6, 7). Air pollution also disproportionately affects older people.

How polluted is the ambient air in my country?	<p>When people are exposed to air pollution levels above the WHO guideline levels, they are at increased risk of health impacts, in particular cardiovascular and respiratory diseases and lung cancer.</p> <p>The current air quality (for PM) can be informed through the following.</p> <ol style="list-style-type: none"> In-situ measurements: Annual mean $PM_{2.5}$ is the indicator of ambient air pollution that best predicts health impacts, and can be measured locally. Assessment of additional indicators is also useful.² <p>In-situ measurements are generally provided by national or subnational institutions. In addition, a global database, the WHO Global Ambient Air Quality Database (8) compiles annual $PM_{2.5}$ measurements for more than 4000 cities or localities in the world. In the absence of a monitoring system, modelled satellite data or use of low-cost sensors may be considered.</p> <ol style="list-style-type: none"> Interactive air pollution map (9): This global interactive map shows modelled $PM_{2.5}$ annual concentration for every location, based on about 60 000 in-situ measurements. <p>Other indicators and their monitoring are also relevant, such as nitrogen and sulfur dioxides, ground-level ozone, carbon monoxide, black and elemental carbon and ultrafine particles. Source apportionment of PM allows for the analysis of PM composition (e.g. with regard to sand and dust).</p> <p>At national level, UN Sustainable Development Goal (SDG) indicators also monitor progress related to ambient air quality.</p> <ul style="list-style-type: none"> – SDG indicator 3.9.1: Mortality rate attributed to household and ambient air pollution (10). – SDG indicator 11.6.2: Annual mean levels of fine particulate matter (e.g. $PM_{2.5}$ and PM_{10}) in cities (population weighted) (10).
What are the main sources contributing to ambient air pollution?	<p>Source apportionment studies assist in identifying the main sources contributing to air pollution, in view of identifying efficient strategies to reduce the pollution in the area of interest (e.g. country, district, city). Some of the air pollution sources may be obvious, or can be assessed through other means (such as estimation of emissions). While local sources contribute to air pollution, sources located further away (even hundreds of kilometres, or transboundary) are important contributors as well.</p> <p>A database on source apportionment studies for airborne PM is available, and a global review provides an overview (11, 12). Main sources of $PM_{2.5}$ have also been estimated through modelling (13).</p>

² Specific information is available from national, subnational and intergovernmental institutions.

What is the air quality we want to achieve?

WHO air quality guidelines (3) are available for a number of pollutants and cover concentrations of pollutants in the air for different averaging times, applicable to both outdoor and indoor environments (Table 2.1). The interim targets shown in Table 2.1 are proposed as incremental steps in the reduction of air pollution and are intended for use in areas where pollution is high. Interim targets should be regarded as steps towards ultimately achieving air quality guideline (AQG) levels, rather than as end targets.

Table 2.1. Recommended AQG levels and interim targets

Pollutant	Averaging time	Interim target				AQG level
		1	2	3	4	
$\text{PM}_{2.5}$, $\mu\text{g}/\text{m}^3$	Annual	35	25	15	10	5
	24-hour ^a	75	50	37.5	25	15
PM_{10} , $\mu\text{g}/\text{m}^3$	Annual	70	50	30	20	15
	24-hour ^a	150	100	75	50	45
O_3 , $\mu\text{g}/\text{m}^3$	Peak season ^b	100	70	—	—	60
	8-hour ^a	160	120	—	—	100
NO_2 , $\mu\text{g}/\text{m}^3$	Annual	40	30	20	—	10
	24-hour ^a	120	50	—	—	25
	1-hour	—	—	—	—	200
SO_2 , $\mu\text{g}/\text{m}^3$	24-hour	125	50	—	—	40
	10-minute	—	—	—	—	500
CO , mg/m^3	24-hour ^a	7	—	—	—	4
	8-hour	—	—	—	—	10
	1-hour	—	—	—	—	35
	15-minute	—	—	—	—	100

Source: Adapted from (3).

^a 99th percentile (i.e. 3–4 exceedance days per year).

^b Average of daily maximum 8-hour mean O_3 concentration in the six consecutive months with the highest six-month running average O_3 concentration.

The air quality guideline levels recommended in previous WHO air quality guidelines for pollutants and averaging times not covered in the 2021 update remain valid (the reader is referred to *Air quality guidelines for Europe* (14), *Air quality guidelines for Europe, 2nd edition* (15); and *WHO guidelines for indoor air quality: selected pollutants* (16)). A summary of all air quality guidelines is also available (17).

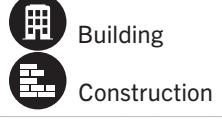
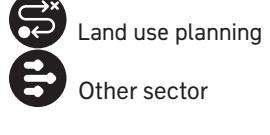
Current evidence is insufficient for guideline levels for specific types of PM, notably black carbon or elemental carbon, ultrafine particles and particles originating from sand and dust storms. Good practice statements are included in the current WHO global air quality guidelines (3); some of them are included below.

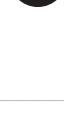
Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Transport systems: policies and actions			
<p>Note: More guidance that promotes walking and cycling is listed in Section 9.2 Environments for safe and sustainable transport, active mobility and physical activity.</p>			
1. Develop or improve transport systems that prioritize efficiency, pollution reduction and inclusiveness; and which take into account vulnerable users, use of non-motorized transportation and alternatives to private motorized transport. ³ This includes plans for rapid urban transit and walking and cycling networks, as well as consideration of urban and regional development policies, integrated transport and spatial planning, and travel demand management (18-21).	 Transport Land use planning	Community; national	Infrastructure, technology and built environment; taxes and subsidies
2. Shift to cleaner lower-emission vehicles and fuels, including fuels with reduced sulfur content, for public transport, transport of goods and services and private vehicle users (18, 21, 22). This may involve disincentives for the use of private vehicles.	 Transport Environment	National	Taxes and subsidies; regulation; infrastructure, technology and built environment
3. Implement stricter vehicle emissions and efficiency standards (21).	 Transport	National	Regulation
4. Enforce mandatory inspection and maintenance for vehicles (21, 22).	 Transport	National	Regulation
5. Regulate the trade of used vehicles using for example age limits for imported vehicles and fiscal instruments such as age-based taxation, progressive excise tax based on CO ₂ emissions or engine size, and exemptions for specific vehicles, such as hybrid electric and electric vehicles (23).	 Transport	National	Regulation
Industry: policies and actions			
6. Adopt improved industrial emission standards, clean technologies that reduce industrial smokestack emissions and post-emission controls (21, 24).	 Industry Environment	National	Regulation; infrastructure, technology and built environment
7. Enforce energy efficiency standards for industries (21).	 Industry Environment	National	Regulation
8. Improve efficiency and emission standards for brick kilns and coke ovens (21).	 Industry Environment	National	Regulation

³ Transport, often on rapid transit (rail, bus or metro), with high passenger capacities and frequency of service, and usually separated from other traffic.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
9. Reduce industrial solvent emissions through leak detection, repairs and solvent recovery (21).	 Industry	National; community	Infrastructure, technology and built environment
10. Introduce low-solvent paints (21).	 Industry	National	Infrastructure, technology and built environment
11. Improve existing oil and gas production by increasing recovery and use of gas released during fossil fuel production, stopping routine flaring and improving leakage control (21).	 Industry	National; community	Infrastructure, technology and built environment
12. Improve efficiency of existing coal mining by encouraging pre-mining recovery of coal mine gas (21).	 Industry	National; community	Infrastructure, technology and built environment
Power generation: policies and actions	 Energy  Environment	National	Taxes and subsidies; regulation; infrastructure, technology and built environment
13. Transition away from fossil fuel combustion (oil, coal) for large-scale energy production, and diesel generators for small-scale production (21).	 Energy  Environment	National	Taxes and subsidies; infrastructure, technology and built environment; regulation
14. Increase the use of low-emission fuels and renewable combustion-free power sources (like solar or wind); use incentives to achieve this (21).	 Energy  Environment	National; community	Taxes and subsidies; infrastructure, technology and built environment; regulation
15. Increase reliance on the co-generation of heat and power, and distributed energy generation (e.g. mini-grids and rooftop solar power generation) (21).	 Energy	National; community	Taxes and subsidies; infrastructure, technology and built environment; regulation
Waste and wastewater management: policies and actions	 Environment  Industry  Waste	National; community	Taxes and subsidies; infrastructure, technology and built environment; regulation
16. Support waste reduction, waste separation, recycling and reuse or waste reprocessing (21).	 Environment  Industry  Waste	National; community	Regulation
17. Stop open waste burning (21).			

 Guidance	 Sector principally involved in planning/ implementation	 Level of implementation	 Instruments
<p>18. Improve methods of biological waste management such as anaerobic waste digestion to produce biogas, and low-cost alternatives to the open incineration of solid waste. Where incineration is unavoidable, use of combustion technologies with strict emission controls are critical (21).</p>	 Environment  Industry  Waste	National; community	Regulation; infrastructure, technology and built environment
<p>19. Practise landfill gas recovery (21, 25).</p>	 Environment  Industry  Waste	National; community	Infrastructure, technology and built environment
<p>20. Introduce two-stage wastewater treatment with biogas recovery (21).</p>	 Environment  Water/sanitation	National; community	Infrastructure, technology and built environment
Agriculture and forestry: policies and actions			
<p>21. Reduce or ban the burning of agricultural fields and waste (21).</p>	 Agriculture  Environment	National; community	Regulation
<p>22. Alternate wet/dry rice irrigation (21).</p>	 Agriculture	National; community	Infrastructure, technology and built environment
<p>23. Improve the management of agricultural waste and livestock manure, including the capture of methane gas emitted from waste processing and waste sites (21).</p>	 Agriculture  Waste  Environment	National; community	Infrastructure, technology and built environment
<p>24. Improve the use of nitrogen fertilizers through efficient application; for urea use urease inhibitors and/or substitute with, for example, ammonium nitrate (21).</p>	 Agriculture	National; community	Infrastructure, technology and built environment
<p>25. Adopt improved forest, land and water management and fire prevention strategies to prevent forest and peatland fires (21).</p>	 Agriculture  Forestry  Water	National; community	Other management and control
Housing: policies and actions			
<p>26. Improve energy efficiency of homes and commercial buildings through insulation and passive design principles such as natural ventilation and lighting (21).</p>	 Housing  Construction	National; community	Infrastructure, technology and built environment

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>27. Optimize ventilation methods, siting of access roads and exercise areas in order to minimize population exposure (26).</p>	 <ul style="list-style-type: none">  Housing  Construction  Land use planning 	National; community	Infrastructure, technology and built environment
Land use: policies and action			
<p>28. Design land use and reallocation policies that reduce travel demand, shift transport modes towards non-motorized mobility options, ensure adequate access to public open space and favour more densely (compact and diverse) urban design and energy-efficient housing (18).</p>	 <ul style="list-style-type: none">  Land use planning 	National; community	Infrastructure, technology and built environment
<p>29. Consider planning or redesigning sites with reduced air pollution exposure for facilities with vulnerable populations (nurseries, schools, care facilities) (26).</p>	 <ul style="list-style-type: none">  Land use planning  Health  Education 	National; community	Infrastructure, technology and built environment
<p>30. Reduce dusts from construction and roads, for example by increasing green areas, their quality and management (21, 27, 28).</p>	 <ul style="list-style-type: none">  Land use planning  Construction  Transport 	National; community	Infrastructure, technology and built environment
Other: policies and actions			
<p>31. Consider mass sport events in locations and/or times when reduced air pollution is expected (26).</p>	 <ul style="list-style-type: none">  Health  Other sectors 	National; community Universal health coverage	Other management and control
<p>32. Consider provision of end-of-trip facilities for cycling in urban centres and at all public amenities; and design access to prioritize walking and cycling (29).</p>	 <ul style="list-style-type: none">  Building  Construction 	National; community	Infrastructure, technology and built environment
<p>33. Consider measures for reducing exposure for vulnerable occupations (26).</p>	 <ul style="list-style-type: none">  Health  Other sectors 	National; community Universal health coverage	Other management and control
<p>34. To reduce exposure to sand and dust storms (3):</p> <ul style="list-style-type: none"> • implement wind erosion control through carefully planned expansion of green spaces; • clean the streets in urban areas with high population density and low rainfall to prevent resuspension by road traffic as a short-term measure after intense sand and dust storms. 	 <ul style="list-style-type: none">  Land use planning  Other sector 	National; community	Infrastructure, technology and built environment

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Awareness raising and capacity building			
35. Raise awareness about health effects of air pollution and personal measures to reduce air pollution. Examples include: <ul style="list-style-type: none">• promote walking, cycling and other forms of active mobility (29);• promote healthy diets low in red and processed meat and rich in plant-based foods (30).	 Health  Environment	National; community Universal health coverage	Information, education and communication
36. Raise awareness about vulnerable populations including children, periods with high air pollution/high ozone levels and recommended behaviour (5, 7, 26). Examples include: <ul style="list-style-type: none">• schedule outdoor activities for the morning or evening when ozone is usually lower, and select less physically intense activities (31);• adapt timing and intensity of physical activity to the level of air pollution (26).	 Health  Environment	National; community Universal health coverage	Information, education and communication
37. Implement dust forecasting programmes including early warning systems and short-term air pollution action plans to alert the population to stay indoors and take personal measures to minimize exposure (3).	 Health  Environment	National; community Universal health coverage	Information, education and communication

Selected tools

WHO 2021: *WHO global air quality guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide* (3)

UNEP 2021: *Actions on air quality: a global summary of policies and programmes to reduce air pollution* (32)

UNEP 2021: *Regulating air quality: the first global assessment of air pollution legislation* (33)

UNEP 2020: *Frequently asked questions on air pollution* (34)

EEA 2019: *EMEP/EEA air pollutant emission inventory guidebook 2019* (35)

This report provides technical guidance to prepare national emission inventories.

WHO Regional Office for Europe 2017: *Evolution of WHO air quality guidelines: past, present and future* (17)

UNICEF 2017: *Danger in the air: how air pollution may be affecting the brain development of young children around the world* (7)

UNICEF 2016: *Clear the air for children. The impact of air pollution on children* (36)

WHO/CCAC/UNEP 2018: *The BreatheLife Campaign* (37)

The campaign combines public health and climate change expertise with guidance on implementing solutions to air pollution in support of global development goals.

Selected tools

WHO Regional Office for Europe 2020: *AirQ+ software tool for health risk assessment of air pollution* (38)

WHO Regional Office for Europe 2019: *Health and Economic Assessment Tool (HEAT) for walking and cycling* (39)

UNECE 1979: *1979 Convention on Long-range Transboundary Air Pollution* (40)

The protocols of the Convention, including its protocols, programmes and activities, identify specific measures to be taken by the parties that ratified the Convention to cut their emissions.

EMEP 2020: Tools under the *Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe* (41)

The United Nations Economic Commission for Europe (UNECE) also has materials on capacity building activities (42) and programmes (43)

2.3 Indoor air pollution: household air pollution, second-hand tobacco smoke, dampness and mould



This section covers guidance to improve the quality of air within and around household environments from various pollutants and polluting sources. The most important source of pollution worldwide, in particular in low- and middle-income countries,⁴ comes from inefficient fuel combustion for cooking, heating and lighting, generating PM and other noxious gases. Other harmful pollutants include second-hand tobacco smoke, as well as radon and compounds released into the air from microbial growth (moulds). This section also includes information on the context and relevant tools for assessment and implementation.

Measures to reduce indoor air pollution from combustion sources overlap with those to reduce harmful emissions that contribute to ambient air pollution and climate change – and thereby create multiple benefits. Synergies between measures to reduce air pollution and those mitigating climate change should be actively sought when prioritizing action.

Most households using unclean fuels and technologies are poor. General measures to reduce poverty often will enable people to switch to cleaner fuels and technologies and thereby reduce their exposure to air pollutants.

For guidance on radon, see [Section 6.4 Radon](#).

⁴ Country income classification of low, lower-middle, upper-middle and high are determined by the World Bank and based on gross national income (GNI) per capita; see: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups> and <https://blogs.worldbank.org/opendata/new-country-classifications-income-level-2019-2020>. Classifications are updated annually.



Overview

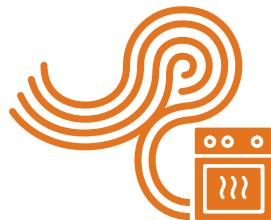
Almost half of the world's population live in households polluted with smoke from cooking with unclean fuels and technologies. Exposure is particularly high among women and young children, who spend the most time near the domestic hearth (44). The fine PM (e.g. PM_{2.5} and PM₁₀) component of this pollution mix leads to an estimated 3.8 million deaths per year (2016 data) (5). Of those 3.8 million deaths, 27% were due to IHD, 18% were due to stroke and 54% were due to COPD. Household air pollution is responsible for 45% of all pneumonia deaths in children aged under 5 years and contributes to 28% of all pneumonia deaths in adults (4, 44).

In addition, small PM and other pollutants in indoor smoke lead to airway inflammation, which impedes normal immune function and the oxygen-carrying capacity of the blood (44).

Exposure to second-hand tobacco smoke and radon cause 1.3 million and 84 000 deaths per year (2019 data) respectively (45).

Note: active smoking causes 7.7 million deaths per year but is not considered an environmental risk and therefore not directly considered in this compendium.

2.3.1 Particulate matter, carbon monoxide and other pollutants from incomplete combustion processes



What is the proportion of households impacted by indoor combustion in my country?

When people are exposed to household air pollution levels above the WHO air quality guidelines, they are at increased risk of health impacts, in particular cardiovascular and respiratory diseases and lung cancer, cataract and adverse pregnancy outcomes.

The proportion of households using polluting or unclean fuels and technologies can be informed through the following.

- a. Household surveys: Household surveys are used to assess the proportion of households mainly using clean fuels and technologies used for cooking, heating and lighting. Harmonized household energy survey questions are available to assist in this assessment (46).
- b. Global database on clean fuel and technology use (4): Energy use at household level is monitored by an SDG indicator (10): 7.1.2 – Proportion of population with primary reliance on clean fuels and technology. WHO data on this indicator are available in this global database with estimates of the proportion of the population cooking with clean fuels and technologies by country, based on recent household surveys; this database is used for SDG reporting (47).
- c. Global household energy database (48): WHO maintains an exhaustive database that compiles all nationally representative survey data on fuels and technologies used for cooking, heating and lighting.

What is the proportion of households impacted by indoor combustion in my country?	Conducting field measurements of household air pollution is not required (although encouraged); use of the resources above to ascertain the extent of polluting fuel use for cooking should be sufficient to motivate action to expand clean household energy in the home. However, if there is interest in monitoring the level of household air pollution, this can be assessed through the following.																																																														
What is the contribution of residential biomass burning to ambient air pollution?	<p>The contribution of domestic fuel burning to ambient air pollution can be estimated through source apportionment studies.</p> <p>A database on source apportionment studies for airborne PM is available, and a global review provides an overview (11, 12).</p>																																																														
What is the indoor air quality we want to achieve?	<p>WHO air quality guidelines are available for a number of pollutants and cover concentrations of pollutants in the air. Worldwide, the most important indoor air health hazard originates from PM due to combustion. Health-based guideline values include the following maximum values and interim targets (Table 2.2). Interim targets are proposed as incremental steps in the reduction of air pollution and are intended for use in areas where pollution is high (3). Interim targets should be regarded as steps towards ultimately achieving AQG levels, rather than as end targets.</p>																																																														
	<p>Table 2.2. AQG levels and interim targets for selected (indoor) air</p> <table border="1"> <thead> <tr> <th rowspan="2">Pollutant</th> <th rowspan="2">Averaging time</th> <th colspan="4">Interim target</th> <th rowspan="2">AQG level</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td rowspan="2">PM_{2.5}, µg/m³</td> <td>Annual</td> <td>35</td> <td>25</td> <td>15</td> <td>10</td> <td>5</td> </tr> <tr> <td>24-hour^a</td> <td>75</td> <td>50</td> <td>37.5</td> <td>25</td> <td>15</td> </tr> <tr> <td rowspan="2">PM₁₀, µg/m³</td> <td>Annual</td> <td>70</td> <td>50</td> <td>30</td> <td>20</td> <td>15</td> </tr> <tr> <td>24-hour^a</td> <td>150</td> <td>100</td> <td>75</td> <td>50</td> <td>45</td> </tr> <tr> <td rowspan="4">CO, mg/m³</td> <td>24-hour^a</td> <td>7</td> <td>—</td> <td>—</td> <td>—</td> <td>4</td> </tr> <tr> <td>8-hour</td> <td>—</td> <td>—</td> <td>—</td> <td>—</td> <td>10</td> </tr> <tr> <td>1-hour</td> <td>—</td> <td>—</td> <td>—</td> <td>—</td> <td>35</td> </tr> <tr> <td>15-minute</td> <td>—</td> <td>—</td> <td>—</td> <td>—</td> <td>100</td> </tr> </tbody> </table>	Pollutant	Averaging time	Interim target				AQG level	1	2	3	4	PM _{2.5} , µg/m ³	Annual	35	25	15	10	5	24-hour ^a	75	50	37.5	25	15	PM ₁₀ , µg/m ³	Annual	70	50	30	20	15	24-hour ^a	150	100	75	50	45	CO, mg/m ³	24-hour ^a	7	—	—	—	4	8-hour	—	—	—	—	10	1-hour	—	—	—	—	35	15-minute	—	—	—	—	100
Pollutant	Averaging time			Interim target					AQG level																																																						
		1	2	3	4																																																										
PM _{2.5} , µg/m ³	Annual	35	25	15	10	5																																																									
	24-hour ^a	75	50	37.5	25	15																																																									
PM ₁₀ , µg/m ³	Annual	70	50	30	20	15																																																									
	24-hour ^a	150	100	75	50	45																																																									
CO, mg/m ³	24-hour ^a	7	—	—	—	4																																																									
	8-hour	—	—	—	—	10																																																									
	1-hour	—	—	—	—	35																																																									
	15-minute	—	—	—	—	100																																																									

Source: Adapted from (3)

^a 99th percentile (i.e. 3–4 exceedance days per year).

Additional information, including on other pollutants, is available:

- WHO global air quality guidelines. Particulate matter (PM_{2.5} and PM₁₀), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide (3);
- WHO guidelines for indoor air quality: household fuel combustion (51);
- WHO guidelines for indoor air quality: selected pollutants (16).

⁵ That is, particles with an aerodynamic diameter equal or less than 2.5 micrometre.

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments								
General: policies and actions											
<p>1. 1. Develop or update policies and strategies to meet the following device and fuel emission rate targets for household fuel combustion (51):</p> <table> <tr> <td>PM_{2.5} (unvented):</td> <td>0.23 mg/min</td> </tr> <tr> <td>PM_{2.5} (vented):</td> <td>0.80 mg/min</td> </tr> <tr> <td>Carbon monoxide (unvented):</td> <td>0.16 g/min</td> </tr> <tr> <td>Carbon monoxide (vented):</td> <td>0.59 g/min</td> </tr> </table> <p>Where intermediate steps are necessary, transition fuels and technologies that offer substantial health benefits should be prioritized.</p>	PM _{2.5} (unvented):	0.23 mg/min	PM _{2.5} (vented):	0.80 mg/min	Carbon monoxide (unvented):	0.16 g/min	Carbon monoxide (vented):	0.59 g/min	 Environment  Health	National	Regulation
PM _{2.5} (unvented):	0.23 mg/min										
PM _{2.5} (vented):	0.80 mg/min										
Carbon monoxide (unvented):	0.16 g/min										
Carbon monoxide (vented):	0.59 g/min										
2. Establish effective mechanisms for policy coordination at government level, to address the challenge of taking action by multiple sectors to address household energy (51).	 Environment  Health  Other sectors	National	Governance								
3. Conduct systematic monitoring and evaluation of policies that promote progress towards cleaner fuels and technologies for household energy (51).	 Environment  Health  Other sectors	National	Assessment and surveillance								
Use of clean fuels and technologies: policies and actions											
<p>4. Support implementation of clean cooking solutions: a combination of fuel and technology for cooking that is considered clean for health.</p> <p>A cooking device burning biomass is classified as clean if it meets the emission rate targets in the WHO <i>Guidelines for indoor air quality: household fuel combustion</i>, according to the international laboratory testing protocol and tested by a third party (21, 51, 52).</p>	 Health  Environment  Energy  Industry	National; community Universal health coverage	Taxes and subsidies; infrastructure, technology and built environment; regulation								
<p>5. Support implementation of clean space heating solutions – a combination of fuel and technology that is considered clean for health.</p> <p>A heating device burning biomass is classified as clean if it meets the emission rate targets in the WHO Guidelines for indoor air quality: household fuel combustion, according to the international laboratory testing protocol and tested by a third party (21, 51, 52).</p>	 Health  Industry  Environment	National; community Universal health coverage	Taxes and subsidies; regulation								
6. Support implementation of clean lighting solutions – a combination of fuel and technology that is considered clean for health (21, 51, 52).	 Health  Environment	National; community Universal health coverage	Taxes and subsidies; regulation								

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
7. Restrict using unprocessed ⁶ coal as a household fuel (51).	 Health  Environment	National; community Universal health coverage	Regulation
8. Discourage use of kerosene as a household fuel until data show its safety (51).	 Health  Environment	National; community Universal health coverage	Regulation; information, education and communication
9. Improve energy efficiency of household appliances, buildings, lighting, heating and cooling (21).	 Housing  Industry  Energy	National; community	Infrastructure, technology and built environment
10. Encourage solar and wind-based electricity; support installation of rooftop solar panels (21, 52).	 Housing  Industry  Energy	National; community	Infrastructure, technology and built environment
11. Subsidize or exempt tax on cleaner fuels and improved technologies for household cooking, heating and lighting (52).	 Finance  Environment  Other sectors	National; community	Taxes and subsidies
12. Foster consumer credit/lease arrangements for cook-stove purchases (52).	 Finance  Industry	National; community	Taxes and subsidies
13. Make available microfinance schemes to help entrepreneurs and small businesses set up kiosks to sell or service cleaner technologies, such as solar light charging points (52).	 Finance  Industry	National; community	Taxes and subsidies
14. Develop/adopt standards for laboratory testing of cook-stoves, including PM and carbon monoxide emissions and safety (which are in line with the WHO Guidelines for indoor air quality: household fuel combustion (51)), such as Household air pollution: interventions & tools (52) or ISO 19867-1:2018 (53).	 Health  Industry  Environment	National	Regulation
15. Implement third-party emission rate testing before promoting a technology or fuel, optimally including measuring of actual air pollution levels during everyday use in homes (51).	 Health  Environment	National	Regulation

⁶ Which has not been treated by chemical, physical or thermal means to reduce contaminants.

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Housing: policies and actions			
16. Reduce the need for extra heating or cooling by designing homes that utilize passive heating and cooling principles (52).	 Housing  Construction	National; community	Infrastructure, technology and built environment
17. Incorporate adequate ventilation sources into homes to vent smoke from cooking, heating and lighting activities (52).	 Housing  Construction	National; community	Infrastructure, technology and built environment
Awareness raising and capacity building			
18. Encourage health-protective behaviour appropriate to the local setting, such as cooking outdoors, improving ventilation, spending less time close to the smoky cooking and heating hearths, drying fuel wood before use and using lids on pots to shorten cooking time (31).	 Health	National; community Universal health coverage	Information, education and communication
19. Promote replacing traditional household solid fuel cook-stoves with lower-emission cook-stoves (37, 51, 54).	 Health  Environment	National; community Universal health coverage	Information, education and communication
20. Conduct awareness raising activities to promote behaviour change for use of cleaner technologies and fuel use (51, 55).	 Health  Environment	National; community Universal health coverage	Information, education and communication
21. Implement labelling scheme for cooking devices and fuels with information for consumers on whether device emissions are safe for health (51).	 Health  Environment	National	Information, education and communication

Selected tools

WHO 2021: *WHO global air quality guidelines. Particulate matter (PM_{2.5} and PM₁₀), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide* (3)

WHO/CCAC/UNEP 2018: *The BreatheLife Campaign* (37)

The campaign combines public health and climate change expertise with guidance on implementing solutions to air pollution in support of global development goals.

WHO 2018: *Clean Household Energy Solutions Toolkit (CHEST)* (56)

A step-by-step guide and tools to support the implementation of the WHO *Guidelines for indoor air quality: household fuel combustion* (51).

The module Guidance on Standards and Testing provides practical guidance on setting national standards for and testing of cook-stoves and clean cooking solutions.

WHO 2020: *Household Energy Assessment Rapid Tool (HEART) for Situational Assessment and Stakeholder Mapping* (57)

This tool is a component of the WHO CHEST.

WHO 2020: *Household Multiple Emission Sources (HOMES) model* (58)

This model helps planners and policy-makers estimate the pollution concentration (PM, CO) that will result from the use of different cook-stoves or devices in different settings.

WHO 2020: *Performance Target (PT) model* (59)

This model calculates the emission performance of cook-stoves or other household energy devices (e.g. space heaters or lights). The primary application of the PT model is to derive context-specific targets (or tiers) for PM and carbon monoxide emissions, such as tier of performance for cook-stoves when locally collected data are available.

Clean Cooking Alliance 2020: *Clean cooking catalogue* (60)

This catalogue contains a list of cooking fuels and technologies with emissions data from laboratory testing.

WHO 2008: *Evaluating household energy and health interventions: a catalogue of methods* (49)

This catalogue includes information on evaluating laboratory performance, cook-stove adoption and use, household and personal concentrations of various pollutants, including exposure levels, health and safety, economic impacts and more.

2.3.2 Environmental impacts of tobacco: second-hand tobacco smoke and environmental pollution



This section particularly relates to exposure to second-hand tobacco smoke and the environmental pollution that results from tobacco agriculture and the production and use of tobacco products. This section focuses on air pollution, so the environmental impacts of tobacco and tobacco use are discussed here, although other issues are also covered. Specific guidance about preventing and stopping tobacco use and related interventions can be found on the WHO website (61).



Overview

Tobacco pollutes the planet and damages the health of all people (62). More than 8 million deaths are attributable to tobacco each year. More than 7 million of those deaths are the direct result of tobacco use (e.g. active smoking, the immense health impacts of which are not addressed in this chapter). An estimated 1.3 million deaths are the result of nonsmokers being exposed to second-hand smoke (i.e. tobacco smoke that is present in the environment during and after smoking), which is proven to cause cancer and cardiovascular, respiratory and other diseases (63, 64). Moreover, the use of tobacco pollutes the air and leaves third-hand smoke toxins on surfaces (i.e. residual pollutants that remain on surfaces and in dust after tobacco has been smoked) (65) that harm smokers and nonsmokers (66). It is estimated that in the United States alone, cigarette smoking cost US\$ 600 billion in 2018. Of this total amount, US\$ 7 billion resulted from lost productivity due to premature deaths caused by exposure to second-hand smoke (67). The costs of tobacco's impact on health and the environment are underestimated (e.g. the economic cost of waste generated by the tobacco industry, its contribution to climate change and the loss in productivity resulting from poor health among farmers). More research is needed to better understand the full cost of the tobacco epidemic (66, 68).

The toxic mix in tobacco smoke contains more than 7 000 chemicals, and at least 70 are known to cause cancer in humans and animals (66); the chemicals are similar to those resulting from other incomplete combustion processes and include additional ones that are specific to tobacco smoke. This smoke is often measured as particulate matter. Children and infants are particularly susceptible to second-hand smoke, and exposure puts them at increased risk for respiratory disease, ear infections and sudden infant death syndrome. Exposure to tobacco smoke occurs mostly in private settings, such as homes, and has a disproportionate impact on children and women (67).

Exposure to second-hand smoke is an urgent public health concern due to its pervasive and severe health risks. It has been acknowledged as one of the three time-bound measures in the WHO Framework Convention on Tobacco Control (FCTC) due to its significant impact on nonsmokers' health. In recognition of its immediate and detrimental effects, addressing exposure to second-hand smoke became a critical goal within the WHO FCTC to safeguard the health of individuals globally (69, 70). Comprehensive laws to ensure smoke-free environments result in reduced exposure to second-hand smoke, reduced hospital admissions for acute coronary syndrome and reduced mortality from smoking-related illnesses, including reduced infant mortality (67).

Growing tobacco, producing tobacco products, and packaging and transporting them have widespread environmental impacts through generating substantial amounts of greenhouse gas emissions; causing deforestation (up to 5% of global deforestation is associated with growing and curing tobacco, further contributing to CO₂ emissions and climate change) and soil and water depletion; and generating waste, including toxic waste (62, 66). In particular, cigarette butts create large amounts of toxic waste, and there is growing public concern regarding environmental plastic pollution resulting from single-use cellulose acetate cigarette filters, which do not have any proven health benefits and harm the environment (71). The problem of waste is aggravated by the growing number of single-use electronic smoking devices and nicotine delivery products, which contain metals, plastics and batteries, thus increasing the amount of toxic waste produced (66).

Growing tobacco is resource intensive and requires the heavy use of pesticides, fertilizers and water, which contribute to soil degradation and contamination. This means that land used for growing tobacco has less capacity to support growing other crops, such as food (62, 66).

Tobacco farmers and their families are exposed to several health risks. For example, about 25% of tobacco farmers suffer from green tobacco sickness, caused by nicotine absorbed while handling tobacco leaves. They are also exposed to harmful substances, such as tobacco dust and pesticides. Additionally, tobacco farmers often carry harmful substances home on their bodies, clothes or shoes, leading to tertiary exposure for their families. Children are especially vulnerable due to their smaller size and greater nicotine absorption through the skin. Pregnant women are at higher risk of miscarriage (62, 66).

What is the proportion of people impacted by second-hand tobacco smoke in my country?	Information about current exposure to second-hand tobacco smoke can be found through the following websites: <ul style="list-style-type: none">– national and regional household surveys, such as the Global Adult Tobacco Survey (72, 73) and the Global Youth Tobacco Survey (74, 75);– WHO's STEPwise approach to risk factor surveillance (STEPS) for noncommunicable diseases (NCDs) (76); the STEPS approach is a simple, standardized method for collecting, analysing and disseminating data about NCDs and risk factors;– Global Burden of Disease estimates for second-hand tobacco smoke (64).
What levels of exposure to second-hand tobacco smoke do we want to achieve?	There is no safe level of exposure to tobacco smoke. Only 100% smoke-free indoor environments without any exceptions – such as for designated smoking areas or smoking rooms – are proven to protect health (67, 69). Note: Indoor areas include any space covered by a roof or enclosed by one or more walls or sides, regardless of the type of material used for the roof, wall or sides, and regardless of whether the structure is permanent or temporary (69).
What are the environmental impacts resulting from tobacco in my country?	Despite the challenges that might be faced in collecting most of these data, the environmental impact resulting from tobacco can be assessed by: <ul style="list-style-type: none">– collecting data about water use, deforestation, soil depletion and the chemicals in tobacco products, including those that are lethal and those that degrade the environment, and about the environmental harm caused by these components to soil, drinking-water and human and animal health;– estimating the total amount of waste from tobacco products, as well as its impact and the total environmental impact of a single tobacco product;<ul style="list-style-type: none">○ to inform health policy and practice and improve public health outcomes, governments and society can benefit from cost estimates of preventing, properly disposing of and cleaning up tobacco product waste, and these estimates could motivate a shift in accountability for the costs of tobacco product waste to the global tobacco industry (77).

The Guidance table provides an overview of the most relevant advice from WHO and other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
Policies and actions: Reducing tobacco use				
1. Comprehensively implement the WHO FCTC (70). To help countries implement the WHO FCTC, WHO introduced MPOWER (78), a package of technical measures and resources intended to assist in the country-level implementation of effective interventions to reduce the demand for tobacco. MPOWER builds the capacity of countries to implement six measures to reduce the demand for tobacco products by: <ul style="list-style-type: none">• monitoring policies for tobacco use and prevention;• protecting people from tobacco use;• offering help to quit tobacco use;• warning about the dangers of tobacco;• enforcing bans on tobacco advertising, promotion and sponsorship;• raising taxes on tobacco.	 Health  Multiple sectors	National	Regulation; governance	A, B
2. Ban smoking in all public indoor areas, including but not limited to public transport; workplaces; health institutions; educational and government facilities; universities; retail shops and shopping malls; hospitality and catering facilities, such as restaurants, pubs, bars, hotels, and community and sports centres; manufacturing and processing plants; and all public areas in multiple-unit dwellings, including lobbies, elevators and stairwells (69, 79).		National	Regulation	A, B
3. Protect tobacco control policies from commercial interests and others with vested interests in the tobacco industry (70).		National	Regulation	A, B
4. Refrain from approaches that do not aim to ensure a 100% smoke-free indoor environment (67, 69). Other approaches – such as ventilation, air filtration and the use of designated smoking areas – are ineffective to sufficiently protect the health of the population.		National	Regulation	A, B
5. Consider making outdoor or quasi-outdoor areas and public places smoke-free, for example playgrounds, parks, beaches, outdoor stadiums and patios (67). This will also reduce tobacco product waste from smoked cigarettes, which contains more than 7 000 toxic chemicals, including 70 known human carcinogens that leach into and accumulate in the environment (68).		National	Regulation	B
6. Monitor compliance with smoking bans, and impose legal responsibilities both on businesses and individual smokers, specifying fines or administrative sanctions for violations, or both (69).		National	Assessment and surveillance; regulation	A

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>7. Require managers or owners of public establishments to implement the smoking ban (67, 69). Key actions might include:</p> <ul style="list-style-type: none"> posting signs at entrances that clearly state smoking is not permitted; displaying clear instructions about how to report a violation; removing ashtrays from premises; supervising observance of the rules; discouraging individuals from smoking by asking them not to smoke. <p>In case of noncompliance, encourage owners or managers to:</p> <ul style="list-style-type: none"> discontinue service; ask the person to leave the premises; contact a law enforcement agency. 	 Multiple sectors	National	Regulation; other management and control; assessment and surveillance	A, B
8. Implement inspections to ensure compliance with nonsmoking policies in all businesses and workplaces (67, 69).	 Multiple sectors	National	Assessment and surveillance	A, B
9. Implement national smoking cessation services, ideally with full cost coverage (67, 70).	 Multiple sectors	National	Other management and control	A, B
Policies and actions: reducing the environmental impact of tobacco				
<p>10. Impose on the tobacco industry the policy principle of “extended producer responsibility” (based on the “polluter pays” principle) to hold it accountable for the risks posed to the environment and the costs of cleaning up tobacco product waste (62, 66, 68). This means that the tobacco industry should be responsible for the cost of cleaning up improperly discarded waste from tobacco products, among other responsibilities (66).</p>	 Environment  Industry	National	Regulation	B
11. Require tobacco manufacturers to supply timely and regular information and data about the environmental and health risks of tobacco throughout the production and distribution processes (68).	 Environment  Agriculture  Industry	National	Regulation; assessment and surveillance	B
12. Levy an environmental tax on tobacco manufacturers, distributors and consumers, across the supply chain, to account for carbon emissions, air pollution and other environmental costs (66). Levying an environmental tax on tobacco products adds an additional charge to their cost, and the revenue generated can be directed towards environmental protection and restoration efforts.	 Environment  Industry  Transport	National	Regulation	B

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
13. Progressively ban single-use plastics, including cigarette filters, which do not have any proven health benefit and are known to harm the environment (66).	 Industry	National	Regulation	B
14. Stop providing direct tobacco subsidies to tobacco farming and reallocate them to tobacco control programmes (e.g. support alternative livelihoods for tobacco farmers) (62, 66).	 Agriculture  Food	National; community	Governance	B
15. Strengthen the regulation of tobacco agriculture to prevent deforestation and land degradation (68).	 Environment  Agriculture	National	Regulation	B
16. Support academic and intergovernmental organizations to collect data about water use, deforestation, soil depletion and the chemicals in tobacco products that are lethal and degrade the environment so the total environmental impact of tobacco can be estimated (66), and make this evidence available to policy-makers (68).	 Industry  Environment  Education	National	Assessment and surveillance	B
Awareness-raising and capacity-building				
17. Raise awareness about the risks of exposure to second-hand tobacco smoke (e.g. through information campaigns and community engagement sessions), and implement educational strategies to reduce exposure to second-hand smoke in homes (67, 69).	 Health	National; community Universal health coverage	Information, education and communication	A, B
18. Raise awareness about the environmental impacts of tobacco across the life cycle, including impacts from cultivation to production, distribution, use and waste (66, 68). This might also include raising awareness about the tobacco industry's greenwashing tactics, as well as raising awareness among farmers and informing them about viable alternative livelihoods and the benefits of switching to other value chains (62, 66).	 Environment  Multiple sectors	National; community	Information, education and communication	B
19. Inform, consult with and involve the public by clearly explaining the purpose of a smoking ban to ensure support and smooth implementation. This may involve engaging the community in monitoring compliance and reporting violations, for example by establishing a free telephone complaint hotline or similar system (69).	 Health	National; community Universal health coverage	Information, education and communication; assessment and surveillance	A

FCTC: WHO Framework Convention on Tobacco Control; MPOWER: monitoring tobacco use; protecting people from tobacco smoke; offering help to quit tobacco; warning about the dangers of tobacco; enforcing bans on tobacco advertising, promotion and sponsorship; raising taxes on tobacco.

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

WHO 2023: WHO report on the global tobacco epidemic, 2023: protect people from tobacco smoke (67) – This report tracks the progress made in tobacco control by countries since 2008 and marks 15 years since the introduction of the MPOWER technical package (78), which is designed to help countries implement the demand-reduction measures of the WHO FCTC.

WHO 2022: Tobacco: poisoning our planet (66) – This report not only describes the health risks of tobacco but also the environmental risks of tobacco cultivation, production, distribution, consumption and waste.

WHO 2017: Tobacco and its environmental impact: an overview (68) – This overview assembles evidence from an environmental perspective about the ways in which tobacco affects human well-being.

WHO 2013: Guidelines for implementation of Article 8: WHO Framework Convention on Tobacco Control. Protection from exposure to tobacco smoke (69) – These guidelines contain recommendations for the steps required to satisfy the obligations of the Convention and to achieve effective protection from the hazards of second-hand tobacco smoke.

WHO 2003: WHO Framework Convention on Tobacco Control (70) – The WHO FCTC was the first treaty negotiated under the auspices of the World Health Organization.

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

WHO 2024: Noncommunicable disease surveillance, monitoring and reporting: STEPwise approach to NCD risk factor surveillance (STEPS) [website] (76) – STEPS is a simple, standardized method for collecting, analysing and disseminating data about NCDs and their risk factors.

WHO 2023: Heated tobacco products: summary of research and evidence of health impacts (80) – This policy brief summarizes the eighth report of the WHO Study Group on Tobacco Product Regulation (81), which addresses novel and emerging nicotine and tobacco products and provides a quick reference guide for countries.

WHO Regional Office for Europe 2023: Nicotine- and tobacco-free schools: policy development and implementation toolkit (82) – This toolkit provides practical advice about developing policies to ensure nicotine- and tobacco-free schools.

WHO 2022: Q&A: World No Tobacco Day 2022 [website] (83) – This website provides information in the format of questions and answers about multiple issues, including the environmental impacts of tobacco (e.g. deforestation, soil depletion, water and air pollution, and waste).

Lam et al. 2022: *Modelling the global economic costs of tobacco product waste* (77) – This article proposes an approach to estimate the economic costs of waste from tobacco products based on its negative environmental externalities.

WHO 2020: How to make your campus smoke-free (84) – This step-by-step guide provides support for establishing smoke-free campuses.

WHO 2019: Second-hand smoke: training for health care providers, second edition (85) – This set of slides provides an overview of the health effects of tobacco and second-hand tobacco smoke, and addresses the special vulnerability of children. It describes strategies to prevent and reduce exposure to second-hand smoke.

WHO 2018: Cigarette smoking: an assessment of tobacco's global environmental footprint across its entire supply chain, and policy strategies to reduce it (86) – This report assesses all of the resources needed across the tobacco supply chain and the environmental impact of tobacco smoking.

WHO, UN Development Programme 2017: The WHO Framework Convention on Tobacco Control: an accelerator for sustainable development (87) – This discussion paper supports the integration of tobacco control efforts as part of implementation of the Sustainable Development Goals (88).

2.3.3 Dampness and mould



This section summarizes measures to control mould growth indoors. The most important means for avoiding adverse health effects is the prevention (or minimization) of persistent dampness and microbial growth on interior surfaces and in building structures.



Overview

Indoor moisture can lead to microbial pollution caused by hundreds of species of bacteria and fungi, in particular filamentous fungi (mould), growing indoors. The most important effects are increased prevalence of respiratory symptoms, allergies and asthma as well as perturbation of the immunological system.

What is the indoor air quality we want to achieve?

Persistent dampness and microbial growth on interior surfaces and in building structures should be avoided or minimized, as they may lead to adverse health effects (89).

Additional information, including on other pollutants, is available: *WHO guidelines for indoor air quality: dampness and mould* (89).



Guidance



Sector principally involved in planning/implementation



Level of implementation



Instruments

Policies and actions: prevention of dampness and mould

1. Develop comprehensive national regulations, strategies and campaigns about healthy buildings that include dampness and mould prevention (90)	Housing Construction Health	National	Regulation
2. Equip local authorities with a clear mandate and sufficient resources to work on the prevention of dampness and mould (90).	Housing Construction	National	Governance
3. Implement preventive measures against dampness and mould in building design and construction such as adequate insulation, ventilation and heating (90). Building design and construction needs to consider climate, culture, location and intended use.	Housing Construction	National; community	Other management and control; infrastructure, technology and built environment
4. Implement regular professional building inspection and maintenance (90).	Housing Construction	National; community	Assessment and surveillance; other management and control

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Policies and actions: existing dampness and mould			
5. Provide targeted and easy-to-access information by health, housing and consumer protection agencies, which tend to be the first agencies contacted for support (90).	 Housing  Construction  Health	National; community	Information, education and communication
6. Ensure prompt and adequate remediation including both moisture control and mould abatement (90).	 Housing  Construction	National; community	Other management and control
7. Remove or mechanically clean all mould and contaminated materials (90).	 Housing  Construction	National; community	Other management and control
8. Identify the root causes of damp, moisture or mould occurrence (90). Selected key actions include: <ul style="list-style-type: none">• identify and address indoor and outdoor sources of dampness;• improve thermal insulation;• control or adapt ventilation;• increase indoor temperatures as necessary.	 Housing  Construction	National; community	Assessment and surveillance; other management and control
9. Avoid the use of biocides and/or chemical compounds for the prevention of mould and, to the extent possible, minimize their use in mould remediation (90).	 Housing  Construction	National; community	Other management and control
Awareness raising and capacity building			
10. Develop and disseminate information to the public with a focus on vulnerable population groups – such as people with asthma, allergies or respiratory disorders; those immunocompromised; and children, older people and people living in substandard housing (90). This should entail information on the health effects of indoor dampness and mould, advice on preventing dampness and excessive moisture (e.g. through information on adequate residential behaviour, ventilation and building maintenance) and on suitable steps to take if mould growth does occur.	 Health  Housing  Construction	National; community Universal health coverage	Information, education and communication
11. Implement appropriate training and education curricula within the housing and construction sectors to address the relevance of building quality and its links to health (90).	 Housing  Construction  Health	National	Information, education and communication

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
12. Raise awareness among building users about key indicators and signs that indicate problems with moisture or mould (90).	 Housing  Construction  Health	National; community Universal health coverage	Information, education and communication
13. Raise awareness among building owners about their responsibility for providing healthy workplaces or living environments that are free of excessive moisture and mould (90).	  	National; community Universal health coverage	Information, education and communication
14. Raise awareness among the health sector about key indicators and typical health outcomes associated with indoor environments (90).		National; community Universal health coverage	Information, education and communication
15. Develop housing manuals that summarize the operative tasks and challenges of the building, its construction style and its equipment as a guidance and information tool for building users (90).	 	National; community	Information, education and communication

Selected tools

WHO Regional Office for Europe 2010: *Technical and policy recommendations to reduce health risks due to dampness and mould* (90)

WHO Regional Office for Europe/Health and Environment Alliance 2009: *Damp and mould: health risks, prevention and remedial actions. Information brochure* (91)

WHO Regional Office for Europe 2007: *Guidelines for indoor air quality: dampness and mould* (89)

References

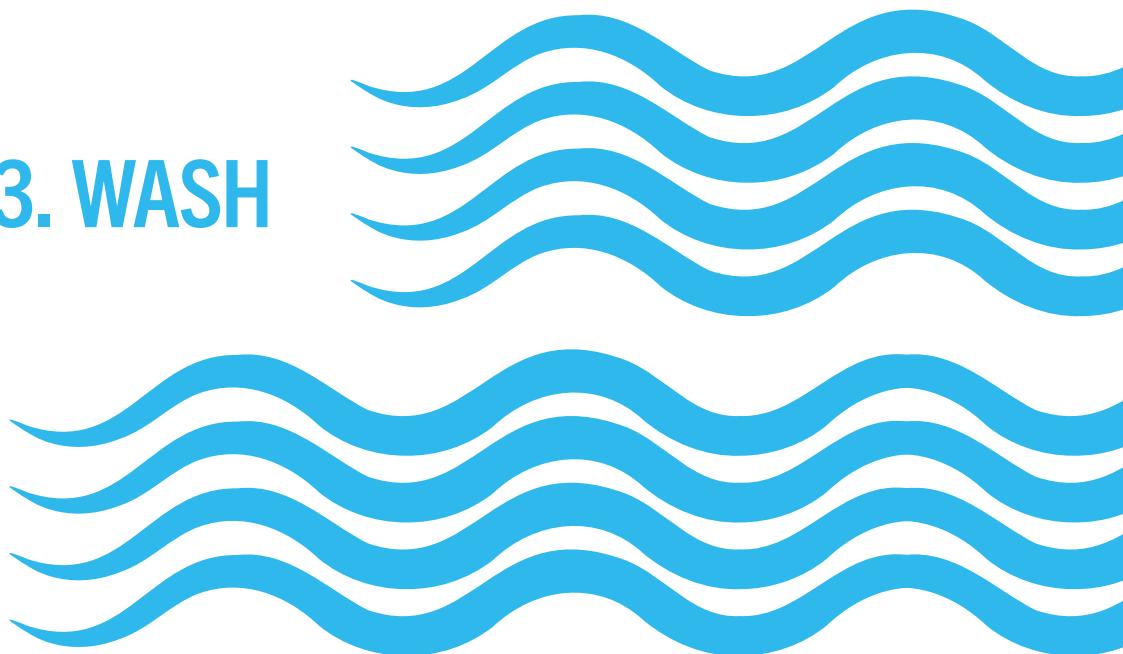
1. Air pollution. Geneva: World Health Organization; 2020 (https://www.who.int/health-topics/air-pollution#tab=tab_1, accessed 23 December 2020).
2. Maas R, Grennfelt P. Towards cleaner air. Scientific assessment report 2016: United Nations Economic Commission for Europe; 2016 (https://unece.org/sites/default/files/2021-06/CLRTAP_Scientific_Assessment_Report_en.pdf, accessed 2 October 2019).
3. WHO global air quality guidelines. Particulate matter, ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Geneva: World Health Organization; 2021 (<https://apps.who.int/iris/handle/10665/345329>, accessed 23 September 2021).
4. Global Health Observatory – Data Repository. Geneva: World Health Organization; 2020 (<https://apps.who.int/gho/data/node.main.122?lang=en>, accessed 29 May 2020).
5. Healthy environments for healthier populations: Why do they matter, and what can we do? Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/325877>, accessed 14 June 2021).
6. Air pollution and child health: prescribing clean air. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/275545>, accessed 15 January 2021).
7. Danger in the air: how air pollution may be affecting the brain development of young children around the world. New York (NY): United Nations Children's Fund; 2017 (https://www.unicef.org/sites/default/files/press-releases/glo-media-Danger_in_the_Air.pdf, accessed 15 September 2021).
8. WHO global ambient air quality database (update 2018). Geneva: World Health Organization; 2018 (<https://www.who.int/data/gho/data/themes/air-pollution/who-air-quality-database> accessed 5 November 2021).
9. Global ambient air pollution. Interactive map. Geneva: World Health Organization; 2019 (<https://www.who.int/data/gho/data/themes/air-pollution/ambient-air-pollution>, accessed 5 November 2021).
10. Monitoring health for the SDGs. World Health Organization; 2019 (<http://apps.who.int/gho/data/node.sdg>, accessed 3 October 2019).
11. Database on source apportionment studies for particulate matter in the air (PM10 and PM2.5). Geneva: World Health Organization; 2015 (<https://www.who.int/data/gho/data/themes/air-pollution/source-apportionment-db>, accessed 14 June 2021).
12. Hopke PK, Dai Q, Li L, Feng Y. Global review of recent source apportionments for airborne particulate matter. *Sci Total Environ.* 2020;740:140091. doi:10.1016/j.scitotenv.2020.140091.
13. McDuffie EE, Martin RV, Spadaro JV, Burnett R, Smith SJ, O'Rourke P et al. Source sector and fuel contributions to ambient and attributable mortality across multiple spatial scales. *Nat Commun.* 2021;12(1):3594. doi:10.1038/s41467-021-23853-y.
14. Air quality guidelines for Europe. Copenhagen: WHO Regional Office for Europe; 1987 (<https://apps.who.int/iris/handle/10665/107364>).
15. Air quality guidelines for Europe, 2nd ed. Copenhagen: WHO Regional Office for Europe; 2000 (<https://apps.who.int/iris/handle/10665/107335>).
16. WHO guidelines for indoor air quality: selected pollutants. Copenhagen: WHO Regional Office for Europe; 2010 (<https://iris.who.int/handle/10665/260127>).
17. Evolution of WHO air quality guidelines: past, present and future. Copenhagen: WHO Regional Office for Europe; 2010 (<https://apps.who.int/iris/handle/10665/341912>).
18. Health in the green economy. Health co-benefits of climate change mitigation – Transport sector. Geneva: World Health Organization; 2011 (<https://apps.who.int/iris/handle/10665/70913>, accessed 14 June 2021).
19. UN Habitat, WHO. Integrating health in urban and territorial planning: sourcebook for urban leaders, health and planning professionals. Geneva: UN Habitat, World Health Organization; 2020 (<https://unhabitat.org/integrating-health-in-urban-and-territorial-planning-a-sourcebook-for-urban-leaders-health-and>, accessed 4 August 2020).
20. Health as the pulse of the new urban agenda. United Nations Conference on Housing and Sustainable Urban Development. Geneva: World Health Organization; 2016 (<https://apps.who.int/iris/handle/10665/250367>, accessed 14 June 2021).
21. CCAC, UNEP. Air pollution in Asia and the Pacific: science-based solutions. Bangkok: United Nations Environment Programme Programme; 2019 (<https://ccacoalition.org/en/resources/air-pollution-asia-and-pacific-science-based-solutions-summary-full-report>, accessed 2 June 2021).
22. Guidance document on emission control techniques for mobile sources under the Convention on Long-Range Transboundary Air Pollution. Geneva: United Nations Economic Commission for Europe; 2016 (https://www.unece.org/fileadmin/DAM/env/documents/2016/AIR/Publications/ECE_EB.AIR_138_En.pdf, accessed 17 October 2019).
23. Used vehicles and the environment. Nairobi: United Nations Environment Programme; 2020 (<https://www.unep.org/resources/report/global-trade-used-vehicles-report>, accessed 12 October 2021).
24. Human health in areas with industrial contamination. Copenhagen: WHO Regional Office for Europe; 2020 (<https://apps.who.int/iris/handle/10665/144490>, accessed 15 January 2021).
25. Waste and contaminated sites. European health information gateway. Copenhagen: WHO Regional Office for Europe; 2020 (<https://gateway.euro.who.int/en/themes/waste-and-contaminated-sites/>, accessed 27 November 2020).
26. Personal interventions and risk communication on Air Pollution. Geneva: World Health Organization; 2020 (<https://apps.who.int/iris/handle/10665/333781>, accessed 15 January 2021).
27. Urban green spaces: a brief for action. Copenhagen: WHO Regional Office for Europe; 2017 (<https://www.euro.who.int/en/health-topics/environment-and-health/urban-health/publications/2017/urban-green-spaces-a-brief-for-action-2017>, accessed 15 January 2021).

28. Urban green spaces and health – a review of the evidence. Copenhagen: World Health Organization Regional Office for Europe; 2016 (http://www.euro.who.int/__data/assets/pdf_file/0005/321971/Urban-green-spaces-and-health-review-evidence.pdf?ua=1, accessed 16 October 2018).
29. Global action plan on physical activity 2018–2030: more active people for a healthier world. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/272722>, accessed 14 June 2021).
30. Special report on climate change and land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems Geneva: Intergovernmental Panel on Climate Change; 2019 (<https://www.ipcc.ch/srccl/>, accessed 19 July 2020).
31. WHO, UNEP. Healthy environments for healthy children: key messages for action. Geneva: World Health Organization; 2010 (<https://apps.who.int/iris/handle/10665/44381>, accessed 16 August 2021).
32. Actions on Air Quality: A Global Summary of Policies and Programmes to Reduce Air Pollution. Nairobi: United Nations Environment Programme; 2021 (<https://www.unep.org/resources/report/actions-air-quality-global-summary-policies-and-programmes-reduce-air-pollution>, accessed 19 July 2020).
33. Regulating Air Quality: the First Global Assessment of Air Pollution Legislation. Nairobi: United Nations Environment Programme; 2021 (<https://www.unep.org/resources/report/regulating-air-quality-first-global-assessment-air-pollution-legislation>, accessed 19 July 2020).
34. Frequently asked questions on air pollution. Nairobi: United Nations Environment Programme Programme; 2020 (<https://www.cleanairblueskies.org/did-you-know/frequently-asked-questions-air-pollution>, accessed 2 December 2020).
35. EEA. EMEP/EEA air pollutant emission inventory guidebook 2019. Luxembourg: EEA; 2019 (<https://www.eea.europa.eu/publications/emep-eea-guidebook-2019>, accessed 21 May 2020).
36. Clear the air for children. The impact of air pollution on children. New York (NY): United Nations Children's Fund; 2016 (https://www.unicef.org/publications/index_92957.html, accessed 15 January 2021).
37. WHO, CCAC, UNEP. Breathelife campaign. Geneva: World Health Organization; 2018 (<https://breathelife2030.org/>, accessed 15 January 2021).
38. AirQ+: software tool for health risk assessment of air pollution Bonn: World Health Organization Regional Office for Europe; 2020 (<http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/activities/airq-software-tool-for-health-risk-assessment-of-air-pollution>, accessed 21 May 2020).
39. Health Economic Assessment Tool (HEAT) for walking and cycling. Copenhagen: WHO Regional Office for Europe; 2019 (<https://www.heatwalkingcycling.org/#homepage>, accessed 11 June 2020).
40. 1979 Convention on Long-Range Transboundary Air Pollution. Geneva: United Nations Economic Commission for Europe; 1979 (<https://unece.org/sites/default/files/2021-06/20191003-CAPACITY-BUILDING-DIGITAL-PAGE-EN.pdf>, accessed 4 June 2021).
41. EMEP. Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe. Norway: European Monitoring and Evaluation Programme; 2020 (<https://www.emep.int/index.html>, accessed 21 May 2020).
42. Capacity building. Geneva: United Nations Economic Commission for Europe; 2020 (<http://www.unece.org/environmental-policy/conventions/envlratapwelcome/capacity-building.html>, accessed 21 May 2020).
43. On the way to clean air. The capacity-building programme under the Convention on Long-Range Transboundary Air Pollution in Eastern Europe, the Caucasus and Central Asia. Geneva: United Nations Economic Commission for Europe; 2019 (<https://unece.org/environment-policy/publications/way-clean-air>).
44. Household air pollution and health. Fact sheet. Geneva: World Health Organization; 2018 (<http://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health>, accessed 24 September 2018).
45. GBD Results tool. Seattle (WA): Institute for Health Metrics and Evaluation; 2021 (<http://ghdx.healthdata.org/gbd-results-tool>, accessed 8 April 2021).
46. Harmonized household energy survey questions. Geneva: World Health Organization; 2019 (https://www.who.int/airpollution/household/1_Harmonized_household_energy_survey_questions-list_format_final_Nov2019.pdf?ua=1, accessed 14 June 2021).
47. IEA, IRENA, United Nations Statistics Division, World Bank, WHO. The energy progress report. International Energy Agency, International Renewable Energy Agency, United Nations Statistics Division, The World Bank, World Health Organization; 2020 (<https://trackingsdg7.esmap.org/>, accessed 29 November 2020).
48. WHO Household energy database. Geneva: World Health Organization; 2010 (<https://www.who.int/data/gho/data/themes/air-pollution/who-household-energy-db>, accessed 14 June 2021).
49. Evaluating household energy and health interventions: a catalogue of methods. Geneva: World Health Organization; 2008 (<https://apps.who.int/iris/handle/10665/338960>, accessed 12 June 2020).
50. Global database of household air pollution measurements. Geneva: World Health Organization; 2021 (<https://www.who.int/data/gho/data/themes/air-pollution/hap-measurement-db>, accessed 14 June 2021).
51. WHO guidelines for indoor air quality: household fuel combustion. Geneva: World Health Organization; 2014 (<https://www.who.int/publications/i/item/9789241548885>, accessed 15 January 2021).
52. Household air pollution: identifying solutions for countries. Geneva: World Health Organization; 2021 (<https://www.who.int/activities/air-pollution-identifying-solutions-for-countries>, accessed 14 June 2021).
53. ISO 19867-1:2018. Clean cookstoves and clean cooking solutions — Harmonized laboratory test protocols — Part 1: Standard test sequence for emissions and performance, safety and durability. Geneva: International Organization for Standardization; 2018 (<https://www.iso.org/committee/4857971.html>, accessed 1 June 2020).
54. Ambient air pollution: interventions & tools. Geneva: World Health Organization; 2019 (<https://www.who.int/airpollution/ambient/interventions/en/>, accessed 2 October 2019).
55. Air pollution. Behaviour change. Geneva: World Health Organization; 2020 (<https://www.who.int/airpollution/household/interventions/behaviour/en/>, accessed 29 May 2020).

56. Clean household energy solutions toolkit (CHEST). Geneva: World Health Organization; 2018 (<https://www.who.int/tools/clean-household-energy-solutions-toolkit>, accessed 14 June 2021).
57. Situational Assessment and Stakeholder Mapping with the Household Energy Assessment Rapid Tool (HEART). Geneva: World Health Organization; 2020 (<https://www.who.int/publications/m/item/household-energy-assessment-rapid-tool-heart-for-situational-assessment-and-stakeholder-mapping-environmental-health-specialist>, accessed 14 June 2021).
58. Household multiple emission sources (HOMES) model. Geneva: World Health Organization; 2020 (<https://www.who.int/tools/household-multiple-emission-source-homes-model>, accessed 14 June 2021).
59. Performance Target (PT) model. Geneva: World Health Organization; 2020 (<https://www.who.int/tools/clean-household-energy-solutions-toolkit>, accessed 14 June 2021).
60. Clean Cooking Alliance. The clean cooking catalog. Washington (DC): Clean Cooking Alliance; 2020 (<http://catalog.cleancookstoves.org/>, accessed 1 June 2020).
61. Tobacco [website]. Geneva: World Health Organization; 2023 (https://www.who.int/health-topics/tobacco#tab=tab_1, accessed 16 January 2024).
62. World No Tobacco Day 2023: grow food, not tobacco. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/368076>, accessed 16 January 2024).
63. Tobacco: key facts [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/news-room/fact-sheets/detail/tobacco>, accessed 16 January 2024).
64. GBD results [Global Burden of Disease website]. Seattle (WA): Institute for Health Metrics and Evaluation; 2023 (<http://ghdx.healthdata.org/gbd-results-tool>, accessed 16 January 2024).
65. Matt GE, Greiner L, Record RA, Wipfli H, Long J, Dodder NG, et al. Policy-relevant differences between secondhand and thirdhand smoke: strengthening protections from involuntary exposure to tobacco smoke pollutants. *Tob Control*. 2023;2023: tc-2023-057971. doi:10.1136/tc-2023-057971.
66. Tobacco: poisoning our planet. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/354579>, accessed 16 January 2024).
67. WHO report on the global tobacco epidemic, 2023: protect people from tobacco smoke. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/372043>, accessed 16 January 2024).
68. Tobacco and its environmental impact: an overview. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/255574>, accessed 16 January 2024).
69. Guidelines for implementation of Article 8: WHO Framework Convention on Tobacco Control. Protection from exposure to tobacco smoke. Geneva: World Health Organization; 2013 (<https://fctc.who.int/publications/m/item/protection-from-exposure-to-tobacco-smoke>, accessed 16 January 2024).
70. WHO Framework Convention on Tobacco Control. Geneva: World Health Organization; 2003 (<https://apps.who.int/iris/handle/10665/42811>, accessed 16 January 2024).
71. Novotny TE, Hamzai L. Cellulose acetate cigarette filter is hazardous to human health. *Tob Control*. 2023;2023: tc-2023-057925. doi:10.1136/tc-2023-057925.
72. Noncommunicable disease surveillance, monitoring and reporting: Global Adult Tobacco Survey [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/global-adult-tobacco-survey>, accessed 16 January 2024).
73. The Global Adult Tobacco Survey (GATS) Atlas. Atlanta (GA): US Centers for Disease Control and Prevention; 2024 (https://www.cdc.gov/tobacco/global/gtss/tobacco_atlas/index.htm, accessed 16 January 2024).
74. Global Youth Tobacco Survey [website]. Geneva: World Health Organization 2023 (<https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/global-youth-tobacco-survey>, accessed 16 January 2024).
75. Global Tobacco Surveillance System Data (GTSSData). Global Youth Tobacco Survey (GYTS) – overview [website]. Atlanta (GA): US Centers for Disease Control and Prevention; 2024 (<https://nccd.cdc.gov/gtssdatasurveymaterials/Ancillary/Documentation.aspx?SUID=1&DOCT=1>, accessed 16 January 2024).
76. Noncommunicable disease surveillance, monitoring and reporting: STEPwise approach to NCD risk factor surveillance (STEPS) [website]. Geneva: World Health Organization; 2024 (<https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/steps>, accessed 16 January 2024).
77. Lam J, Schneider J, Shadbegian R, Pega F, St Claire S, Novotny TE. Modelling the global economic costs of tobacco product waste. *Bull World Health Organ*. 2022;100(10):620-7. doi:10.2471/BLT.22.288344.
78. MPOWER [website]. Geneva: World Health Organization; 2024 (<https://www.who.int/initiatives/mpower>, accessed 16 January 2024).
79. MPOWER groups – protect from tobacco smoke [online database]. Geneva: World Health Organization, Global Health Observatory; 2024 (<https://www.who.int/data/gho/indicator-metadata-registry/imr-details/341>, accessed 16 January 2024).
80. Heated tobacco products: summary of research and evidence of health impacts. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/368022>, accessed 16 January 2024).
81. WHO Study Group on Tobacco Product Regulation. Report on the scientific basis of tobacco product regulation: eighth report of a WHO study group. Geneva: World Health Organization; 2021 (WHO Technical Report Series, no. 1029; <https://iris.who.int/handle/10665/341113>, accessed 16 January 2024).
82. Nicotine- and tobacco-free schools: policy development and implementation toolkit. Copenhagen: WHO Regional Office for Europe; 2023 (<https://iris.who.int/handle/10665/372960>, accessed 16 January 2024).
83. Q&A: World No Tobacco Day 2022 [website]. Geneva: World Health Organization; 2022 (<https://www.who.int/news-room/questions-and-answers/item/q-a-world-no-tobacco-day-2022>, accessed 16 January 2024).
84. How to make your campus smoke-free. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/330766>, accessed 16 January 2024).
85. Second-hand smoke: training for health care providers, second edition. Geneva: World Health Organization; 2019 (<https://iris.who.int/handle/10665/331800>, accessed 16 January 2024).

86. Zafeiridou M, Hopkinson NS, Voulvoulis N. Cigarette smoking: an assessment of tobacco's global environmental footprint across its entire supply chain, and policy strategies to reduce it. Geneva: World Health Organization; 2018 (<https://fctc.who.int/publications/m/item/cigarette-smoking>, accessed 16 January 2024).
87. The WHO Framework Convention on Tobacco Control: an accelerator for sustainable development. Geneva: World Health Organization, United Nations Development Programme; 2017 (<https://fctc.who.int/publications/m/item/the-who-framework-convention-on-tobacco-control-an-accelerator-for-sustainable-development>, accessed 16 January 2024).
88. The 17 Sustainable Development Goals [website]. New York: United Nations Department of Economic and Social Affairs; 2024 (<https://sdgs.un.org/goals>, accessed 16 January 2024).
89. WHO guidelines for indoor air quality: dampness and mould. Copenhagen: WHO Regional Office for Europe; 2009 (<https://apps.who.int/iris/handle/10665/164348>, accessed 26 June 2021).
90. Technical and policy recommendations to reduce health risks due to dampness and mould. Copenhagen: WHO Regional Office for Europe; 2010 (https://www.euro.who.int/__data/assets/pdf_file/0015/121425/E92998.pdf, accessed 17 June 2020).
91. WHO Regional Office for Europe, Health & Environment Alliance. Damp and mould. Health risks, prevention and remedial actions. Information brochure. Copenhagen: WHO Regional Office for Europe; 2009 (https://www.euro.who.int/__data/assets/pdf_file/0003/78636/Damp_Mould_Brochure.pdf, accessed 17 June 2020).

3. WASH



3.1 Introduction

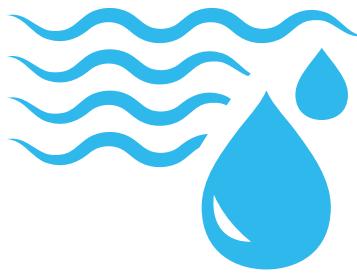
Safe WASH are crucial to human health and well-being. Safe WASH are not only a prerequisite to health, but contribute to livelihoods, school attendance and dignity and help to create resilient communities living in healthy environments (1).

Inadequate or unsafe WASH may cause disease through a range of interrelated transmission pathways, which include among others:

- ingestion of water that is contaminated with faeces or chemicals
- inadequate personal hygiene which may be linked to lack of water
- contact with pathogen-containing water
- proximity to water bodies where disease vectors proliferate (2).

An estimated 829 000 diarrhoeal disease deaths were estimated to be caused by unsafe WASH in 2016. Other diseases caused by inadequate WASH include among others acute respiratory infections, malnutrition, malaria, soil-transmitted helminth infections, schistosomiasis and trachoma (3). In addition, environmental enteropathy, a chronic subclinical inflammatory condition of the gut, which is related to faecal contamination of the environment, might be a key mediating pathway for adverse effects on child nutritional and developmental status from inadequate WASH (4, 5).

3.2 Water



3.2.1 Drinking-water



This section focuses on water that is used for drinking, though safe water is essential also for other domestic purposes and food production (6). Safe water used for recreational purposes is treated in [Section 3.2.2 Recreational water](#).



Overview

As of 2020, 26% of the worldwide population lack safely managed drinking-water services. Approximately 144 million people still collect drinking-water directly from surface water. Contaminated drinking-water is estimated to cause 485 000 diarrhoeal deaths each year, in addition to malnutrition and many other diseases (3, 7, 8).

Note: A safely managed drinking-water service is defined as being accessible on premises, available when needed and free from contamination.

What is the situation in terms of drinking-water supply and drinking-water quality in my country?

Most countries monitor access to safe water and progress in improving it. This is usually performed through surveys of households, schools and health care facilities, as well as through routine water quality surveillance.

At national and global levels, SDG monitoring includes indicators related to drinking-water (9):

- SDG indicator 3.9.2: Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene (WASH) services).
- SDG indicator 6.1.1: Proportion of population using safely managed drinking-water services.

WHO and UNICEF, through the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP), serve as custodian agencies for the global monitoring of these WASH indicators in the framework of measuring progress towards the SDGs (1).

What is the level of drinking-water quality and safety we want to achieve?	<p>WHO produces guidelines for drinking-water quality (GDWQ) that form the basis for national drinking-water regulations and standards (10). The GDWQ cover a broad range of chemicals, pathogenic bacteria, viruses and parasites, radioactive substances and aspects of taste, odour and appearance that can affect drinking-water quality. The GDWQ provide health-based targets for over 200 parameters.</p> <p>WHO guidance on water quality parameters and safe limits is presented within a broader framework for safe drinking-water, which addresses the following.</p> <ul style="list-style-type: none"> • Health-based targets: These include parameters with associated limits (such as those included in drinking-water quality regulations and standards). Health-based targets that include chemical guideline values in the GDWQ can be used to establish country-specific targets. Guideline values generally represent a concentration of a parameter in drinking-water that does not represent a significant risk to health over a lifetime of consumption. • Water safety plans (WSPs): These are part of a comprehensive risk assessment and risk management approach that encompass all steps of water supply from catchment to consumer. • Independent surveillance: This refers to the continuous and vigilant public health assessment and review of drinking-water supplies to confirm effective risk management and safety.
---	---

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
Policies and actions			
<p>1. Develop or update drinking-water quality regulations and standards (10, 11).</p> <p>National (or subnational) drinking-water regulations and standards should be based on the GDWQ, incorporating the three components of the framework for safe drinking-water. Regulations should be customized to consider local needs, priorities and capacities, as well as the economic and health benefits resulting from improved drinking-water supplies.</p> <p>Suggested practical steps for developing/revising drinking-water quality regulations and standards are:</p> <ul style="list-style-type: none"> • identify the lead institution • define roles to support the process • define objectives and scope of the regulations and standards • review existing regulations and standards • gather baseline data for analysis • prepare the separate sections of the regulations and standards • ensure peer review. <p>These steps are further detailed in <i>Developing drinking-water quality regulations and standards</i> (11), with a particular focus on taking a risk-based approach to establishing parameters, limits and monitoring requirements.</p>	 Water/sanitation	National	Regulation

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>2. Protect drinking-water supplies using WSPs (12).</p> <p>Proactive management of risks to drinking-water supplies through WSPs should be promoted at national (or subnational) level, with related support (e.g. capacity building) provided to drinking-water suppliers.</p> <p>A WSP involves the following steps.</p> <ul style="list-style-type: none"> (a) Assemble the team. (b) Describe the water supply system. (c) Identify hazards and hazardous events and assess the risk. (d) Determine and validate control measures and reassess the risk. (e) Develop, implement and maintain an upgrade/improvement plan. (f) Define monitoring of control measures. (g) Verify the effectiveness of the WSP. (h) Prepare management procedures. (i) Develop supporting programmes. (j) Plan and carry out periodic review of the WSP. (k) Revise the WSP following an incident. <p>These WSP steps are further detailed in the <i>Water safety plan manual: step-by-step risk management for drinking-water suppliers</i> (13) with an alternative six-task approach for small water supply systems (14) (see also the “Special considerations for small water supply systems” section below.) Guidance on the systematic consideration of women and disadvantaged groups through the WSP process in order to ensure equitable benefit is also available (15). Additional practical guidance on WSPs is available in the various resources outlined in <i>Water safety planning: a roadmap to supporting resources</i> (10).</p> <p>Guidance on applying the WSP approach to identify and manage the impacts of climate variability and change on drinking-water systems is presented in <u>Chapter 7. Climate change</u>.</p>	 Water/sanitation	National	Other management and control
<p>3. Confirm water safety through independent surveillance (10).</p> <p>Surveillance provides independent verification that drinking-water supplies are safe and water suppliers are proactively managing risks. Surveillance includes:</p> <ul style="list-style-type: none"> • direct testing to confirm compliance with drinking-water quality standards; • WSP auditing or sanitary inspection to confirm effective risk management; • review of supplier monitoring records to confirm that compliance monitoring practices and results are in accordance with requirements in drinking-water quality standards. <p>Guidance on surveillance is provided in Chapter 5 of the GDWQ and volume 3 of the GDWQ: surveillance and control of community supplies (10, 16). Guidance on establishing WSP audit schemes and carrying out audits is provided in <i>A practical guide to auditing water safety plans</i> (17). An associated training package on WSP auditing is available (18).</p>	 Water/sanitation	National; community	Assessment and surveillance

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>4. For the management of chemicals in drinking-water, including cyanotoxins, the key components of the GDWQ framework for safe drinking-water should be applied. This includes selecting which priority parameters to include in drinking-water quality regulations (and associated limits), taking management actions to reduce concentrations of these contaminants as part of WSPs, and monitoring as part of surveillance. Refer to the GDWQ (10) and <i>Developing drinking-water quality regulations and standards</i> (11).</p> <p>The WSP approach can be adapted to manage pharmaceuticals and microplastics by preventing their entry, or the entry of their precursors, in the water cycle. This could include improved recycling programmes and minimizing inappropriate disposal. These contaminants have the potential to reach drinking-water, although the concentrations generally found in drinking-water or its sources are unlikely to pose a risk to human health. Therefore, routine monitoring of these contaminants is not necessary and concerns over these emerging contaminants should not divert resources from known dangers, including removing of microbial pathogens (19).</p>	 Water/sanitation	National	Other management and control
<p>5. For the management of radioactivity in drinking-water in non-emergency situations the key components of the GDWQ framework for safe drinking-water should be applied, as described above.</p> <p>Radionuclides in drinking-water generally present a very low health risk compared to microbial pathogens and chemicals. Radiation exposure through drinking-water in normal situations mostly results from naturally occurring rather than human-made radionuclides. In contrast, following radiation emergencies involving radioactive release, human-made radionuclides may represent the major source of exposure. These factors should be considered for establishing criteria included in drinking-water quality regulations, management actions and surveillance activities (see <u>Section 6.5 Radioactivity in food and drinking-water</u> and <u>6.6 Radiological emergencies</u>) (10, 19-21).</p>	 Water/sanitation	National	Other management and control
<p>6. Include safe drinking-water, sanitation and hygiene in relevant health policies, strategies and programmes (22).</p>	 Water/sanitation  Health	National; community Universal health coverage	Regulation

Note: For additional publications related to drinking-water safety, see *Supporting publications to the guidelines for drinking-water quality* (18).

Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
Special considerations for small water supply systems			
7. Consider the special needs, challenges and opportunities for small water supply systems when applying the framework for safe drinking-water (10).	 Water/sanitation	National; community	Regulation
<p>Small water supply systems tend to share a common set of characteristics that set them apart from other systems. For instance, there are often great numbers of systems covering a large geographic spread (including remote locations); limited technical and financial support; reliance on undertrained and/or unpaid staff; and limited surveillance oversight and support.</p> <p>Developing drinking-water quality regulations and standards (11) offers considerations for small systems and other settings with limited resources, and water safety planning for small community water supplies (14) presents a simplified six-task WSP approach for the small systems context (which is an abridged version of the 11-module approach outlined in point 2 above). See volume 3 of the GDWQ: surveillance and control of community supplies (16) and the associated sanitary inspection forms for further guidance (23).</p>			
8. Consider water safety improvements within the context of broader WASH efforts.	 Water/sanitation	National; community	Regulation; infrastructure, technology and built environment
<p>As those responsible for managing or overseeing small systems may also be responsible for hygiene and sanitation, it is important to consider WASH improvements holistically.</p>			
9. Provide sufficient and safe drinking-water in communities, schools, health care facilities, workplaces and public places (22, 24-26).	 Water/sanitation	Community; schools/child-care settings; health care; workplace	Infrastructure, technology and built environment
10. Support and provide point-of-use/household drinking-water treatment and safe storage as an interim solution for safer drinking-water while longer-term infrastructure improvements are being planned and implemented (22).	 Water/sanitation	Community	Infrastructure, technology and built environment
<p>Further guidance and detail can be found in the following documents (27, 28).</p>			
Awareness-raising and capacity building			
11. Promote the use of safe drinking-water in communities, schools, health care facilities, workplaces and public places (22, 24-26).	 Health Education	Community; schools/child-care settings; health care; workplace Universal health coverage	Information, education and communication

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>12. Promote point-of-use/household drinking-water treatment and safe storage as an interim solution for safer drinking-water until longer-term infrastructure improvements can be implemented (22).</p>	 Health  Education	Community; schools/child-care settings; health care; workplace Universal health coverage	Information, education and communication

Selected tools

WHO 2020: *WHO sanitary inspection (SI) forms support water safety planning and/or surveillance by presenting a simple set of questions designed to assess key sanitary risks to drinking-water supplies.* SI packages – which include an updated SI form, technology fact sheet and management advice sheet – have been developed for various water supply system technologies (23). SI forms for additional technologies are included in volume 3 of the GDWQ: surveillance and control of community supplies (16).

WHO 2017: *Water safety planning: a roadmap to supporting resources* (10)

This overview includes publications by WHO and partners and provides guidance on various aspects of water safety planning, such as development, implementation, training, advocacy and auditing.

WHO/Neglected Tropical Disease NGO Network 2020: *WASH and health working together: a 'how to' guide for NTD programmes* (29)

This is a toolkit to address WASH and neglected tropical diseases.

UNICEF 2017: *Thirsting for a future: water and children in a changing climate* (30)



3.2.2 Recreational water



Overview

Recreational use of fresh and coastal waters as well as waters in swimming pools and similar environments can deliver important benefits to health and well-being such as physical activity, relaxation, cultural and religious use. Yet, recreational water use can pose risks to health through exposure to microbial and chemical pollution as well as physical risk such as drowning and injury.

What is the status of recreational water quality in my country?

Most high-income countries and some middle-income countries monitor safety of recreational water sites with the purpose of identifying and addressing pollution sources and providing water users with timely information on whether it is safe to enter.

At national and global levels, SDG monitoring includes indicators related to, but not directly assessing, water quality of water bodies used for recreation (9).

- SDG indicator 6.3.1: Proportion of domestic and industrial wastewater flow safely treated.
- SDG indicator 6.3.2: Proportion of bodies of water with good ambient water quality.

WHO and UN-HABITAT serve as custodian agencies monitoring that wastewater is safely treated globally and UNEP is the custodian agency for monitoring ambient water quality globally (31).

What is the level of recreational water safety we want to achieve?

WHO produces guidelines for recreational water in two volumes: *Guidelines on recreational water quality. Volume 1: coastal and fresh waters* and *Guidelines for safe recreational water environments. Volume 2: swimming pools and similar environments* (32, 33). These guidelines focus on water quality-related health hazards for the general population engaging in all type of recreational water use involving contact with water and beach sand.

WHO guidance on recreational water quality parameters and safe limits is presented within a broader recreational water safety framework including three core recommendations for coastal and fresh water (as listed in Tables 3.1–3.3).

Table 3.1. Guideline values for microbial quality of coastal and fresh recreational waters

Microbial water quality assessment categories ^a	Intestinal enterococci (95th percentile value per 100 ml water sample)
A	≤ 40
B	41–200
C	201–500
D	> 500

Categories A–D: Based on risk evaluation, e.g. estimated risk of gastrointestinal illness per exposure: A: <1%, B: 1–5%, C: 5–10%, D: >10%.

^a See (32) for further information on combining categories with sanitary surveys for beach classification.

Source: Adapted from (32).

Table 3.2. Indicators and guideline values for harmful algal blooms in freshwater

	Cyanobacterial biomass indicator values	Cyanotoxin guideline values, recreation (cyanotoxin type)
Vigilance level	1–4 mm ³ /L biovolume or 1–12 µg/L chlorophyll a (with dominance of cyanobacteria)	–
Alert level 1	4–8 mm ³ /L biovolume or 12–24 µg/L chlorophyll a (with dominance of cyanobacteria)	24 µg/L ^a (microcystin) 6 µg/L ^a (cylindrospermopsin)
Alert level 2	Scum or transparency < 0.5–1 m	60 µg/L (anatoxin-a) 30 µg/L (saxitoxin)

^a Provisional value.**Source:** Adapted from (32).**Table 3.3. Guidelines and operational monitoring limits for other hazards**

Hazard category	Guideline values or operational monitoring limit
Beach sand	Provisional guideline value of 60 CFU/g of intestinal enterococci.
Chemicals	Chemical concentration 20 times higher than the guideline value in the WHO <i>Guidelines for drinking-water quality</i> as a screening approach.
Other microbial hazards	No dose-response relationship established for these organisms to support guideline values. Monitor environmental conditions favouring proliferation of organisms ^a .
Nuisance aspects	No guideline value. Operational monitoring via visual inspection and data collection on priority aesthetic aspects of concern.

CFU: colony forming units.

^a Examples of bacteria: *Aeromonas* spp., *Leptospira* spp., *Pseudomonas aeruginosa*, *Staphylococcus aureus*, noncholera *vibrio cholerae*; examples of free-living amoebae: *Acanthamoeba* spp., *Naegleria fowleri*; examples of Helminth: *Schistosoma mansoni*, *S. intercalatum*, *S. guineensis*, *S. mekongi*, *S. japonicum*, *S. haematobium*, *Trichobilharzia* spp.)

Source: Adapted from (32).

Swimming pools and related water environments

Volume 2 of the WHO guidelines on safe recreational water environments (33) provide guideline values for chlorine- and bromine-based disinfectants, chlorine dioxide, ozone (in air), pH and operational guidelines for microbial testing. The WHO guidelines are intended to form the basis for national and international regulations and standards.

Guidance to create safe environments to prevent drownings is provided in [Section 9.3.1 Drownings](#).

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
Coastal and fresh water environments: policies and actions			
<p>1. Set national health-based targets for recreational water bodies (32).</p> <ul style="list-style-type: none"> Express targets as microbial water quality standards for sources of faecal contamination based on WHO guideline values (see Table 3.1). Develop additional water quality standards for cyanotoxins or biovolume indicators from harmful algal blooms based on WHO guideline values (see Table 3.2). Consider additional standards based on provisional guideline values for beach sand and chemicals, operational monitoring limits for other microbial hazards and aesthetic and nuisance aspects, if justified by national or local risk assessment and resource availability for monitoring and control measures (see Table 3.3). 	 Health  Environment	National	Regulation
<p>2. Develop and implement recreational WSPs for priority bathing sites (32). Steps for developing an RWSP include the following.</p> <ol style="list-style-type: none"> Identify the lead entity and assemble a team to develop the recreational WSP. This includes identifying the lead entity and key stakeholders and forming a coordination committee that includes relevant stakeholders with clear roles and responsibilities. Undertake a system assessment for each existing priority recreational water site (or group of sites within the same catchment) and before developing new sites. <ul style="list-style-type: none"> Describe the recreational water environment – by combining a sanitary survey of adjacent land and water drainage with an initial microbial quality assessment to assign a beach classification. Identify hazards and hazardous events, considering seasonality and predicted local climate change scenarios. Assess and prioritize the risks. Identify existing control measures, assess risks and prioritize risks that are insufficiently controlled. Establish plans, with sustainable funding, for managing currently effective control measures. Establish improvement plans, with sustainable funding, for incrementally implementing control measures where priority risks are insufficiently controlled. Conduct and maintain system monitoring. <ul style="list-style-type: none"> Establish and implement an operational monitoring regime for priority control measures in the catchment to give rapid warning when operational limits are exceeded. Establish and implement corrective actions for exceedances of operational limits. Conduct ongoing verification monitoring of water quality. Establish procedures to verify effectiveness of the recreational WSP. 	 Health  Infrastructure  Environment	Community	Infrastructure, technology and built environment; information, education and communication; other management and control

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>d. Establish coordinated management and communication strategies to support effective pollution control and public communications.</p> <ul style="list-style-type: none"> • Document management procedures for normal and incident conditions, including incident response plans. • Where feasible, develop predictive models to support timely communication to water users. • Develop supporting programmes – for example, training, research and development, standard operating procedures (SOPs), quality control activities, procedures for visual inspections, sample collection and equipment calibration. • Establish communication protocols between responsible organizations and agencies. • Establish mechanisms for communication with users and managers of the site. <p>e. Review and update recreational WSPs. This includes meeting periodically and after incidents to review performance of plans, including operational monitoring and water quality results, an updated sanitary survey and beach classification, the occurrence of incidents, communication and complaints; if necessary, update the risk assessment.</p> <p>More information is provided in the <i>Guidelines on recreational water quality. Volume 1: coastal and fresh waters</i> (32).</p>			
<p>3. Conduct ongoing surveillance and risk communication of recreational water-related illness (32).</p> <ul style="list-style-type: none"> • Collect, analyse and interpret health-related data on suspected or confirmed illness in humans and/or animals, and systematically document outbreaks associated with recreational waters. • Provide the public with timely information about the status of health risks, and provide water users with advisory warnings before, during and after a public health incident, in conjunction with recreational WSPs. 	 Health	National; community	Assessment and surveillance
<p>4. Develop a pool safety plan for swimming pools and similar environments (33). Points to consider include:</p> <ul style="list-style-type: none"> • adequate water treatment including filtration and disinfection, pool hydraulics, addition of fresh water, cleaning and ventilation. • Provision and encouragement of the use of showers and toilets • Monitoring of turbidity, residual disinfectant and pH. <p>Note: The WHO guidelines for safe recreational water environments (volume 2) provide operational guidelines for microbial testing (33).</p>	 Health  Environment	National; community	Assessment and surveillance
<p>5. Ensure adequate clarity of pool water to minimize injury hazard (e.g. through filtration and pool design) (33).</p>	 Health  Infrastructure  Recreation	Community; national	Infrastructure, technology and built environment; other management and control

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>6. Provide rescue services and access to emergency response/services. Pre-set maximum water temperatures to < 40°C (33).</p> <p>Examples for rescue services and emergency response include: first aid availability, accessible emergency shut-off for pool water outlet pumps, telephones with emergency numbers, properly trained and equipped lifeguards, emergency accessibility.</p>	 Health  Recreation  Infrastructure	Community; national Universal health coverage	Infrastructure, technology and built environment; other management and control

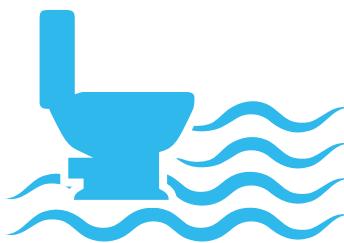
Selected tools

WHO 2021: *Guidelines on recreational water quality. Volume 1: coastal and fresh waters* (32)

WHO 2006: *Guidelines for safe recreational water environments. Volume 2: swimming pools and similar environments* (33)

Bartram J, Rees G, editors (2000): *Monitoring bathing waters: a practical guide to the design and implementation of assessments and monitoring programmes* (34)

3.3 Sanitation



Overview

Nearly half the world's population lacked safely managed sanitation services in 2020. Such deficiencies cause 432 000 diarrhoeal disease deaths globally each year (2016), and also lead to soil-transmitted helminth infections, malnutrition and numerous other diseases (3, 7, 8). Poor sanitation contributes to the spread of antimicrobial resistance and negatively affects broader well-being (35).

Benefits of improving sanitation extend well beyond reducing the risk of diarrhoea and other diseases and include among others increased dignity and safety, particularly among women and girls, and increased school attendance.

Evidence suggests that simply improving sanitation facilities might not lead to the desired health impacts but needs to be accompanied with the safe disposal of children's and animal faeces, and the cessation of open defecation (36).

Who has inadequate sanitation in my country?	<p>Most countries are monitoring progress on access to safe sanitation. This is usually performed through surveys of households, and also schools and health care facilities.</p> <p>At national level, SDG indicators also monitor progress related to sanitation (9):</p> <ul style="list-style-type: none"> – SDG indicator 3.9.2: Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH)). – SDG indicator 6.2.1: Proportion of population using safely managed sanitation services, including a handwashing facility with soap and water. – SDG indicator 6.3.1: Proportion of domestic and industrial wastewater flow safely treated. <p>Chapters 3 and 4 of the WHO <i>Guidelines on sanitation and health</i> (37) provide definitions of safely managed sanitation for all steps of the chain (toilet, containment, conveyance, treatment, disposal/end use) and good practice advice on translating definitions into national targets, policies, regulations and monitoring systems.</p>
What do we want to achieve in terms of sanitation services to protect people's health?	<p>Safe sanitation systems should be designed and used to separate human excreta from human contact at all steps of the sanitation service chain from toilet capture and containment, through emptying, transport, treatment (in-situ or offsite) and final disposal or end use.</p> <p>The WHO <i>Guidelines on sanitation and health</i> (37) provide guidance to maximize the health impact of sanitation interventions including preventing infections and maintaining mental and social well-being through four main recommendations: i) ensuring universal access to and use of toilets that safely contain excreta among entire communities, institutions, workplaces and public places; ii) ensuring universal access to safe systems along the entire sanitation service chain based on context-specific solutions and local health risk assessment to protect the health of individuals, communities and workers; iii) integrating sanitation into regular local government-led planning and service provision; and iv) ensuring the health sector fulfil core functions to ensure sanitation interventions effectively protect public health.</p>

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Policies and actions			
1. Develop or update government-led multisectoral sanitation policies, planning processes and coordination (37).	 Water/sanitation  Health	National	Regulation
2. Sustain health sector engagement in sanitation through dedicated staffing and resourcing, and through action on sanitation in health services (37).	 Health	National; community	Information, education and communication
3. Develop or update national guidelines, standards and regulations, to ensure sanitation systems and services protect public health (37), to include the following elements: <ul style="list-style-type: none"> safe management at each step of the sanitation chain, for example through minimum requirements for toilets and pit latrines or septic tanks, SOPs for safe emptying and transport of faecal waste, and health based standards for faecal sludge and wastewater treatment and disposal or use in agriculture and aquaculture (38); risk management and management along the entire sanitation chain – see <i>Sanitation safety planning</i> (39); occupational health and safety for sanitation workers (35). 	 Water/sanitation  Health	National	Regulation
4. Include sanitation in health policies where sanitation is needed for primary prevention, to enable coordination and integration into health programmes (37). For example, by including sanitation promotion in training curricula of health professionals, in job descriptions and local budgets.	 Health  Water/sanitation	National; community Universal health coverage	Regulation
5. Conduct national risk assessment using health surveillance data to target sanitation services to settings with high disease burden, and to support outbreak prevention efforts. This process involves standardized data gathering and a stakeholder meeting, possibly as part of a joint sector review (37).	 Health  Water/sanitation	National	Assessment and surveillance
6. Implement local risk assessment and management to prioritize improvements and manage system performance. Sanitation safety planning involves an assessment of the sanitation system, identification of hazardous events and assessment of control measures, development of an incremental improvement plan, and monitoring and evaluation. The WHO manual <i>Sanitation safety planning</i> provides specific training and support (39).	 Water/sanitation	National; community	Assessment and surveillance; other management and control
7. Address demand and supply of sanitation facilities and services concurrently by enabling marketing of sanitation services and developing sanitation services and business models (37). Approaches to generate demand may include social marketing or incentives such as subsidies, etc.	 Environment  Industry  Water/sanitation	National; community	Taxes and subsidies

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>8. Design, implement and monitor locally appropriate and safe systems along the entire sanitation chain (37). Examples include the following.</p> <ul style="list-style-type: none"> Toilets should be made of durable material that can be easily cleaned, provide safety and privacy, with facilities for anal cleansing, hand washing and menstrual hygiene management. Ensure safe containment of faecal waste through adequate design, operation and maintenance. Use motorized emptying and transport over manual emptying and transport wherever possible, implement SOPs and health and safety measures for workers. Ensure adequate treatment of faecal waste before end use/disposal. Ensure multi-barrier approach is used along the entire service chain. <p>For more information, Annex 1 of <i>WHO guidelines on sanitation and health</i> contains sanitation system fact sheets which describe applicability of different sanitation systems to a given context, with consideration on design, operation and maintenance and mechanisms for protecting public health (37).</p>	 Water/sanitation Health Environment	National; community	Infrastructure, technology and built environment
Awareness raising and capacity building			
9. Perform context-specific behaviour change programming based on understanding sanitation behaviours and their determinants (37).	 Health Water/sanitation	Community; national Universal health coverage	Information, education and communication
10. Promote access to safe toilets in schools (25), health care facilities (26), workplaces and public places.	 Health Water/sanitation Environment	Community: schools/child-care settings; health care; workplace Universal health coverage	Information, education and communication
11. Promote shared and public toilet facilities that safely contain excreta as an incremental step when individual household facilities are not feasible (37).	 Health Water/sanitation Environment	Community Universal health coverage	Information, education and communication
12. Provide training and technical support to community health workers/environmental health officers for inspection of sanitary facilities and supporting households in improving their sanitation facilities (37). See SI forms and sanitation system fact sheets (40, 41).	 Health Water/sanitation Environment	Community; national Universal health coverage	Information, education and communication
13. Raise awareness about climate adaptation options for sanitation systems, such as selecting sites less prone to floods, taking measures during/after extreme weather events, constructing simplified sewer networks to withstand flooding and flotation, etc. (37) (42). Also see “Sanitation safety: Adaptation and increased resilience” section in Chapter 7. Climate change .	 Health Water/sanitation Environment	Community; national Universal health coverage	Information, education and communication

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
14. Involve children at home and in school in promotion of safe sanitation (43).	 Health  Water/sanitation  Environment  Education	Community; schools/child-care settings Universal health coverage	Information, education and communication
15. Involve and support all community members in the design, construction and use of sanitation facilities (43).	 Health  Water/sanitation  Environment	Community Universal health coverage	Information, education and communication
16. Promote avoiding open defecation and adopting safe sanitation facilities (37).	 Health  Environment	Community; national Universal health coverage	Information, education and communication
17. Promote safe disposal of child faeces, that is, into latrines (37).	 Health  Environment	Community; national Universal health coverage	Information, education and communication
18. Promote washing hands with soap at critical times, such as after defecation, after child cleaning and before preparing food (37).	 Health  Environment	Community; national Universal health coverage	Information, education and communication
19. Promote maintaining functional and clean toilets (37).	 Health  Environment	Community; national Universal health coverage	Information, education and communication
20. Promote safe management of domestic animals and their excreta (37).	 Health  Environment	Community; national Universal health coverage	Information, education and communication

Selected tools

WHO 2018: Sanitation system fact sheets: Annex 1 of the *Guidelines for sanitation and health* (37)

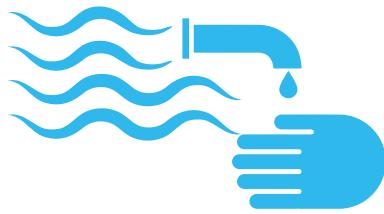
WHO 2006: *Guidelines for the safe use of wastewater, excreta and greywater in agriculture and aquaculture*; volumes 1–4 (38)

WHO 2020: *Sanitary inspection forms for sanitary systems, sanitation system fact sheets* (40, 41)

WHO/Neglected Tropical Disease NGO Network 2020: *WASH and health working together: a ‘how to’ guide for NTD programmes* (29)

This is a toolkit to address WASH and neglected tropical diseases.

3.4 Personal hygiene



Because of its proven health benefits, hand washing with soap and water (44) is usually the top priority for both health promotion and hygiene monitoring.

This section focuses on individual hygiene behaviours in different settings and covers mainly hand hygiene but also other aspects of personal hygiene such as face washing. It does not address hygiene in health care facilities, which is included in the section on health care facilities ([Section 12.4 Health care facilities](#)).



Overview

Hygiene is multi-faceted and comprises many behaviours, including hand- and face washing, menstrual hygiene and food hygiene. Hand washing with soap at crucial events such as after visiting the toilet, defecating or before preparing food was estimated to be a poorly practised behaviour globally (45).

Approximately 2.3 billion people lacked functioning hand-washing facilities with water and soap in 2020 (7). Inadequate hygiene behaviours are an important risk factor for infectious diseases like diarrhoea, soil-transmitted helminth infections, respiratory diseases and contribute to malnutrition and other diseases; they were estimated to have caused 165 000 deaths from diarrhoea alone in 2016 (3, 8).

Who has inadequate access to basic hygiene facilities in my country?

Direct assessment of hand-washing practices is usually considered too resource-intensive, especially at national level. Personal hygiene practices can be estimated by the proportion of people with access to hand-washing facilities with soap and water on premises (basic hand-washing facilities). Access to basic hand-washing facilities is usually assessed in large and nationally representative household surveys. Survey data on access to hand-washing facilities are also available for individual countries for schools and health care facilities (1).

Progress related to hygiene and improved hand washing with soap is also assessed within the SDGs (9). SDG 6 includes a target of adequate and equitable sanitation and hygiene for all. SDG indicators specifically mentioning hygiene or hand washing with soap include the following.

- SDG indicator 3.9.2: Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH)).
- SDG indicator 4.A.1: Proportion of schools with access to: [...] (e) basic drinking-water; (f) single-sex basic sanitation facilities; and (g) basic handwashing facilities (as per the WASH indicator definitions).
- SDG indicator 6.2.1: Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water.

What do we want to achieve in terms of personal hygiene?

Everyone should have access to basic hygiene facilities at home, at school, at the workplace and in public buildings (37). Hand washing should be practised with soap and water and at crucial events such as after visiting the toilet, defecating or before preparing food (37, 46).

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Policies and actions			
1. Support the installation of hand-washing facilities, especially in homes and public places such as schools and health care facilities (see also Section 12.4 Health care facilities), bus and train stations and private commercial buildings (37, 47). Hand-washing facilities with soap and water should be available close to (usually within 5 m) of sanitation facilities (25, 37).	 Health	National; community Universal health coverage	Infrastructure, technology and built environment
2. Enforce hand-washing facilities in public places such as food establishments and markets, and include them in routine inspection and monitoring schemes (37).	 Health  Industry	National; community	Regulation; assessment and surveillance
3. Make soap and water available to households, institutions and in public places (25, 37).	 Health	Community; national	Infrastructure, technology and built environment
4. Support the inclusion of culturally- and context-appropriate facilities for hand washing, anal cleansing and menstrual hygiene management into toilet design (37).	 Health  Construction	Community; national	Infrastructure, technology and built environment
Awareness raising and capacity building			
5. Promote regular hand hygiene outside of private homes such as when entering public buildings or public transport (47).	 Health  Education	Community; national Universal health coverage	Information, education and communication
6. Promote hand washing with soap after defecation and any potential contact with faeces (e.g. child faeces) (37).	 Health  Education	Community; national Universal health coverage	Information, education and communication
7. Promote hand washing with soap before handling food and during food preparation (46).	 Health 	Community; national Universal health coverage	Information, education and communication
8. Promote face washing for the prevention of certain infectious diseases such as trachoma (48).	 Health	Community; national Universal health coverage	Information, education and communication
9. Promote safe hygiene behaviours such as hand washing with soap in communities, institutions such as schools and in public places (25, 37).	 Health	Community; schools/child-care settings Universal health coverage	Information, education and communication

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
10. Promote the installation and availability of hand-washing facilities with soap and water (37).	 Health	Community; national Universal health coverage	Information, education and communication

Selected tools

WHO 2020: Awareness-raising and educational material on how to hand-wash, how to hand-rub and when and how to perform hand hygiene in health care settings (49)

WHO 2009: Water, sanitation and hygiene standards for schools in low-cost settings (25)
This includes an assessment checklist for WASH in schools.

WHO 2006: Five keys to safer food manual (46)
The manual provides key messages, resources and training materials related to food hygiene.

References

- WHO/UNICEF Joint Monitoring Programme for water supply, sanitation and hygiene (JMP) [website]. New York (NY): United Nations Children's Fund/World Health Organization; 2020 (<https://washdata.org>, accessed 5 October 2021).
- Prüss A, Kay D, Fewtrell L, Bartram J. Estimating the burden of disease from water, sanitation, and hygiene at a global level. Environ Health Perspect. 2002;110(5):537-42.
- Prüss-Ustün A, Wolf J, Bartram J, Clasen T, Cumming O, Freeman MC et al. Burden of disease from inadequate water, sanitation and hygiene for selected adverse health outcomes: An updated analysis with a focus on low- and middle-income countries. Int J Hyg Environ Health. 2019;222(5):765-77. doi:10.1016/j.ijheh.2019.05.004.
- Ngure FM, Reid BM, Humphrey JH, Mbuya MN, Peltz G, Stoltzfus RJ. Water, sanitation, and hygiene (WASH), environmental enteropathy, nutrition, and early child development: making the links. Ann N Y Acad Sci. 2014;1308:118-28. doi:10.1111/nyas.12330.
- Brown J, Cairncross S, Ensink JH. Water, sanitation, hygiene and enteric infections in children. Arch Dis Child. 2013;98(8):629-34. doi:10.1136/archdischild-2011-301528.
- Drinking-water. Fact sheet [website]. Geneva: World Health Organization; 2019 (<https://www.who.int/news-room/fact-sheets/detail/drinking-water>, accessed 10 October 2021).
- Progress on household drinking water, sanitation and hygiene 2000-2020: five years into the SDGs. Geneva: World Health Organization/United Nations Children's Fund; 2021 (<https://washdata.org/sites/default/files/2021-06/jmp-2021-wash-households-LAUNCH-VERSION.pdf> <https://www.who.int/data/gho/data/indicators/indicator-details/GHO/number-of-diarrhoea-deaths-from-inadequate-water>, accessed 2 July 2021).
- Public health and environment. In: Global Health Observatory data repository [website]. Geneva: World Health Organization; 2020 (<https://apps.who.int/gho/data/node.main.122?lang=en>, accessed 2 July 2021).
- Monitoring health for the SDGs [website]. Geneva: World Health Organization; 2019 (<http://apps.who.int/gho/data/node.sdg>, accessed 7 October 2021).
- Water safety planning: a roadmap to supporting resources. Geneva: World Health Organization; 2017 (<https://www.who.int/publications/m/item/water-safety-planning-a-roadmap-to-supporting-resources>, accessed 27 March 2020).
- Developing drinking-water quality regulations and standards. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/272969>, accessed 14 June 2021).
- Schmoll O, Howard G, Chilton J, Chorus I, editors. Protecting groundwater for health: managing the quality of drinking-water sources. London: International Water Association/World Health Organization; 2006 (<https://apps.who.int/iris/handle/10665/43186>, accessed 14 June 2021).
- Water safety plan manual: step-by-step risk management for drinking-water suppliers. Geneva: World Health Organization/International Water Association; 2009 (<https://apps.who.int/iris/handle/10665/75141>, accessed 14 June 2021).

14. Water safety planning for small community water supplies. Geneva: World Health Organization; 2012 (<https://apps.who.int/iris/handle/10665/75145>, accessed 14 June 2021).
15. A guide to equitable water safety planning. Ensuring no one is left behind. Geneva: World Health Organization; 2019 (<https://www.who.int/publications/i/item/9789241515313>, accessed 14 June 2021).
16. Guidelines for drinking-water quality, 2nd edition: Volume 3 – surveillance and control of community supplies. Geneva: World Health Organization; 1997 (<https://apps.who.int/iris/handle/10665/42002>, accessed 14 June 2021).
17. A practical guide to auditing water safety plans. Geneva: World Health Organization/International Water Association; 2015 (<http://apps.who.int/iris/handle/10665/204280>, accessed 14 June 2021).
18. Microplastics in drinking-water. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/326499>, accessed 14 June 2021).
19. Management of radioactivity in drinking-water. Geneva: World Health Organization; 2018 (<https://www.who.int/publications/i/item/9789241513746>, accessed 4 June 2021).
20. IAEA, FAO, ILO, PAHO, WHO. Criteria for use in preparedness and response for a nuclear or radiological emergency. Vienna: International Atomic Energy Agency; 2011 (http://www-pub.iaea.org/MTCD/publications/PDF/Pub1467_web.pdf, accessed 8 October 2021).
21. IAEA, FAO, ICAO, ILO, IMO, INTERPOL et al. Preparedness and response for a nuclear or radiological emergency. Vienna: International Atomic Energy Agency; 2015 (http://www-pub.iaea.org/MTCD/publications/PDF/P_1708_web.pdf, accessed 14 June 2021).
22. Water, sanitation, hygiene and health. A primer for health professionals. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/330100>, accessed 14 June 2021).
23. New sanitary inspection packages for drinking-water. Geneva: World Health Organization; 2020 (<https://wsportal.org/news-item/new-sanitary-inspection-packages-for-drinking-water/>, accessed 15 June 2021).
24. Safely managed drinking-water. Thematic report on drinking-water 2017. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/325897>, accessed 14 June 2021).
25. Water, sanitation and hygiene standards for schools in low-cost settings. Geneva: World Health Organization; 2009 (<https://www.who.int/publications/i/item/9789241547796>, accessed 14 June 2021).
26. Essential environmental health standards in health care. Geneva: World Health Organization; 2008 (<https://apps.who.int/iris/handle/10665/43767>, accessed 14 June 2021).
27. Evaluating household water treatment options. Health-based targets and microbiological performance specifications. Geneva: World Health Organization; 2011 (<https://apps.who.int/iris/handle/10665/44693>, accessed 15 January 2021).
28. Toolkit for monitoring and evaluating household water treatment and safe storage. Geneva: World Health Organization; 2012 (<https://apps.who.int/iris/handle/10665/76568>, accessed 14 June 2021).
29. WASH and health working together: a ‘how to’ guide for NTD programmes. Geneva: World Health Organization/Neglected Tropical Disease NGO Network; 2020 (<http://apps.who.int/wash-health-toolkit/disclaimer/>, accessed 27 June 2021).
30. Thirsting for a future: water and children in a changing climate. New York (NY): United Nations Children’s Fund; 2017 (https://www.unicef.org/media/49621/file/UNICEF_Thirsting_for_a_Future_ENG.pdf, accessed 7 June 2021).
31. Monitoring water and sanitation in the 2030 Agenda for Sustainable Development. Integrated monitoring for SDG 6. New York (NY): United Nations-Water; 2020 (<https://www.unwater.org/publications/monitoring-water-and-sanitation-in-the-2030-agenda-for-sustainable-development/>, accessed 22 July 2021).
32. WHO guidelines on recreational water quality: volume 1: coastal and fresh waters. Geneva: World Health Organization; 2021 (<https://www.who.int/publications/i/item/9789241580472>, accessed 16 July 2021).
33. Guidelines for safe recreational waters. Volume 2 – swimming pools and similar environments. Geneva: World Health Organization; 2006 (<https://apps.who.int/iris/handle/10665/43336>, accessed 16 July 2021).
34. Bartram J, Rees G, editors. Monitoring bathing waters: a practical guide to the design and implementation of assessments and monitoring programmes. London/New York (NY): E & FN Spon on behalf of the World Health Organization, the United States Environmental Protection Agency and the Commission of the European Communities; 2000 (<https://www.who.int/publications/m/item/monitoring-bathing-waters-a-practical-guide-to-the-design-and-implementation-of-assessments-and-monitoring-programmes>, accessed 22 July 2021).
35. World Bank, WHO, ILO, Water Aid. Health, safety and dignity of sanitation workers. An initial assessment. Washington (DC): World Bank; 2019 (<https://www.who.int/publications/m/item/health-safety-and-dignity-of-sanitation-workers>, accessed 15 June 2021).
36. Cumming O, Arnold BF, Ban R, Clasen T, Esteves Mills J, Freeman MC et al. The implications of three major new trials for the effect of water, sanitation and hygiene on childhood diarrhea and stunting: a consensus statement. *BMC Medicine*. 2019;17(1):173. doi:10.1186/s12916-019-1410-x.
37. Guidelines on sanitation and health. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/274939>, accessed 15 June 2021).
38. Guidelines for the safe use of wastewater, excreta and greywater in agriculture and aquaculture. Geneva: World Health Organization; 2006 (<https://apps.who.int/iris/handle/10665/78265>, accessed 7 October 2021).
39. Sanitation safety planning: manual for safe use and disposal of wastewater, greywater and excreta. Geneva: World Health Organization; 2015 (<http://apps.who.int/iris/handle/10665/171753>, accessed 15 June 2021).
40. Sanitary inspections for sanitation systems. Geneva: World Health Organization; 2020 (<https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/sanitation-safety/sanitation-inspection-packages>, accessed 15 June 2021).
41. Sanitation system fact sheets Geneva: World Health Organization; 2020 (<https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/sanitation-safety/sanitation-inspection-packages>, accessed 26 February 2020).

42. Discussion paper: climate, sanitation and health. Geneva: World Health Organization; 2019 (<https://www.who.int/publications/m/item/discussion-paper-climate-sanitation-and-health>, accessed 8 October 2021).
43. Healthy environments for healthy children: key messages for action. Geneva: United Nations Environment Programme/World Health Organization; 2010 (<https://apps.who.int/iris/handle/10665/44381>, accessed 16 August 2021).
44. Wolf J, Hunter PR, Freeman MC, Cumming O, Clasen T, Bartram J et al. Impact of drinking water, sanitation and handwashing with soap on childhood diarrhoeal disease: updated meta-analysis and meta-regression. *Trop Med Int Health.* 2018. doi:10.1111/tmi.13051.
45. Wolf J, Johnston R, Freeman MC, Ram PK, Slaymaker T, Laurenz E et al. Handwashing with soap after potential faecal contact: global, regional and country estimates. *Int J Epidemiol.* 2019;48(4):1204-18. doi:10.1093/ije/dyy253.
46. Five keys to safer food manual. Geneva: World Health Organization; 2006 (<https://apps.who.int/iris/handle/10665/43546>, accessed 16 April 2020).
47. Interim recommendations on obligatory hand hygiene against transmission of COVID-19. Geneva: World Health Organization; 2020 (<https://www.who.int/publications/m/item/interim-recommendations-on-obligatory-hand-hygiene-against-transmission-of-covid-19>, accessed 8 October 2021).
48. Trachoma. Fact sheet. Geneva: World Health Organization; 2020 (<https://www.who.int/news-room/fact-sheets/detail/trachoma>, accessed 17 April 2020).
49. Save lives – clean your hands: Annual global campaign. Geneva: World Health Organization; 2020 (<https://www.who.int/campaigns/world-hand-hygiene-day>, accessed 5 June 2021).

4. Solid waste



Overview

Waste is defined as any substance or object that the holder discards, intends to discard or is required to discard (1). Waste is categorized in several different ways, by origin (e.g. municipal solid waste), type (e.g. electrical and electronic waste, known as e-waste) and character (e.g. hazardous waste).

Worldwide, more than 2 billion tonnes of municipal solid waste (i.e. waste generated by households or similar waste generated by industry, commerce and institutions) are produced every year (2, 3), and this is projected to increase to nearly 4 billion tonnes annually by 2050 (4). About 54 million tonnes of e-waste are generated globally per year (2019 data), with an expected increase to 75 million tonnes by 2030.

Improper waste management can lead to adverse health outcomes, for example through contamination of water, soil and air, as well as by creating hazardous conditions for those working in the waste management sector. Billions of people live in areas that lack adequate waste collection services and rely on uncontrolled disposal sites (5). Hazardous or unsafe waste management practices, such as open burning, can directly harm waste-workers or residents of neighbouring communities. Vulnerable groups, including women and children and marginalized communities, are at increased risk of adverse health outcomes.

Poor waste management leads to environmental pollution, both on land and in aquatic environments, such as lakes and oceans. Drains that are blocked by solid waste can result in flooding, and other types of standing water promote the transmission of cholera and vector-borne diseases, such as malaria and dengue fever (2). Emissions from uncontrolled waste can reach the food chain and disturb natural ecosystems.

A lack of or poor waste management has negative socioeconomic effects, including on living standards, economic growth potential and community relations. Governing waste management is complex and requires specialized skills that are often underrepresented in institutional and organizational frameworks, and political decision-making processes.

The waste hierarchy provides a guiding principle for actions to reduce and manage waste in a given order of preference (6). A key focus should be placed on waste prevention, followed by reuse, recycling and recovery. Nevertheless, all waste management systems require disposal facilities that, in turn, need to be operated well in order to safeguard public health and the quality of the environment.

Operating systems to manage solid waste involve a complex chain of interdependent logistical processes, which include waste prevention, generation, collection, transport, recovery and disposal. Waste management operations require dedicated attention to the establishment, monitoring and supervision of these complex systems. Health impacts can occur at each stage of the waste management service and recovery and recycling value chains.

Challenges to and pressures on solid waste management systems include rapid urbanization, population growth and ever-decreasing urban spaces. The relatively high costs of waste management, and often weak governance and regulatory systems, are major causal factors in poor waste management. Systemic shortfalls in collection, recovery, quality and coverage of disposal services can give rise to recurring disease outbreaks, and they place a major strain on the fabric of governance.

This section includes information about municipal solid waste and e-waste. Coverage of health care waste can be found in [Section 12.4 Health care facilities](#).

Approaches to managing consumption and production aimed at reducing the use of natural resources, environmental pollution and waste

A circular economy is a model of production and consumption that involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products for as long as possible to extend the life cycle of the products, thereby reducing the extraction of new resources in favour of reusing existing ones. It also aims to minimize the dumping or burning of waste. It offers a transition to a green economy (6). The links to health are diverse, but the direct impacts of circular economies on health have not yet been quantified (7). Research is needed to show countries how important it is to invest in a circular economy and which co-benefits a circular economy can have on health. An interesting application of the circular economy is in the waste management sector, where the health impact and health economic arguments are instrumental for decision-making (8, 9).

Life-cycle assessment is a methodology for assessing the environmental impacts associated with all stages of the life cycle of a commercial product, process or service, from the extraction of raw materials, processing, manufacturing, distribution and use to recycling and final disposal. Upstream control of resource use and minimization of health and environmental impacts can eventually lead to improved sustainability at the end of a product's life practices (8).

Integrated sustainable waste management is the coordinated use of a set of waste management approaches and solutions, each of which has a functional role in an overall system to manage solid waste, that are combined together as a recognizably coherent whole (10).

What is the situation regarding solid waste in my country?

Municipal solid waste

Sustainable Development Goal (SDG) indicator 11.6.1 monitors progress related to safe solid waste management: it is defined as the “proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities” (11).

The Waste Wise Cities Tool, developed by UN-Habitat, is a diagnostic tool that helps cities monitor progress towards SDG indicator 11.6.1 by providing a standardized approach to collecting the data required to inform the indicator. Cities can apply the tool to assess the performance of their municipal solid waste management systems and can use it as a basis for developing sustainable solid waste management plans (12).

Reducing food waste

Target 12.3: By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses (11).

Managing hazardous waste and environmental pollution

Target 12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment (11).

Reducing waste by transitioning to a circular economy model

Target 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse (11).

And Target 12.B suggests removing market distortions that encourage wasteful consumption (the full text of this Target has been omitted for brevity) (11).

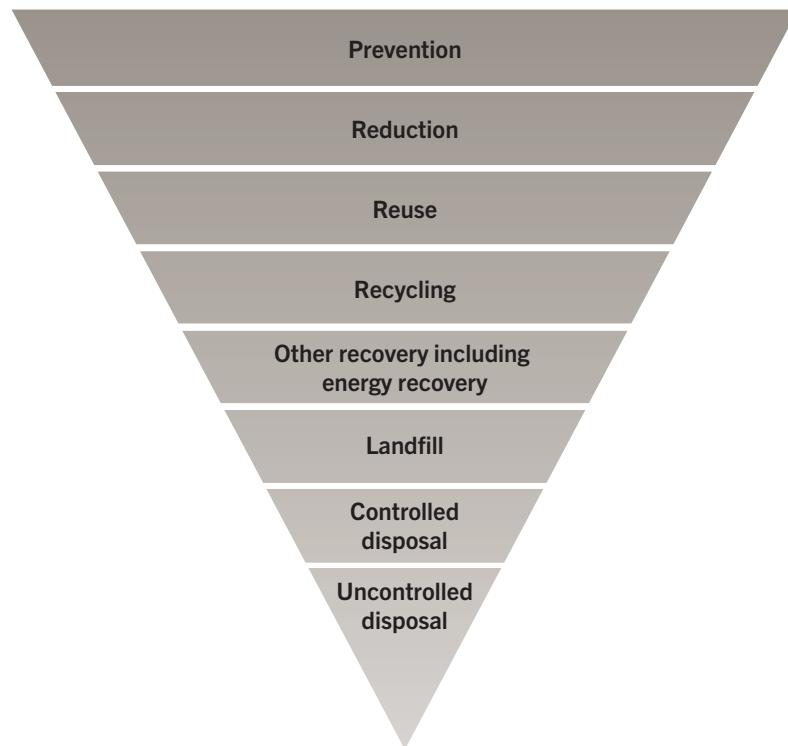
E-waste: The Global E-Waste Statistics Partnership monitors developments related to e-waste and assists countries and regions in producing their own e-waste statistics (13).

What do we want to achieve?

Prevention: reduced waste generation

Most important is to reduce the amount of solid waste that is generated by implementing waste prevention, reuse and recycling strategies (Fig. 4.1). In addition to protecting human health and the environment, waste prevention saves money by reducing the burden on waste management systems. Waste prevention also reduces the amount of waste that remains uncollected and that would otherwise contaminate the environment.

Fig. 4.1. The waste hierarchy



Source: Figure adapted from (14).

A safe management system for solid waste

A sustainable solid waste management system considers the whole process, from waste prevention to generation, collection, transport, recovery and disposal. Solid waste management is a key budgetary expenditure for most local governments, is important for economic and social development and protects the health of all, especially the most vulnerable populations. Proper regulation and management of municipal solid waste structures and systems, including those for hazardous waste, play crucial roles in providing a safe and sustainable environment for all.

The Guidance table provides an overview of the most relevant advice from WHO and other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
Policies and actions				
1. Implement a solid waste management system prioritizing actions according to the waste management hierarchy (Fig. 4.1) (2, 8, 15). Waste prevention should be prioritized, and subsequent steps are to reduce, reuse, recycle, recover and implement controlled disposal.	 Environment  Waste	National; community	Other management and control, regulation	B, C
2. Develop or update policies and actions across relevant sectors that reduce the harmful exposure of all waste-workers to all types of waste (8, 16). Improvements can be made in occupational health and safety by implementing standards and practices that include the use of personal protective equipment, safe working practices and regular health check-ups.	 Multiple sectors	National	Regulation; other management and control	B
3. Implement international accords such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (17), the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (18), the Stockholm Convention on Persistent Organic Pollutants (19) and the Minamata Convention on Mercury (20).	 Environment  Health	National	Regulation; governance	B, C
4. Eradicate child labour within all facets of waste management (15, 21). Eradicating child labour in the waste and recycling sectors is an urgent global imperative. Child labour is especially prevalent in the management of e-waste.	 Environment  Labour	National; community	Regulation	B
5. Promote screening for and biomonitoring of harmful waste exposure in at-risk populations, and accompany this with environmental monitoring of water, soil and air quality (15). Biomonitoring and surveillance of communities exposed to health risks can aid in assessing chemical exposure levels, particularly among children and pregnant women (22).	 Environment  Health	National; community, health care Universal health coverage	Assessment and surveillance	B
6. Plan for sufficient financial resources to sustain waste management systems and services, from waste prevention to segregation, collection and transportation, and to recovery and disposal (2, 8, 9, 23). Operating costs make up a large part of total waste management costs and need to be ensured. Coverage of universal collection services, appropriate recovery and recycling systems and controlled disposal facilities should be prioritized.	 Finance  Waste	National; community	Governance; taxes and subsidies	B, C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>7. Consider the use of economic instruments to diversify revenue streams and incentivize waste prevention and landfill diversion (8, 24).</p> <p>Economic instruments may include landfill and incineration taxes, unit-based waste-pricing schemes (“pay-as-you-throw”) for households, general consumption taxes, advance disposal fees (i.e. product-based fees added at the point of sale) and deposit-refund or product take-back schemes, as well as EPR mechanisms to incentivize manufacturers to design their products to reduce waste and maximize recycling and reuse (23, 24).</p> <p>Ensure revenues from waste-related charges are earmarked for waste prevention and management, with a focus on diverting waste from landfill (8, 24).</p>	 Finance  Waste	National; community	Regulations, taxes and subsidies, governance	B, C
Understand waste streams to optimize management				
<p>8. Conduct an assessment of waste quantities, composition and material flows through the system to determine any gaps in waste management services and help identify priorities (2).</p> <p>Data on waste quantities and characteristics are required at the local and national levels to effectively plan and implement the required steps to strengthen and optimize existing waste management systems.</p>	 Waste	National; community	Assessment and surveillance	C
<p>9. Implement systems for separate waste collection at source (2).</p> <p>Separate collection systems include the use of distinct containers or drop-off points for different materials, adapted collection vehicles and equipment, and economic incentives and behavioural change campaigns to encourage the adoption of habitual practices. Waste separation can occur before or after collection (e.g. at the household level) or after waste collection (e.g. at materials recovery or sorting facilities). Separate collection and bring systems can be designed for materials that have a locally accessible market outlet. Implement economic instruments (e.g. deposit-refund schemes and EPR) and behavioural change campaigns alongside the roll out of these systems.</p>	 Waste	National; community	Infrastructure, technology and built environment; other management and control	C

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
Reduce and reuse				
10. Introduce policies that help to stimulate the diversion of waste from landfill (2). Implement EPR for packaged goods placed on the market. Introduce deposit–refund systems for beverage containers and other readily returnable products. Phase out unnecessary single-use plastics, such as plastic bags, plastic cutlery or Styrofoam products (25). Promote durable and reusable goods that can be locally reused or recycled.	 Environment	National; community	Regulation; taxes and subsidies	C
Recycle				
11. Apply a circular economy approach and Health Impact Assessments to waste management (8, 9). A reuse-recycle-recover approach should be adopted, shifting away from disposal, maximizing a product's lifetime and the return of secondarily recovered materials into the economy, and reducing the extraction of virgin resources (10).	 Waste	National; community	Infrastructure, technology and built environment; assessment and surveillance	B
12. Understand the economics of the health implications of waste management when applying a circular economy approach (8). Shifting to a waste management system that is more sustainable and transitioning to a circular economy have economic consequences and can bring significant benefits (10). The transition reduces the environmental impacts associated with waste management and subsequently can have a positive impact on public health.	 Waste	National; community	Assessment and surveillance	B
13. Divert as much waste from landfills as possible, for example through waste segregation and recycling (2, 8). Common materials that can be recycled include organics, plastics, aluminium, glass and paper. Separation at the household, commercial and industry levels can assist in optimizing recoverable waste streams; reduce waste flowing to disposal sites; and improve health and safety for those generating, handling, collecting and working with waste.	 Waste	National; community	Infrastructure, technology and built environment; other management and control	B, C
14. Bring in organic waste management systems to recover and return nutrients to the environment. Implement separate collection systems for food and green organic waste, and their associated recovery facilities (26). Utilize appropriate methods to recover organic waste, return nutrients to the soil and enhance local agricultural value chains.	 Waste	National; community	Infrastructure, technology and built environment; other management and control	C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
Energy recovery				
15. Consider waste incineration with energy recovery (i.e. waste to energy) for solid waste that is otherwise not recyclable (2, 8, 9, 26) and where landfills pose challenges due to the availability of land or other issues. Where incineration facilities are deployed, they should be equipped with pollution controls and operated professionally to minimize environmental emissions, reducing risks to workers and neighbouring communities.	 Waste	National; community	Infrastructure, technology and built environment; other management and control	B, C
Disposal				
16. Restrict and discourage open dumping of waste by providing regular and reliable collection services and incentivizing (or requiring) site managers to operate waste disposal sites to at least basic levels of control (2). The reduction and elimination of the open dumping and open burning of waste are urgent global priorities. These actions will reduce the environmental hazards and potential adverse health outcomes for waste-workers and communities.	 Environment	National; community	Regulation	C
17. Establish controlled disposal facilities with adequate measures to avoid environmental contamination from waste. Ensure basic minimum standards are met, and subsequently seek to reach the full standard for environmentally sound management of sanitary landfills (12, 26). A basic level of control should be ensured at all disposal facilities. This entails allocating a sufficient budget to: <ul style="list-style-type: none">• ensure fencing and access control, perimeter drainage, compaction and cover;• maintain slope stability;• ensure there are no fires on site; and• record waste types and quantities. Full-time staff are needed at disposal facilities to observe environmental health and safety protocols and progressively plan for the ongoing development of the site.	 Waste  Environment	National; community	Regulation; infrastructure, technology and built environment; other management and control	C
18. Clean up and remediate contaminated sites or hot spots (14, 27, 28). Historical disposal sites should be remediated before closure to reduce contamination in the environment.	 Environment	National; community	Other management and control	B

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
----------	--	-------------------------	-------------	----------------------

<p>19. Ensure sufficient financial resources for landfill closure and rehabilitation of the site (2).</p> <p>Ongoing responsibilities after a landfill has been closed include:</p> <ul style="list-style-type: none"> • maintaining the final cover of the landfill (e.g. soil, vegetation); • maintaining and operating the leachate collection system; • monitoring groundwater and surrounding freshwater; • maintaining and operating the landfill gas monitoring and collection system. 	 Waste  Environment  Finance	National; community	Regulation; governance; infrastructure, technology and built environment; other management and control	C
---	---	---------------------	--	---

E-waste policies and actions

Note: Please also consider the guidance discussed in [Section 5.2 Chemical safety](#).

<p>20. Phase out, to the extent possible, the use of toxic chemicals in electrical and electronic equipment, and clearly mark products and packaging to identify any hazardous chemicals still present (15, 21, 23).</p> <p>Implement national and international accords that target phasing out components that are hazardous to health. Substitute materials with benign or less hazardous properties (7).</p>	 Industry  Environment  Health	National	Regulation	B
<p>21. Monitor and regulate the illegal transboundary movement of electrical and electronic equipment and e-waste (21).</p> <p>Implement policies and regulations to control transboundary shipments, ensuring customs authorities are trained accordingly (7).</p>	 Industry  Environment  Health	National	Regulation	B
<p>22. Identify e-waste streams, and formalize and regulate waste management and recycling to ensure safe treatment of e-waste (15, 21, 23).</p> <p>Develop local or regional recovery and recycling facilities, or both. E-waste should be treated using the best available technology to minimize the risks associated with recycling and processing (7).</p>	 Environment  Waste  Health	National	Assessment and surveillance; regulation; infrastructure, technology and built environment	B
<p>23. Implement regulations to prevent the discharge of toxic chemicals into the environment (21), such as by ensuring corporate legal liability to finance any rehabilitation or clean up required following any prohibited or accidental discharge.</p> <p>Place responsibility on those who generate or improperly manage waste. This aligns financial incentives with implications and ensures polluters remediate the environmental contamination generated by their actions.</p>	 Environment  Industry  Health	National	Regulation	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>24. Implement e-waste standards, and actions and programmes to reduce e-waste generation and exposure, such as:</p> <ul style="list-style-type: none"> • reduce and reuse waste policies; • take-back programmes; • design that maximizes durability, reparability and reusability (15, 21, 23). 	 Environment	National; community	Regulation; other management and control	B
<p>25. Ensure sufficient health sector capacity to respond to harmful waste exposures (8, 9, 16).</p>	 Health	Health care Universal health coverage	Other management and control; information, education and communication	B
Capacity-building and awareness-raising				
<p>26. Train health care workers about the health hazards related to e-waste exposure and the symptoms of possible exposure and to recognize informal recycling contexts (8, 15, 21).</p>	 Health	Health care Universal health coverage	Information, education and communication	B
<p>27. Train workers at formal and informal waste settings, such as disposal or recycling sites, about good practices in waste management, including with regards to hazardous waste and e-waste (15, 29).</p> <p>Providing education to workers in both formal and informal sectors about the potential health risks associated with their roles can equip them with the necessary knowledge and tools to protect themselves.</p>	  Waste Environment	Workplace	Information, education and communication	B
<p>28. Raise awareness among the general population about the importance of reducing waste and properly segregating waste, and about the adverse health impacts of exposure to harmful waste, such as e-waste (16, 23, 29).</p> <p>Implement waste reduction campaigns, for example to encourage people to avoid single-use plastic bags (25).</p>	   Waste Health Environment	National; community Universal health coverage	Information, education and communication	B, C
<p>29. Increase awareness of the polluter pays principle – including the need for polluters to contribute to the full cost of waste management, from collection to disposal – as well as of environmental externalities and their associated costs (8).</p> <p>Launch behavioural change campaigns using online media and posters to educate and shift the waste-generation and -management mindset of political leaders, communities and businesses.</p>	  Environment Waste	Community; national	Information, education and communication	B

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy
 EPR: extended producer responsibility; e-waste: electrical and electronic waste.

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

[WHO Regional Office for Europe 2023: Assessing the health impacts of waste management in the context of the circular economy](#) (9) – This report considers the public health implications of the transition to a circular economy that are relevant to the waste sector.

[UN-Habitat 2021: Waste Wise Cities Tool](#) (12) – a step-by-step guide to assess a city's solid waste management performance by monitoring SDG indicator 11.6.1.

[WHO 2021: Children and digital dumpsites: e-waste exposure and health](#) (21) – This report summarizes scientific knowledge about the links between informal e-waste recycling activities and health outcomes in children and is intended to increase awareness and knowledge among health professionals of the dangers of e-waste recycling.

[World Bank Group 2020: solid waste management](#) (2) – an open online course about solid waste management.

[International Monetary Fund 2019: Disposal is not free: fiscal instruments to internalize the environmental costs of solid waste](#) (24) – This paper provides an overview of the environmental costs of solid waste generation and evaluates fiscal instruments that can be used to encourage waste reduction and to finance proper disposal.

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

[World Bank 2020: Solid waste management knowledge silo breaker \(known as KSB\)](#) (30) – This is a community of practice aiming to share knowledge about the challenges of and innovations in dealing with solid waste among community members of all affiliations.

[UN Environment Programme \(UNEP\) and Institute for Global Environmental Studies 2020: Waste management during the COVID-19 pandemic: from response to recovery](#) (31) – Fact sheets on topics such as waste management, green jobs and resource efficiency, among others, are also available from the UNEP (32).

[WHO 2018: Children's environmental health: the paediatric environmental history](#) (33) – A series of basic, concise questions that enable health professionals to identify children's potential exposure to environmental risks and their special vulnerabilities.

[UNEP 2015: Global waste management outlook](#) (5) – This is a global assessment of the state of waste management and a call to action for the international community.

[UN-Habitat: Waste Wise Academy](#) (34) – this site shares online courses, toolkits and guides, training, webinars and good practices to improve knowledge about solid waste management.

[École polytechnique fédérale de Lausanne \(Swiss Federal Institute of Technology in Lausanne\) 2023: Municipal solid waste management in developing countries](#) (35) – an open online course.

[US Environmental Protection Agency 2020: Best practices for solid waste management: a guide for decision-makers in developing countries](#) (36) – The US Environmental Protection Agency's Office of Resource Conservation and Recovery developed this best practices guide about solid waste management that is aimed at decision-makers in urban areas in low-resource countries; it details topics such as planning solid waste management systems; economic aspects; waste characterization, separation, collection and transportation; disposal site management; sanitary landfills; organic waste management; and each of the steps in the waste management hierarchy. It lists many examples of good practices from around the world.

[The Climate and Clean Air Coalition 2015: Municipal Solid Waste Knowledge Platform](#) (37) – The platform provides a forum for exchanging information and resources about best practices in solid waste management. It supports cities and national governments in their efforts to reduce short-lived climate pollutants.

E-waste

[UN University, UN Institute for Training and Research, Sustainable Cycles Programme, International Telecommunication Union, International Solid Waste Association 2020: Global e-waste monitor](#) (38) – This report provides comprehensive insight into addressing the global challenges of e-waste.

References

1. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives [website]. Luxembourg: EUR-Lex; 2008 (L312/3; <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098>, accessed 9 October 2023).
2. World Bank: Solid waste management [online course]. Cambridge (MA): edX; 2020 (https://www.edx.org/course/solid-waste-management?webview=false&campaign=Solid+Waste+Management&source=edx&product_category=course, accessed 9 October 2023).
3. Kaza S, Yao L, Bhada-Tata P, Van Woerden F. What a waste 2.0: a global snapshot of solid waste management to 2050. Washington (DC): World Bank; 2018 (<https://openknowledge.worldbank.org/handle/10986/30317>, accessed 9 October 2023).
4. Kaza S, Shrikanth S, Chaudhary S. More growth, less garbage. Washington (DC): World Bank; 2021 (<https://openknowledge.worldbank.org/entities/publication/ba7feea4-0abe-59fb-bc60-ce6b60eb1ceb>, accessed 19 July 2023).
5. Global waste management outlook. Nairobi: United Nations Environment Programme, International Solid Waste Association; 2015 (<https://www.unenvironment.org/resources/report/global-waste-management-outlook>, accessed 9 October 2023).
6. Circular economy and health: opportunities and risks. Copenhagen: WHO Regional Office for Europe; 2018 (<https://apps.who.int/iris/handle/10665/342218>, accessed 9 October 2023).
7. Assessing the health impacts of a circular economy. Copenhagen: WHO Regional Office for Europe; 2019 (<https://apps.who.int/iris/handle/10665/346222>, accessed 9 October 2023).
8. Economics of the health implications of waste management in the context of a circular economy. Copenhagen: WHO Regional Office for Europe; 2023 (<https://iris.who.int/handle/10665/365579>, accessed 9 October 2023).
9. Assessing the health impacts of waste management in the context of the circular economy. Copenhagen: WHO Regional Office for Europe; 2023 (<https://iris.who.int/handle/10665/366667>, accessed 1 August 2023). [cited 2023 Aug 1].
10. Whiteman A, Wilson DC, Mingyu Q, Mitiaieva N, Xiao L, Xinrui L. Wastewise benchmark indicators for integrated sustainable waste management in Chinese cities. Bonn: Deutsche Gesellschaft für Internationale Zusammenarbeit; 2019 [<https://rwm.global/utilities/documents/wabi.pdf>, accessed 14 September 2023].
11. The 17 Sustainable Development Goals [website]. New York: United Nations Department of Economic and Social Affairs; 2023 (<https://sdgs.un.org/goals>, accessed 9 October 2023).
12. Waste Wise Cities Tool [website]. Nairobi: UN-Habitat; 2021 (<https://unhabitat.org/wwc-tool>, accessed 19 July 2023).
13. The Global E-waste Statistics Partnership [website]. Tokyo: United Nations University, International Telecommunication Union; 2023 (<https://globalewaste.org/about-us/>, accessed 9 October 2023).
14. Whiteman A, Webster M, Wilson DC. The nine development bands: a conceptual framework and global theory for waste and development. Waste Manag Res. 2021;39(10):1218–36.
15. Electrical/electronic waste and children's health: training for health care providers, second edition. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/372852>, accessed 9 October 2023).
16. Environment, climate change and health: e-waste and children's health [website]. Geneva: World Health Organization; 2020 (<https://www.who.int/teams/environment-climate-change-and-health/settings-populations/children/e-waste>, accessed 20 July 2023).
17. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal [website]. Basel: United Nations Environment Programme; 2019 (<https://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx>, accessed 9 October 2023).
18. Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade [website]. Rotterdam: United Nations Environment Programme; 2019 (<http://www.pic.int/TheConvention/Overview/TextoftheConvention/tabid/1048/language/en-US/Default.aspx>, accessed 9 October 2023).
19. Stockholm Convention on Persistent Organic Pollutants (POPs) [website]. Stockholm: United Nations Environment Programme; 2019 (<https://chm.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx>, accessed 9 October 2023).
20. Minamata Convention on Mercury [website]. Geneva: United Nations Environment Programme; 2013 (<http://www.mercuryconvention.org/Convention/Text/tabid/3426/language/en-US/Default.aspx>, accessed 9 October 2023).
21. Children and digital dumpsites: e-waste exposure and health. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/341718>, accessed 9 October 2023).
22. Human biomonitoring: facts and figures. Copenhagen: WHO Regional Office for Europe; 2015 (<https://apps.who.int/iris/handle/10665/164588>, accessed 14 September 2023).
23. Children and e-waste: key messages. Geneva: World Health Organization, United Nations Children's Fund; 2022 (<https://iris.who.int/handle/10665/364380>, accessed 14 July 2023).
24. Matheson T. Disposal is not free: fiscal instruments to internalize the environmental costs of solid waste. Washington (DC): International Monetary Fund; 2019 (IMF Working Paper no.: WP/19/283; <https://www.imf.org/en/Publications/WP/Issues/2019/12/20/Disposal-is-Not-Free-Fiscal-Instruments-to-Internalize-the-Environmental-Costs-of-Solid-Waste-48854>, accessed 9 October 2023).
25. Single-use plastics: a roadmap for sustainability. Nairobi: United Nations Environment Programme; 2018 (<https://www.unep.org/ietc/resources/publication/single-use-plastics-roadmap-sustainability>, accessed 9 October 2023).

26. Kaza S, Bhada-Tata P. Decision maker's guides for solid waste management technologies. Washington (DC): World Bank; 2018 (<https://elibrary.worldbank.org/doi/abs/10.1596/31694>, accessed 9 October 2023).
27. Protecting health through urban redevelopment of contaminated sites: planning brief. Copenhagen: WHO Regional Office for Europe; 2021 (<https://iris.who.int/handle/10665/349922>, accessed 8 August 2023).
28. Urban redevelopment of contaminated sites: a review of scientific evidence and practical knowledge on environmental and health issues. Copenhagen: WHO Regional Office for Europe; 2021 (<https://apps.who.int/iris/handle/10665/340944>, accessed 19 July 2023).
29. Foellmer J, Liboiron M, Rechenburg A, Kistemann T. How do the cultural contexts of waste practices affect health and well-being? Copenhagen: WHO Regional Office for Europe; 2022 (<https://apps.who.int/iris/handle/10665/354695>, accessed 1 August 2023).
30. Solid waste management KSB [website]. Washington (DC): World Bank; 2020 (<https://collaboration.worldbank.org/content/sites/collaboration-for-development/en/groups/solid-waste-management.html>, accessed 9 October 2023).
31. Waste management during the COVID-19 pandemic: from response to recovery. Nairobi: United Nations Environment Programme, Institute for Global Environmental Studies; 2020 (<https://wedocs.unep.org/bitstream/handle/20.500.11822/33416/WMC-19.pdf?sequence=1&isAllowed=y>, accessed 9 October 2023).
32. Working with the environment to protect people: Covid-19 response [website]. Nairobi: United Nations Environment Programme; 2020 (<https://www.unenvironment.org/resources/working-environment-protect-people-covid-19-response>, accessed 9 October 2023).
33. Children's environmental health: the paediatric environmental history [website]. Geneva: World Health Organization; 2018 (<https://www.who.int/news-room/q-a-detail/q-a-the-paediatric-environmental-history>, accessed 9 October 2023).
34. Waste Wise Academy [website]. Nairobi: UN-Habitat; 2023 (<https://unhabitat.org/waste-wise-academy>, accessed 14 September 2023).
35. École polytechnique fédérale de Lausanne. Municipal solid waste management in developing countries [online course]. Mountain View (CA): Coursera; 2023 (https://www.coursera.org/learn/solid-waste-management?irclickid=0EPwV73UHxyPRMFxycUKd1arUkFWRKVI1Vwl3k0&irgwc=1&utm_medium=partners&utm_source=impact&utm_campaign=3307331&utm_content=b2c, accessed 14 September 2023).
36. Best practices for solid waste management: a guide for decision-makers in developing countries. Washington (DC): US Environmental Protection Agency; 2020 (<https://www.epa.gov/international-cooperation/best-practices-solid-waste-management-guide-decision-makers-developing>, accessed 19 July 2023).
37. Municipal Solid Waste Knowledge Platform [website]. United Nations Environment Programme, Climate and Clean Air Coalition; 2015 (<https://www.ccacoalition.org/en/resources/municipal-solid-waste-knowledge-platform>, accessed 19 July 2023).
38. Forti V, Baldé CP, Kuehr R, Bel G. The global e-waste monitor 2020: quantities, flows, and the circular economy potential. Bonn/Geneva/Rotterdam: United Nations University, United Nations Institute for Training and Research, Sustainable Cycles Programme, International Telecommunication Union, International Solid Waste Association; 2020 (<https://www.itu.int/en/ITU-D/Environment/Pages/Spotlight/Global-Ewaste-Monitor-2020.aspx>, accessed 9 October 2023).

5. Chemicals

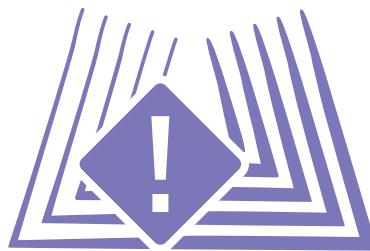


5.1 Introduction

Chemicals, whether of natural origin or produced by human activities, are part of our environment and daily life (1). Manufactured chemicals include industrial and agricultural products such as pesticides, petroleum products and processed metals. Some chemicals are manufactured for specific uses, while others are unwanted by-products, including waste or products of combustion, such as toxic gases and particles from industrial emissions and the burning of fuel. In 2017, the chemical industry was the second largest manufacturing industry in the world, and the trend is upwards: sales of chemical are projected to almost double from 2017 to 2030 (2).

All people come into contact with chemicals as part of normal life, through the food and drinking-water they consume, the products they use or are surrounded by at home or in the workplace, through contact with the environment (e.g. while breathing air, touching the soil, and swimming in recreational waters) or as a result of a chemical incident. Many of the chemicals people use and are exposed to are harmless or even beneficial; others pose a threat and are hazardous to people's health and the environment. Levels of exposure and the resulting health impacts are determined by social as well as biological factors. Men, women and children are exposed to different kinds and levels of chemicals and are exposed at different frequency. In addition, men, women and children vary in their physiological susceptibility to the health effects of exposure to hazardous chemicals (3, 4).

5.2 Chemical safety



In May 2017, the Seventieth World Health Assembly approved the Chemicals Road Map to enhance health sector engagement in the Strategic Approach to International Chemicals Management (SAICM) (5). The Road Map identifies concrete actions in which the health sector has a lead or important supporting role to play in the sound management of chemicals, while recognizing the need for multisectoral cooperation. The health sector plays an important part in helping reduce health risks from exposures to chemicals by promoting health protection strategies, regulating chemicals, increasing public education, and sharing information and best practices. In taking these actions, the role of the health sector is to increase knowledge and evidence about the toxicological properties of chemicals and their related risks to and impact on human health. Another role of the health sector is to promote the inclusion of health considerations in all chemicals policies, including those developed by other sectors.

At the national level, countries usually have laws to ensure the safe handling of chemicals, and to protect the environment from contamination and consumers and workers from exposure to hazardous chemicals. In addition, laws are often in place to prevent, prepare for and respond to chemical incidents, including accidents at hazardous installations (e.g. chemical plants) and during transport. Regulations may specify how hazardous materials, including chemicals, must be classified, labelled, packaged and transported (6). National laws often also define quality standards for chemicals and standards for chemical emissions, for example the permitted concentration of specific chemicals in air, water, food and consumer products. Specific laws may regulate the management of groups of chemicals, for example pesticides.



Overview

In 2019, a small number of chemicals for which data are available were estimated to cause 2 million deaths from a variety of health outcomes, including poisoning, heart disease, chronic respiratory disease and cancer (7). Chemical pollution also negatively impacts different facets of the ecosystem, which can harm human health.

Some hazardous chemicals raise particular health concerns because of their widespread presence in the environment, their toxicity and their capacity to magnify and accumulate in the environment and in people, and the fact that many people come into contact with them, thereby harming the health of large populations. Chemicals or groups of chemicals of major public health concern include air pollution, arsenic, asbestos, benzene, cadmium, dioxin and dioxin-like substances, inadequate or excess fluoride, lead, mercury and highly hazardous pesticides (HHPs) (8).

<p>Who is impacted by unsafe levels of chemicals in my country?</p>	<p>Exposure of the general population Some countries routinely conduct surveys to study current exposure to chemicals (e.g. through the environment, food and consumer products), changes in exposures over time and the related health risks. Biomonitoring is often used to determine chemical exposure – that is, concentrations of chemicals are measured in human fluids (e.g. blood, urine) or cells (e.g. hair, fingernails) (9, 10).</p> <p>Exposure through air, water and food Mandatory environmental and food monitoring programmes routinely measure chemicals in certain contexts, for example in ambient and indoor air, surface water and groundwater, and in foods, as well as in occupational environments. Often these programmes focus on monitoring specific chemicals that indicate a broader exposure pattern and, therefore, the range of substances being monitored may be limited (see Chapter 2. Air pollution and Sections 3.2.1 Drinking-water, 10.1 Food safety and the environment, and 12.3 Workplaces). Environmental monitoring data provide an estimate of health risks when compared with the WHO Global Air Quality Guidelines and the WHO Guidelines for Drinking-Water Quality (11, 12).</p> <p>Data from monitoring food for pesticide residues, additives and contaminants can be compared with guidance values (e.g. acceptable daily intakes prepared by the Joint Food and Agriculture Organization of the UN (FAO)/WHO Meeting on Pesticide Residues and the Joint FAO/WHO Expert Committee on Food Additives (13, 14).</p> <p>Exposure through soil Chemicals in soil are generally assessed only when contamination is suspected, for example in the case of an abandoned waste site where there is a risk of pollution affecting groundwater. Activities and industries that have been shown to pollute soil include, among others, the recycling of used lead-acid batteries, mining and ore processing, tanning, smelting, artisanal small-scale gold mining, product manufacturing, chemical manufacturing and the dye industry; places such as dumpsites and industrial estates are also associated with soil pollution.</p>
<p>What levels of chemicals do we want to achieve, for example in the air, water and products?</p>	<p>Chemicals in the air The WHO Global Air Quality Guidelines present standards for concentrations of pollutants: in ambient air, these are for particulate matter, ozone, nitrogen dioxide and sulfur dioxide; and there are additional standards for chemicals in indoor air, such as formaldehyde, benzene and naphthalene (11, 15) (see Chapter 2. Air pollution).</p> <p>Chemicals in drinking-water The WHO Guidelines for Drinking-Water Quality propose values for a variety of chemicals (12).</p> <p>Chemicals in soil Some countries have set different standards for contaminants in soil in residential areas and for farming and crop production.</p> <p>Chemicals in food WHO and the FAO established the Codex Alimentarius, which is a collection of standards, guidelines and codes of practice intended to protect consumer health as it relates to food; the Codex includes information about chemical contaminants and food additives (14, 16, 17).</p> <p>Additional guidance and guideline values (e.g. for occupational exposure limits) can be found in environmental health criteria documents, concise international chemical assessments and International Chemical Safety Cards (ICSCs); all of these resources are available in the International Programme on Chemical Safety (IPCS) Internationally Peer Reviewed Chemical Safety Information (INCHEM) database (18) and in the Inter-Organization Programme for the Sound Management of Chemicals (IOMC) Internet-based Toolbox for Decision Making in Chemicals Management (19).</p>

The Guidance table provides an overview of the most relevant advice from WHO and other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
Policies and actions				
<p>1. Implement the WHO Chemicals Road Map, approved by the World Health Assembly in 2017, to enhance health sector engagement in the SAICM towards meeting the 2020 goal and beyond (5, 20).</p> <p>The Chemicals Road Map contains information about the following action areas:</p> <ul style="list-style-type: none"> managing health risks from exposure to chemicals – developing health protection strategies, regulating chemicals, educating the public about health risks, sharing information and best practices, developing high-quality health care settings; improving knowledge and evidence about the health effects and impacts of chemicals – improving risk assessment methodologies, increasing biomonitoring and surveillance, estimating the disease burden from chemicals, sharing information and collaborating with partners; strengthening national capacities to address health threats from chemicals, including in response to chemical incidents and emergencies – strengthening national policies and regulatory frameworks, implementing the IHR (2005) and providing training and education; strengthening leadership and coordination – promoting the inclusion of health considerations in all policies related to chemicals; engaging the health sector in chemicals management activities at the national, regional and international levels; and ensuring engagement between the health sector and other sectors. 	 Health	National; health care; workplace	Governance; regulation; assessment and surveillance; information, education and communication	B
2. Implement the IHR (2005) to establish or strengthen core capacities for preparedness for chemical incidents and emergencies and to detect and respond to chemical events, including by increasing capacity at poison centres and laboratories (5, 21, 22).	 Health	National	Regulation	A, B
3. Implement multilateral environmental agreements focusing on chemicals and waste, particularly those concentrating on health protection (5), for example the: <ul style="list-style-type: none"> Minamata Convention on Mercury (23); Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (24); Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (25); Stockholm Convention on Persistent Organic Pollutants (26); Montreal Protocol on Substances that Deplete the Ozone Layer (27). 	 Health  Environment	National	Regulation	B, C

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
4. Nominate a health ministry contact point for issues related to chemicals and health, including for implementation of the Chemicals Road Map, and establish a national network of professionals focusing on chemicals and health (5).	 Health	National	Governance	B
5. Support the inclusion of health priorities in all policies relevant to chemicals (5).	 Health  Multiple sectors	National	Governance	B
6. Facilitate the participation of all relevant sectors and stakeholders in chemicals management and strengthen the engagement between the health sector and other sectors, recognizing the shared leadership of the health and environmental sectors (5).	 Health  Multiple sectors	National	Governance	B
7. Establish health-based guidelines for chemicals in water, air, soil, food and products, and for occupational exposure, and participate in their development, drawing on WHO norms, standards and guidelines, as appropriate (5, 11, 12).	 Health  Environment	National	Regulation	A, B
8. Support regulations to prevent the discharge of toxic chemicals and advocate for appropriate recovery and recycling technology, as well as for safe storage and disposal (5).	 Health  Environment  Agriculture  Industry	National	Regulation	B
9. Support implementation of the Globally Harmonized System of Classification and Labelling of Chemicals, coordinating internationally, where appropriate (5, 6).	 Health  Environment	National	Regulation	B, C
10. Prevent the construction of homes, schools and playgrounds near polluted areas and hazardous installations (i.e. places that process, store or handle hazardous substances) (28, 29).	 Health  Land use planning  Construction  Housing	National; community	Regulation	B
Awareness-raising and capacity-building				
11. Promote the communication of relevant information, including training, about chemicals used in products and processes to enable informed decision-making by all actors throughout a product's life cycle and to promote safer alternatives (5).	 Health  Environment  Labour	National; workplace	Information, education and communication	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>12. Educate the population (e.g. the public, teachers, medical professionals, staff at nongovernmental organizations) and raise awareness about the health effects of chemicals and about actions to prevent exposure to toxic chemicals (5, 8).</p>	 Health	National; community; workplace Universal health coverage	Information, education and communication	B
<p>13. Promote the safe storage of chemicals at home (28, 29). Selected actions include:</p> <ul style="list-style-type: none"> • keeping all chemicals out of the reach of children, either locked away or stored in places they cannot access. This applies to cleaning products, paraffin or kerosene, medicines, fuels, caustic products and pesticides; • using child-resistant packages for pharmaceuticals and other chemical products; • never storing chemicals in drinking-water bottles. 	 Health	National; community Universal health coverage	Information, education and communication	B
<p>14. Ensure clear labelling on cleaning products, fuels, solvents, pesticides and other chemicals used, for example, at home and in schools (29).</p>	 Health	National; community Universal health coverage	Information, education and communication	B
<p>15. Raise awareness among parents, teachers and childminders about potential chemical hazards in the places where children spend their time (8, 28).</p>	 Health	National; community Universal health coverage	Information, education and communication	B
<p>16. Raise awareness among families and communities about poison control centres and ways to contact them (28). See also the <i>World directory of poison centres</i> (30) and guidance about establishing them (22).</p>	 Health	National; community Universal health coverage	Information, education and communication	A, B
Arsenic: reducing exposure through drinking-water				
<p>17. Screen drinking-water and identify whether it contains more than the WHO provisional guideline value of 10 µg arsenic/L or the national permissible limit (12, 31). Combine screening activities with awareness-raising campaigns.</p>	  	National; community Universal health coverage	Assessment and surveillance	A, B
<p>18. Use and make available alternative groundwater sources, microbiologically safe surface water (e.g. via rainwater harvesting) or arsenic removal technologies, if necessary (31).</p>	  	National; community	Infrastructure, technology and built environment	B

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
Asbestos: eliminating asbestos-related diseases				
19. Stop the use of all types of asbestos, which is the most efficient way to eliminate asbestos-related disease (32).	 Health  Construction  Housing	National; community	Regulation	B
20. Replace asbestos with safer substitutes, and develop economic and technological mechanisms to stimulate its replacement (32).	 Construction  Housing	National; community	Infrastructure, technology and built environment; regulation; taxes and subsidies	B
21. Prevent exposure to asbestos that is already in place and prevent exposure during removal (i.e. during abatement) (32).	 Construction  Housing  Labour	National; community	Infrastructure, technology and built environment; regulation	B
22. Improve the early diagnosis and treatment, and social and medical rehabilitation of people with asbestos-related diseases, and establish registries of people with past or current exposure to asbestos (32).	 Health	Health care; community Universal health coverage	Assessment and surveillance; other management and control	B
Benzene: reducing exposure at work and for the population				
23. Support the use of alternative solvents in industrial processes (33).	 Health  Industry  Labour	Workplace	Regulation; information, education and communication	B
24. Develop or update policies and legislation to remove benzene from consumer products (33).	 Health  Industry	National	Regulation	B
25. Minimize exposure to emissions from vehicle exhaust through encouraging less motorized traffic and improving the design and regular monitoring of engine settings (33).	 Land use planning  Industry	National	Regulation; infrastructure, technology and built environment	B
26. Promote building codes requiring detached garages (33).	 Construction  Housing	National	Regulation	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
27. Prevent exposure to tobacco smoke, which is a significant source of benzene exposure (33).	 Health	National; community Universal health coverage	Regulation; information, education and communication	B
28. Increase public awareness to discourage the domestic use of benzene-containing products (33).	 Health	National; community Universal health coverage	Information, education and communication	B
Cadmium: reducing exposure at work and for the population				
29. Reduce cadmium emissions from mining and smelting, and waste incineration; reduce the application of sewage sludge to the land; and reduce the use of phosphate fertilizers and cadmium-containing manure, among others (34).	   Industry Agriculture Labour	Workplace; national; community	Infrastructure, technology and built environment; regulation	B
30. Support safe and effective measures to increase the recycling of cadmium (34).	 Industry	Workplace; national; community	Infrastructure, technology and built environment; regulation	B
31. Restrict nonrecyclable uses of cadmium (34).	 Industry	National	Regulation	B
32. Eliminate the use of cadmium in products such as toys, jewellery and plastics (34).	  Health Industry	National	Regulation; other management and control; information, education and communication	B
33. Prevent exposure to tobacco smoke, which is a significant source of cadmium exposure (34).	 Health	National; community Universal health coverage	Regulation; information, education and communication	B
Dioxins and dioxin-like substances: reducing emissions of these substances as required by the Stockholm Convention (26)				
34. Identify and safely dispose of material containing or likely to generate dioxins and dioxin-like substances, such as electrical equipment (35).	   Industry Environment Waste	Workplace; national; community	Regulation; infrastructure, technology and built environment	B

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
35. Ensure appropriate combustion practices are implemented, for example in waste management, to prevent emission of dioxins and dioxin-like substances (35).	 Industry  Waste  Environment	Workplace; national; community	Regulation; infrastructure, technology and built environment	B
36. Implement FAO/WHO strategies to reduce contamination by dioxins and dioxin-like substances in food and feed, and monitor food items and human breastmilk (35, 36).	 Food  Agriculture	National	Regulation; assessment and surveillance	B, C
Inadequate or excess fluoride				
37. Ensure sufficient fluoride intake where it is lacking to minimize tooth decay (37).	 Health  Food  Water/sanitation	National; community Universal health coverage	Regulation	B
38. Provide drinking-water with a safe fluoride level in areas where groundwater contains high levels (37). Guideline values for fluoride in drinking-water and air are available (12, 37).	 Water/sanitation  Health	National; community	Regulation	A, B
39. Provide guidance on the need to control population exposure to fluoride while balancing the important needs for caries prevention and protection against adverse effects (37).	 Health	National; community Universal health coverage	Information, education and communication	B
Lead: mitigating risks				
40. Develop and enforce health, environmental and safety standards for manufacturing and recycling lead-acid batteries, electronic waste (i.e. e-waste) and other substances that contain lead (38-40).	 Health  Industry  Waste  Environment	National; workplace	Regulation	B
41. Enforce environmental and air-quality regulations for smelting operations (38, 39).	 Health  Industry  Environment	National; workplace	Regulation	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>42. Include strict standards for lead in national drinking-water quality standards, and monitor them as part of a drinking-water quality surveillance programme (12).</p> <p>The provisional guideline value is 0.01 mg/L, although lead concentrations should be kept as low as possible because no safe threshold for health effects has been established (38, 39).</p>	 Health  Industry  Environment	National	Regulation	A
<p>43. Ensure that health care practitioners have training in, and resources for, diagnosing and managing lead poisoning (38, 39).</p>	 Health	National; community Universal health coverage	Information, education and communication	B
<p>44. Ensure the availability of laboratories with the capacity to test blood for lead (38, 39).</p>	 Health	National; community Universal health coverage	Regulation	B
<p>45. Phase out the use of lead additives in fuels and lead in paint if this has not yet been done; adopt legally binding limits on lead in paint (38, 39).</p>	 Industry  Transport  Environment  Health	National	Regulation	B
<p>46. Eliminate the use of leaded solder in food and drink cans and water pipes; and eliminate lead in homes, schools, school materials and children's toys; in glazing for pottery intended for cooking, eating or drinking; spices; and in traditional medicine and cosmetics (38, 39).</p>	 Industry  Multiple sectors	National	Regulation	B
<p>47. Identify lead-contaminated sites and exposure routes, and take necessary action to prevent human exposure to lead from these areas (38, 39). Identify sources of lead exposure in children, such as lead in contaminated soil, paint, toys and water distribution pipes (29, 41).</p>	 Environment  Health  Multiple sectors	National; community	Assessment and surveillance; information, education and communication	B
<p>48. In at-risk populations, monitor blood lead concentrations using sensitive analytical methods (38, 39, 42).</p>	 Health	National; community Universal health coverage	Assessment and surveillance	B
<p>49. Enhance the collection of data about lead in foodstuffs, and make this information publicly available so that appropriate action can be taken (38, 39).</p>	 Food	National; community	Assessment and surveillance; information, education and communication	B

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
----------	--	-------------------------	-------------	----------------------

50. Educate the public regarding the dangers of using lead-containing products, including risks from lead exposure, and about ways to protect themselves, their families and their communities (38, 39).

These efforts may include public education campaigns aimed at parents and caregivers; at schools, including classroom teachers and students; at youth associations, community leaders and health care workers; and workers at and owners of lead-related industries (e.g. lead-acid battery recyclers and smelters, ceramic potters, spice adulterators) (38, 39).

Media and communication resources can be used to reach audiences that may not be aware of the risks of lead exposure to children and pregnant women (38, 39).



Instruments

B

Mercury: preventing health risks

51. Implement the Minamata Convention on Mercury (23).

Strengthen the engagement of health ministries in implementing the health-related articles of the Minamata Convention (45).



National

Regulation

B, C

52. Phase out the use of mercury-containing medical devices and consumer products; promote mercury-free alternatives; and ensure that mercury-containing devices are properly disposed of (43, 44).



National

Regulation

B

53. Conduct national assessments of mercury use and disposal (43, 44).



National

Assessment and surveillance

B

54. Implement educational activities about mercury and its health and environmental impacts for those working in the health, environment and other sectors, and raise awareness among the general population, including providing special advice for pregnant and lactating women and about children (43, 44).



National; community

Universal health coverage

Information, education and communication

B

HHPs: reducing exposure

55. Establish national regulations for the registration, licensing, labelling, marketing, purchase and use of pesticides, including regulations for HHPs (46–50).



National

Regulation

A, C

56. Implement FAO guidance on the appropriate handling and use of pesticides (46, 51).



National

Regulation

B, C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
57. Eliminate the use of persistent HHPs and eliminate inappropriate waste disposal, especially of HHPs subject to the Stockholm and Rotterdam Conventions (25, 26, 46).	 Agriculture  Labour	National	Regulation	B, C
58. Supply and ensure that appropriate, comfortable and affordable personal protective equipment is used, and provide training on appropriate use (46).	 Agriculture  Labour	National; community	Regulation; other management and control	B
59. Promote integrated vector management rather than relying primarily on pesticides (46).	 Agriculture  Labour	National; community	Information, education and communication; other management and control; regulation	B
60. Ensure proper storage and disposal of pesticides to prevent human exposure and contamination of the environment (46).	 Agriculture  Labour	National; community	Regulation; other management and control	B
61. Train people who apply pesticides in their appropriate use, and raise awareness about the importance and ways of protecting health and the environment, and educate them about the existence of less hazardous alternatives (46).	 Health  Agriculture  Environment  Labour	National; community Universal health coverage	Information, education and communication	B
62. Educate health professionals about how to recognize and treat pesticide-related poisoning (46).	 Health	Health care Universal health coverage	Information, education and communication	B
63. Monitor exposure to pesticides and conduct health surveillance in those who use them and in other vulnerable populations (46).	 Health	National; community Universal health coverage	Assessment and surveillance	B

Note: Actions to reduce risks from chemicals used in health care settings are described in [12.4 Health care facilities](#). Additional information and more comprehensive guidance about health sector engagement is available in the Chemicals Road Map (5).

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy

FAO: Food and Agriculture Organization of the UN; HHPs: highly hazardous pesticides; IHR (2005): International Health Regulations (2005); SAICM: Strategic Approach to International Chemicals Management.

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

WHO 2020: Ten chemicals of public health concern [website] (8) – This page includes information for decision-makers about different chemicals of public health concern, including tools for action, norms and guidelines, and fact sheets.

Additional information about these chemicals is also available (31–35, 37, 38, 44, 46).

WHO 2017: Chemicals road map (5) – The Road Map identifies concrete actions for the safe management of chemicals that can be led by those working in the health sector. An accompanying workbook helps to prioritize and plan actions outlined in the Road Map (20).

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

Inter-Organization Programme for the Sound Management of Chemicals (IOMC) 2024: IOMC Toolbox for Decision Making in Chemicals Management [website] (19) – The Toolbox is a web-based platform that provides access to information and tools for the safe management of chemicals. It was developed by organizations participating in the IOMC: the FAO, the International Labour Organization (ILO), the UN Development Programme, the UN Environment Programme (UNEP), the UN Industrial Development Organization, the UN Institute for Training and Research (UNITAR), WHO, the World Bank and the Organisation for Economic Co-operation and Development.

WHO 2024: INCHEM: Internationally Peer Reviewed Chemical Safety Information [online database] (18) – This database, published through IPCS, contains detailed information about the physicochemical properties and toxicological effects of numerous chemicals.

ILO, WHO 2024: ILO–WHO International Chemical Safety Cards (ICSCs) [online database] (52) – The ICSCs provide essential health and safety information about chemicals to promote their safe use. The cards are used on the shop floor by workers and by those responsible for health and safety in factories, agriculture, construction and other workplaces; also, they are often a component of education and training activities. They can also be used by agencies responding to chemical incidents. ICSCs are available in many languages for more than 1 700 chemicals.

WHO 2024: Chemical hazards in drinking-water [website] (53) – This website provides links to background documents about chemicals covered in the Guidelines for Drinking-Water Quality (12) that can be used as an authoritative basis for setting national regulations and standards for water safety to support public health.

UNITAR 2024: Risk reduction of chemicals [online course] (54) – This course provides guidance to national governments and authorities about the risk assessment and risk management of chemicals.

ILO 2022: Framework for Action on Chemicals and Waste (55) – The Framework aims to identify concrete actions for which the labour sector has either a lead or important supporting role to play in the sound management of chemicals, while recognizing the need for multisectoral cooperation.

SAICM 2022: The potential key role of SAICM national focal points in reducing harm from highly hazardous pesticides (HHPs): factsheet 2022 (56) – This factsheet assists SAICM national focal points in informing relevant stakeholders about HHPs and provides advice and suggestions about how to phase out HHPs.

Secretariats of the Basel, Rotterdam, Stockholm Conventions and the Minamata Convention on Mercury 2021: Chemicals, wastes and climate change: interlinkages and potential for coordinated action (57) – This report presents a comprehensive technical review of the literature about climate change and the management of hazardous chemicals, and works to identify opportunities for simultaneously addressing these two critical elements of the broader sustainability challenge.

ILO 2020: The sound management of chemicals and waste in the world of work (58) – This brochure provides a detailed summary of the ILO's engagement with the areas of chemicals and waste.

UNEP 2019: UNEP guidance: enforcement of chemicals control legislation (59) – This document provides guidance about how to ensure effective compliance with rules and regulations for industrial and consumer chemicals through the use of enforcement mechanisms.

[UNEP 2015: UNEP guidance: on the development of legal and institutional infrastructures and measures for recovering costs of national administration for sound management of chemicals \(60\)](#) – This guidance aims at providing practical, step-by-step support to policy-makers for strengthening national legislation and institutional set-ups for achieving the sound management of chemicals, and includes proposals for measures to finance the necessary related administration activities.

Arsenic

[UN Children's Fund \(UNICEF\), WHO 2018: Arsenic primer: guidance on the investigation & mitigation of arsenic contamination \(61\)](#) – This primer provides practical advice for the staff of UN agencies, their government counterparts and development workers responding to the challenge of arsenic contamination of drinking-water.

Asbestos

[WHO 2014: Chrysotile asbestos \(62\)](#) – This document provides general information about chrysotile asbestos and the health effects associated with exposure to it; it also addresses questions commonly raised during policy discussions.

Dioxins and dioxin-like substances

[UNEP, Stockholm Convention 2013: Toolkit for identification and quantification of releases of dioxins, furans and other unintentional POPs under Article 5 of the Stockholm Convention \(63\)](#) – This toolkit provides a harmonized framework to establish comparable figures on the release of unintentional persistent organic pollutants (or POPs), and it provides default emission factors and detailed complementary technical information.

Fluoride

[WHO 2013: Oral health surveys: basic methods, fifth edition \(64\)](#) – This manual encourages countries to conduct standardized oral health surveys that are comparable internationally.

Lead

[WHO 2022: Lead in drinking-water: health risks, monitoring and corrective actions \(65\)](#) – This document provides practical guidance about assessing and managing lead contamination in drinking-water.

[WHO 2022: Update on the global status of legal limits on lead in paint, December 2021 \(66\)](#) – This report describes lead paint laws in different countries, as well as activities undertaken by countries where such laws are in the process of being established.

[WHO 2021: WHO guideline for clinical management of exposure to lead \(67\)](#) – The purpose of this guideline is to assist physicians in making decisions about the diagnosis and treatment of lead exposure.

[WHO 2020: Global elimination of lead in paint: why and how countries should take action. Policy brief \(68\)](#) and [Technical brief \(69\)](#) – These documents explain the health and economic importance of preventing lead exposure by establishing legally binding controls to stop the addition of lead to paint. They also describe the support available to countries to take this action.

[WHO 2020: Guidance on organizing an advocacy or awareness-raising campaign on lead paint \(70\)](#) – This document provides guidance and tools to support advocacy or awareness-raising activities to build momentum in a country to develop, adopt and implement legally binding measures, such as lead paint laws.

[UNICEF, Pure Earth 2020: The toxic truth: children's exposure to lead pollution undermines a generation of future potential \(71\)](#) – This joint report describes how lead is a potent neurotoxin that causes irreparable harm to children's brains.

[UNEP 2019: Suggested steps for establishing a lead paint law \(72\)](#) – This factsheet helps countries by providing basic information about adopting lead paint laws.

[UNEP 2018: Model law and guidance for regulating lead paint \(73\)](#) – This document assists countries in establishing and implementing regulations about lead paint.

Mercury

[WHO 2022: Prevention and treatment of dental caries with mercury-free products and minimal intervention \(74\)](#) – This document provides guidance for dental professionals, nonspecialists and the general public about replacing mercury-containing products when treating dental caries.

[UNEP, Minamata Convention on Mercury 2022: Becoming a party to the Minamata Convention on Mercury: factsheet \(75\)](#) – This factsheet provides basic information about the key steps to becoming a party to the Convention, including the obligations and benefits.

[WHO 2021: Minamata Convention on Mercury: annotated bibliography of WHO information \(76\)](#) – This annotated bibliography of key WHO resources is relevant to the Minamata Convention and the associated World Health Assembly Resolution, WHA67.11 (Public health impacts of exposure to mercury and mercury compounds: the role of WHO and ministries of public health in the implementation of the Minamata Convention).

[WHO 2021: Mercury and human health: educational course \(77\)](#) – This course supports the training of public health and health care professionals, medical and other allied students and professionals, and decision-makers in the health and environmental sectors.

[WHO 2021: Step-by-step guide for developing a public health strategy for artisanal and small-scale gold mining in the context of the Minamata Convention on Mercury \(78\)](#) – This guide provides easy-to-use instructions for developing a public health strategy as part of a national action plan for artisanal and small-scale gold mining.

[WHO 2019: Strategic planning for implementation of the health-related articles of the Minamata Convention on Mercury \(79\)](#) – This guide supports national health authorities in understanding the implications that the Minamata Convention has for national health programmes and in planning the implementation of the mercury risk assessment and control measures required by the Convention.

[WHO 2018: Health sector involvement in the Minamata Convention on Mercury: outcomes of World Health Organization regional workshops for ministries of health \(80\)](#) – This document provides information about the outcomes of workshops focusing on health sector involvement in implementing the Minamata Convention, including region-specific challenges and opportunities.

[WHO 2015: Developing national strategies for phasing out mercury-containing thermometers and sphygmomanometers in health care, including in the context of the Minamata Convention on Mercury: key considerations and step-by-step guidance \(81\)](#) – This document provides advice to health ministries about their role in leading the phasing out of manufacturing, importing and exporting mercury-containing thermometers and sphygmomanometers.

Highly hazardous pesticides

[UNEP 2022: Synthesis report on the environmental and health impacts of pesticides and fertilizers and ways to minimize them \(82\)](#) – This report is a comprehensive review of information about the environmental and health effects and potential impacts of pesticides and fertilizers.

[WHO 2020: The WHO recommended classification of pesticides by hazard and guidelines to classification, 2019 edition \(83\)](#) – This document lists common technical grade pesticides and their recommended classifications, together with active ingredients believed to be obsolete or discontinued for use as pesticides, pesticides subject to the prior informed consent procedure from the Rotterdam Convention, limitations to trade arising from the Stockholm Convention regarding POPs, and gaseous or volatile fumigants not classified under these recommendations.

[FAO, WHO 2019: Detoxifying agriculture and health from highly hazardous pesticides: a call for action \(84\)](#) – This brochure explains the risks posed by HHPs, the possible alternatives and what can be done to phase them out and opt for more sustainable solutions.

5.3 Chemical incidents



Overview

A chemical incident is the uncontrolled release of a toxic substance, potentially resulting in harm to public health and the environment.

Chemical events arising from technological incidents (such as industrial and transport accidents), natural disasters, conflict and terrorism, polluted environments, and contaminated food and products are common and occur worldwide. The term chemical incident refers to anthropogenic or technological events, including:

- an explosion at a factory that stores or uses chemicals;
- contamination of the food or water supply with a chemical;
- an oil spill;
- a leak from a storage unit during transportation;
- the deliberate release of chemicals during conflicts or as a result of terrorism;
- an outbreak of disease that is associated with exposure to a chemical.

Between 2000 and 2020, there were more than 1 000 technological incidents involving chemicals worldwide, affecting more than 1.85 million people (85).

Some chemical incidents can have international consequences, for example when a chemically contaminated product is distributed to multiple countries or when a chemical release contaminates the environment, such as the air or water and subsequently traverses national borders (86). Such incidents fall under the International Health Regulations (2005) (IHR) (21). Under the IHR (2005), Member States must have in place the necessary capacities to detect, evaluate and respond to public health events caused by any hazard, including chemicals. WHO, in turn, should provide assistance on request to Member States to investigate and control such events.

How do we assess a chemical incident?

Many chemical incidents are overt and are quickly recognized, such as a fire at or large leak from a chemical plant. Some chemical releases may, however, become apparent only with the presentation or reporting of a number of cases with similar signs and symptoms, who have a common history and are linked in time and space. The timely identification of the cause of clusters or suspected outbreaks associated with exposure to chemicals may require a detailed investigation involving clinical, toxicological, epidemiological, environmental and laboratory analytical approaches.

Adequately resourced poison centres can play a key role in identifying chemical incidents and in supporting the necessary assessment and response. They are centres of expertise on clinical toxicology and have access to databases about products and substances. Most poison centres perform toxicovigilance – that is, they actively engage in the process of identifying and assessing toxic risks in a community or population from consumer products, pesticides, pharmaceuticals, environmental and industrial chemicals, controlled substances and natural toxins. Toxicovigilance involves monitoring data from poison centres to identify trends in exposures to poisons and the emergence of new risks associated with toxic substances (22).

What do we want to achieve?	<p>Comprehensive management of chemical incidents requires prevention and preparedness, early detection and effective response and recovery.</p> <p>Prevention focuses on general measures that can be taken to diminish the likelihood of a chemical incident and to limit its severity.</p> <p>Emergency planning and preparedness detail broad goals that can be achieved to ensure adequate public health preparedness for all parties involved in responding to a chemical incident.</p> <p>Detection and alert describe the various channels that can be used to detect a chemical incident and to alter the response of the stakeholders involved in a chemical event emergency.</p> <p>Response deals with the public health tasks that should be carried out during an emergency.</p> <p>Recovery details the methods used to evaluate the causes of and responses to chemical incidents and to follow up with victims to learn from incidents and near-incidents, and to restore and remediate the affected environment (87, 88).</p> <p>National guidelines for addressing acute chemical exposure are available, including guidelines on levels for acute exposure to airborne chemicals (89) and values for occupational exposures that are considered immediately dangerous to life or health (90).</p>
------------------------------------	--

The Guidance table provides an overview of the most relevant advice from WHO and other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
Policies and actions				
1. Implement international agreements through national laws. Selected international agreements include: <ul style="list-style-type: none"> • the IHR (2005), a legally binding agreement providing a framework to ensure better prevention of, preparedness for and response to public health events and emergencies potentially of international concern, including chemical events (21); • the ILO Prevention of Major Industrial Accidents Convention (also known as C174) (91). 	 Multiple sectors	National	Regulation	B, C
2. Develop or update national policies and plans for ensuring the prevention of, preparedness for, response to, detection of and recovery from chemical incidents, including from chemical incidents arising from natural hazard events (e.g. earthquakes, floods and cyclones) (88).	 Multiple sectors	National	Regulation	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
Core capacities required under the International Health Regulations (2005)				
<p>3. Establish designated focal points for IHR (2005) in all authorities that have an important role in managing chemical events to coordinate and communicate; establish a multisectoral national chemical emergency coordinating body; and ensure there is adequate health-sector preparedness capacity to provide prompt and adequate responses to chemical events (21, 86).</p>	 Health	National	Governance	B
<p>4. Implement a tested surveillance system for the detection, verification and risk assessment of chemical events potentially of international health concern as part of a multihazard surveillance strategy, and ensure the system is accompanied by a surveillance plan (21, 86).</p> <p>Important sources of chemical incident notifications and alerts include:</p> <ul style="list-style-type: none"> • poison centres; • hospital emergency departments; • primary health care facilities; • toxicology laboratories; • non-health-sector sources, such as agencies for consumer protection and food safety, environmental agencies, chemical plant operators, first responders and the public (21, 86). 	 Health	National	Assessment and surveillance	B
<p>5. Implement tested emergency response plans that take into account possible event scenarios and address priority chemicals, hazardous sites and vulnerable populations (21, 86).</p> <p>Detailed information about developing an emergency response plan is provided in the <i>Manual for the public health management of chemical incidents</i> (88).</p>	 Health	National	Other management and control	B
<p>6. Ensure access to expertise – that is, maintain an updated roster of experts and specialized centres, including poison centres, for:</p> <ul style="list-style-type: none"> • risk assessment; • exposure modelling; • chemical fate and transport assessment; • biological and environmental monitoring; • clinical toxicology; • diagnosis and treatment; • health surveillance (21, 86). 	 Health	National	Information, education and communication	B
<p>7. Ensure that experts and specialist centres have access to specialized medicines and equipment that are placed strategically to ensure national coverage of:</p> <ul style="list-style-type: none"> • antidotes; • personal protective equipment; • decontamination equipment; • equipment for biological and environmental monitoring (21, 86). 	 Health	National	Infrastructure, technology and built environment	B

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
8. Ensure access to toxicological and environmental laboratories – that is, ensure that laboratories are prepared to accept and analyse human and environmental samples during a chemical emergency and arrangements are in place to ship the samples to them (21, 86).	 Health  Environment	National	Information, education and communication; other management and control	B
9. Conduct chemical event scenario analyses, including modelling adverse impacts, to guide the building of surveillance and response plans and to develop related capacities (21, 86).	 Environment  Health	National	Other management and control	B

Additional recommendations for the prevention of, preparedness for, detection of, response to and recovery from chemical incidents

Prevention

10. Avoid locating chemical facilities in hazard-prone or densely populated areas (88).	 Land use planning	National	Regulation	B
11. Enforce a minimum set of safety standards and building regulations for all chemical facilities (88).	 Environment	National	Regulation	B
12. Restrict and control the transportation and storage of chemicals, including requiring licensing for hazardous sites and transport routes (88).	 Environment	National	Regulation	B
13. Implement labour, health and safety regulations that include minimum levels of training, protection from chemicals and medical surveillance (88).	 Labour	National; workplace	Regulation	B
14. Control waste disposal sites (88).	 Waste  Environment	National; community	Regulation; other management and control	B
15. Implement inspections of hazardous sites and the transportation sector to help enforce the minimum set of safety standards (88).	 Environment	National	Regulation	B
16. Implement early-warning systems for weather-related natural events (88).	 Health  Environment	National	Assessment and surveillance; other management and control	B
17. Raise awareness about potential exposures and vulnerabilities to, and health impacts from, chemicals (88).	 Health	National; community Universal health coverage	Information, education and communication	B

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
Preparedness				
18. Establish databases of hazardous sites, contents of transportation (e.g. containers or ships), information about chemicals, health care resources and emergency contact information (88).	 Health  Environment	National	Assessment and surveillance	B
19. Implement an incident management system – that is, a standardized approach to the command, control and coordination of emergency responses (88).	 Environment  Health	National	Other management and control	B
Response				
20. A response should aim to stop the release of the chemical, prevent the spread of contamination and limit exposure (88).	 Multiple sectors	National; community	Other management and control	B
21. Provide an initial risk assessment, and advise and alert health care services (88).	 Health  Environment	National; community Universal health coverage	Assessment and surveillance	B
22. Disseminate information and advice to responders, the public and the media (88).	 Health  Environment	National; community Universal health coverage	Information, education and communication	B
23. Register all individuals exposed during an incident. Collect appropriate human and environmental samples, which may include blood, urine, and soil and water (88).	 Health  Environment	National; community Universal health coverage	Assessment and surveillance	B
24. Conduct investigations during the incident (88).	 Health  Environment	National; community Universal health coverage	Assessment and surveillance	B
Recovery				
25. Provide support to those affected, such as medical care and a single point of contact for information and advice (88).	 Health	Health care; national; community Universal health coverage	Information, education and communication; other management and control	B
26. Register exposed persons to ensure there are follow up and surveillance (88).	 Health	Health care; national; community Universal health coverage	Assessment and surveillance	B

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
27. Conduct risk and health outcome assessments and environmental assessments (88).	 Health  Environment	Health care; national; community Universal health coverage	Assessment and surveillance	B
28. Implement rehabilitation actions, including remediation and restoration of the environment; actions to prevent a further occurrence, such as through causative factor analysis and emergency response evaluations; and actions to improve health in the affected community (88).	 Health  Environment	Community; national Universal health coverage	Other management and control	B
29. Contribute information about the event to the international community (88).	 Health  Environment	National	Information, education and communication	B

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy
IHR (2005): International Health Regulations (2005); ILO: International Labour Organization.

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

WHO 2020: Guidelines for establishing a poison centre (22) – These guidelines address the history and policy background of poison centres as well as the practical aspects of planning a poison centre, and its services and operation.

WHO 2016: International Health Regulations (2005), third edition (21) – The IHR (2005) provides an overarching legal framework that defines countries' rights and obligations in handling public health events and emergencies that have the potential to cross borders. The IHR (2005) is an instrument of international law that is legally binding on 196 countries, including the 194 WHO Member States.

WHO 2015: International Health Regulations (2005) and chemical events (86) – This document provides information about building IHR (2005) core capacities for chemical events, assists national IHR (2005) focal points in identifying institutions that have a role in managing chemicals, raises awareness about the IHR (2005) among professionals who have a role in managing chemicals in various regulatory contexts but who are not familiar with the Regulations, and provides information to facilitate an interministerial approach to managing chemical events, including building synergies in implementing relevant international agreements.

WHO 2009: Manual for the public health management of chemical incidents (88) – This manual provides a comprehensive overview of the principles and roles of public health during each phase of the management of chemical incidents and emergencies.

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

ILO, WHO 2024: ILO–WHO International Chemical Safety Cards (ICSCs) [online database] (52) – The ICSCs provide essential health and safety information about chemicals to promote their safe use.

WHO 2021: WHO human health risk assessment toolkit: chemical hazards, second edition (92) – This toolkit provides guidance for decision-makers about how to identify and characterize chemical hazards, assess exposures to these chemicals and determine whether these exposures are dangerous to public health.

WHO 2021: Manual for investigating suspected outbreaks of illnesses of possible chemical etiology: guidance for investigation and control (93) – This manual describes methods for investigating clusters or outbreaks that may be of chemical origin and discusses the importance of using a structured, coordinated, collaborative, multidisciplinary and multiagency approach at the local, regional, national and international levels.

WHO 2019: Health Emergency and Disaster Risk Management Framework (87) – This Framework emphasizes the critical importance of the prevention of, preparedness for and readiness to respond to emergencies and disasters.

WHO 2018: Chemical releases caused by natural hazard events and disasters: information for public health authorities (94) – This manual describes methods for investigating clusters or outbreaks that are potentially of chemical origin.

WHO 2017: Health emergency and disaster risk management: chemical emergencies (95) – This factsheet is part of a series focusing on emergency and disaster risk management, and it is an introduction for health workers engaged in the disaster risk management sector and for multisectoral partners to help them consider how to integrate health into their disaster risk management strategies.

References

1. WHO. Chemical safety: public health concern [website]. Geneva: World Health Organization; 2024 (https://www.who.int/health-topics/chemical-safety#tab=tab_2, accessed 25 January 2024).
2. Global chemicals outlook II: from legacies to innovative solutions. Nairobi: United Nations Environment Programme; 2019 (<https://www.unenvironment.org/resources/report/global-chemicals-outlook-ii-legacies-innovative-solutions>, accessed 25 January 2024).
3. Chemicals and gender. Geneva: United Nations Development Programme; 2011 (https://www.undp.org/content/undp/en/home/librarypage/environment-energy/chemicals_management/chemicals-and-gender.html, accessed 25 January 2024).
4. Open online course on gender and environment. Module 6: chemicals and waste [online course]. Geneva: One UN Climate Change Learning Partnership; 2023 (<https://unccelearn.org/course/view.php?id=39&page=overview&lang=en>, accessed 25 January 2024).
5. Chemicals road map. Geneva: World Health Organization; 2017 (<https://iris.who.int/handle/10665/273137>, accessed 24 January 2024).
6. Globally Harmonized System of Classification and Labelling of Chemicals (GHS), tenth revised edition. New York (NY), Geneva: United Nations; 2023 (<https://unece.org/sites/default/files/2023-07/GHS%20Rev10e.pdf>, accessed 24 January 2024).
7. The public health impact of chemicals: knowns and unknowns – data addendum for 2019. Geneva: World Health Organization; 2021 (<https://www.who.int/publications/item/WHO-HEP-ECH-EHD-21.01>, accessed 25 January 2024).
8. Ten chemicals of public health concern [website]. Geneva: World Health Organization; 2020 (<https://www.who.int/news-room/photo-story/photo-story-detail/10-chemicals-of-public-health-concern>, accessed 24 January 2024).
9. Assessment of prenatal exposure to mercury: standard operating procedures. Geneva: WHO Regional Office for Europe, United Nations Environment Programme; 2018 (<https://apps.who.int/iris/handle/10665/332161>, accessed 25 January 2024).
10. Human biomonitoring: facts and figures. Copenhagen: WHO Regional Office for Europe; 2015 (<https://apps.who.int/iris/handle/10665/164588>, accessed 25 January 2024).
11. WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Geneva: World Health Organization; 2021 (<https://apps.who.int/iris/handle/10665/345329>, accessed 24 January 2024).
12. Guidelines for drinking-water quality: fourth edition incorporating the first and second addenda. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/254637>, accessed 24 January 2024).

13. Joint FAO/WHO Meeting on Pesticide Residues (JMPR) [website]. Rome: Food and Agriculture Organization of the United Nations, World Health Organization; 2020 [cited 2023 Nov 14]. Available from: [https://www.who.int/groups/joint-fao-who-meeting-on-pesticide-residues-\(jmpr\)/about](https://www.who.int/groups/joint-fao-who-meeting-on-pesticide-residues-(jmpr)/about)
14. Codex Alimentarius: international food standards [website]. Rome: Food and Agriculture Organization of the United Nations; 2024 (<https://www.fao.org/fao-who-codexalimentarius/about-codex/science/en/>, accessed 24 January 2024).
15. WHO guidelines for indoor air quality: selected pollutants. Copenhagen: WHO Regional Office for Europe; 2010 (<https://apps.who.int/iris/handle/10665/260127>, accessed 24 January 2024).
16. Food safety collaborative platform [online database]. Geneva: World Health Organization, Food and Agriculture Organization of the United Nations; 2018 (<https://apps.who.int/foscollab/Dashboard/FoodConta>, accessed 24 January 2024).
17. Nutrition and food safety: databases [online database]. Geneva: World Health Organization; 2024 (<https://www.who.int/teams/nutrition-and-food-safety/databases>, accessed 24 January 2024).
18. INCHEM: Internationally Peer Reviewed Chemical Safety Information [online database]. Geneva: World Health Organization; 2023 (<https://www.inchem.org/#/>, accessed 24 January 2024).
19. Inter-Organization Programme for the Sound Management of Chemicals. IOMC toolbox for decision making in chemicals management [website]. Paris: Organisation for Economic Co-operation and Development; 2024 (<https://www.iomtoolbox.org/>, accessed 24 January 2024).
20. Chemicals road map workbook. Geneva: World Health Organization; 2018 (<https://iris.who.int/handle/10665/273136>, accessed 24 January 2024).
21. International Health Regulations (2005), third edition. Geneva: World Health Organization; 2016 (<https://iris.who.int/handle/10665/246107>, accessed 25 January 2024).
22. Guidelines for establishing a poison centre. Geneva: World Health Organization; 2020. Geneva: World Health Organization; (<https://iris.who.int/handle/10665/338657>, accessed 25 January 2024).
23. Minamata Convention on Mercury [website]. Geneva: United Nations Environment Programme; 2013 (<http://www.mercuryconvention.org/Convention/Text/tabid/3426/language/en-US/Default.aspx>, accessed 24 January 2024).
24. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal [website]. Basel: United Nations Environment Programme; 2019 (<https://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx>, accessed 24 January 2024).
25. Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade [website]. Rotterdam: United Nations Environment Programme; 2019 (<http://www.pic.int/TheConvention/Overview/TextoftheConvention/tabid/1048/language/en-US/Default.aspx>, accessed 24 January 2024).
26. Stockholm Convention on Persistent Organic Pollutants (POPs) [website]. Stockholm: United Nations Environment Programme; 2019 (<https://chm.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx>, accessed 24 January 2024).
27. Montreal Protocol on Substances that Deplete the Ozone Layer. Nairobi: United Nations Environment Programme; 1998 (<https://ozone.unep.org/sites/default/files/2019-05/TEAPAS98.pdf>, accessed 31 January 2024).
28. Healthy environments for healthy children: key messages for action. Geneva: World Health Organization, United Nations Environment Programme; 2010 (<https://apps.who.int/iris/handle/10665/44381>, accessed 24 January 2024).
29. Inheriting a sustainable world? Atlas on children's health and the environment. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/254677>, accessed 24 January 2024).
30. World directory of poisons centres [online database]. Geneva: World Health Organization, Global Health Observatory; 2024 (<https://www.who.int/gho/data/themes/topics/indicator-groups/poison-control-and-unintentional-poisoning/>, accessed 24 January 2024).
31. Exposure to arsenic: a major public health concern. Geneva: World Health Organization; 2019 (<https://iris.who.int/handle/10665/329482>, accessed 24 January 2024).
32. Asbestos: elimination of asbestos-related diseases. Key facts [website]. Geneva: World Health Organization; 2018 (<https://www.who.int/news-room/fact-sheets/detail/asbestos-elimination-of-asbestos-related-diseases>, accessed 24 January 2024).
33. Exposure to benzene: a major public health concern. Geneva: World Health Organization; 2019 (<https://iris.who.int/handle/10665/329481>, accessed 24 January 2024).
34. Preventing disease through healthy environments. Exposure to cadmium: a major public health concern. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/329480>, accessed 24 January 2024).
35. Preventing disease through healthy environments. Exposure to dioxins and dioxin-like substances: a major public health concern. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/329485>, accessed 24 January 2024).
36. Code of practice for the prevention and reduction of dioxins, dioxin-like PCBs and non-dioxin-like PCBs in food and feed. Rome: Food and Agriculture Organization of the United Nations, World Health Organization; 2018 (http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCX%C2B62-2006%252FCXC_062e.pdf, accessed 24 January 2024).
37. Preventing disease through healthy environments. Inadequate or excess fluoride: a major public health concern. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/329484>, accessed 24 January 2024).

38. Preventing disease through healthy environments. Exposure to lead: a major public health concern. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/329953>, accessed 24 January 2024).
39. Recycling used lead-acid batteries: health considerations. Geneva: World Health Organization; 2017 (<https://iris.who.int/handle/10665/259447>, accessed 24 January 2024).
40. Children and digital dumpsites: e-waste exposures and child health. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/341718>, accessed 24 January 2024).
41. Brief guide to analytical methods for measuring lead in paint, second edition. Geneva: World Health Organization; 2020 (<https://www.who.int/publications/i/item/9789240006058>, accessed 24 January 2024).
42. Brief guide to analytical methods for measuring lead in blood, second edition. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/332932>, accessed 24 January 2024).
43. Public health impacts of exposure to mercury and mercury compounds: the role of WHO and ministries of public health in the implementation of the Minamata Convention. In: Sixty-seventh World Health Assembly, Geneva, 24 May 2014. Geneva: World Health Organization; 2014 (https://apps.who.int/gb/ebwha/pdf_files/WHA67/A67_R11-en.pdf?ua=1, accessed 24 January 2024).
44. Preventing disease through healthy environments. Exposure to mercury: a major public health concern, second edition. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/340715>, accessed 24 January 2024).
45. Review of Minamata Convention initial assessment reports: key findings for health. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/351133>, accessed 24 January 2024).
46. Preventing disease through healthy environments. Exposure to highly hazardous pesticides: a major public health concern. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/329501>, accessed 24 January 2024).
47. Guidelines on pesticide legislation: International Code of Conduct on Pesticide Management, second edition. Rome, Geneva: Food and Agriculture Organization of the United Nations, World Health Organization; 2020 (<https://iris.who.int/handle/10665/338043>, accessed 24 January 2024).
48. Pesticide registration toolkit [online decision support]. Rome: Food and Agriculture Organization of the United Nations; 2019 [<http://www.fao.org/pesticide-registration-toolkit/en/>, accessed 24 January 2024].
49. OECD-FAO guidance for responsible agricultural supply chains. Paris, Rome: Organisation for Economic Co-operation and Development, Food and Agriculture Organization of the United Nations; 2016 (<http://dx.doi.org/10.1787/9789264251052-en>, accessed 24 January 2024).
50. International Code of Conduct on Pesticide Management: guidance on pesticide licensing schemes. Rome: Food and Agriculture Organization of the United Nations, World Health Organization; 2021 (<https://iris.who.int/handle/10665/343795>, accessed 24 January 2024).
51. Managing pesticides in agriculture and public health: an overview of FAO and WHO guidelines and other resources. Rome: Food and Agriculture Organization of the United Nations, World Health Organization; 2019 (<http://www.fao.org/3/ca5201en/ca5201en.pdf>, accessed 24 January 2024).
52. ILO-WHO International Chemical Safety Cards (ICSCs) [online database]. Geneva: International Labour Organization; 2024 (<https://chemicalsafety.ilo.org/dyn/icsc/showcard.home>, accessed 25 January 2024).
53. Chemical hazards in drinking-water [website]. Geneva: World Health Organization; 2024 (<https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/chemical-hazards-in-drinking-water>, accessed 25 January 2024).
54. Risk reduction of chemicals [online course]. Geneva: United Nations Institute for Training and Research; 2024 (<https://event.unistar.org/full-catalog/risk-reduction-chemicals-course>, accessed 25 January 2024).
55. ILO Framework for Action on Chemicals and Waste. Geneva: International Labour Organization; 2022 (https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---lab_admin/documents/publication/wcms_852031.pdf, accessed 25 January 2024).
56. The potential key role of SAICM national focal points in reducing harm from highly hazardous pesticides (HHPs): factsheet 2022. Geneva: Strategic Approach to International Chemicals Management; 2022 (<https://saicmknowledge.org/sites/default/files/publications/SAICMUCT%20HHP%20CoP%20Factsheet%202022%20Final.pdf>, accessed 25 January 2024).
57. Chemicals, wastes and climate change: interlinkages and potential for coordinated action. Geneva, Rome: Secretariats of the Basel, Rotterdam, Stockholm Conventions and the Minamata Convention on Mercury; 2021 (https://minamataconvention.org/sites/default/files/documents/2021-07/Climate_Change_Interlinkages.pdf, accessed 25 January 2024).
58. The sound management of chemicals and waste in the world of work. Geneva: International Labour Organization; 2020 (https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/publication/wcms_731974.pdf, accessed 25 January 2024).
59. UNEP guidance: enforcement of chemicals control legislation. Nairobi: United Nations Environment Programme; 2019 (<https://wedocs.unep.org/handle/20.500.11822/28402>, accessed 25 January 2024).
60. UNEP guidance: on the development of legal and institutional infrastructures and measures for recovering costs of national administration for sound management of chemicals. Nairobi: United Nations Environment Programme; 2015 (<https://wedocs.unep.org/handle/20.500.11822/12224>, accessed 25 January 2024).
61. Arsenic primer: guidance on the investigation & mitigation of arsenic contamination. New York: United Nations Children's Fund; 2018 (<https://www.unicef.org/documents/arsenic-primer-guidance-investigation-mitigation-arsenic-contamination>, accessed 25 January 2024).
62. Chrysotile asbestos. Geneva: World Health Organization; 2014 (<https://iris.who.int/handle/10665/143649>, accessed 25 January 2024).
63. Toolkit for identification and quantification of releases of dioxins, furans and other unintentional POPs under Article 5 of the Stockholm Convention. Geneva: United Nations Environment Programme; 2013 (<https://>

- webdosya.csb.gov.tr/db/pops/editordosya/UNEP-POPS-GUID-2013-Toolkit%20PCDDF-En.pdf, accessed 25 January 2024).
64. Petersen PE, Baez RJ, World Health Organization. Oral health surveys: basic methods, fifth edition. Geneva: World Health Organization; 2013 (<https://iris.who.int/handle/10665/97035>, accessed 25 January 2024).
 65. Lead in drinking-water: health risks, monitoring and corrective actions. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/361821>, accessed 25 January 2024).
 66. Update on the global status of legal limits on lead in paint, March 2023. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/373149>, accessed 22 May 2024).
 67. WHO guideline for clinical management of exposure to lead. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/347360>, accessed 25 January 2024).
 68. Global elimination of lead paint: why and how countries should take action. Policy brief. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/333812>, accessed 25 January 2024).
 69. WHO, UNEP. Global elimination of lead paint: why and how countries should take action. Technical brief. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/333840>, accessed 25 January 2024).
 70. Guidance on organizing an advocacy or awareness-raising campaign on lead paint. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/334339>, accessed 25 January 2024).
 71. Rees N, Fuller R. The toxic truth: children's exposure to lead pollution undermines a generation of future potential. New York: United Nations Children's Fund, Pure Earth; 2020 (<https://www.unicef.org/media/73246/file/The-toxic-truth-children%20%99s-exposure-to-lead-pollution-2020.pdf>, accessed 25 January 2024).
 72. Suggested steps for establishing a lead paint law. Nairobi: United Nations Environment Programme; 2019 (<https://www.unenvironment.org/resources/factsheet/suggested-steps-establishing-lead-paint-law>, accessed 25 January 2024).
 73. Model law and guidance for regulating lead paint. Nairobi: United Nations Environment Programme; 2018 (<https://www.unenvironment.org/resources/publication/model-law-and-guidance-regulating-lead-paint>, accessed 25 January 2024).
 74. Prevention and treatment of dental caries with mercury-free products and minimal intervention. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/352480>, accessed 25 January 2024).
 75. Becoming a party to the Minamata Convention on Mercury: factsheet. Geneva: United Nations Environment Programme, Minamata Convention on Mercury; 2022 (https://minamataconvention.org/sites/default/files/documents/2022-08/Becoming-party-Minamata-Convention_2022_EN.pdf, accessed 25 January 2024).
 76. Minamata Convention on Mercury: annotated bibliography of WHO information. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/341198>, accessed 25 January 2024).
 77. Mercury and human health: educational course. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/345443>, accessed 25 January 2024).
 78. Step-by-step guide for developing a public health strategy for artisanal and small-scale gold mining in the context of the Minamata Convention on Mercury. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/340411>, accessed 25 January 2024).
 79. Strategic planning for implementation of the health-related articles of the Minamata Convention on Mercury. Geneva: World Health Organization; 2019 (<https://iris.who.int/handle/10665/329449>, accessed 25 January 2024).
 80. Health sector involvement in the Minamata Convention on Mercury: outcomes of World Health Organization regional workshops for ministries of health. Geneva: World Health Organization; 2018 (<https://iris.who.int/handle/10665/275938>, accessed 25 January 2024).
 81. Developing national strategies for phasing out mercury-containing thermometers and sphygmomanometers in health care, including in the context of the Minamata Convention on Mercury: key considerations and step-by-step guidance. Geneva: World Health Organization; 2015 (<https://iris.who.int/handle/10665/259448>, accessed 25 January 2024).
 82. Synthesis report on the environmental and health impacts of pesticides and fertilizers and ways of minimizing them. Geneva: United Nations Environment Programme; 2022 (<https://wedocs.unep.org/handle/20.500.11822/38409>, accessed 25 January 2024).
 83. The WHO recommended classification of pesticides by hazard and guidelines to classification, 2019 edition. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/332193>, accessed 25 January 2024).
 84. Detoxifying agriculture and health from highly hazardous pesticides: a call for action. Rome: Food and Agriculture Organization of the United Nations, World Health Organization; 2019 (<http://www.fao.org/publications/card/en/c/CA6847EN/>, accessed 25 January 2024).
 85. EM-DAT: the International Disaster Database. Inventorying hazards and disasters worldwide since 1988 [online database]. Brussels: Centre for Research on the Epidemiology of Disasters; 2023 (<https://www.emdat.be/>, accessed 25 January 2024).
 86. International Health Regulations (2005) and chemical events. Geneva: World Health Organization; 2015 (<https://iris.who.int/handle/10665/249532>, accessed 25 January 2024).
 87. Health Emergency and Disaster Risk Management Framework. Geneva: World Health Organization; 2019 (<https://iris.who.int/handle/10665/326106>, accessed 25 January 2024).
 88. Manual for the public health management of chemical incidents. Geneva: World Health Organization; 2009 (<https://iris.who.int/handle/10665/44127>, accessed 25 January 2024).
 89. Acute exposure guideline levels for airborne chemicals [website]. Washington (DC): US Environmental Protection Agency; 2023 (<https://www.epa.gov/aegl>, accessed 25 January 2024).

90. Immediately dangerous to life or health (IDLH) values [website]. Washington (DC): National Institute for Occupational Safety and Health, US Centers for Disease Control and Prevention; 2019 (<https://www.cdc.gov/niosh/idlh/default.html>, accessed 25 January 2024).
91. C174 – Prevention of Major Industrial Accidents Convention, 1993 (No. 174). Geneva: International Labour Organization; 1993 (http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:55:0::NO::P55_TYPE,P55_LANG,P55_DOCUMENT,P55_NODE:CON,en,C174,/Document, accessed 25 January 2024).
92. WHO human health risk assessment toolkit: chemical hazards, second edition. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/350206>, accessed 25 January 2024).
93. Manual for investigating suspected outbreaks of illnesses of possible chemical etiology: guidance for investigation and control. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/342818>, accessed 25 January 2024).
94. Chemical releases caused by natural hazard events and disasters: information for public health authorities. Geneva: World Health Organization; 2018 (<https://iris.who.int/handle/10665/272390>, accessed 25 January 2024).
95. Health emergency and disaster risk management: chemical emergencies. Geneva: World Health Organization; 2017 (<https://www.who.int/publications/i/item/health-emergency-and-disaster-risk-management-chemical-emergencies>, accessed 25 January 2024).

6. Radiation



6.1 UV radiation – natural and artificial



Overview

Human exposure to solar UV radiation may result in acute and chronic health effects of the skin (such as skin cancers) the eye (such as cataracts) and the immune system. All skin types can be affected (1, 2). Natural UV radiation levels depend on sun elevation, latitude and altitude, cloud cover and ground reflection. More than 60 000 skin melanoma-related deaths were estimated to be caused by solar UV radiation in the year 2000 (3).

Exposures can occur through UV radiation from the sun, but also from sunbeds and other artificial tanning devices. While all populations are potentially at risk, specific subpopulations such as children, outdoor workers and fair skinned people are at particular risk of skin cancer.

What exposure levels to UV radiation do we want to achieve?

Only small amounts of UV radiation are beneficial for people and essential in the production of vitamin D. The UV index can assist to make healthy choices about the level of sun protection needed (4).

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Solar UV radiation exposure from the sun: policies and actions			
1. Develop or update national sun protection policies and action plans to help prevent skin cancer and eye disease from solar radiation exposure.	 Health	National	Regulation
2. Support the production, labelling and distribution of affordable UV protection products that use national or international protection labels/standards such as sunscreens (sun protection factor), clothing (UV protection factor), and sunglasses to ensure clear and safe guidelines for manufacturers and consumers (1).	 Health	National	Regulation
3. Establish and enforce exposure limits and protective measures for outdoor workers, such as education programmes, tailored working hours, PPE, health surveillance (5).	 Health  Industry  Agriculture  Construction	National; workplace	Regulation
4. Establish national registries/statistics on UV radiation-induced skin and eye diseases (1).	 Health	National	Assessment and surveillance
5. Support the provision of shaded areas in schools and in public places such as playgrounds, parks and swimming pools (1).	 Health	National; community; schools/child-care settings; Universal health coverage	Infrastructure, technology and built environment
Artificial UV radiation: policies and actions			
6. Establish and enforce exposure limits and protective measures for indoor workers (e.g. welders) such as engineering controls and administrative controls, such as training, access limitation, hazard warning and signs and PPE (5).	 Health  Industry	National; workplace	Regulation;
7. Ban the use, marketing and promotion of artificial tanning services (sunbeds for cosmetic purposes) (6).	 Health	National	Regulation
8. Ban the hire and sale of sunbeds and other artificial tanning devices for domestic use (6).	 Health	National	Regulation
Note: in case no bans (actions 7 and 8) are being implemented, a combination of the following (actions 9 to 10) can be opted for.			
9. Restrict the use of sunbeds and other artificial tanning devices (6): • prohibit unsupervised access; • set an age limit on the use of sunbeds and other artificial tanning devices.	 Health	National	Regulation
10. Manage the use of sunbeds and other artificial tanning devices (6): • require surveillance and licensing of artificial tanning services; • set tanning lamp limits and exposure times; • require eye protection; • train operators.	 Health	National	Regulation

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
11. Impose taxes on sunbed sessions (6).	 Health  Finance	National	Regulation; taxes and subsidies
12. Require informing users of sunbeds and other artificial tanning devices about health risks and display of warning signs (6).	 Health	National	Regulation
Awareness raising and capacity building			
13. Develop a risk communication strategy to sustainably raise awareness and educate the public about the health risks of skin cancer and eye diseases from UV radiation exposure.	 Health	National; community Universal health coverage	Information, education and communication
14. Use the UV Index through the media as part of public awareness programmes (1).	 Health	National; community Universal health coverage	Information, education and communication
15. Implement repeated education programmes to raise awareness about the health risks from prolonged UV exposure and protection measures to take, including (1) the following. <ul style="list-style-type: none"> • Supply health care professionals, teachers and caregivers of children with educational material for distribution to the public. • Organize workshops for medical doctors and other health professionals. • Establish education programmes for teachers. • Establish education programmes for outdoor workers. 	 Health	National; community; health care; schools/child-care settings; workplace Universal health coverage	Information, education and communication
16. Inform the public about the risks of sunbeds and other artificial tanning devices (6).	 Health	National; community Universal health coverage	Information, education and communication

Selected tools

WHO 2021: *The Global Health Observatory data repository – legislation of artificial tanning sunbeds* (7)

WHO 2017: *Artificial tanning devices: public health interventions to manage sunbeds* (6)

WHO 2020: *Ultraviolet (UV) radiation* (8)



6.2 Electromagnetic fields



Overview

EMF covered in this section include those generated by consumer products (electric appliances, mobile phones), fixed installations (power lines, base stations, TV antennas, medical devices (e.g. those using magnetic resonance imaging) and other technologies which can be found in the environment, at the workplace and in health care facilities.

What EMF exposure levels do we want to achieve?

Exposure standards for EMF generally refer to maximum levels of exposure to the body. Such standards have been developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP)⁷, and the Institute of Electrical and Electronics Engineers (IEEE/ICES),⁸ as well as many national authorities. WHO provides a framework which can be used to develop national standards (9).

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
--	---	--	--

Policies and actions

1. Establish exposure standards that limit EMF exposures to the public and workers as part of national legislation (9).



National

Regulation

Awareness raising and capacity building

2. Inform the public about potential health risks from EMF (mobile phones, antennas and emerging technologies). Updates should be made as evidence from ongoing studies becomes available (10).



National; community

Information, education and communication

Engage in dialogue and consider the issues, perceptions and concerns of all interested parties, while relying on the available evidence.

Universal health coverage

Selected tools

WHO Global Health Observatory – Database of national regulations for electromagnetic fields (11)

⁷ <http://www.icnirp.org>

⁸ <https://www.ices-emfsafety.org/>

6.3 Radiation exposures in health care



Overview

Every year, millions of patients globally benefit from medical uses of radiation. Because of the risks associated with radiation exposure, enhancing access to radiation technologies should be linked to building capacity to their safe and appropriate utilization. A balanced approach is required to maximize the benefits while minimizing risks for patients, health care workers and members of the public.

Policies and interventions are needed to ensure that radiation safety standards (12) are applied and that guidance and tools are available for health facilities utilizing radiation for diagnostic and/or therapeutic purposes (13, 14). Radiation protection should be integrated into policies and actions to improve quality of care, thus providing a framework for intersectoral cooperation involving all relevant stakeholders.

What radiation exposure levels do we want to achieve in medical settings?

Justification and optimization are the two fundamental principles of radiation protection in medicine. Medical exposures must result in a sufficient benefit to the patient, based on a benefit–risk analysis that provides the basis for the justification of radiological medical procedures. To ensure optimization of protection and safety, the design and construction of equipment and installations as well as the protocols and working procedures applied should result in the minimum patient dose required to achieve the clinical purpose and the probability of errors/incidents should be minimized. While dose limits are not applied to medical exposures, annual radiation dose limits are applied to health workers and members of the public. Further information on radiation safety in health care settings can be found on the WHO web site: <https://www.who.int/activities/enhancing-radiation-safety-in-health-care>. Description of guidance, examples of policies and practices, as well as of awareness raising and capacity building interventions are provided in [Section 12.4 Health care facilities](#) under “Radiation”.

6.4 Radon



Overview

Radon is a radioactive gas that emanates from uranium in rocks and soils and tends to concentrate in enclosed spaces such as buildings and underground mines. It can also be present in water and in some building materials. Radon causes increased risk of lung cancer. A combination of smoking and indoor radon gas further increases the cancer risk. Exposure to radon causes 84 000 deaths per year (2019 data) (15).

How polluted are indoor environments with radon?	<p>The air concentration of radon can be informed through the following.</p> <ul style="list-style-type: none"> – In-situ measurements: devices for measuring radon levels in homes are available and measurements should comply with prevailing (national) protocols (16). – Radon maps: several countries/regions have created radon maps and databases (16).
What are the indoor radon levels we want to achieve?	<p>To limit the risk to individuals, a national reference level of 100 Bq/m³ is recommended. Wherever this is not possible, the chosen level should not exceed 300 Bq/m³ (16, 17).</p> <p>Additional information is available.</p> <ul style="list-style-type: none"> – <i>WHO handbook on indoor radon: a public health perspective</i> (16). – <i>WHO guidelines for indoor air quality: selected pollutants</i> (18).

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Policies and actions			
1. Develop or update a national radon action plan covering both radon prevention (new buildings) and mitigation (existing buildings) to control public and occupational radon exposure in order to achieve an overall risk reduction (16).	Housing Construction Health Workplace	National	Regulation
2. Establish national reference levels for air concentration in homes/buildings with high public occupancy, and workplaces (12, 17).	Housing Construction Workplace Health	National	Regulation

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
3. Establish national regulations, building codes and/or guidelines for radon prevention and mitigation (16).	 Housing  Construction  Workplace  Health	National	Regulation
4. Test radon levels and monitor to determine the effectiveness of any radon prevention or mitigation effort, especially in the context of energy efficiency programmes (16, 18, 19).	 Housing  Construction	National; community	Assessment and surveillance
5. Incorporate radon as a risk factor in national cancer control, tobacco control, energy conservation and indoor air quality strategies and health promotion programmes (16).	 Housing  Health	Community; national Universal health coverage	Governance
6. Subsidize or provide tax incentives to householders carrying out radon mitigation renovations (16).	 Finance  Housing	National; community	Taxes and subsidies
7. Impose radon measurements and remediation as part of property transactions, where relevant (16).	 Finance  Housing	National; community	Regulation
Awareness raising and capacity building			
8. Educate radon professionals, who are key for controlling radon exposure. Radon control choices depend on concentration, sources and levels of transport of radon through housing materials. Examples of control options include active and passive ventilation and soil depressurization (16).	 Housing  Construction	National; community	Information, education and communication
9. Develop a risk communication strategy to raise awareness and educate the public about the health risks of lung cancer from radon exposure (12, 16).	 Health  Housing  Construction	Community; national Universal health coverage	Information, education and communication
10. Raise awareness among policy-makers and health practitioners that radon is an important public health issue that requires action (16).	 Health	National; community Universal health coverage	Information, education and communication

Selected toolsWHO 2020: *Global Health Observatory – database of national regulations on radon exposure* (20)WHO 2018: *Management of radioactivity in drinking-water* (21)WHO 2009: *Handbook on indoor radon: a public health perspective* (16)

6.5 Radioactivity in food and drinking-water



Overview

Food and drinking-water can contain radioactive substances (radionuclides) that could present a risk to human health. The radiation exposure resulting from ingestion of radionuclides makes a contribution to the overall population radiation dose from the many different natural and human-made radiation sources of radiation found in our everyday lives. Foods and drinking-water can have a considerable range in variation of radionuclide concentrations, reflecting the radionuclide content of water, rocks, soil and fertilizers from where they originated and the prevalent circumstances (e.g. normal situations vs radiation emergencies).

What are the radiation exposure levels we want to achieve in food and drinking-water?

In normal circumstances, natural radionuclides are the major source of exposure through ingestion, and the radiation risks are usually small compared with the risks from microorganisms and chemicals that may be present in food and drinking-water. Following radiation emergencies, human-made radionuclides released into the environment may be transferred to food and water and represent a significant source of exposure. These factors should be considered for establishing criteria for food and water safety regulation, management and surveillance. In normal situations, the International Basic Safety Standards require that the national relevant regulatory authorities establish specific reference levels for radiation exposure due to radionuclides in food and drinking-water, each of which shall typically be expressed as, or based on, an annual effective dose to the representative person generally that does not exceed a value of about 1 mSv (12). Specific standards for response to nuclear and radiological emergencies include criteria for management of radioactivity in food and drinking-water (22). Further guidance on radioactivity in food and drinking-water has been developed by WHO and other international organizations (21, 23-25); for further information specifically related to drinking-water, see [Section 3.2.1 Drinking-water](#).

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Policies and actions			
<p>1. Manage radioactivity in food and drinking-water (3.2.1 Drinking-water) (25).</p> <p>Radioactivity in food Ensure consistency with international radiation safety standards for the provision of food in the market, which includes the following.</p> <ul style="list-style-type: none"> Consider the international standards developed by the FAO/WHO Codex Alimentarius Commission when adopting criteria in terms of levels of individual radiation dose, levels of activity concentration of specific radionuclides or both. Seek to improve radiation safety in food trade and consumption engaging relevant stakeholders including regulators, suppliers and consumers. Foster cooperation between relevant authorities in the field of public health, food and agriculture, radiation protection and trade to ensure consistency in policies, and regulations about radioactivity in food. 	 Sector principally involved in planning/implementation  Water/sanitation  Agro-food  Health	National	Regulation; other action

6.6 Radiological emergencies



IHR (2005) have established provisions and requirements for countries to be prepared for radiological and nuclear emergencies, and be able to detect, assess and respond to a crisis (26). WHO, in turn, should provide technical assistance on request to Member States for assessment and management of risks, as well as for a long-term recovery process.

For radioactivity in drinking-water, please refer to [Section 6.5 Radioactivity in food and drinking-water](#) and [Section 3.2.1 Drinking-water](#).



Overview

Radiation emergencies (including radiological and nuclear emergencies) may result from technological incidents, natural disasters, transport accidents, acts of terrorism, polluted environments, and may involve over-exposure from external sources or internally from contaminated air, drinking-water, foods and products. Large-scale nuclear accidents such as those that occurred in Chernobyl or Fukushima are rare but may affect millions and have global consequences.

Detection, monitoring, and assessing risk of radiation emergencies	<p>In most countries, the responsibility for monitoring radioactivity and detecting radiation emergencies rests with specialized competent authorities (e.g. radiation protection or nuclear safety agencies) and environmental protection agencies. In case of an industrial accident, the operator of the facility will notify the competent authorities, which in turn will notify the International Atomic Energy Agency (IAEA) under the international convention for early notification in case of a nuclear accident or radiological emergency (27). For other accidents not involving licensed activities – such as human over-exposure from a lost radioactive source or due to a malevolent act – health specialists may be the first to identify a cluster of radiation injuries. In this case, the notification channel will involve the national IHR focal point and WHO, which will promptly inform the IAEA, according to Article 6 of the IHR (2005) (26).</p> <p>The timely identification of the cause of clusters or suspected outbreaks associated with exposure to radiation may require a detailed investigation involving clinical, epidemiological, environmental and laboratory analytical approaches from multiple sectors/agencies.</p> <p>Risk assessment in case of radiological and nuclear emergencies also involves a multidisciplinary approach. Identification and assessment of exposure and determining the radiation dose for affected individuals/populations will be crucial for risk assessment.</p>
What do we want to achieve?	<p>Comprehensive management of radiation emergencies requires prevention and preparedness, early detection and effective response and recovery (22).</p> <p>Prevention focuses on general measures that can be taken to diminish the likelihood of a radiation emergency and to limit its severity.</p> <p>Emergency planning and preparedness involve putting in place relevant legislation, financing for a whole system of emergency preparedness and response based on the protection strategy, putting in place operating procedures and well-coordinated emergency response plans. In addition, adequate public health preparedness involves designated health facilities to be equipped and well-resourced and emergency response staff to be trained regularly.</p> <p>Response deals with the various aspects of radiation emergencies (24), including public health aspects of emergency sheltering and evacuation, distribution of potassium iodide pills if needed (28), ensuring adequate risk communication and management of the psychosocial impact of radiation emergencies.</p> <p>Recovery follows the transition period and includes evaluation of the lessons learned of the past radiation emergencies, long-term follow up of the affected persons, ensuring access to social, health care and welfare services, and restoring the affected communities and environment and return to normality.</p>

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Policies and actions (22, 24, 26)			
1. Develop or update national policies and plans for prevention, preparedness, monitoring, response and recovery after radiation emergencies.	 National competent authority (NCA) with the mandate pertaining to nuclear safety and/or radiation protection  Environment  Emergencies  Health  Law enforcement  Civil defence	National	Regulation
2. Implement international agreements into national laws. Selected international agreements include the following. <ul style="list-style-type: none">• IHR (2005) – a legally binding agreement providing a framework to better prevent, prepare for and respond to public health events and emergencies of potential international concern (26).• Convention on Early Notification of a Nuclear Accident (27).• Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (27).	 Environment	National	Regulation
Core capacities required under the International Health Regulations (2005) (26, 29)			
3. Establish designated focal points for IHR (2005) in all authorities that have an important role in the management of chemical events, for coordination and communication. <ul style="list-style-type: none">• Establish a multisectoral national radiation emergency coordinating body.• Ensure adequate capacity for health-sector preparedness for prompt and adequate response to radiation emergencies.	 Health  NCA  Environment	National	Governance
4. Implement a radiation monitoring system for the detection, verification and exposure assessment of environmental radiation, as part of a multi-hazard surveillance strategy and accompanied by specific criteria for activating emergency response. Important sources of radiological and nuclear emergency notification and alert include: <ul style="list-style-type: none">• non-health sector sources of ionizing radiation, such as industry, agriculture, academia and nuclear installations operators;• first responders and the public;• hospital emergency departments;• primary health care facilities.	 Environment  NCA  Health  Civil defence  Emergency and disaster management sector	National	Assessment and surveillance

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>5. Develop national emergency response plans that consider the country's risk profile and address possible event scenarios and the needs of vulnerable populations.</p>		National	Other action
<p>6. Ensure access to expertise, that is, maintain an updated list and roster of experts and specialized centres for:</p> <ul style="list-style-type: none"> • environmental monitoring • exposure modelling • radiation dose and risk assessment • bio-dosimetry (30) • diagnosis and treatment of radiation injuries (31) • radiation emergency stockpile agents (32) • health surveillance • mental health and psychosocial support. 		National	Information, education and communication; other action

References

1. WHO, WMO, UNEP, ICNIRP. Global Solar UV Index: a practical guide. Geneva: World Health Organization; 2002 (<https://apps.who.int/iris/handle/10665/42459>, accessed 10 October 2021).
2. IARC, WHO. Radiation. Volume 100D. A review of human carcinogens. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Lyon: International Agency for Research on Cancer; 2009 (<https://publications.iarc.fr/Book-And-Report-Series/larc-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans/Radiation-2012>, accessed 15 January 2021).
3. Lucas R, McMichael T, Smith W, Armstrong B. Solar ultraviolet radiation: global burden of disease from solar ultraviolet radiation. Environmental Burden of Disease Series, No. 13. Geneva: World Health Organization; 2006 (<https://apps.who.int/iris/handle/10665/339523>, accessed 1 June 2021).
4. Radiation: the ultraviolet (UV) Index [website]. Geneva: World Health Organization; 2017 ([https://www.who.int/news-room/q-a-detail/radiation-the-ultraviolet-\(uv\)-index](https://www.who.int/news-room/q-a-detail/radiation-the-ultraviolet-(uv)-index), accessed 1 June 2021).
5. ICNIRP, WHO, ILO. Protecting workers from ultraviolet radiation. Berschleißheim: International Commission on Non-Ionizing Radiation Protection; 2007 (<http://www.icnirp.org/cms/upload/publications/ICNIRPUVWorkers.pdf>, accessed 15 June 2021).
6. Artificial tanning devices: public health interventions to manage sunbeds. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/255695>, accessed 15 June 2021).
7. Legislation of artificial tanning sunbeds. In: Global Health Observatory Data Repository (European Region) [website]. Geneva: World Health Organization; 2021 (<https://apps.who.int/gho/data/node.main-euro.SUNBEDS?lang=en>, accessed 25 June 2021).
8. Ultraviolet (UV) radiation. World Health Data Platform. Geneva: World Health Organization; 2020 ([https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/ultraviolet-\(uv\)-radiation](https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/ultraviolet-(uv)-radiation), accessed 8 October 2020).
9. Framework for developing health-based EMF standards. Geneva: World Health Organization; 2006 (<https://apps.who.int/iris/handle/10665/43491>, accessed 15 June 2021).
10. Establishing a dialogue on risk from electromagnetic fields. Geneva: World Health Organization; 2002 (<https://apps.who.int/iris/handle/10665/42543>, accessed 15 June 2021).
11. Electromagnetic fields. In: The Global Health Observatory [website]. Geneva: World Health Organization; 2020 (<https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/electromagnetic-fields>, accessed 14 October 2021).
12. European Commission, FAO, IAEA, ILO, NEA, PAHO et al. Radiation protection and safety of radiation sources: International Basic Safety Standards. Vienna: International Atomic Energy Agency; 2014 (https://www-pub.iaea.org/MTCD/publications/PDF/Pub1578_web-57265295.pdf, accessed 7 October 2020).
13. Bonn Call for Action: 10 actions to improve radiation protection in medicine in the next decade. Vienna: International Atomic Energy Agency/World Health Organization; 2012 (<https://www.who.int/publications/m/item/bonn-call-for-action>, accessed 15 June 2021).

14. IAEA, ILO, PAHO, WHO. Radiation protection and safety in medical uses of ionizing radiation. Vienna: International Atomic Energy Agency; 2018 (<https://www.iaea.org/publications/11102/radiation-protection-and-safety-in-medical-uses-of-ionizing-radiation>, accessed 8 October 2021).
15. GBD results tool. Seattle (WA): Institute for Health Metrics and Evaluation; 2020 (<http://ghdx.healthdata.org/gbd-results-tool>, accessed 6 October 2021).
16. WHO guidelines for indoor air quality: dampness and mould. Copenhagen: WHO Regional Office for Europe; 2009 (<https://apps.who.int/iris/handle/10665/164348>, accessed 26 June 2021).
17. WHO guidelines for indoor air quality – selected pollutants. Copenhagen: WHO Regional Office for Europe; 2010 (<https://apps.who.int/iris/handle/10665/260127>, accessed 7 October 2019).
18. IAEA, WHO. Protection of the public against exposure indoors due to radon and other natural sources of radiation. Vienna: International Atomic Energy Agency; 2015 (<https://www.iaea.org/publications/10671/protection-of-the-public-against-exposure-indoors-due-to-radon-and-other-natural-sources-of-radiation>, accessed 15 January 2021).
19. Design and conduct of indoor radon surveys. Vienna: International Atomic Energy Agency; 2019 (<https://www.iaea.org/publications/12351/design-and-conduct-of-indoor-radon-surveys>, accessed 15 January 2021).
20. Radon database. In: The Global Health Observatory [website]. Geneva: World Health Organization; 2020 (<https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/gho-phe-radon-database>, accessed 8 April 2021).
21. Management of radioactivity in drinking-water. Geneva: World Health Organization; 2018 (<https://iris.who.int/handle/10665/272995>, accessed 4 June 2021).
22. IAEA, FAO, ICAO, ILO, IMO, INTERPOL et al. Preparedness and response for a nuclear or radiological emergency. Vienna: International Atomic Energy Agency; 2015 (http://www-pub.iaea.org/MTCD/publications/PDF/P_1708_web.pdf, accessed 4 June 2021).
23. Water safety planning: a roadmap to supporting resources. Geneva: World Health Organization; 2017 (<https://www.who.int/publications/m/item/water-safety-planning-a-roadmap-to-supporting-resources>, accessed 27 March 2020).
24. IAEA, FAO, ILO, PAHO, WHO. Criteria for use in preparedness and response for a nuclear or radiological emergency. Vienna: International Atomic Energy Agency; 2011 (http://www-pub.iaea.org/MTCD/publications/PDF/Pub1467_web.pdf, accessed 8 October 2021).
25. IAEA, FAO, WHO. Criteria for radionuclide activity concentrations for food and drinking water. Vienna: International Atomic Energy Agency; 2016 (<https://www.iaea.org/publications/11061/criteria-for-radionuclide-activity-concentrations-for-food-and-drinking-water>, accessed 8 October 2020).
26. International Health Regulations (2005). Third edition. Geneva: World Health Organization; 2016 (<https://www.who.int/ihr/publications/9789241580496/en/>, accessed 22 July 2020).
27. Convention on Early Notification of a Nuclear Accident. Vienna: International Atomic Energy Agency; 1986 (<https://www.iaea.org/topics/nuclear-safety-conventions/convention-early-notification-nuclear-accident>, accessed 8 October 2020).
28. Iodine thyroid blocking: guidelines for use in planning for and responding to radiological and nuclear emergencies. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/259510>, accessed 15 January 2021).
29. International Health Regulations (2005) and chemical events. Geneva: World Health Organization; 2015 ([https://ahpsr.who.int/publications/i/item/international-health-regulations-\(2005\)-and-chemical-events](https://ahpsr.who.int/publications/i/item/international-health-regulations-(2005)-and-chemical-events), accessed 8 June 2021).
30. IAEA, PAHO, WHO. Cytogenetic dosimetry: applications in preparedness for and response to radiation emergencies. Vienna: International Atomic Energy Agency; 2011 (<https://www.iaea.org/publications/8735/cytogenetic-dosimetry-applications-in-preparedness-for-and-response-to-radiation-emergencies>, accessed 15 January 2021).
31. Medical management of radiation injuries. Vienna: International Atomic Energy Agency; 2020 (<https://www.iaea.org/publications/12370/medical-management-of-radiation-injuries>, accessed 15 January 2021).
32. Development of stockpiles for radiation emergencies. Geneva: World Health Organization; 2007 (https://cdn.who.int/media/docs/default-source/documents/radiation/development-of-stockpiles-for-radiation-emergencies.pdf?sfvrsn=1c75f987_7, accessed 15 June 2021).

7. Climate change



Overview

Climate change impacts health in a myriad of ways, including by leading to death and illness from increasingly frequent extreme weather events, such as heatwaves, storms and floods; increased malnutrition, as many current food systems do not deliver healthy and sustainable diets; increases and alterations in zoonoses and food-, water- and vector-borne diseases; and mental health issues through, for example, fear about the future or the damage to and loss of natural habitats. Furthermore, climate change is undermining many of the social determinants of good health, such as livelihoods, equality and access to health care and social support structures. The indirect effects of climate change result from, for example, food, nutrition and water insecurity; increasing transmission of vector- and water-borne diseases; the disruption of health care systems and water and sanitation supplies; increased health inequalities; and climate-induced displacement and migration of communities.

There are several contributors to global climate change, including fossil fuel combustion and industrial processes, food systems (including related agricultural practices, deforestation and other land-use changes and consumption), transportation and energy use. In addition, the health sector is a significant contributor to climate change, being responsible for approximately 5.2% of global greenhouse gas (GHG) emissions (1, 2).

All people are exposed to the hazardous effects of climate change, but some groups are particularly vulnerable. This includes people living in small island developing states and other coastal regions; megacities; and mountainous, polar and drought-prone regions; as well as children, indigenous communities, ageing populations, people with underlying health conditions and those living in low-income countries (1).

Actions to address the health risks of climate change encompass both mitigation and adaptation.

- (a) **Mitigate** climate change by reducing or preventing emissions of GHGs; many of these actions have co-benefits, including for health; for example, they also reduce air pollution, save energy, improve the healthfulness of diets or help to increase physical activity among populations by introducing greener mobility options. Some co-benefits are described in other sections of the Compendium (such as Chapter 2. Air pollution, Chapter 9. Safe environments and mobility, Section 12.1 Cities and other settlements, Section 12.2 Housing and Section 10.2 Healthy diets and the environment).
- (b) **Adapt and increase resilience** to climate change by enhancing the ability to anticipate, respond to, cope with and recover from the effects of climate change. This is necessary not only to maintain essential functions of the health system but also to continue improving population health even in the face of an unstable and changing climate.

Many actions will achieve **both decarbonization and resilience**-building goals. For example, the increased use of renewable energy in health care facilities can reduce GHG emissions and improve the climate resilience of the facility.

What are the main health risks related to climate change and which are the most vulnerable populations?
What actions are needed to address these risks?

To assess the current effects of climate change and forecast future impacts, it is recommended to conduct a climate change and health vulnerability and adaptation assessment. This process aims to identify critical health risks, the most vulnerable populations, weaknesses in the systems that should protect them and interventions that can respond to the risks (3).

The steps in conducting such an assessment include the following.

1. Getting started: plan the assessment.
2. Vulnerability assessment: describe the current burden of climate-sensitive health outcomes, and vulnerabilities to climate variability and recent climate change.
3. Capacity assessment: assess the capacities of health and health-relevant systems.
4. Future risk assessment: qualitatively or quantitatively, or both, project the health risks of climate change.
5. Adaptation assessment: identify and prioritize policies, programmes and actions to address current and projected health risks.
6. Synthesis: integrate the assessment as input into relevant climate change and health policies, plans and reporting mechanisms.

Detailed guidance on how to conduct vulnerability and adaptation assessments is available (3).

Climate change and health in small island developing states

Small island developing states are uniquely vulnerable to climate change due to their frequent exposure to extreme weather and climate events and sea level rise, while also being constrained by limited resources and largely dependent on food imports and trade, as well as fragile local food systems. Therefore, WHO has developed a special initiative on climate change and health in small island developing states (4). Although most of the advice in the Guidance table will apply to small island developing states, even more urgent action to adapt to climate change will be needed in these countries. Small island developing states are among the first countries to be adversely affected by climate change and will experience some of the most severe impacts, despite contributing very little to the causes of climate change.

Selected recommendations from the COP26 special report on climate change and health for priority actions from the global health community, governments and policy makers (5).

- **Our health is not negotiable.**
Place health and social justice at the heart of the UN climate talks.
- **Harness the health benefits of climate action.**
Prioritize those climate interventions with the largest health-, social- and economic gains.
- **Build health resilience to climate risks.**
Build climate-resilient and environmentally sustainable health systems and facilities, and support health adaptation and resilience across sectors.
- **Create energy systems that protect and improve climate and health.**
Guide a just and inclusive transition to renewable energy to save lives from air pollution, particularly from coal combustion. End energy poverty in households and health care facilities.
- **Reimagine urban environments, transport and mobility.**
Promote sustainable, healthy urban design and transport systems, with improved land use, access to green and blue public space, and priority for walking, cycling and public transport.
- **Protect and restore nature as the foundation of our health.**
Protect and restore natural systems, the foundation for healthy lives, sustainable food systems and livelihoods.
- **Promote healthy, sustainable and resilient food systems.**
Promote sustainable and resilient food production and more affordable, nutritious diets that deliver on both climate and health outcomes.
- **Finance a healthier, fairer and greener future to save lives.**
Transition towards a well-being economy.
- **Listen to the health community and prescribe urgent climate action.**
Mobilize and support the health community on climate action.

The Guidance table provides an overview of the most relevant advice from WHO or other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
Climate-resilient and low-carbon health systems				
<p>1. Ensure strong leadership and governance for climate resilience, low-carbon pathways and environmental sustainability in health systems. This includes specific governance for climate change and health, the integration of climate change into health policies and programmes, the integration of health into climate change processes, and cross-sectoral collaboration (6, 7).</p> <p>Concrete examples of outputs may include the following.</p> <p>Governance</p> <ul style="list-style-type: none"> • Climate change and health focal points are designated within the health ministry, with a specific programme of action and budget allocated. • Climate change and health focal points or units work in collaboration with relevant climate-sensitive health programmes (e.g. vector-borne diseases, nutrition, infectious diseases, disaster risk reduction) to build the resilience of programmes. • The health sector participates meaningfully in the main climate change processes at national, regional and global levels. <p>Policy</p> <ul style="list-style-type: none"> • The health component of National Adaptation Plan (known as HNAP) is developed. • Health is integrated into the Nationally Determined Contributions (or NDCs) and Long-Term Low-Emission Development Strategy. <p>Cross-sectoral collaboration</p> <ul style="list-style-type: none"> • Agreements (e.g. memoranda of understanding) are established between the health ministry and main stakeholders at the national level (e.g. meteorological services, and ministries of environment, food and agriculture, energy, transport, planning, water, sanitation, infrastructure/public works) that include specific roles and responsibilities in relation to protecting health from climate change or reducing GHG emissions, or both. • Main policies and strategies from health-determining sectors reflect climate change and health considerations, both in relation to adaptation (e.g. climate-resilient water safety plans [WSPs]) and mitigation (e.g. maximizing health co-benefits in transport systems). • Health Impact Assessments are conducted for new mitigation and adaptation policies, and for programmes in all health-determining sectors. 	 Health  Environment  Other sectors	National	Governance	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>2. Strengthen the technical and professional capacity of the health workforce to manage climate-related health risks, reduce the GHG emissions of the health sector and work with communities and other sectors on climate change and health (6, 7).</p> <p>Concrete examples of outputs may include the following.</p> <p>Health workforce capacity</p> <ul style="list-style-type: none"> Regularly conduct training courses about climate change and health topics for the health workforce. Curricula on climate change and health, covering both resilience and decarbonization, are developed and taught at secondary or tertiary level, or both. <p>Organizational capacity development</p> <ul style="list-style-type: none"> Contingency plans to deploy sufficient health personnel in case of acute shocks, such as extreme weather events and outbreaks, are developed at the relevant level (i.e. national, subnational, local). Innovative approaches to reducing GHG emissions at health care system or facility level are promoted (e.g. teams share best practices across different domains, and a system of rewards is implemented). Innovative capacity-building plans are developed that respond to identified gaps in human resources and institutional capacity. <p>Information, awareness and communication</p> <ul style="list-style-type: none"> Internal and external health communication plans are developed that focus on raising awareness of the risks of climate change and health outcomes, and on implementing efficient strategies to build climate-resilient health systems. Internal and external health communication plans are developed that focus on measuring GHG emissions and implementing strategies to reduce health system emissions. Health professionals, the media and community leaders are trained in risk communication, including how to communicate uncertainty. A stakeholder forum is established that focuses on protecting health from climate change as a way to engage health-determining sectors and the community. 	 Health	National; health care Universal health coverage	Governance; information, education and communication	B

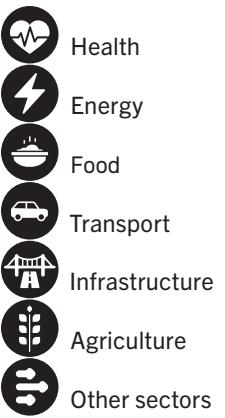
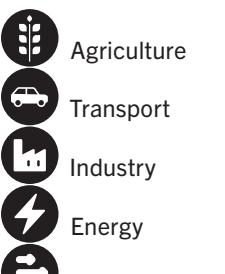
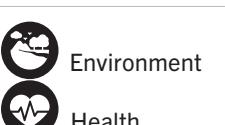
 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>3. Implement integrated risk monitoring, early warning systems and GHG emissions tracking to inform timely action.</p> <p>Key risks to monitor include extreme weather events, temperatures, ultraviolet (or UV) radiation, air quality, rainfall and humidity levels, El Niño/La Niña years, seasonal allergen loads and occurrences, food safety, and water availability and quality (6, 7).</p> <p>Concrete examples of outputs may include the following.</p> <p>Integrated disease surveillance and early warnings</p> <ul style="list-style-type: none"> An integrated climate and health surveillance system is implemented for specific climate-sensitive diseases. Climate-informed health early warning systems that predict the risk of an outbreak of priority infectious diseases (e.g. malaria, dengue, cholera) are developed and implemented. The geographical and seasonal distribution of health risks and outcomes (e.g. risk mapping) are tracked for priority climate-sensitive diseases. <p>Monitoring and progress tracking</p> <ul style="list-style-type: none"> A monitoring process is established within the Ministry of Health that has a tracking system to measure progress in reducing GHG emissions. Indicators of climate change are included in relevant monitoring systems at the national level, are reported over time and incorporate information about risks, impacts, vulnerabilities and the capacity of health and emergency preparedness systems, as well as about climate and environmental variables. Periodic reviews are conducted to detect improvement or deterioration in capacities, and these are identified through vulnerability and adaptation assessments. <p>Communication</p> <ul style="list-style-type: none"> A communication plan or strategy to address climate risks to health and health system decarbonization is developed and implemented, outlining the scope of information for diverse audiences (e.g. media, public, health personnel and other sectors) and events. Information about the health system's carbon emissions and best reduction practices and opportunities is shared with relevant stakeholders and communities. Community engagement and feedback mechanisms are established to empower affected populations to respond to warnings and to guide future development of monitoring and warning systems. 	 Health  Environment	National; community Universal health coverage	Assessment and surveillance; information, education and communication	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>4. Increase resilience and reduce GHG emissions from infrastructure, technologies and the supply chain (6, 7).</p> <p>Concrete examples of outputs may include the following.</p> <p>Adaptation of current infrastructures, technologies and supply chain</p> <ul style="list-style-type: none"> Iterative review and revision in line with projected climate risks are undertaken of specifications for the siting and construction of health facilities; the provision of energy, water, waste management and sanitation; technologies and the selection of products and processes for services. Health care facilities are retrofitted according to climate resilience and low-carbon standards. Training and recommendations for the prescription of pharmaceuticals during extreme heat conditions are revised. An improvement plan is developed for ensuring health service delivery during extreme weather events and outbreaks of climate-sensitive diseases, based on the results of vulnerability assessments of health care facilities. <p>Promotion of new technologies</p> <ul style="list-style-type: none"> Access to renewable energy in health care facilities is promoted as an adaptation and sustainable low-carbon measure. Environmentally sustainable technologies suitable for harsh conditions (e.g. green cooling) are adopted. <p>Environmental sustainability of health operations</p> <ul style="list-style-type: none"> Assessments are conducted of health sector impacts on the environment, including GHG emissions. Decarbonization actions are implemented at health system or facility level, or both. GHG emissions and environmental sustainability considerations are integrated within health sector procurement policies and practices. <p>Further guidance is provided in Section 12.4 Health care facilities.</p>	 Health  Other sectors	National; community Universal health coverage	Infrastructure, technology and built environment; assessment and surveillance	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>5. Improve efforts to respond to environmental risks to health by strengthening monitoring and management of environmental determinants of health, developing and implementing regulatory instruments and mechanisms, and promoting coordinated intersectoral management (6, 7).</p> <p>Concrete examples of outputs may include the following.</p> <p>Monitoring</p> <ul style="list-style-type: none"> Integrated monitoring systems collect data about environmental hazards (e.g. water quality, water availability, air quality), socioeconomic factors and health outcomes. <p>Regulatory mechanisms</p> <ul style="list-style-type: none"> Regulations for key environmental determinants of health (e.g. air quality, water quality, food quality and safety, waste management) are designed to reflect broader ranges of expected climatic conditions and the health sector's own contribution to GHG emissions and environmental impacts. Regulations for clean energy systems are promoted as a means to improve local air quality and reduce the number of premature deaths from exposure to air pollution. <p>Coordinated cross-sectoral management</p> <ul style="list-style-type: none"> Environmental Health Impact Assessments for policy and programmes, in sectors such as transport, agriculture and energy, are implemented in coordination with the Ministry of Health. Joint multisectoral risk management approaches to health risks related to disasters, water, waste, food and air pollution are implemented. A sustainable low-carbon approach is integrated into management of the environmental determinants of health. 	 Health  Transport  Energy  Agriculture  Environment  Water/sanitation	National; community	Governance; regulation; assessment and surveillance	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>6. Emerging climate and environmental risks to health require updates of existing health programmes and their management to strengthen their response capacity with adequate, effective and sustainable interventions. These programmes include emergency and disaster risk management, public health preparedness, early warnings, food security and nutrition, infectious disease monitoring, climate-sensitive disease surveillance, and several vertical programmes for communicable and noncommunicable diseases, and injury prevention (6, 7).</p> <p>Concrete examples of outputs may include the following.</p> <p>Health programming</p> <ul style="list-style-type: none"> • Health programmes use climate information and evidence to inform action on climate-sensitive health programmes and integrate climate change, health adaptation, and resilience and mitigation (and include procurement processes). • Service delivery is informed by a sound understanding of the different exposure pathways to climate-related hazards and targeted to those most at risk, considering gender differences and diverse vulnerability factors. • Investment plans are developed to address identified capacity gaps in health programmes to deal with the increased health risks from climate variability and change. <p>Delivery of interventions</p> <ul style="list-style-type: none"> • Risk maps and analyses of seasonal trends in diseases are used to target resources and preventive measures to those most at risk. • Short- and long-term climate resilience and sustainable low-carbon interventions are defined and prioritized by key health programmes. 	 Health	National; health care Universal health coverage	Other management and control	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>7. Build preparedness, response capacity and health security in health systems and communities to cope with outbreaks and emergencies triggered by climate variability (6, 7).</p> <p>Concrete examples of outputs may include the following.</p> <p>Inform policies and protocols</p> <ul style="list-style-type: none"> Policies, protocols and strategies for Health Emergency and Disaster Risk Management (or Health EDRM) plans are reviewed and improved through the integration of information about climate-sensitive health risks, weather and climate (e.g. El Niño/La Niña conditions). Health sector contingency plans for extreme weather events are developed in line with the WHO Emergency Response Framework, and include risk reduction, preparedness and response. <p>Risk management</p> <ul style="list-style-type: none"> Risk assessments for current and projected future exposure to extreme weather events are routinely used to inform strategic development plans for the health sector. <p>Community empowerment</p> <ul style="list-style-type: none"> Stakeholder mechanisms are established to support participation, dialogue and information exchange among stakeholders and, particularly, to empower civil society and community groups as primary actors in emergency preparedness and response. Capacity development programmes are implemented to identify and support the role of local communities in recognizing risks, preventing exposure to hazards and taking action to save lives during extreme weather events. Mechanisms are in place to ensure information related to health risks from extreme weather events reaches communities in a way that triggers preventive action by them. 	 Health	National; health care Universal health coverage	Other management and control; assessment and surveillance	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
Climate change mitigation				
<p>8. Conduct health co-benefits assessments of mitigation and adaptation actions in other sectors to inform and drive climate action (8–10).</p>		National; community Universal health coverage	Assessment and surveillance	B
<p>9. Reduce GHG emissions from health care facilities through transition to renewable energy in buildings, transportation and other operations, and through development of green supply chains (7).</p>		National; health care	Regulation; infrastructure, technology and built environment; other management and control	B
<p>10. Mitigate climate change by reducing GHG emissions and other climate-changing pollutants, such as black carbon, for example through more sustainable energy-use choices, agricultural practices, transport options, and a shift to a more plant-based diet, reduced food loss and waste, city densification and use of industrial technology and practices (1, 11).</p>		National; community	Taxes and subsidies; infrastructure, technology and built environment	B, C
<p>11. Reduce deforestation and implement afforestation and sustainable forest management practices (11).</p>		National; community	Other management and control; regulation	C
<p>12. Implement sustainable infrastructure development and spatial planning to avoid locking societies into GHG-intensive emission pathways that may be difficult or costly to change (11).</p>		National; community	Infrastructure, technology and built environment	C
<p>13. Establish and enforce air quality standards, in line with the 2021 update to the WHO air quality guidelines (12).</p>		National	Regulation	A

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
14. Adopt energy-efficient building codes for new buildings and retrofit established buildings (11).	 Housing  Construction	National; community	Regulation; infrastructure, technology and built environment	C
15. Improve the efficiency of material use, the reuse of materials and products, and recycling, particularly in the industry sector, and reduce product demand overall (11).	 Industry  Waste	National; community	Infrastructure, technology and built environment; other management and control	C
16. Promote demand-side mitigation that encompasses changes in infrastructure use, end-use technology adoption, and sociocultural and behavioural changes (11). Examples may include the following: <ul style="list-style-type: none">• ensuring healthy diets from sustainable food systems and reduced consumption of red and processed meat, while acknowledging nutritional needs and contexts (13);• reducing food waste;• implementing adaptive heating and cooling choices for thermal comfort;• using building-integrated renewable energy;• using electric light-duty vehicles and encouraging a shift to walking, cycling, and shared pooled and public transit;• encouraging sustainable consumption by intensive use of long-life repairable products.	 Agriculture  Transport  Industry  Energy  Other sectors	National; community Universal health coverage	Information, education and communication; governance; other management and control	C
Heat-health response				
17. Develop and implement a national heat–health action plan (14).	 Health  Environment	National	Governance	B
18. Designate an agency with the authority to coordinate response activities and disseminate information about heat-related health impacts (15).	 Health  Environment	National	Governance	B, C
19. Plan places that are more resilient to climate change and natural disasters: create well-designed and accessible green and blue spaces that also act as buffer zones and functional landscapes (15).		Community; national	Infrastructure, technology and built environment	B
20. Inform the public about anticipated heatwaves and how long they are forecast to last (15).	 Health  Environment	National; community Universal health coverage	Information, education and communication	B, C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>21. Communicate clearly about the dangers of heatwaves, emphasizing that health protection is the first priority. Where possible, encourage people to postpone outdoor or sporting activities during the heat of the day, including at schools. Work with utilities to prevent suspension of water and electricity services (15).</p> <p>Messages may include the following (16).</p> <ul style="list-style-type: none"> • Keep out of the heat as best as possible, including at night; avoid strenuous physical activity; and ensure children and animals are not left in parked vehicles. • Keep your body cool and hydrated. Wear light and loose-fitting clothing and use light bed linen; take cool showers or baths; and drink regularly but avoid alcoholic, caffeinated and sugary drinks. If necessary and possible, try to spend 2-3 hours of the day in a cool place. • Breastfeeding is the best way to keep your baby hydrated during hot weather. • Keep your home cool. Use the night air to cool down your home by opening windows, and reduce the heat inside your home during the day by using blinds or shutters and turning off non-essential appliances. 	  Health Environment	National; community; health care; schools/ childcare settings; workplace Universal health coverage	Information, education and communication; other management and control	B, C
<p>22. Inform caregivers and those responsible for particularly vulnerable populations about the risks of and appropriate responses to heatwaves. Additional emergency medical personnel may be assigned to address any increase in demand for services. Cooling centres can be opened to provide relief, and transportation to them can be provided for the most vulnerable (15).</p>	 Health	National; community Universal health coverage	Information, education and communication; other management and control	B, C
<p>23. Provide access to additional sources of information, such as media broadcasts and websites offering additional information, and telephone services to report concerns about individuals who may be at risk from a heatwave (15).</p>	 Health	National; community Universal health coverage	Information, education and communication	B, C
<p>24. Prevent heat stress in outdoor workers; most can be prevented by (15):</p> <ul style="list-style-type: none"> • engineering controls, such as general ventilation; evaporative cooling and spot cooling; • changing work practices, such as by providing plenty of drinking-water; • scheduling heavy work during the cooler parts of the day or reducing the physical demands during the hottest part of the day; • alternating periods of work and rest, and ensuring that rest periods can be spent in a cool area; • wearing appropriate clothing; • educating employees about the hazards of heat stress. 	  Health Labour	Workplace Universal health coverage	Other management and control	B, C

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
Water, sanitation and hygiene (WASH)				
25. Assess climate risks and vulnerabilities or use information from existing assessments to inform implementation of strategies for climate resilience of water and sanitation systems (17).	 Water/sanitation	National; community	Assessment and surveillance	B
26. Increase the climate resilience of WASH and waste management services in health care facilities by integrating climate considerations into facility-based improvement tools (18). For more detailed information about safe and climate-resilient health care facilities, please consult Section 12.4 Health care facilities .	 Water/sanitation  Waste  Health	National; community Universal health coverage	Other management and control	B
Drinking-water safety				
Water safety may be affected by (i) more intense precipitation and flooding, (ii) increased drought, (iii) increased temperature and (iv) sea level rise. These can lead to increased levels of waterborne pathogens and other harmful contaminants, increased vector breeding sites, floods, and water and food scarcity.				
27. Develop a WSP to systematically manage all risks within a water supply system – from catchment to consumer – that may impact public health, including climate-related risks. Note: This section describes only how climate considerations can be integrated into the WSP approach. For general information about WSPs, see Section 3.2.1 Drinking-water . The key actions for water safety planning for climate resilience include the following.	 Water/sanitation	National; community	Other management and control	B
<ul style="list-style-type: none"> • Augment the WSP team with relevant climate-related expertise. • Integrate relevant climate information into the description of the water supply system. • Identify climate-related hazards and assess the risks. • Develop an incremental improvement plan to increase climate resilience. • Develop management procedures and supporting programmes that strengthen the climate resilience of the system (19). 				

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
Sanitation safety				
Similar to water safety, sanitation safety may be affected by (i) more intense precipitation, (ii) more variable or declining rainfall or runoff, (iii) more frequent or more intense storms or cyclones, (iv) sea level rise and (v) more variable and increasing temperatures. These can lead to damaged infrastructure, flooding of latrines and other sanitation systems that causes faecal environmental contamination and bypassing of treatment processes, spillage and contamination, higher pollution concentrations in wastewater and increased deposits and blockages due to water scarcity (17, 20).				
28. Integrate climate considerations into sanitation safety plans (21) by targeting the greatest health risks and planning for incremental improvements. The main steps to addressing these concerns include (17): <ul style="list-style-type: none"> engaging climate-related experts when preparing a sanitary safety plan to define its scope and priorities; describing the sanitation system; identifying hazards and assessing risks; developing and implementing an incremental improvement plan; monitoring control measures and verifying performance; developing supporting programmes and reviewing plans. 	 Water/sanitation	National; community	Other management and control	B
29. Increase the climate resilience of sanitation systems. Detailed guidance on safe sanitation systems is provided in (20).	 Water/sanitation	National; community	Other management and control	A
Food systems				
If a vulnerability and adaptation assessment (3) has pointed to food systems as a thematic priority, a number of actions can be taken to assess food systems, anticipate any challenges to them and adapt to improve them. This section lists possible examples of concrete actions that can be taken, according to local risks and circumstances, beyond health system strengthening for nutrition (22).				
30. Promote cross-sectoral communication to align adaptation actions in agriculture or infrastructure (e.g. increasing WASH coverage), as well as within the health sector (22).	   Agriculture Health Other sectors	National	Governance	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>31. Promote national commitments to shift towards healthy diets from sustainable food systems (this includes breastfeeding). Where appropriate, shift food consumption patterns to diets that include more plant protein (e.g. beans, chickpeas, lentils and nuts), a reduced amount of animal-based foods (e.g. red and processed meat and dairy) and less saturated fats (e.g. butter, milk, cheese, meat, coconut oil and palm oil) (13, 23).</p> <p>These changes may include:</p> <ul style="list-style-type: none"> • development of national food-based dietary guidelines that consider sustainability; • development of public food procurement regulations that consider the healthfulness and environmental footprint of food and beverages purchases. 	 Food  Health  Environment	National	Information, education and communication	B
<p>32. Raise awareness about and support policy revisions that highlight links between nutrition and climate change within, for example, food-based dietary guidelines, fiscal policies, and food procurement, among decision-makers and policy-makers, and provide education about healthy diets and sustainable food systems to the general public (22).</p>	 Food  Health  Environment	National; community	Information, education and communication	B
<p>33. Train health personnel how to use climate information and early warning systems (22).</p>	 Health	Health care Universal health coverage	Information, education and communication	B
<p>34. Integrate risk monitoring for relevant diseases and food hazards, and improve the use of nutrition early warning and early response systems (22).</p>	 Food  Health  Environment	National; community Universal health coverage	Assessment and surveillance; information, education and communication	B
<p>35. Promote better crop diversity and biodiversity to improve nutrition, for example through agricultural subsidies and extension services, with an emphasis on vegetables and fruits, and ensure these are accessible and affordable (22).</p>	 Food  Agriculture	National; community	Other management and control	B
<p>36. Exploit synergies among horticulture, aquaculture and the rearing of small livestock to reduce waste and expenses on agricultural inputs, and increase the diversity of food production (22).</p>	 Food  Agriculture	National; community	Infrastructure, technology and built environment	B
<p>37. Improve household food production and livelihoods (i.e. diversify household food production for household consumption to improve the nutritional quality of the family's diet) (22, 24).</p>	 Agriculture  Health	Community Universal health coverage	Information, education and communication	B
<p>38. Enhance access to and the affordability of healthy foods from sustainable food systems (22).</p>	 Food  Agriculture	National; community	Taxes and subsidies; other management and control	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>39. Promote sustainable land-use management and integrated agroforestry systems to reduce deforestation, restore degraded soils and promote biodiversity within the agricultural system; promote sustainable exploitation of nutrient-rich non-wood forest products, particularly in areas with traditional agroforestry knowledge (22).</p>	 Land use planning  Agriculture	National; community	Other management and control	B
<p>40. Create a restored and diversified natural resource base and ensure that populations have the capacities and means to sustainably manage their natural resources (22).</p>	 Environment	Community; national	Other management and control	B
<p>41. Add school-based approaches (e.g. school feeding programmes, school gardens, nutrition education) that include consideration of climate variability and long-term change into existing school and nutrition initiatives to create healthy school environments (22, 25, 26).</p>	 Education  Health	Schools/ childcare settings Universal health coverage	Other management and control; information, education and communication	B

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy

GHG: greenhouse gas; WSP: water safety plan.

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

WHO 2023: Operational framework for building climate resilient and low carbon health systems (6) – The framework's goal is to increase the climate resilience of health systems to protect and improve the health of communities in an unstable and changing climate, while optimizing the use of resources and implementing strategies to reduce GHG emissions.

Intergovernmental Panel on Climate Change 2023: Climate change 2022 – mitigation of climate change (11) – This report provides an updated global assessment of progress in climate change mitigation and pledges, and examines the sources of global emissions.

WHO 2021: Climate change and health: vulnerability and adaptation assessment (3) – This report provides guidance and support to countries conducting national or subnational assessments of current and future vulnerability to the health risks of climate change and developing policies and programmes that could increase resilience.

WHO 2020: WHO guidance for climate-resilient and environmentally sustainable health care facilities (7) – This guidance document provides a set of suggested interventions to increase climate resilience and environmental sustainability in health care facilities.

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

WHO Regional Office for Europe 2023: Zero regrets: scaling up action on climate change mitigation and adaptation for health in the WHO European Region: key messages from the Working Group on Health in Climate Change, second edition (27) – This paper supports the implementation of strategies that not only reduce GHG emissions but also enhance resilience and preparedness in health care systems by promoting sustainable and healthy communities.

WHO 2022: Technical series on adapting to climate sensitive health impacts: diarrhoeal diseases (28) – provides specific guidance on vulnerability and adaptation assessment for climate-driven diarrhoeal diseases, among others.

WHO 2021: WHO country support on climate change and health – visual guide (29) – This guide provides an overview of the various means of support WHO offers to Member States to advance climate-resilient health.

WHO 2021: Quality criteria for Health National Adaptation Plans (30) – This guide presents examples of good practice in devising Health National Adaptation Plans (or HNAPs) to assist countries in developing a comprehensive, feasible and implementable Plan.

WHO 2021: Checklists to assess vulnerabilities in health care facilities in the context of climate change (31) – Designed as a complementary tool to WHO's guidance for climate-resilient and environmentally sustainable health care facilities (7), this document supports health care facility managers and other health workers in establishing a baseline with regards to climate change resilience in health care facilities.

WHO 2021: Quality criteria for the evaluation of climate-informed early warning systems for infectious diseases (32) – This guide aims to outline the key technical and operational criteria surrounding the performance, application, implementation and effectiveness of early warning systems.

Committee on World Food Security, Food and Agriculture Organization of the United Nations 2021: CFS voluntary guidelines on food systems and nutrition (33) – The Voluntary Guidelines present a range of recommendations to promote policy coherence and reduce policy fragmentation between relevant sectors, including agriculture, health and environment. They aim to support the development of coordinated, multisectoral national policies, laws, programmes and investment plans to enable safe and healthy diets achieved through sustainable food systems.

WHO 2018: Achieving health benefits from carbon reductions: manual for CaRBonH calculation tool (34) – This tool allows quantification of the physical and economic consequences for human health that are achieved through country-level improvements in air quality by reducing domestic carbon emissions.

WHO 2017: Flooding: managing health risks in the WHO European Region (35) – This publication proposes a range of measures that address the health risks of floods and actions to protect population health care, organized around prevention, preparedness, response and recovery.

UNICEF 2015: Unless we act now: the impact of climate change on children (36) – This report looks at how children, and particularly the most vulnerable children, are affected by climate change and what concrete steps need to be taken to protect them.

References

1. Climate change and health [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health>, accessed 10 October 2021).
2. Romanello M, Di Napoli C, Drummond P, Green C, Kennard H, Lampard P, et al. The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels. *Lancet*. 2022;400:1619–54.
3. Climate change and health: vulnerability and adaptation assessment. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/345968>, accessed 16 August 2023).
4. Climate change and health in small island developing states: a WHO special initiative. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/279987>, accessed 15 June 2021).
5. COP26 special report on climate change and health: the health argument for climate action. Geneva: World Health Organization; 2021 (<https://apps.who.int/iris/handle/10665/346168>, accessed 14 August 2023).
6. Operational framework for building climate resilient and low carbon health systems. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/373837>, accessed 20 December 2023)
7. WHO guidance for climate-resilient and environmentally sustainable health care facilities. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/335909>, accessed 23 October 2020).
8. A framework for the quantification and economic valuation of health outcomes originating from health and non-health climate change mitigation and adaptation action. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/367385>, accessed 25 September 2023).
9. Health in the green economy: health co-benefits of climate change mitigation – housing sector. Geneva: World Health Organization; 2011 (<https://iris.who.int/handle/10665/44609>, accessed 25 September 2023).
10. Health in the green economy: health co-benefits of climate change mitigation – transport sector. Geneva: World Health Organization; 2012 (<https://iris.who.int/handle/10665/70913>, accessed 25 September 2023).
11. Summary for policymakers. In: Shukla PR, Skea J, Slade R, Fradera R, Pathak M, Al Khourdajie A, et al., editors. Climate change 2022 – mitigation of climate change: Working Group III contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, first edition. Cambridge: Cambridge

- University Press; 2023:3-48 (https://www.cambridge.org/core/product/identifier/9781009157926%23pre2/type/book_part, accessed 17 August 2023).
- 12. WHO global air quality guidelines: particulate matter (PM_{2.5} and PM₁₀), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Geneva: World Health Organization; 2021 (<https://apps.who.int/iris/handle/10665/345329>, accessed 10 August 2023).
 - 13. Red and processed meat in the context of health and the environment: many shades of red and green. Information brief. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/370775>, accessed 25 September 2023).
 - 14. Heat and health in the WHO European Region: updated evidence for effective prevention. Copenhagen: WHO Regional Office for Europe; 2021 (<https://apps.who.int/iris/handle/10665/339462>, accessed 12 August 2023).
 - 15. Heatwaves and health: guidance on warning-system development. Geneva: World Meteorological Organization, World Health Organization; 2015. (<https://library.wmo.int/records/item/54600-heatwaves-and-health>, accessed 8 October 2023).
 - 16. Staying safe in the heat: health advice for times of extreme temperature and wildfires [website]. Geneva: World Health Organization; 2022 (<https://www.who.int/europe/news/item/27-07-2022-staying-safe-in-the-heat--health-advice-for-times-of-extreme-temperature-and-wildfires>, accessed 16 August 2023).
 - 17. Kohlitz J, Willetts J, Gero A, Lyons S, Boisson S, Medlicott K. Climate, sanitation and health: discussion paper. Geneva: World Health Organization; 2019 (<https://www.who.int/publications/m/item/discussion-paper-climate-sanitation-and-health>, accessed 8 October 2021).
 - 18. Water and sanitation for health facility improvement tool (WASH FIT): a practical guide for improving quality of care through water, sanitation and hygiene in health care facilities, second edition. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/353411>, accessed 7 August 2023).
 - 19. Climate-resilient water safety plans: managing health risks associated with climate variability and change. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/258722>, accessed 15 June 2021).
 - 20. Guidelines on sanitation and health. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/274939>, accessed 15 June 2021).
 - 21. Sanitation safety planning: manual for safe use and disposal of wastewater, greywater and excreta. Geneva: World Health Organization; 2015 (<http://apps.who.int/iris/handle/10665/171753>, accessed 15 June 2021).
 - 22. Technical series on adapting to climate sensitive health impacts: undernutrition. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/325751>, accessed 15 January 2021).
 - 23. Enabling sustainable lifestyles in a climate emergency. Nairobi: United Nations Environment Programme; 2022 (https://wedocs.unep.org/bitstream/handle/20.500.11822/39972/Lifestyles_climate.pdf?sequence=6&isAllowed=y, accessed 12 August 2023).
 - 24. Sustainable healthy diets: guiding principles. Geneva: World Health Organization, Food and Agriculture Organization of the United Nations; 2019 (<https://iris.who.int/handle/10665/329409>, accessed 6 October 2023).
 - 25. Action framework for developing and implementing public food procurement and service policies for a healthy diet. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/338525>, accessed 6 October 2023).
 - 26. How together we can make the world's most healthy and sustainable public food procurement. Copenhagen: WHO Regional Office for Europe; 2022 (<https://iris.who.int/handle/10665/363337>, accessed 6 October 2023).
 - 27. Zero regrets: scaling up action on climate change mitigation and adaptation for health in the WHO European Region: key messages from the Working Group on Health in Climate Change, second edition. Copenhagen: WHO Regional Office for Europe; 2023 (<https://iris.who.int/handle/10665/368161>, accessed 10 August 2023).
 - 28. Technical series on adapting to climate-sensitive health impacts: diarrhoeal diseases. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/365582>, accessed 26 September 2023).
 - 29. WHO country support on climate change and health – visual guide. Geneva: World Health Organization; 2021 (<https://www.who.int/publications/m/item/who-country-support-on-climate-change-and-health--visual-guide>, accessed 25 September 2023).
 - 30. Quality criteria for Health National Adaptation Plans. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/339454>, accessed 17 August 2023).
 - 31. Checklists to assess vulnerabilities in health care facilities in the context of climate change. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/340656>, accessed 17 August 2023).
 - 32. Quality criteria for the evaluation of climate-informed early warning systems for infectious diseases. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/345530>, accessed 10 August 2023).
 - 33. CFS voluntary guidelines on food systems and nutrition. Rome: Food and Agriculture Organization of the United Nations, Committee on World Food Security; 2021 (https://www.fao.org/fileadmin/templates/cfs/Docs2021/Documents/CFS_VGs_Food_Systems_and_Nutrition_Strategy_EN.pdf, accessed 6 October 2023).
 - 34. Achieving health benefits from carbon reductions: manual for CaRBonH calculation tool. Copenhagen: WHO Regional Office for Europe; 2018 (<https://iris.who.int/handle/10665/346551>, accessed 10 August 2023).
 - 35. Flooding: managing health risks in the WHO European Region. Copenhagen: WHO Regional Office for Europe; 2017 (<https://iris.who.int/handle/10665/329518>, accessed 10 August 2023).
 - 36. Unless we act now: the impact of climate change on children. New York (NY): United Nations Children's Fund; 2015 (<https://www.unicef.org/reports/unless-we-act-now-impact-climate-change-children>, accessed 15 January 2021).

8. Nature and health



8.1 Protection of nature, biodiversity and ecosystems for health



Many interventions that protect nature, biodiversity and ecosystems, such as interventions for mitigating climate change, are not included here but are discussed in several other sections of the Compendium. Related sections examine topics such as raising awareness about pollution abatement in recreational water bodies ([Section 3.2.2 Recreational water](#)), interventions for a sustainable, healthy diet ([Section 10.2 Healthy diets and the environment](#)) and interventions for safe and sustainable mobility ([Section 9.2 Environments for safe and sustainable transport, active mobility and physical activity](#)).



Overview

Human health and well-being depend on the natural environment and biodiversity, which are the sources of clean air, water, healthy soils, medicines and vaccines, food and nutrition, and livelihoods. Biodiversity and functional ecosystems play an important role in preventing infectious diseases, including those that give rise to pandemics, and supporting mental health. Biodiversity comprises diversity within species, between species and within ecosystems, which when healthy and thriving, also confer protection against climate change and reduce the risk of natural disasters. Ecosystems include, for example, forests, marine and freshwater ecosystems, coral reefs, grasslands, wetlands and mountains, and comprise a range of different species that interact with each other and the surrounding environment. The stability and health of ecosystems, however, depend on biodiversity.

Ecosystems and biodiversity are directly threatened by human activities such as urbanization, agriculture, overexploitation of resources, climate change, pollution and invasive alien species. Reducing pressure on ecosystems and preserving biodiversity will protect the environment that humans rely on for their health and well-being and, ultimately, their economy (1–4).

Biodiversity is a contraction of the term biological diversity. It refers to the variability among living organisms: within species, between species and within ecosystems. Article 2 of the Convention on Biological Diversity (CBD) (5) defines biological diversity, or biodiversity. It encompasses variability among living organisms, including those found in terrestrial and marine and other aquatic ecosystems, as well as the ecological complexes among which they exist.

What is the situation regarding the protection of nature and biodiversity in my country?	<p>The indicators for Sustainable Development Goal (SDG) 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development) and SDG 15 (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss) are directly relevant for assessing national efforts made to ensure greater protection of nature, ecosystems and biodiversity (6).</p> <p>The majority of SDGs are directly or indirectly related to biodiversity.</p> <p>The Aichi Biodiversity Targets were a set of 20 specific targets adopted under the Strategic Plan for Biodiversity 2011–2020 at the 10th meeting of the Conference of the Parties to the CBD, held in Aichi Prefecture, Japan, in 2010. These targets were designed to guide global efforts to conserve biodiversity and ensure its sustainable use during the course of the decade (7, 8).</p> <p>The Strategic Plan for Biodiversity 2011–2020 provided a foundation for and a set of experiences that informed and guided the development of the Kunming-Montreal Global Biodiversity Framework, adopted at the 15th meeting of the Conference of the Parties in Montreal, Canada, in December 2022 (9).</p>
What do we want to achieve?	<p>The Kunming-Montreal Global Biodiversity Framework builds upon the achievements and challenges of the Strategic Plan for Biodiversity and its Aichi Biodiversity Targets, while addressing emerging issues and setting new targets to advance efforts to conserve and sustainably use biodiversity for the period 2022–2030 (9).</p> <p>The 23 Targets of the Kunming-Montreal Global Biodiversity Framework are listed here, and additional detail about each target is given in reference (10); the Targets aim to:</p> <ol style="list-style-type: none"> 1. plan and manage all areas to reduce biodiversity loss; 2. restore 30% of all degraded ecosystems; 3. conserve 30% of land, water and seas; 4. halt species extinction, protect genetic diversity and manage human-wildlife conflicts; 5. ensure sustainable, safe and legal harvesting and trade of wild species; 6. reduce the introduction of invasive alien species by 50% and minimize their impact; 7. reduce pollution to levels that are not harmful to biodiversity; 8. minimize the impacts of climate change on biodiversity and build resilience; 9. manage wild species sustainably to benefit people; 10. enhance biodiversity and sustainability in agriculture, aquaculture, fisheries and forestry; 11. restore, maintain and enhance nature's contributions to people, including by protecting ecosystem functions and services as well as by adopting nature-based solutions or ecosystem-based approaches; 12. enhance green spaces and urban planning for human well-being and biodiversity; 13. increase the sharing of benefits from genetic resources, digital sequence information and traditional knowledge; 14. integrate biodiversity into decision-making at every level; 15. encourage and enable businesses to assess, disclose and reduce biodiversity-related risks and negative impacts; 16. enable sustainable consumption choices to reduce waste and overconsumption; 17. strengthen biosafety and distribute the benefits of biotechnology; 18. reduce harmful incentives by at least US\$ 500 billion per year and scale up positive incentives for biodiversity; 19. mobilize US\$ 200 billion per year for biodiversity from all sources, including US\$ 30 billion through international finance; 20. strengthen capacity-building, technology transfer and scientific and technical cooperation for biodiversity; 21. ensure that knowledge is available and accessible to guide biodiversity action; 22. ensure participation in decision-making and access to justice and information related to biodiversity for all; 23. ensure gender equality and a gender-responsive approach for biodiversity action.

The Framework also acknowledges the interlinkages between biodiversity and health and the three objectives of the CBD. The Framework is to be implemented with consideration of the One Health Approach (see [Section 8.3 One Health](#)), among other holistic approaches that are based on science; that mobilize multiple sectors, disciplines and communities to work together; and that aim to sustainably balance and optimize the health of people, animals, plants and ecosystems, recognizing the need for equitable access to tools and technologies, including medicines, vaccines and other health products related to biodiversity, while also highlighting the urgent need to reduce pressures on biodiversity and decrease environmental degradation to reduce risks to health and, as appropriate, developing practical access and benefit-sharing arrangements.

The Guidance table provides an overview of the most relevant advice from WHO and other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
General: policies and actions				
1. Implement and update NBSAPs in line with the 23 Targets of the Kunming-Montreal Global Biodiversity Framework (9, 11). Practical guidance materials about NBSAPs are listed in the table at the end of this Chapter titled Additional selected tools and further resources. The rights, knowledge, innovations, worldviews, values and practices of indigenous people and local communities must be respected during implementation of the Framework (9).	 Environment  Multiple sectors	National	Governance	C
2. Prepare long-term strategies (i.e. for a minimum 25-50 years) for sustainably managing and preserving natural resources in the context of environmental and social change (4).	 Environment  Multiple sectors	National	Governance	B
3. Incorporate biodiversity values, ecosystem protection and the value of nature into political and economic decisions at all levels (2, 4, 12).	 Multiple sectors	National	Governance	B, C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>4. Implement policies and interventions that simultaneously mitigate biodiversity loss and improve public health or mitigate climate change (2, 4, 13, 14).</p> <p>Examples of actions include:</p> <ul style="list-style-type: none"> protecting areas to address biodiversity loss, which has the co-benefits of climate mitigation and adaptation; changing consumption by encouraging a shift to a more plant-based diet and making progress towards ensuring the sustainable exploitation of natural resources, including reducing postharvest waste; in cities, increasing carbon neutrality and the amount of biodiverse green spaces; removing harmful subsidies (e.g. those that increase the use of fossil fuels, deforestation and excessive use of fertilizer); strengthening education about the climate and biodiversity; improving the availability and accessibility of sustainable and diverse diets; tightening control of and ensuring the rational use of antimicrobial agents, pesticides and other biocides. 	 Health Multiple sectors	National Universal health coverage	Regulation; other management and control	B, C
<p>5. Eliminate or reform incentives and subsidies that are harmful to biodiversity (e.g. those that favour monoculture production systems), and scale up positive incentives that encourage the conservation and sustainable use of biodiversity (4, 9, 13, 15, 16).</p>	 Industry Multiple sectors	National	Taxes and subsidies	B, C
<p>6. Implement integrated surveillance of the environment and health to support timely and evidence-based decisions and to effectively identify and manage short- and long-term risks to human health posed by ecosystem degradation and biodiversity loss (2).</p>	 Health Environment	National; community Universal health coverage	Assessment and surveillance	B
<p>7. Ensure sufficient financial resources to effectively protect nature and preserve and restore biodiversity and ecosystems (4, 9, 15).</p>	 Finance Environment Health	National	Governance	C
<p>8. Strengthen international and regional partnerships, joint work programmes and intersectoral collaboration focusing on the links between biodiversity and health and environmental protection (2, 4).</p>	 Environment Health	National	Governance	B
<p>9. Adopt integrated approaches to health, such as One Health, EcoHealth and Planetary Health, which promote cross-disciplinary or cross-sectoral collaboration, or both, for health and biodiversity (2, 4, 9).</p>	 Health	National	Governance; other management and control	B, C

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
Ecosystems: policies and actions				
10. Develop and implement policies to restore degraded land, including policies for coastal and marine restoration (13, 15).	 Environment	National	Governance; regulation	C
11. Avoid ecosystem loss and degradation; promote ecosystem integrity; and promote the resilience and protection of species and genetic resources (2, 4, 13, 15).	 Environment  Agriculture	National; community	Regulation; other management and control	B, C
12. Implement policies to ensure the sustainable use of wild species that are tailored to local ecological and social contexts (17). Conditions that enable policies for sustainable use include those that: <ul style="list-style-type: none">• are adaptive and democratic;• ensure robust institutions;• are tailored to their context;• align with broader policies;• are inclusive and participatory;• recognize plural knowledge systems and values;• share benefits equitably.	 Environment	National; community	Governance; regulation	C
13. Reduce the adverse impact on biodiversity and ecosystems of land-use change, loss of natural habitats, overexploitation and destructive harvest practices, chemical pollution, invasive alien species and climate change (2, 4).	 Multiple sectors	National; community	Regulation; other management and control	B
14. Strengthen core national capacities that enable health systems to prepare for and effectively respond to public health threats resulting from ecosystem degradation, such as environmental pollution and emerging infectious diseases (2).	 Health  Environment	National	Governance	B
Food systems: policies and actions				
15. Reduce postharvest losses, and reduce food wasted by producers, retailers and consumers (2, 13, 15).	 Agriculture  Education	National; community	Regulation; other management and control; information, education and communication	B, C
16. Make more efficient use of agricultural land (2, 15).	 Agriculture	National; community	Regulation; other management and control	B, C
17. Encourage a shift to a more plant-based diet to improve nutrition, reduce pressure on biodiversity and ecosystems, and mitigate climate change (13, 15, 16).	 Health  Environment  Education	National; community	Information, education and communication; other management and control	B, C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>18. Reform and repurpose policies that support agricultural producers to achieve healthier, more sustainable, equitable and efficient food systems, and ensure there is sufficient recognition of smallholder farmers (18).</p> <p>These changes may require compensating those who are affected, such as by making direct payments to low-income households.</p>	 Agriculture  Finance	National	Taxes and subsidies	C
Medicine and disease: policies and actions				
<p>19. Recognize the contribution to medicine of genetic resources and traditional knowledge (2).</p>	 Health	Health care Universal health coverage	Information, education and communication	B
<p>20. Ensure that benefits arising from the utilization of genetic resources are shared (2, 9, 19).</p> <p>These benefits may include the results of research and development carried out on genetic resources, the transfer of technologies that make use of the resources and participation in biotechnological research activities. Benefits may also be monetary when products based on genetic resources are commercialized.</p>	 Multiple sectors	National	Regulation	B, C
<p>21. Limit the unnecessary use of antibiotics and other pharmaceuticals (2).</p>	 Health	Health care; national Universal health coverage	Regulation	B
<p>22. Limit or control human-wildlife contact to reduce the risk of infectious diseases, including zoonotic and vector-borne diseases (2).</p>	 Agriculture  Environment  Health	Workplace; national; community	Regulation	B
Awareness-raising and capacity-building				
<p>23. Increase awareness about the health benefits of biodiversity and ecosystem protection (2, 4, 15).</p> <p>Examples include highlighting the positive impacts of biodiversity on:</p> <ul style="list-style-type: none"> • food security and nutrition; • the water supply and other essential services that depend on a healthy ecosystem; • pharmaceuticals and traditional medicines; • mental health and physical and cultural well-being. 	 Health  Environment  Education	National; community Universal health coverage	Information, education and communication	B, C
<p>24. Develop education programmes and training for professionals in the health and biodiversity sectors and the general public about the importance of the links between health and biodiversity and about the sustainable management of ecosystems (2).</p>	 Health  Environment	Health care; national; community Universal health coverage	Information, education and communication	B

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
<p>25. Promote lifestyles that contribute to positive outcomes for health and biodiversity (2, 4). Other relevant interventions are discussed in Section 10.2 Healthy diets and the environment, and in Section 9.2 Environments for safe and sustainable transport, active mobility and physical activity .</p>	 Sector principally involved in planning/implementation  Health  Environment	 Level of implementation National; community Universal health coverage	 Instruments Information, education and communication	B

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy

NBSAPs: National Biodiversity Strategies and Action Plans.

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

[Secretariat of the CBD 2023: The biodiversity plan for life on Earth: 2030 Targets \(with guidance notes\)](#) [website] (10) – This webpage for the Kunming-Montreal Global Biodiversity Framework describes its 23 action-oriented global targets and provides guidance and information about each target.

[WHO, Regional Office for Europe 2021: Nature, biodiversity and health: an overview of interconnections](#) (4) – This report summarizes some important impacts of the natural environment on human health and well-being.

[UN Environment Programme \(UNEP\) 2021: Becoming #GenerationRestoration: ecosystem restoration for people, nature and climate](#) (15) – This synthesis report calls for action to prevent, halt and reverse the degradation of ecosystems worldwide and was launched at the beginning of the UN Decade on Ecosystem Restoration.

[Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services \(IPBES\), Intergovernmental Panel on Climate Change \(IPCC\) 2021: IPBES-IPCC co-sponsored workshop report on biodiversity and climate change](#) (13) – This report from a joint IPBES-IPCC workshop explores the complex and multiple connections between climate and biodiversity. The workshop was the first ever collaboration between the two intergovernmental bodies.

[WHO, Secretariat of the CBD, UNEP 2015: Connecting global priorities: biodiversity and human health. A state of knowledge review](#) (2) – This review synthesizes information about the most important interlinkages between biodiversity, ecosystem stability, nutritional diversity and health.

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

[Secretariat of the CBD, UNEP, UN Development Programme 2023: NBSAP Forum: supporting the world to implement the Kunming-Montreal Global Biodiversity Framework](#) [website] (20) – This resource provides a global partnership and web portal to support countries in finding relevant information for developing and implementing effective NBSAPs and preparing national reports.

[WHO, Regional Office for Europe 2023: Assessing the value of urban green and blue spaces for health and well-being](#) (21) – This report outlines the range of benefits gained from urban green and blue spaces and the different approaches, both qualitative and quantitative, that policy-makers and practitioners (e.g. local and national government officials, health practitioners) can use to assess the value of these urban spaces and their impacts on health and well-being.

[Secretariat of the CBD 2022: Annex 1: Guidance for revising or updating National Biodiversity Strategies and Action Plans to align with the Kunming-Montreal Global Biodiversity Framework](#) (22) – This annex provides guidance about updating NBSAPs so they reflect the goals and targets of the Framework, and it includes a template for submitting national targets to the Secretariat.

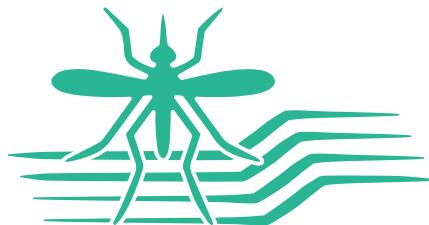
[Secretariat of the CBD 2022: 15.5. Monitoring framework for the Kunming-Montreal Global Biodiversity Framework](#) (23) – This statement contains headline, component and complementary indicators for national planning processes related to biodiversity, including NBSAPs.

[WHO, Regional Office for Europe 2021: Green and blue spaces and mental health: new evidence and perspectives for action](#) (24) – This report summarizes key findings of systematic reviews looking at the mental health impacts of green and blue spaces, briefly looks at the relevant WHO tools and strategies, and reflects on future needs for research and action.

[Secretariat of the CBD 2021: NBSAP capacity building modules](#) [website] (25) – This resource provides a set of modules to help national focal points who are responsible for implementing the CBD.

[UNEP 2019: Global environment outlook 6](#) (26) – This comprehensive report on the global environment calls on decision-makers to take immediate action to address pressing environmental issues.

8.2 Vector control



Overview

Vector-borne diseases are human illnesses caused by parasites, viruses and bacteria that are transmitted by vectors (i.e. living organisms). In most, but not all, cases the vector is a female mosquito in search of a blood meal. Vector-borne diseases account for more than 17% of all infectious diseases and cause more than 700 000 deaths annually (27). Vector-borne diseases include malaria, dengue, Chagas disease, human African trypanosomiasis, leishmaniasis and others.

The diversity, composition and abundance of vector populations are closely linked to local climates and ecosystems. The abundance and distribution of vectors may be influenced by changes in environmental factors and systems, such as those that occur through climate change, and also those related to land use and management, the clearing of forests, mining and other extractive industries, large-scale construction and development projects, urban and periurban development, water resources and solid waste management (28, 29).

Table 8.1 lists some important vectors and the diseases they transmit (27).

Vector	Disease
Mosquitoes	Chikungunya, dengue, Japanese encephalitis, lymphatic filariasis, malaria, Mayaro virus disease, Oropouche virus disease (also transmitted by midges), Rift Valley fever, West Nile fever, yellow fever and Zika virus disease
Sandflies	Leishmaniasis
Tsetse flies	Human African trypanosomiasis
Blackflies	Onchocerciasis
Triatomine bugs	Chagas disease
Ticks	Tick-borne encephalitis
Aquatic snails	Schistosomiasis

Vector-borne diseases are mainly prevented through vector control. Vector control includes both chemical, insecticide-based methods and non-chemical methods (see the section on integrated vector management [IVM]).

WHO response to vector control: integrated vector management

The WHO *Global vector control response 2017–2030* (29) provides strategic guidance to countries and development partners to aid in urgent strengthening of vector control activities as a fundamental approach to preventing disease and responding to outbreaks. It requires a realignment of vector control programmes, supported by increased technical capacity, improved infrastructure, strengthened monitoring and surveillance systems, and greater community mobilization.

The global vector control response builds on the basic concept of IVM but has a renewed focus on improving human capacity at the national and subnational levels and strengthening infrastructure and systems.

IVM, a rational decision-making process that optimizes the use of resources for vector control, was presented by WHO in 2004 as a global strategic framework and subsequently in other supporting documents (30, 31). IVM improves the efficacy, cost-effectiveness, ecological soundness and sustainability of vector control interventions by using available tools and resources. One of the key elements of an integrated approach to vector control for disease prevention is the integrated or combined use of different, often chemical and non-chemical, control methods against multiple vector-borne diseases.

Chemical vector control methods include the use of insecticide-treated nets, indoor residual spraying, outdoor spraying and other methods, such as adding chemicals to water bodies to prevent larvae from developing and using insect repellents. Concerns about resistance to insecticides and environmental toxicity have increased the need for alternatives and, where feasible, more environmentally sound approaches (31).

Non-chemical methods include biological management (e.g. utilization of natural enemies of the vector or biological toxoids) and other methods, as well as environmental management. Making improvements to housing can also facilitate vector control, although in many cases these changes also include an insecticide, for example on insect screens (32).

Environmental management seeks to change the environment in order to prevent or minimize vector propagation and human contact with the vector pathogen by destroying, altering, removing or recycling non-essential containers that provide larval habitats. It comprises the planning, organization, carrying out and monitoring of activities to modify or manipulate environmental factors or their interaction with humans with a view to preventing or minimizing vector propagation and reducing human-vector-pathogen contact (33).

Three types of environmental management exist.

1. Environmental modification: This refers to long-lasting physical transformations made to reduce vector larval habitat.
2. Environmental manipulation: These are temporary changes made to vector habitats.
3. Changes to human habitation or behaviours: This refers to actions taken to reduce human-vector contact. It includes, for example, reducing vector breeding habitats, using personal protective equipment and making alterations to housing (32, 34).

How prevalent are vector-borne diseases in my country?

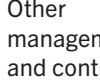
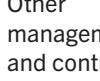
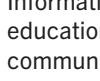
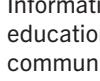
National reporting systems may capture statistics about different vector-borne diseases. As part of Sustainable Development Goal (SDG) 3 (Ensure healthy lives and promote well-being for all at all ages) (35), Target 3.3 – by 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases – and its indicators also monitor the occurrence of vector-borne diseases at the national level:

- SDG indicator 3.3.3 – malaria incidence per 1 000 population;
- SDG indicator 3.3.5 – number of people requiring interventions against neglected tropical diseases.

In addition, WHO's Global Health Observatory offers health estimates that provide comprehensive and comparable assessments of death and disability due to diseases and injuries for all WHO Member States and regions (36).

The Guidance table provides an overview of the most relevant advice from WHO and other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
General: policies and actions				
<p>Resolution WHA70.16, endorsed by the Seventieth World Health Assembly, and WHO's <i>Global vector control response 2017-2030</i> (28, 29) all promote effective, locally adaptable and sustainable vector control by:</p> <ul style="list-style-type: none"> strengthening inter- and intrasectoral collaboration; engaging and mobilizing communities; enhancing vector surveillance, and the monitoring and evaluation of interventions; providing guidance about scaling up and integrating tools and approaches. 				
1. Develop or update national and regional vector control policies and action plans in line with WHO's global vector control response strategy (28, 29). Priority activities include the following: <ul style="list-style-type: none"> conduct or update the national vector control needs assessment (37) and develop a resource mobilization plan, including for outbreak responses; appraise and enhance the national entomology and cross-sectoral workforces to meet identified requirements for vector control; train relevant staff from ministries of health or their supporting institutions in public health entomology; establish national and regional institutional networks to support training and education in public health entomology and provide technical support; establish or review the progress made on the national agenda for basic and applied research on entomology and vector control; establish a national interministerial task force to encourage multisectoral engagement in vector control; develop a national plan to ensure effective community engagement with and mobilization for vector control; strengthen national vector surveillance systems and integrate them with health information systems to guide vector control efforts; align national targets for protecting at-risk populations with appropriate vector control across vector-borne diseases. 	     	National	Regulation	B
2. Promote a multisectoral approach to the prevention and control of vector-borne diseases (29, 38). The conceptual framework for the multisectoral approach builds on 3 pillars: (i) government commitment and strong leadership, (ii) coordination among sectors and (iii) community participation.	     	National	Governance	B

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
<p>3. Enhance vector surveillance and monitoring and evaluation of interventions (28, 29).</p> <ul style="list-style-type: none"> • Strengthen and integrate national surveillance systems for vectors, interventions and diseases. • Coordinate surveillance and actions with neighbouring countries. 	  Health  Education	 National; community Universal health coverage	 Assessment and surveillance	B
<p>4. Scale up and integrate tools for and approaches to vector control (28, 29).</p> <ul style="list-style-type: none"> • Ensure that vector control methods appropriate to the local setting are selected and combined. • Integrate innovations as recommended by WHO. 	 Health	 National; community Universal health coverage	 Other management and control	B
<p>5. Combine different vector control methods and interventions, and integrate control efforts for different vectors and diseases in an appropriate and evidence-based way (28, 29).</p> <p>Vector control strategies need to be adapted to and appropriate for the local context. When choosing vector control methods, consider their effectiveness, human and environmental safety, risk for development of resistance and affordability. When implementing vector control methods, consider the needs for community engagement and for appropriate policies and logistical support.</p>	 Health	 National; community Universal health coverage	 Other management and control	B
<p>6. Support improved management of water resources, wastewater and solid waste to enhance the control of many disease vectors (28, 29, 39).</p>	 Health  Water/sanitation  Education  Waste  Environment	 National; community Universal health coverage	 Infrastructure, technology and built environment	B
Awareness-raising and capacity-building				
<p>7. Educate the community, community health workers and community leaders, and raise awareness about the linkages between vector occurrence and disease prevalence, transmission mechanisms and ways of avoiding exposure (28, 29).</p> <p>To strengthen capacity in the community, special training could be required for community health workers and agricultural extension workers, for example.</p>	 Health  Multiple sectors	 National; community Universal health coverage	 Information, education and communication	B
<p>8. Engage the community in vector control efforts to achieve greater coverage and sustainability of these efforts and thereby their effectiveness (28, 29).</p> <p>Enable communities to lead and sustain vector control activities, such as by eliminating vector habitats from their environment and improving housing.</p>	 Health	 Community Universal health coverage	 Information, education and communication	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
---	--	--	---	--

Note: The next two sections summarize the recommendations for malaria and dengue, two important vector-borne diseases.

Malaria

The two interventions recommended by WHO for large-scale deployment for malaria vector control are the use of insecticide-treated nets and indoor residual spraying (40, 51). One of these two interventions should be chosen and supplied to the entire population at risk for malaria. In specific settings, and under special circumstances, these large-scale interventions can be supplemented by using a larvicide (conditional recommendation) or another form of larval source management (no recommendation). At present, there is no evidence of the public health value of using personal protection measures, such as repellents and treated clothing (conditional recommendation against the deployment of topical repellents and insecticide-treated clothing as interventions with public health value); however, topical repellents and insecticide-treated clothing may provide personal protection against malaria. In areas affected by humanitarian emergencies, long-lasting insecticidal nets treated with only pyrethroid or pyrethroid and PBO are recommended (42).

Urban areas have a unique transmission dynamic because of their particular environmental and socioeconomic factors, and the health care resources available in these areas. Therefore, the overall transmission of malaria is usually lower in urban areas. However, in a few years most people living in malaria-endemic countries will reside in urban areas, which may put urban populations at increased risk. Rapid and unplanned urbanization might result in a malaria disease burden that is disproportionately high among the urban poor. Vector control is the main method for preventing malaria in urban areas, such as by using environmental management, insecticides and microbial larvicides. Improving drainage, sanitation, roads and sidewalks, offices and industrial buildings, and managing urban agriculture are especially relevant for reducing malaria transmission in urban areas (43).

Due to limited evidence, no recommendation is given about the non-chemical methods for malaria vector control discussed below. They should be applied only to supplement one of the interventions recommended for large-scale deployment. Space spraying against malaria is not recommended, given the limited evidence of the intervention's effectiveness and the potential for wasting resources (42).

9. Support larval source management as a supplementary intervention for mosquito reduction (42).	 Health	National; community Universal health coverage	Other management and control	A
Larval source management refers to managing water bodies that are potential habitats for mosquito larvae to prevent complete development of the vector's immature stages. Larval source management as a supplementary intervention for malaria vector control includes environmental management, such as habitat modification and manipulation, larvicing and the use of biological controls (34, 42, 44).	   Housing Construction Health	National; community Universal health coverage	Infrastructure, technology and built environment	A, B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
---	--	--	---	--

11. Implement strategies to stop the spread of invasive malaria vectors, such as *Anopheles stephensi*. In general, three sequential approaches can be considered when responding to invasive species: controlling, containing and eliminating the vector (45).

Some steps that countries should take in areas where a vector has been detected include (i) managing vector larval sites in urban and periurban environments; (ii) regularly conducting surveillance, mapping remaining and new larval sites, and inspecting the sites for larvae once a week, where feasible; (iii) introducing and enforcing by-laws to regulate water storage, construction and other practices to avoid creating potential breeding sites; (iv) raising public awareness about the mosquito species; (v) engaging local communities and schools in *An. stephensi* surveillance and control activities; (vi) enforcing International Health Regulations (2005) to ensure that airports, seaports, ground crossings and other points of entry and exit are free from vectors (46, 47).



National; community
Universal health coverage

Governance; regulation; assessment and surveillance; education and communication

B

Dengue

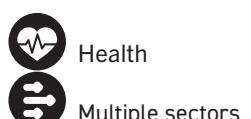
Targeting *Aedes aegypti* mosquitoes in urban habitats will help reduce the incidence of dengue (48), although a sustainable tool for doing so is lacking. Different methods have been developed to control *Aedes* vector populations, including using residual killing agents and targeted indoor residual spraying, which show promise for reducing dengue. Adulticiding for dengue prevention is most effective when it is conducted as part of an IVM plan that includes source reduction and larviciding. However, there are limitations to these conventional vector control programmes. Another promising method for *Aedes* control is the sterile insect technique, which involves the rearing and mass release of sterile male insects into target populations (49).

Successful dengue prevention programmes include a combination of tools and strategies that are applied with enhanced intersectoral and interdisciplinary cooperation and strong community engagement.

12. Implement environmental management (i.e. source reduction) measures as the main pillar of dengue vector control (50).

Environmental management measures for controlling dengue vectors include:

- making environmental modification, such as installing reliable piped water on premises;
- manipulating the environment, such as by frequently emptying or cleaning water containers, or using mosquito-proof coverings; removing or filling non-essential water containers; improving solid waste management; and screening construction sites, open drains and water bodies where stagnant water collects;
- changing human habitation and behaviour, such as by installing mosquito screens on windows, doors and other entry points;
- ensuring perifocal treatment of larval habitats and peripheral mosquito resting surfaces or using targeted residual spraying in homes and other settings, such as schools and workplaces, as part of an IVM programme for dengue vectors.



National; community
Universal health coverage

Other management and control

A

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

WHO 2023: WHO guidelines for malaria: 16 October 2023 [online database] (50) – The consolidated *WHO guidelines for malaria* bring together all recommendations for malaria, including for prevention using vector control, preventive chemotherapy and the vaccine, as well as those about diagnosis, treatment and elimination strategies.

WHO 2020: Guidance framework for testing the sterile insect technique as a vector control tool against Aedes-borne diseases (48) – This is a comprehensive guide for programme managers tasked with recommending a “go/no-go” decision about testing, full deployment and scale up of the sterile insect technique in areas affected by diseases transmitted by *Aedes* mosquitoes.

WHO 2020: Multisectoral approach to the prevention and control of vector-borne diseases: a conceptual framework (37) – This framework covers the essential elements of successful multisectoral collaborations and is based on systematic reviews of evidence from programmes aiming to prevent and control vector-borne diseases.

WHO 2017: Global vector control response 2017–2030 (29) – This describes WHO’s strategy to strengthen vector control worldwide by increasing workforce capacity, improving surveillance, ensuring better coordination and integrating action across sectors and diseases.

WHO 2017: Framework for a national vector control needs assessment (36) – This framework sets the standards for baseline assessments and tracking progress in line with the goals, targets, milestones and priorities of the Global vector control response 2017–2030.

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

Special Programme for Research and Training in Tropical Diseases (known as TDR) 2023: Investigating the links between vector-borne diseases, people, ecology and the environment in selected settings [website] (51) – This online platform highlights TDR’s research into vector-borne diseases, vector control and insecticide resistance, among others, as well as focusing on multisectoral approaches and vulnerable and hard-to-reach populations.

WHO 2021: Guidance framework for testing genetically modified mosquitoes, second edition (52) – This framework is intended to foster quality and consistency in procedures for testing genetically modified mosquitoes, which will contribute to the comparability of results and credibility of conclusions to support decision-making by those considering using these mosquitoes as a public health tool to control mosquito-borne diseases.

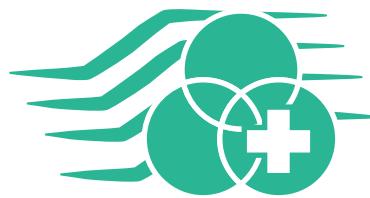
WHO 2020: Incorporating intersectional gender analysis into research on infectious diseases of poverty: a toolkit for health researchers (53) – This toolkit aims to strengthen the capacity of researchers working on infectious diseases of poverty by incorporating an intersectional gender analysis approach.

WHO and TDR 2019: Operationalizing a One Health approach building on the TDR-IDRC research initiative on vector-borne diseases in the context of climate change (54) – This report identifies gaps and capacity-strengthening opportunities for operationalizing and implementing One Health in line with the TDR-International Centre for Research and Development’s research initiative for vector-borne diseases and climate change.

WHO and TDR 2016: Technical handbook for dengue surveillance, dengue outbreak prediction/detection and outbreak response (55) – This is an evidence-based handbook to aid in the early detection and management of dengue fever outbreaks.

WHO 2013: Larval source management: a supplementary malaria vector control measure (56) – This operational manual is targeted primarily to staff in national malaria control programmes as well as field personnel engaged in controlling mosquito breeding sites. It provides recommendations about selecting larval control interventions as well as for planning and managing larval control programmes.

8.3 One Health



Overview

While economic development has often improved human lives, rapid and unsustainable economic growth causes significant damage to the ecosystems on which human health crucially depends. Large-scale deforestation and land-use changes have led to massive loss of biodiversity, imbalanced ecosystems and increased risks to human health. A healthy environment is fundamental to the health and well-being of humans, animals and plants. These all are considered in the One Health approach, which is a holistic way of addressing public health challenges at the human-animal-plant-environment interface. The One Health approach emphasizes the importance of multisectoral and multidisciplinary collaboration, which includes considering public health, animal health and environmental health, to combat health risks and achieve meaningful results. The relevance of this approach has been identified in specific areas such as food safety, control of zoonotic and neglected tropical diseases, laboratory services, environment and health, and efforts to reduce antimicrobial resistance (AMR). For example, the emergence and increased risk of zoonotic diseases (i.e. those that spread from animals to humans), such as Ebola virus, COVID-19, Zika virus and avian influenza, has highlighted the need for closer collaboration between the animal and human health sectors.

Anthropogenic stressors – such as changes in land use, declines in biodiversity, and the effects of climate change and increased pollution – emphasize the importance of the environment as a key component of the One Health approach (58).

One Health is defined as an integrated, unifying approach that aims to sustainably balance and optimize the health of humans, animals, plants and ecosystems. It recognizes that the health of humans, animals, plants and the wider environment (including ecosystems) is closely linked and interdependent. The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing collective needs for clean water, energy and air; safe and nutritious food; to take action on climate change; and to contribute to sustainable development (59).

A few examples of One Health issues and interventions include the following.

- Animals are used as sentinels for the early detection of pathogens; for example, in the United States, flocks of poultry are used as sentinels to detect West Nile Virus (58).
- In Chad, vaccination coverage was improved among hard-to-reach nomadic, pastoralist communities by combining livestock vaccination and veterinary care with childhood vaccination campaigns. In this way, the programme's costs were also reduced by up to 15% as a result of sharing logistics that included personnel, transport and the cold chain (60).
- A significant portion of pharmaceuticals and their by-products are discharged into freshwater bodies from untreated wastewater, as are effluents from wastewater treatment plants and direct discharges related to animal or aquaculture use. Polluted waterways harbour microorganisms and provide a favourable environment for the development of AMR. Pharmaceutical wastes are also harmful to aquatic animals. Creating awareness among medical and veterinary doctors, pharmacists and the general public can help reduce the use of unnecessary pharmaceuticals and ensure that hospital and household pharmaceutical waste is disposed of appropriately (61, 62).

The Guidance table provides an overview of the most relevant advice from WHO and other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
One Health capacities: policies and actions				
1. Strengthen political commitments to and increase financial investments in developing and delivering a One Health approach (59).	 Finance  Environment  Health	National	Governance	B, C
2. Involve all relevant stakeholders, including indigenous and local communities, in the design, implementation and review of One Health interventions and policies (63).	 Environment  Health	National	Governance	B, C
3. Innovate and scale up One Health initiatives and networks (64).	 Environment  Health	National; community Universal health coverage	Assessment and surveillance	B
4. Evaluate the costs and benefits of the health, environmental and socioeconomic components of One Health interventions (59).	 Finance  Environment  Health	National; community	Assessment and surveillance	B, C
5. Invest in research and ensure data are shared across the public health, veterinary services and environmental sectors (59). Points to consider include collecting data: <ul style="list-style-type: none">• to detect, respond to and prevent disease outbreaks (64);• to understand the prevalence of AMR in humans, animals and plants as well as its economic burden (65);• for surveillance of foodborne diseases and food contamination (59).	 Finance  Environment  Health  Food	National; community Universal health coverage	Governance; assessment and surveillance	B, C
Zoonotic and vector-borne diseases: policies and actions				
6. Strengthen the control and prevention of both emerging and endemic zoonotic, neglected tropical and vector-borne diseases by using a One Health approach (59). Selected examples include: <ul style="list-style-type: none">• conducting joint risk assessments and mapping human, animal and environmental health;• identifying and prioritizing targeted, evidence-based interventions at higher levels of decision-making;• strengthening national and regional detection of diseases to trigger rapid action through multisectoral surveillance and early warning and response systems.	 Health  Environment	National; community Universal health coverage	Governance; other management and control; assessment and surveillance	B, C

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
Antimicrobial resistance: policies and actions				
7. Use a One Health approach to implement national AMR action plans (59). For example, integrate environmental considerations into national AMR action plans and integrate AMR into environmental-related plans, such as national plans aimed at addressing chemical pollution, waste management, biodiversity and planning for climate change (62).	 Environment  Health  Agriculture  Industry  Water/sanitation	National	Governance	B, C
8. Implement integrated surveillance of AMR and antimicrobial use, and improve reporting, surveillance and monitoring systems (59, 62).	 Health  Agriculture	National; community Universal health coverage	Assessment and surveillance	B, C
Food safety: policies and actions				
9. Strengthen the use of the One Health approach in national food safety systems and food safety coordination (59). Points to consider include establishing or improving: <ul style="list-style-type: none">• critical infrastructure, including laboratory capacity;• food safety legislation and standards and guidelines;• surveillance of foodborne diseases and food contamination;• emergency preparedness.	 Health  Environment  Food	National	Governance; infrastructure, technology and built environment	B, C
10. Support and promote the transition to more sustainable and equitable food production and consumption (64). Some possible actions include: <ul style="list-style-type: none">• developing solutions to help food producers and retailers make it easier for consumers to choose healthier, more sustainable and local foods;• labelling locally produced foods and providing information to increase awareness about the benefits of these.	 Health  Agriculture  Food  Environment	National; community Universal health coverage	Regulation; taxes and subsidies; information, education and communication	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
Environment: policies and actions				
<p>11. Build urban resilience against environmental stressors, vulnerability and uncertainty caused by, for example, extreme weather events such as heatwaves, floods, pollution or new disease vectors, and promote healthy urban planning (64, 66).</p> <p>Healthy urban planning includes fostering healthy behaviours, for example by providing active and public transport systems that include lanes for bikes and pedestrians, biodiversity through high-quality green and blue spaces, and affordable housing.</p>	 Multiple sectors	National; community Universal health coverage	Infrastructure, technology and built environment; other management and control; assessment and surveillance; information, education and communication	B
<p>12. Protect, restore and prevent environmental and ecosystem degradation (59, 67).</p>	 Environment  Land use planning	National; community	Assessment and surveillance; regulation; taxes and subsidies	B
Capacity-building and awareness-raising				
<p>13. Assess and build institutional and workforce capacities in the One Health approach, for example in public health or veterinary services and in the environmental sector (60).</p>	 Environment  Health  Industry	National; community Universal health coverage	Assessment and surveillance; information, education and communication; infrastructure, technology and built environment	B
<p>14. Develop an interoperable One Health training programme for relevant health and environment professionals (59, 68).</p> <p>This can be done by including One Health and Planetary Health in the curricula for the medical, veterinary and environmental sectors.</p>	 Health  Environment  Education	Health care; national; community Universal health coverage	Information, education and communication	B, C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>15. Support community-centric, risk-based solutions to neglected zoonotic diseases (59).</p> <p>Selected examples of actions include (59, 64):</p> <ul style="list-style-type: none"> • identifying key risk behaviours, and levels of acceptance and feasibility of proposed mitigation measures through anthropological and participatory research; • engaging with local and indigenous communities to identify sustainable solutions to prevent and control the emergence and re-emergence of zoonotic diseases; • increasing community awareness about the identified risk factors, solutions for risk mitigation and the benefits of a healthy ecosystem to prevent the emergence and spread of zoonotic diseases. 	 Health  Environment	National; community Universal health coverage	Assessment and surveillance; information, education and communication; other management and control	B, C
<p>16. Increase community awareness about the interconnections between human, animal and environmental health to minimize risks and ensure food safety (58, 59).</p>	 Health  Environment  Food	Community Universal health coverage	Information, education and communication	B, C
<p>17. Raise awareness about healthy and sustainable food production and consumption practices (64).</p>	 Health  Agriculture  Food  Environment	National; community Universal health coverage	Information, education and communication	B
<p>18. Use effective risk communication techniques (69).</p> <p>Effective risk communication techniques entail, for example:</p> <ul style="list-style-type: none"> • recognizing and reflecting public concerns; • selecting the most appropriate channels for addressing the public; • ensuring consistent and accurate messaging from influencers; • involving the public and stakeholders and engaging in dialogue. 	 Health  Environment	National; community Universal health coverage	Information, education and communication	B

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

[Food and Agriculture Organization of the United Nations \(FAO\), UN Environment Programme \(UNEP\), WHO, World Organisation for Animal Health \(WOAH, founded as OIE\) 2022: One Health joint plan of action \(2022–2026\): working together for the health of humans, animals, plants and the environment \(58\)](#)
– This action plan has been developed by the Quadripartite Organizations – FAO, UNEP, WOAH and WHO
– in response to international requests to prevent future pandemics and to sustainably promote health through the One Health approach.

[WHO 2022: Ending the neglect to attain the Sustainable Development Goals. One Health: approach for action against neglected tropical diseases 2021–2030 \(59\)](#) – This report aims to support a range of stakeholders – including countries in which neglected tropical diseases are endemic, international organizations and non-State actors – to achieve the targets of the road map for neglected tropical diseases by using a transdisciplinary, cross-cutting One Health approach.

[WHO Regional Office for Europe 2022: A health perspective on the role of the environment in One Health \(57\)](#) – This report uses a health perspective to explore and clarify the role of the environment in the One Health approach.

[WHO Regional Office for Europe 2021: Nature, biodiversity and health: an overview of interconnections \(66\)](#) – This report provides an overview of the impacts of the natural environment on human health.

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

[WHO, FAO, OIE 2022: Surveillance and information sharing operational tool: an operational tool of the tripartite zoonoses guide \(69\)](#) – The three tools of the tripartite zoonoses guide (i.e. this surveillance tool, the multisectoral coordination mechanisms and the joint risk assessment operational tool) can be used independently or in coordinated efforts to support national capacities for preparedness and response; they ultimately link to international policies and frameworks, and support efforts for global health security. This tool supports national authorities in their efforts to establish or strengthen a multisectoral One Health coordinated surveillance and information- sharing system for zoonotic diseases.

[WHO, FAO, OIE 2022: Multisectoral coordination mechanisms operational tool: an operational tool of the tripartite zoonoses guide \(70\)](#) – The tool for multisectoral coordination mechanisms provides a standard stepwise approach that countries can use to establish or strengthen a mechanism for multisectoral One Health coordination to manage zoonotic diseases.

[WHO 2021: WHO Costing and budgeting tool for national action plans on antimicrobial resistance: user guide \(71\)](#) – This tool enables countries to budget for the activities in their national AMR action plan and identify funding gaps.

[WHO, FAO, OIE 2020: Joint risk assessment operational tool \(JRA OT\): an operational tool of the tripartite zoonoses guide. Taking a multisectoral One Health approach \(72\)](#) – The JRA OT provides risk assessment support to countries implementing the Tripartite zoonoses guide (73).

[WHO, FAO, OIE 2019: Taking a multisectoral, One Health approach: a tripartite guide to addressing zoonotic diseases in countries \(73\)](#) – This guide supports countries to take a One Health approach to address zoonotic diseases.

[WHO, FAO, OIE 2016: Antimicrobial resistance: a manual for developing national action plans \(74\)](#) – This manual assist countries during the initial phase of developing new, or refining existing, national AMR action plans in line with the strategic objectives of the Global Action Plan on Antimicrobial Resistance (76).

[United States Agency for International Development 2022: One Health workforce competency framework and evaluation toolkit \(76\)](#) – This manual was developed to promote competency-based training and evaluation for the One Health workforce by organizing current approaches, methodologies and tools into a resource library and building a framework and toolkit for assessments.

References

1. WHO manifesto for a healthy recovery from COVID-19. Geneva: World Health Organization; 2020 (<https://www.who.int/publications/m/item/who-manifesto-for-a-healthy-recovery-from-covid-19>, accessed 22 January 2024).
2. Connecting global priorities: biodiversity and human health. A state of knowledge review. Geneva: World Health Organization, Secretariat of the Convention on Biological Diversity, United Nations Environment Programme; 2015 (<https://iris.who.int/handle/10665/174012>, accessed 22 January 2024).
3. Global assessment report on biodiversity and ecosystem services. Bonn: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES); 2019 (<https://ipbes.net/global-assessment>, accessed 22 January 2024).
4. Nature, biodiversity and health: an overview of interconnections. Copenhagen: WHO Regional Office for Europe; 2021 (<https://iris.who.int/handle/10665/341376>, accessed 22 January 2024).
5. The Convention on Biological Diversity. Article 2: Use of terms [website]. Montreal: Secretariat of the Convention on Biological Diversity; 2006 (<https://www.cbd.int/convention/articles/?a=cbd-02>, accessed 22 January 2024).
6. The 17 Sustainable Development Goals [website]. New York: United Nations, Department of Economic and Social Affairs; 2024 (<https://sdgs.un.org/goals>, accessed 22 January 2024).
7. Strategic Plan for Biodiversity 2011–2020, including Aichi Biodiversity Targets [website]. Montreal: Secretariat of the Convention on Biological Diversity; 2020 (<https://www.cbd.int/sp/>, accessed 22 January 2024).
8. Quick guides for the Aichi Biodiversity Targets [website]. Montreal: Secretariat of the Convention on Biological Diversity; 2013 (<https://www.cbd.int/nbsap/training/quick-guides/>, accessed 22 January 2024).
9. Decision adopted by the Conference of the Parties to the Convention on Biological Diversity: 15/4. Kunming-Montreal Global Biodiversity Framework. Montreal: Secretariat of the Convention on Biological Diversity; 2022 (<https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf>, accessed 22 January 2024).
10. The biodiversity plan for life on Earth: 2030 Targets (with guidance notes) [website]. Montreal: Secretariat of the Convention on Biological Diversity; 2024 (<https://www.cbd.int/gbf/targets/>, accessed 22 January 2024).
11. What is an NBSAP? [website]. Montreal: Secretariat of the Convention on Biological Diversity; 2023 (<https://www.cbd.int/nbsap/introduction.shtml>, accessed 22 January 2024).
12. Pascual U, Balvanera P, Christie M, Baptiste B, González-Jiménez D, Anderson CB, et al, editors. Summary for policymakers of the methodological assessment of the diverse values and valuation of nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Bonn: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES); 2022 (<https://doi.org/10.5281/zenodo.6522392>, accessed 22 January 2024).
13. Pörtner HO, Scholes RJ, Agard J, Archer E, Arneth A, Bai X, et al. IPBES–IPCC co-sponsored workshop report on biodiversity and climate change. Bonn: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES); 2021 (https://www.ipbes.net/sites/default/files/2021-06/20210609_workshop_report_embargo_3pm_CEST_10_june_0.pdf, accessed 24 January 2024).
14. Health, environment and climate change: human health and biodiversity. Report by the Director-General. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/276341>, accessed 22 January 2024).
15. Becoming #GenerationRestoration: ecosystem restoration for people, nature and climate. Nairobi: United Nations Environment Programme; 2021 (<https://www.unep.org/resources/ecosystem-restoration-people-nature-climate>, accessed 22 January 2024).
16. Guidance on mainstreaming biodiversity for nutrition and health. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/351047>, accessed 22 January 2024).
17. Fromentin JM, Emery MR, Donaldson J, Danner MC, Hallosserie A, Kieling D, et al., editors. The thematic assessment report on the sustainable use of wild species: summary for policymakers. Bonn: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES); 2022 (<https://doi.org/10.5281/zenodo.6425599>, accessed 22 January 2024).
18. A multi-billion-dollar opportunity: repurposing agricultural support to transform food systems. Rome: Food and Agriculture Organization of the UN, UN Development Programme, UN Environment Programme; 2021 (<https://doi.org/10.4060/cb6562en>, accessed 22 January 2024).
19. Access and benefit-sharing (ABS): access to genetic resources and the fair and equitable sharing of benefits arising from their utilization. Montreal: Secretariat of the Convention on Biological Diversity; 2020 (<https://www.cbd.int/abs/doc/protocol/factsheets/abs-en.pdf>, accessed 22 January 2024).
20. NBSAP Forum: supporting the world to implement the Kunming-Montreal Global Biodiversity Framework [website]. Montreal: Secretariat of the Convention on Biological Diversity, United Nations Environment Programme; 2024 (<https://www.learningfornature.org/en/nbsap-forum/#e-learning>, accessed 22 January 2024).
21. Assessing the value of urban green and blue spaces for health and well-being. Copenhagen: WHO Regional Office for Europe; 2023 (<https://iris.who.int/handle/10665/367630>, accessed 22 January 2024).
22. Annex 1: Guidance for revising or updating National Biodiversity Strategies and Action Plans to align with the Kunming-Montreal Global Biodiversity Framework. Montreal: Secretariat of the Convention on Biological Diversity; 2022 ([https://www.cbd.int/doc/nbsap/Annex%201%20\(NBSAP%20guidance\).pdf](https://www.cbd.int/doc/nbsap/Annex%201%20(NBSAP%20guidance).pdf), accessed 22 January 2024).
23. Decision adopted by the Conference of the Parties to the Convention on Biological Diversity: 15/5. Monitoring framework for the Kunming-Montreal Global Biodiversity Framework. Montreal: Secretariat of the Convention on Biological Diversity; 2022 (<https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-05-en.pdf>, accessed 22 January 2024).
24. Green and blue spaces and mental health: new evidence and perspectives for action. Geneva: WHO Regional Office for Europe; 2021 (<https://iris.who.int/handle/10665/342931>, accessed 22 January 2024).
25. NBSAP capacity building modules [website]. Montreal: Secretariat of the Convention on Biological Diversity; 2021 (<https://www.cbd.int/nbsap/training/>, accessed 22 January 2024).

26. Global environment outlook 6. Nairobi: United Nations Environment Programme; 2019 (<https://www.unenvironment.org/resources/global-environment-outlook-6>, accessed 22 January 2024).
27. Vector-borne diseases: key facts [website]. Geneva: World Health Organization; 2020 (<https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases>, accessed 30 October 2023).
28. Global vector control response: an integrated approach for the control of vector-borne diseases. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/275708>, accessed 30 October 2023).
29. Global vector control response 2017–2030. Geneva: World Health Organization; 2017 (<https://iris.who.int/handle/10665/259205>, accessed 25 August 2023).
30. Global strategic framework for integrated vector management. Geneva: World Health Organization; 2004 (<https://apps.who.int/iris/handle/10665/68624>, accessed 30 October 2023).
31. A toolkit for integrated vector management in sub-Saharan Africa. Geneva: World Health Organization; 2016 (<https://apps.who.int/iris/handle/10665/250267>, accessed 30 October 2023).
32. Keeping the vector out: housing improvements for vector control and sustainable development. Geneva: World Health Organization; 2017 (<https://iris.who.int/handle/10665/259404>, accessed 30 August 2023).
33. Environmental management for vector control: fourth report of the WHO Expert Committee on Vector Biology and Control. Geneva: World Health Organization; 1980 (<https://apps.who.int/iris/handle/10665/41404>, accessed 30 October 2023).
34. Manual on environmental management for mosquito control: with special emphasis on malaria vectors. Geneva: World Health Organization; 1982 (<https://apps.who.int/iris/handle/10665/37329>, accessed 30 October 2023).
35. Global health estimates: life expectancy and leading causes of death and disability. In: The Global Health Observatory [website]. Geneva: World Health Organization; 2019 (<https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates>, accessed 14 August 2023).
36. Framework for a national vector control needs assessment. Geneva: World Health Organization; 2017 (<https://iris.who.int/handle/10665/259405>, accessed 30 October 2023).
37. Multisectoral approach to the prevention and control of vector-borne diseases: a conceptual framework. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/331861>, accessed 28 August 2023).
38. Water, sanitation and hygiene for accelerating and sustaining progress on neglected tropical diseases: a global strategy 2015–2020. Geneva: World Health Organization; 2015 (<https://iris.who.int/handle/10665/182735>, accessed 30 October 2023).
39. Malaria: key facts [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/news-room/fact-sheets/detail/malaria>, accessed 29 August 2023).
40. Global Malaria Programme: vector control [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/teams/global-malaria-programme/prevention/vector-control>, accessed 29 August 2023).
41. WHO Guidelines for malaria: 16 October 2023. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/373339>, accessed 17 October 2023).
42. Global framework for the response to malaria in urban areas. Geneva: World Health Organization, UN-Habitat; 2022 (<https://unhabitat.org/global-framework-for-the-response-to-malaria-in-urban-areas>, accessed 12 October 2023).
43. Handbook for integrated vector management. Geneva: World Health Organization; 2012 (<https://apps.who.int/iris/handle/10665/44768>, accessed 30 October 2023).
44. WHO initiative to stop the spread of *Anopheles stephensi* in Africa: 2023 update. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/372259>, accessed 16 October 2023).
45. Malaria: the spread of *Anopheles stephensi* in Africa [video]. Geneva: World Health Organization; 2023 (<https://www.youtube.com/watch?v=uq7Sq7-qpKk>, accessed 16 October 2023).
46. Vector alert: *Anopheles stephensi* invasion and spread in Africa and Sri Lanka, 27 January 2023. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/365710>, 16 October 2023).
47. Dengue and severe dengue: key facts [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue>, accessed 29 August 2023).
48. Guidance framework for testing the sterile insect technique as a vector control tool against *Aedes*-borne diseases. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/331679>, accessed 29 August 2023).
49. Dengue: guidelines for diagnosis, treatment, prevention and control. Geneva: World Health Organization, Special Programme for Research and Training in Tropical Diseases (TDR); 2009 (<https://iris.who.int/handle/10665/44188>, accessed 30 October 2023).
50. WHO Guidelines for malaria – 16 October 2023 [online database]. Geneva: World Health Organization; 2023 (<https://app.magicapp.org/#/guideline/7661>, accessed 30 October 2023).
51. Investigating the links between vector-borne diseases, people, ecology and the environment in selected settings [website]. Geneva: World Health Organization, Special Programme for Research and Training in Tropical Diseases (TDR); 2023 (<http://vbd-environment.org/>, accessed 29 August 2023).
52. Guidance framework for testing genetically modified mosquitoes, second edition. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/341370>, accessed 29 August 2023).
53. Incorporating intersectional gender analysis into research on infectious diseases of poverty: a toolkit for health researchers. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/334355>, accessed 29 August 2023).
54. Operationalizing a One Health approach building on the TDR–IDRC research initiative on vector-borne diseases in the context of climate change. Geneva: World Health Organization, Special Programme for Research and Training in Tropical Diseases (TDR); 2019 (<https://tdr.who.int/activities/one-health-and-vector-borne-diseases>, accessed 29 August 2023).
55. Technical handbook for dengue surveillance, dengue outbreak prediction/detection and outbreak response (“model contingency plan”). Geneva: World Health Organization, Special Programme for Research and

- Training in Tropical Diseases (TDR); 2016 (<https://iris.who.int/handle/10665/250240>, accessed 30 October 2023).
56. Larval source management: a supplementary malaria vector control measure. An operational manual. Geneva: World Health Organization; 2013 (<https://iris.who.int/handle/10665/85379>, accessed 30 October 2023).
 57. A health perspective on the role of the environment in One Health. Copenhagen: WHO Regional Office for Europe; 2022 (<https://iris.who.int/handle/10665/354574>, accessed 10 August 2023).
 58. One health joint plan of action (2022–2026): working together for the health of humans, animals, plants and the environment. Rome: Food and Agriculture Organization of the UN, UN Environment Programme, World Health Organization, World Organisation for Animal Health; 2022 (<https://doi.org/10.4060/cc2289en>, accessed 10 August 2023).
 59. Ending the neglect to attain the sustainable development goals. One Health: approach for action against neglected tropical diseases 2021–2030. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/351193>, accessed 10 August 2023).
 60. Vieno N, Hallgren P, Wallberg P. Pharmaceuticals in the aquatic environment of the Baltic Sea region: a status report. Paris: United Nations Educational, Scientific and Cultural Organization, International Hydrological Programme; 2017 (<https://unesdoc.unesco.org/ark:/48223/pf0000260743>, accessed 10 August 2023).
 61. Bracing for superbugs: strengthening environmental action in the One Health response to antimicrobial resistance. Nairobi: United Nations Environment Programme; 2023 (<https://www.unep.org/resources/superbugs/environmental-action>, accessed 10 August 2023).
 62. Convention on Biological Diversity: guidance on integrating biodiversity considerations into One Health approaches. New York, Nairobi: United Nations, United Nations Environment Programme; 2017 (<https://www.cbd.int/doc/c/501c/4df1/369d06630c901cd02d4f99c7/sbstta-21-09-en.pdf>, 10 August 2023).
 63. Annual business meeting and technical conference 2022. Local-level policy recommendations: operationalizing a One Health approach. Political statement of the WHO European Healthy Cities Network. Copenhagen: WHO Regional Office for Europe; 2023 (<https://iris.who.int/handle/10665/366322>, accessed 10 August 2023).
 64. Antimicrobial resistance and the United Nations sustainable development cooperation framework: guidance for United Nations country teams. Geneva: World Health Organization, Food and Agriculture Organization of the UN, World Organisation for Animal Health, UN Environment Programme; 2021 (<https://iris.who.int/handle/10665/346658>, accessed 10 August 2023).
 65. Urban planning for resilience and health: key messages – summary report on protecting environments and health by building urban resilience. Copenhagen: WHO Regional Office for Europe; 2022 (<https://apps.who.int/iris/handle/10665/355760>, accessed 14 August 2023).
 66. Nature, biodiversity and health: an overview of interconnections. Copenhagen: WHO Regional Office for Europe; 2021 (<https://iris.who.int/handle/10665/341376>, accessed 14 August 2023).
 67. Bhatia R. National framework for One Health. New Delhi: Food and Agriculture Organization of the UN; 2021 (<https://www.fao.org/3/cb4072en/cb4072en.pdf>, accessed 10 August 2023).
 68. Effective risk communication for environment and health: a strategic report on recent trends, theories and concepts]. Copenhagen: WHO Regional Office for Europe; 2021 (<https://apps.who.int/iris/handle/10665/349338>, accessed 15 August 2023).
 69. Surveillance and information sharing operational tool: an operational tool of the tripartite zoonoses guide. Geneva: World Health Organization, Food and Agriculture Organization of the UN, World Organisation for Animal Health; 2022 (<https://iris.who.int/handle/10665/361443>, accessed 10 August 2023).
 70. Multisectoral coordination mechanisms operational tool: an operational tool of the tripartite zoonoses guide. Geneva: World Health Organization, Food and Agriculture Organization of the UN, World Organisation for Animal Health; 2022 (<https://iris.who.int/handle/10665/359001>, accessed 10 August 2023).
 71. WHO costing and budgeting tool for national action plans on antimicrobial resistance: user guide. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/346344>, accessed 10 August 2023).
 72. Joint risk assessment operational tool (JRA OT): an operational tool of the tripartite zoonoses guide. Taking a multisectoral, One Health approach: a tripartite guide to addressing zoonotic diseases in countries. Geneva: World Health Organization, Food and Agriculture Organization of the UN, World Organisation for Animal Health; 2020 (<https://iris.who.int/handle/10665/340005>, accessed 10 August 2023).
 73. Taking a multisectoral, One Health approach: a tripartite guide to addressing zoonotic diseases in countries. Geneva: World Health Organization, Food and Agriculture Organization of the UN, World Organisation for Animal Health; 2019 (<https://iris.who.int/handle/10665/325620>, accessed 27 October 2023).
 74. Antimicrobial resistance: a manual for developing national action plans. Geneva: World Health Organization; Food and Agriculture Organization of the United Nations, World Organisation for Animal Health; 2016 (<https://iris.who.int/handle/10665/204470>, accessed 10 August 2023).
 75. Global Action Plan on Antimicrobial Resistance. Geneva: World Health Organization; 2015 (<https://iris.who.int/handle/10665/193736>, accessed 27 October 2023).
 76. Getachew K, Raether C, Rabkin M, Tsioris F, Michaels-Strasser S. One Health workforce competency framework and evaluation toolkit. Washington (DC): United States Agency for International Development; 2022 (https://s3.us-east-1.wasabisys.com/owha-sample-bucket/2022/01/One-Health-Competency-Framework-Toolkit-Manual_Version-II_-_August-2022.pdf, accessed 10 August 2023).



9. Safe environments and mobility

9.1 Introduction

Sustainable transport and mobility systems in this section refer to systems that are multi-modal which support walking, cycling, other forms of active transport and mobility (e.g. such as skating, wheelchairs), as well as public transport in addition to private vehicles.

Interventions towards sustainable transport and mobility systems are aimed at reducing road traffic fatalities and injuries while at the same time improving people's health and well-being, protecting the environment and address climate change. They often have broad impacts, and would therefore be relevant for other sections of this compendium as well.

9.2 Environments for safe and sustainable transport, active mobility and physical activity



Comprehensive guidance on this topic beyond health and the environment can be found elsewhere.⁹



Overview

Systems of mobility that include public transport and infrastructure for cycling and walking can contribute to increasing levels of physical activity. Regular physical activity has significant health benefits for hearts, bodies and minds. These include improved muscular and cardiorespiratory fitness, improved bone and functional health, and weight control, and reduced risks for noncommunicable diseases, such as cardiovascular diseases, cancer and diabetes, and falls and fractures. Regular physical activity also improves mental and cognitive health and is recommended for people of all ages and abilities (1). Encouraging and enabling regular physical activity requires adequate provision of, and equitable access to, supportive environments that encourage participation in walking, cycling, sports, active recreation and play by people of all abilities (2).

Transport can also affect health and health equity by enabling and facilitating access to education, decent jobs, health care, leisure activities and clean water. Road infrastructure and urban design can affect social interactions within neighbourhoods while also discouraging motorized transport and slowing the impact of climate change (3).

Road traffic accidents kill around 1.2 million people per year (2021 data); pedestrians, cyclists and motorcyclists in low- and middle-income countries are disproportionately affected (4–6). More cycling and walking tend to lead to fewer road traffic accidents as motorists become sensitized to the presence of non-motorized traffic and to sharing the road. Increased road safety and the provision of public and green spaces can enable and motivate people to walk and cycle more, especially for short trips. Less motorized traffic also reduces air pollution, noise and carbon emissions (3).

As the majority of the world's population is living in urban areas (7), cities have a particular responsibility and opportunity to improve urban design and transport systems to support increasing levels of walking and cycling. Affordable and accessible transport systems and the development of sustainable community infrastructure are, however, equally relevant for periurban and rural areas.

⁹ For additional information, see WHO's guidance on physical activity (<https://www.who.int/health-topics/physical-activity>), road traffic injuries (<https://www.who.int/health-topics/road-safety>) and urban health (<https://www.who.int/health-topics/urban-health>).

How do we assess safe environments for, and levels of, physical activity in my country?

For country assessment of population levels of physical activity in adults, the WHO STEPS approach (8) includes the Global Physical Activity Questionnaire (9). This collects data about physical activity undertaken across three domains during the past week: transport (which is defined as walking and cycling), work (paid and unpaid, and household chores), and recreation, leisure or sport. The Global Physical Activity Questionnaire provides measures of the prevalence of, and time spent, walking and cycling during the past week.

Countries may have their own similar health surveillance system with questions about physical activity; however, these do not always separate measures of walking and cycling from total physical activity or may not include walking and cycling for transport. For example, some countries assess only “sports participation”.

For children, there are school-based instruments that collect data about physical activity, and these can also include questions about travel to and from school by walking and cycling. The Global School-based Student Health Survey (10) and the Health Behaviour in School-aged Children study (11) are two widely used instruments and protocols.

Personal transportation surveys, usually conducted by ministries of transport or similar agencies, can also collect data about walking and cycling trips. The questions and data reporting vary between countries, and there is no global standardized reporting available. Nonetheless, usually data are presented as the proportion of trips by mode of travel that can be tracked over time and assessed by setting (e.g. urban, rural) and by categories of trip length.

Urban design for safe walking and cycling can be assessed using the road safety assessments and criteria set for roads achieving at least a 3-star rating (of a 5-star maximum) (12) for each road user (i.e. for pedestrians, cyclists and users of public transit). New roads and urban infrastructure can be assessed during the approval process for a development plan. Both approaches are recommended as part of the Decade of Action for Road Safety 2021–2030, the Global Action Plan on Physical Activity 2018–2030 and the WHO ACTIVE technical guidance toolkit to increase physical activity (2, 13, 14).

Countries can monitor their progress towards key Sustainable Development Goals (SDGs) to which active mobility and physical activity contribute (15). These include the following.

SDG 3: Ensure healthy lives and promote well-being for all at all ages.

- Indicator 3.4.1: mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease.
- Indicator 3.6.1: death rate due to road traffic injuries.

SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable.

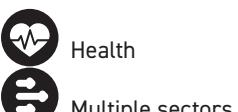
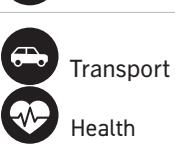
- Indicator 11.2.1: proportion of population that has convenient access to public transport, by sex, age and persons with disabilities.
- Indicator 11.7.1: average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities.

Other SDGs that are directly or indirectly transport-related include, for example, SDG 7, Ensure access to affordable, reliable, sustainable and modern energy for all; SDG 9, Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation; and SDG 13, Take urgent action to combat climate change and its impacts. In addition, SDG indicator 3.9.1 monitors mortality due to air pollution.

What do we want to achieve?	<p>Shift more passenger and freight travel to more environmentally friendly and active modes (e.g. walking, cycling and clean public and freight transport) together with improving the energy efficiency of all motorized transport (private and public) through the use of low-carbon fuel and vehicle technologies (3, 16).</p> <p>Reduce both passenger trips and freight movement by motorized transport by redesigning regional development policies, integrating transport and spatial planning, and implementing travel demand management (17, 18).</p> <p>Investing in transport and mobility systems that take into consideration the underlying social and environmental determinants of health can also help to ensure equitable access to mobility and reduce disparities. For instance, improving mobility for women, children, older people and people with limited financial resources also enhances health equity (3, 16, 17).</p> <p>People of all ages and abilities need equitable access to safe and appropriate places and spaces in their cities and communities in which they can engage in regular physical activity. In addition, people need to know and understand the multiple benefits of regular physical activity, and these can be communicated through regular community-wide campaigns and education (2).</p> <p>WHO recommends that all children and adolescents achieve at least 60 minutes of moderate- to vigorous-intensity physical activity at least 3 days a week. Adults should do at least 150 minutes of moderate-intensity physical activity or do at least 75 minutes of vigorous-intensity physical activity throughout the week. Both age groups should reduce the amount of time they are sedentary, and doing some physical activity is better than doing none. More detailed recommendations about physical activity are provided in the <i>WHO guidelines on physical activity and sedentary behaviour</i> (19).</p> <p>Road traffic crashes and road injuries and fatalities can be reduced, for example by developing, implementing and enforcing a safe systems approach that places the focus on the design of the system rather than on the behaviour of road users. Special attention needs to be paid to how systems that are poorly designed put road users such as walkers and cyclists in positions of vulnerability and the ways in which they can be amended (14).</p>
------------------------------------	--

The Guidance table provides an overview of the most relevant advice from WHO or other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
Governance: policies and actions				
1. Strengthen and support implementation of the Health in All Policies (or HiAP) approach at the national and subnational levels (2, 20, 21) (see also Section 13.2 Health in All Policies).	 Health  Multiple sectors	National	Governance	B
2. Build partnerships between the health sector and other relevant sectors, such as transport and urban planning (2, 17).	 Health  Transport  Multiple sectors	National	Governance	B, C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>3. Support the effective engagement and direct participation of communities in planning and policy development (2, 17).</p>	 Health Multiple sectors	Community; national Universal health coverage	Governance	B, C
<p>4. Conduct health, economic and environmental assessments of future and existing policies and interventions (2, 22–24).</p>	 Health Environment Finance Multiple sectors	National; community Universal health coverage	Assessment and surveillance	B
Road safety: policies and actions				
<p>5. Develop or update national strategies, policies and actions to improve road safety, especially the safety of pedestrians and cyclists and other vulnerable groups, such as children and older people (2, 14).</p>	 Transport Health Multiple sectors	National	Regulation	B
<p>6. Establish a lead agency for road safety (14).</p>	 Transport Health	National	Governance	B
<p>7. Monitor road traffic deaths, injuries and crashes; risks, such as alcohol or drug intake of drivers; and protective factors, such as average speed, rates of helmet and seat-belt use and use of child restraint systems (14).</p>	 Transport Health	National; community Universal health coverage	Assessment and surveillance	B
<p>8. Implement interventions to improve road safety with particular focus on pedestrians and cyclists (2, 3, 25). Selected key interventions include the following.</p> <ul style="list-style-type: none"> • Provide sidewalks and dedicated cycle lanes to separate pedestrians and cyclists from motor traffic. • Provide crossing enhancements for pedestrians and cyclists. • Improve walking and cycling infrastructure around educational facilities, public open and green spaces, sports and leisure facilities, and public transport hubs. • Implement and enforce traffic speed limits and other traffic-calming interventions, such as road-narrowing measures. • Implement regulations to redistribute the impact of motorized vehicles, such as car-free zones; identify hazardous road locations and take corrective measures. <p>These engineering interventions need to be accompanied by education and enforcement of, for example, traffic laws and vehicle safety standards.</p>	 Transport Health	National; community Universal health coverage	Infrastructure, technology and built environment; other management and control	B

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
Infrastructure development, transport and mobility: policies and actions				
9. Develop or update policies and actions that promote walking, cycling and non-motorized transport (2, 13, 17).	 Transport  Land use planning	National; community	Governance	B, C
10. Prioritize active and sustainable mobility as the preferred mode of travel in relevant transport, spatial and urban planning policies (2, 17).	 Transport  Land use planning	National; community	Governance	B, C
11. Ensure transport and urban planning policies are integrated and deliver highly connected, mixed-use and compact neighbourhoods that promote and prioritize active mobility (2, 3, 16). This integration includes street design and urban development regulations that promote neighbourhoods offering pedestrian and bicycle access to shops and services, green areas, and health care and educational facilities. It also includes trip-end facilities (e.g. safe parking for bikes or facilities for changing clothes and showering at workplaces) that encourage active mobility.	 Transport  Land use planning  Multiple sectors	National; community	Governance	B
12. Ensure the provision of walking and cycling infrastructure on all streets designed for use by pedestrians and cyclists, according to best practice street design standards and guidelines (2, 3). This infrastructure may include adequate sidewalk widths and bike lanes (which should be highly connected, direct, safe and comfortable), adequate physical separation between the different transport modes, and the provision of enough space for pedestrians and cyclists, who should be prioritized. Also, the speed of vehicles should be reduced when the physical separation of transportation modes is not possible. Tactical urbanism – which uses a broad range of temporary and typically low-cost ad-hoc measures for changing the urban built environment – could also be used to calm traffic and make road space more liveable (3).	 Transport  Land use planning	National; community	Infrastructure, technology and built environment	B, C
13. Redistribute space from private motorized transport to support active and more sustainable modes of transport (2, 3).	 Transport  Land use planning	National; community	Infrastructure, technology and built environment	B
14. Restrict car parking options for private vehicles to provide more public open and green spaces (2, 3).	 Transport  Land use planning	National; community	Infrastructure, technology and built environment	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>15. Implement proactive urban planning policies, building design and crime prevention strategies to increase access to and use of green infrastructure and safe public spaces, and to increase active and sustainable mobility (3, 17, 26).</p>	 <ul style="list-style-type: none"> Transport Land use planning Housing Construction 	National; community	Infrastructure, technology and built environment	B, C
<p>16. Ensure access to good-quality public and green open spaces for people of all ages and abilities that include safe play areas and sports and recreational spaces for children and young people (2, 26, 27).</p>	 <ul style="list-style-type: none"> Land use planning Sports and leisure 	National; community	Infrastructure, technology and built environment	B
<p>17. Support people to be physically active through implementing appropriate building design and standards, particularly for all public buildings, and for education and day care facilities (2).</p> <p>Selected proposed actions include:</p> <ul style="list-style-type: none"> • ensuring prioritized building access for pedestrians, cyclists and those arriving by public transport; • providing clean, accessible and safe stairways; • providing access to public open space; • limiting car parking options; • ensuring adequate provision of end-of-trip facilities, such as secure bicycle parking, locker facilities and showers and changing rooms. 	 <ul style="list-style-type: none"> Construction 	National; community	Infrastructure, technology and built environment	B
<p>18. Promote walking and cycling through free and accessible public events that foster the use of active mobility and green spaces, such as by regularly closing road networks to motorized vehicles and implementing walk or cycle to school or work programmes (2, 3, 13).</p>	 <ul style="list-style-type: none"> Health Environment Land use planning 	Community Universal health coverage	Other management and control	B
<p>19. Conduct economic assessments of walking and cycling infrastructure and all developments using the Health Economic Assessment Tool (known as HEAT) (23).</p>	 <ul style="list-style-type: none"> Health Environment Finance Multiple sectors 	National; community Universal health coverage	Assessment and surveillance	B
<p>Awareness-raising and capacity-building</p> <p>20. Conduct public campaigns to increase safe behaviours by road users, such as the use of seat belts and helmets, and to reduce risky behaviours, such as speeding, drink-driving and the use of mobile devices (2, 25, 28).</p>	 <ul style="list-style-type: none"> Health Transport 	Community; national Universal health coverage	Information, education and communication	B, C

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments	Category of evidence
21. Raise awareness about the health benefits and the social, economic and environmental co-benefits of increased walking, cycling and other forms of active mobility (2, 19, 23).	 Health  Environment	Community; national Universal health coverage	Information, education and communication	A, B
22. Train professionals from different sectors, such as health, education, transport and urban planning, about the health, social, economic and environmental co-benefits of physical activity, and particularly of more walking, cycling and other forms of active mobility (2).	 Health  Environment	Community; national Universal health coverage	Information, education and communication	B
23. Conduct community surveys about perceptions of road safety, walking and cycling to raise awareness of potential obstacles to making changes and promote community discussion to determine solutions (13).	 Health  Environment	Community; national Universal health coverage	Information, education and communication; assessment and surveillance	B

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

WHO 2023: Pedestrian safety: a road safety manual for decision-makers and practitioners, second edition (25) – This manual provides information about the magnitude of pedestrian deaths and injuries; key risk factors for injuries and deaths; how to assess pedestrian safety in a country or area and prepare an action plan; and how to select, design, implement and evaluate effective interventions.

WHO Regional Office for Europe 2022: Walking and cycling: latest evidence to support policy-making and practice (3) – This publication presents a comprehensive case for why and how to promote walking and cycling, based on the latest evidence from scientific research and planning practice.

WHO 2021: Global Plan for the Decade of Action for Road Safety 2021–2030 (14) – This guidance document supports the implementation of the Decade of Action 2021–2030 and its objectives.

WHO 2020: WHO Guidelines on physical activity and sedentary behaviour (19) – These guidelines provide evidence-based public health recommendations for children, adolescents, adults and older adults about the amount of physical activity (e.g. frequency, intensity and duration) required to obtain significant health benefits and mitigate health risks.

WHO 2018: Global Action Plan on Physical Activity 2018–2030: more active people for a healthier world (2) – This Global Action Plan responds to the requests made by countries for updated guidance and a framework for effective and feasible policy actions to increase physical activity at all levels.

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

WHO 2022: The PEP: building forward better by transforming to new, clean, safe, healthy and inclusive mobility and transport (29) – The PEP – the Transport, Health and Environment Pan-European Programme – is the first and only international programme designed to integrate environmental and health considerations into transport, mobility and urban planning policies.

[WHO 2022: Global status report on physical activity 2022](#) (30) – This first global status report on physical activity charts progress made by countries in implementing recommendations from WHO's Global Action Plan on Physical Activity 2018–2030, which aims to achieve the global target of a 15% relative reduction in the prevalence of physical inactivity by 2030.

[UN-Habitat 2022: Why infrastructure matters: active mobility, public transport, and economic growth in African cities](#) (31) – This study explores the benefits that can accrue when cities prioritize active mobility and public transport. It quantifies the benefits of walking, cycling and public transport in Africa, comparing alternative investment scenarios for the 188 largest African cities.

[UN-Habitat and UN Environment Programme 2022: Walking and cycling in Africa: evidence and good practice to inspire action](#) (32) – This report emphasizes the importance of prioritizing the safety, health and comfort of people who walk and cycle in African countries and sets out recommendations for governments and other stakeholders for retaining, enabling and protecting those who are already moving in the most sustainable way.

[WHO 2020: WHO manifesto for a healthy recovery from COVID-19](#) (33) – The manifesto describes practical steps that can be taken and that aim at creating a healthier, fairer and greener world while encouraging investment to maintain and resuscitate economies affected by the COVID-19 pandemic.

[WHO 2019: The power of cities: tackling noncommunicable diseases and road traffic injuries](#) (34) – This report describes specific areas for interventions to address noncommunicable diseases and road traffic injuries in cities, assesses internal and external drivers for tackling these issues, and discusses common challenges facing urban environments. The report is accompanied by multiple case studies.

[WHO Regional Office for Europe 2017: Towards more physical activity in cities: transforming public spaces to promote physical activity – a key contributor to achieving the Sustainable Development Goals in Europe](#) (35) – This publication provides inspiration and guidance about how different cities, in different contexts and at different stages of development, can use urban planning to encourage more physically active lifestyles for their residents.

9.3 Safe environments to prevent drownings, falls and burns



Comprehensive guidance on this topic beyond health and environment can be found elsewhere.¹⁰

9.3.1 Drownings



Overview

Drowning is a leading cause of unintentional injury and deaths worldwide and about 90% of unintentional drowning deaths occur in low- and middle-income countries (6, 36). In 2019, an estimated 236 000 people died from drowning, making drowning a major public health problem worldwide (6). Children are at increased risk of drowning and 35% of drowning deaths occurred in children aged under 15 years.

How prevalent are drownings in my country?

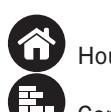
National reporting systems may capture statistics on drownings and other injuries.

Injury surveillance guidelines are available to assess data on injuries (37).

In addition, the WHO Global Health Estimates provide a comprehensive and comparable assessment of death and disability due to diseases and injuries for all WHO Member States and all WHO regions of the world (6).

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Policies and actions			
<p>1. Develop or update water safety policies. Among these are safe boating, shipping and ferry regulations, which may include (38, 39):</p> <ul style="list-style-type: none"> • establishing systems that ensure vessel safety, availability of flotation devices in boats, avoidance of overcrowding, and appropriate travel routes and rules; • laws on alcohol and drug use while boating or swimming; • occupational safety measures, such as the wearing of personal flotation devices and guard-rails, for example on commercial fishing vessels. <p>Other water safety policies may include signage and barriers for high-risk locations, risk assessments for recreational water settings (see <u>Section 3.2.2 Recreational water</u>) and water safety lessons for schools.</p>	 <p>Transport Other sectors such as health, education, migration, land use planning, construction</p>	<p>National</p>	<p>Regulation</p>

¹⁰ <https://www.who.int/health-topics/drowning>

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
2. Develop or update national water safety plans (WSPs) to build resilience and manage flood risks and other hazards (38, 39).	 Water/sanitation Environment	National	Regulation
3. Provide safe places away from water for preschool children, including (the journey to) schools, child-care settings and recreation and leisure settings (39).	 Education	Schools/child-care settings	Infrastructure, technology and built environment
4. Support safe water systems, such as drainage systems and flood control (38).	 Water/sanitation Environment	National; community	Infrastructure, technology and built environment
5. Install barriers or fencing that control access to water, such as lids or mesh covers for open wells, playpens, doorway barriers and pool fencing in the form of four-sided, child-resistant fences and self-closing gates with safety latches (39).	 Housing Construction	National; community	Infrastructure, technology and built environment
6. Create and maintain safe water zones for recreation (38).	 Land use planning	National; community	Infrastructure, technology and built environment
7. Establish supervised child-care programmes (38).	 Education	Schools/child-care settings	Other management and control
Awareness-raising and capacity building			
8. Raise awareness of drowning to highlight the particular risks of children, as well as to signpost dangerous areas and pre-position rescue equipment (38).	 Health Environment	Community; national Universal health coverage	Information, education and communication
9. Implement individual and community education programmes on drowning risks and safety regulations (38).	 Health Education	Community; national Universal health coverage	Information, education and communication
10. Implement training on basic swimming and water safety skills for school-age children (39).	 Education	Community; national	Information, education and communication
11. Train the public in safe rescue and resuscitation (38).	 Education Health	Community; national Universal health coverage	Information, education and communication
12. Raise awareness about the importance of emptying or covering standing water and containers such as wells, tanks, cisterns and baths (38).	 Health	Community; national Universal health coverage	Information, education and communication

Selected tools

WHO 2017: *Preventing drowning: an implementation guide* (39) includes a situational assessment tool.

WHO/CDC 2001: *Injury surveillance guidelines* (37)

Guidelines to assess data on injuries that will help to develop effective prevention strategies in countries.

9.3.2 Falls



Overview

Falls are the second leading cause of accidental or unintentional injury or deaths worldwide. Each year an estimated 684 000 individuals die from falls globally, the majority of which occur in low- and middle-income countries (6) (2019 data). Environmental risk factors for falls include aspects of the built environment such as poor building design, slippery floors and stairs and insufficient lighting (40).

How prevalent are falls in my country?

National reporting systems may capture statistics on falls and other injuries.

Injury surveillance guidelines are available to assess data on injuries (37).

In addition, the WHO Global Health Estimates provide a comprehensive and comparable assessment of death and disability due to diseases and injuries for all WHO Member States and all WHO regions of the world (6).

While all people who fall are at risk of injury, the age, sex and health of the individual can affect the type and severity of injury. Children and adults older than 65 years of age are among the high-risk groups, while the latter have the highest risk of death or serious injury arising from a fall, with the risk increasing with age (40).



Guidance



Sector principally involved in planning/implementation



Level of implementation



Instruments

Policies and actions

1. Develop or update housing standards and building regulations (41).



Housing

Construction

Health

National

Regulation

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>2. Develop or update playground standards, such as for the depth of appropriate surface material, height of equipment and periodic maintenance (42).</p>	 Construction Health Education	National	Regulation
<p>3. Promote policies requiring protective equipment such as helmets during certain sports and leisure activities (42).</p>	 Health Education Sports and leisure	National	Regulation
<p>4. Assess and improve safety, if needed, of sports and recreational equipment (41).</p>	 Industry Health	National	Assessment and surveillance; infrastructure, technology and built environment
<p>5. Support the installation of window guards, bars and child-proof locks for windows in high-rise blocks, stair guards or gates, grab rails, lockable access to balconies and hazard removal (41, 42).</p>	 Housing Construction	National; community	Infrastructure, technology and built environment
<p>6. Consider implementing home visits, assessment of home furniture and environmental modification for people with children or those at an older age/with known risk factors or a history of falling, including stair gates and guard rails (40–42).</p>	 Health	National; community Universal health coverage	Assessment and surveillance; infrastructure, technology and built environment
<p>7. Promote physical activity to prevent falls (2).</p> <p>More guidance to promote physical activity especially through increased levels of walking and cycling is listed in Section 9.2 Environments for safe and sustainable transport, active mobility and physical activity.</p>	 Health	National; Community Universal health coverage	
<p>Awareness raising and capacity building</p> <p>8. Raise awareness about risks of falls, high-risk groups (children and older people) and available interventions (such as installation of window guards and grab rails, balcony risk and protection, promotion of physical activity, and hazard removal) (40, 41).</p>	 Health Housing Construction	Community; national Universal health coverage	Information, education and communication
<p>9. Give parents information about child fall risks and support them to reduce these risks around the home (42).</p>	 Health	Community; national Universal health coverage	Information, education and communication

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
10. Provide parenting programmes for low-income and other marginalized families (42).	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
11. Provide school-based teaching of martial arts-based fall techniques and exercises (42).	 Health  Education  Social welfare and family	Community; national	Information, education and communication
12. Make available gait, balance and functional training and Tai Chi classes, the latter particularly to older people (42).	 Education	Community; national	Information, education and communication
	 Health  Sports and leisure	Community; national Universal health coverage	Information, education and communication

Selected tools

WHO 2012: *TEACH-VIP 2 users' manual: the second iteration of Training, Educating and Advancing Collaboration in Health on Violence and Injury Prevention* (43)

This is a comprehensive injury prevention and control curriculum that has been developed through the efforts of WHO and a network of global injury prevention experts.

WHO/CDC 2001: *Injury surveillance guidelines* (37)

Guidelines to assess data on injuries that will help to develop effective prevention strategies in countries.

WHO 2018: *Global action plan on physical activity 2018–2030: more active people for a healthier world* (2)

9.3.3 Burns



Overview

An estimated 114 000 deaths every year are caused by burns (6) (2019 data), the vast majority of which occur in low- and middle-income countries. Non-fatal burn injuries are a leading cause of morbidity, including prolonged hospitalization, disfigurement and disability, often with resulting stigma and rejection (44).

Burns are preventable and occur mainly in the home and workplace. Women and children are particularly vulnerable to burns, with burns being the fifth most common cause of non-fatal childhood injuries (44). Furthermore, burn victims are often among the poorest and most vulnerable population groups, especially in low- and middle-income countries (45).

How prevalent are burns in my country?

National reporting systems may capture statistics on burns and other injuries.

Injury surveillance guidelines are available to assess data on injuries (37).

In addition, the WHO Global Health Estimates provide a comprehensive and comparable assessment of death and disability due to diseases and injuries for all WHO Member States and all WHO regions of the world (6).

	Guidance
--	-----------------



Sector principally involved in planning/implementation



Level of implementation



Instruments

Policies and actions

1. Develop or update policies on burn prevention, to cover for example the following points (45). <ul style="list-style-type: none"> The placement of smoke alarms in all buildings. Setting and enforcing regulations requiring fire-activated sprinklers in residential and non-residential buildings. A set temperature of hot water for the prevention of scald burns. The safety of cook-stoves in the domestic environment. Child resistant lighters and flame-retardant fabrics. 	 Health Housing Other sectors	National	Regulation
2. Develop or update safety regulations to housing design and materials, including fire and electrical codes; develop or update industrial safety regulations (e.g. for products used in homes and other buildings such as schools, child-care settings and recreational facilities) (41, 44, 45).	 Housing Industry Health Other sectors	National	Regulation
3. Increase safety of construction materials, heating and lighting equipment at homes and public buildings such as schools, child-care settings and recreational facilities, and household materials such as upholstered furniture and mattresses (41).	 Housing Industry	National; community	Infrastructure, technology and built environment

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Awareness raising and capacity building			
4. Raise awareness on risks of burning and preventive interventions, especially for parents, and provide fire safety education programmes and training of communities in first aid (45).	 Health  Education	Community; national Universal health coverage	Information, education and communication
5. Discourage storage of flammable substances at home, schools and child-care settings, and promote the use of safe lamps and cook-stoves (41).	 Environment  Health	Community; national Universal health coverage	Information, education and communication
6. Promote safer cooking practices in the domestic environment by enclosing fires and using safer cook-stoves. This may include installing cook-stove guards, and by separating cooking from living areas (41, 45).	 Health  Housing	Community; national Universal health coverage	Information, education and communication
Selected tools			
WHO 2012: <i>TEACH-VIP 2 users' manual: the second iteration of Training, Educating and Advancing Collaboration in Health on Violence and Injury Prevention</i> (43)			
This is a comprehensive injury prevention and control curriculum that has been developed through the efforts of WHO and a network of global injury prevention experts.			
WHO/CDC 2001: <i>Injury surveillance guidelines</i> (37)			
Guidelines to assess data on injuries that will help to develop effective prevention strategies in countries.			
WHO 2020: <i>Global Burn Registry</i> (46)			
This Registry is based upon a standardized data collection form developed by WHO and a global network of experts. Its aim is an improved, standardized and global data collection system of burns.			

References

- Physical activity: key facts [website]. Geneva: World Health Organization; 2022 (<https://www.who.int/news-room/fact-sheets/detail/physical-activity>, accessed 14 August 2023).
- Global Action Plan on Physical Activity 2018–2030: more active people for a healthier world. Geneva: World Health Organization; 2018 (<https://iris.who.int/handle/10665/272722>, accessed 12 October 2023).
- Walking and cycling: latest evidence to support policy-making and practice. Copenhagen: WHO Regional Office for Europe; 2022 (<https://iris.who.int/handle/10665/354589>, accessed 14 August 2023).
- Road traffic injuries: key facts [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>, accessed 23 May 2024).
- Global status report on road safety 2023. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/350206>, accessed 23 May 2024).
- Global health estimates: life expectancy and leading causes of death and disability. In: WHO Global Health Observatory [online database]. Geneva: World Health Organization; 2019 (<https://www.who.int/gho/data/themes/mortality-and-global-health-estimates>, accessed 14 August 2023).
- Urban health: key facts. Geneva: World Health Organization; 2021 (<https://www.who.int/news-room/fact-sheets/detail/urban-health>, accessed 14 August 2023).
- STEPwise approach to NCD risk factor surveillance (STEPS) [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/steps>, accessed 14 August 2023).
- Global physical activity questionnaire (GPAQ) [website]. Geneva: World Health Organization; 2021 (<https://www.who.int/publications/m/item/global-physical-activity-questionnaire>, accessed 14 August 2023).

10. Global School-based Student Health Survey [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/global-school-based-student-health-survey>, accessed 14 August 2023).
11. About the Health Behaviour in School-aged Children (HBSC) study [website]. Geneva: World Health Organization; 2023 ([https://www.who.int/europe/initiatives/health-behaviour-in-school-aged-children-\(hbsc\)-study](https://www.who.int/europe/initiatives/health-behaviour-in-school-aged-children-(hbsc)-study), accessed 14 August 2023).
12. Are our roads 3-star or better [website]? London: International Road Assessment Programme; 2021 (<https://irap.org/3-star-or-better/>, accessed 12 October 2023).
13. ACTIVE: a technical package for increasing physical activity. Geneva: World Health Organization; 2018 (<https://iris.who.int/handle/10665/275415>, accessed 19 October 2023).
14. Global Plan for the Decade of Action for Road Safety 2021–2030. Geneva: World Health Organization; 2021(<https://www.who.int/publications/m/item/global-plan-for-the-decade-of-action-for-road-safety-2021-2030>, accessed 14 August 2023).
15. THE 17 Sustainable Development Goals [website]. New York: United Nations Department of Economic and Social Affairs; 2023 (<https://sdgs.un.org/goals>, accessed 12 October 2023).
16. Health in the green economy: Health co-benefits of climate change mitigation – transport sector. Geneva: World Health Organization; 2011 (<https://apps.who.int/iris/handle/10665/70913>, accessed 13 October 2023).
17. Integrating health in urban and territorial planning: a sourcebook. Geneva: UN-Habitat, World Health Organization; 2020 (<https://iris.who.int/handle/10665/331678>, accessed 13 October 2023).
18. Health as the pulse of the new urban agenda: United Nations conference on housing and sustainable urban development, Quito, October 2016. Geneva: World Health Organization; 2016 (<https://apps.who.int/iris/handle/10665/250367>, accessed 13 October 2023).
19. WHO guidelines on physical activity and sedentary behaviour. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/336656>, accessed 14 August 2023).
20. Health in all policies: Helsinki statement. Framework for country action. Geneva: World Health Organization, Finland Ministry of Social Affairs and Health; 2014 (<https://apps.who.int/iris/handle/10665/112636>, accessed 12 October 2023).
21. Health in all policies: training manual. Geneva: World Health Organization; 2015 (<https://apps.who.int/iris/handle/10665/151788>, accessed 13 October 2023).
22. Guidance and tools. In: Urban Health Initiative [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/initiatives/urban-health-initiative/guidance-and-tools>, accessed 13 October 2023).
23. Health Economic Assessment Tool (HEAT) for walking and cycling [website]. Copenhagen: WHO Regional Office for Europe; 2019 (<https://www.heatwalkingcycling.org/#homepage>, accessed 12 October 2023).
24. Kahlmeier S, Götschi T, Cavill N, Castro Fernandez A, Brand C, Rojas Rueda D, et al. Health economic assessment tool (HEAT) for walking and for cycling: methods and user guide on physical activity, air pollution, injuries and carbon impact assessments. Copenhagen: WHO Regional Office for Europe; 2017 (<https://apps.who.int/iris/handle/10665/344136>, accessed 15 August 2023).
25. Pedestrian safety: a road safety manual for decision-makers and practitioners, second edition. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/367419>, accessed 15 August 2023).
26. Urban green spaces and health. Copenhagen: WHO Regional Office for Europe; 2016 (<https://apps.who.int/iris/handle/10665/345751>, accessed 13 October 2023).
27. Urban green spaces: a brief for action. Copenhagen: WHO Regional Office for Europe; 2017 (<https://apps.who.int/iris/handle/10665/344116>, accessed 13 October 2023).
28. The PEP implementation mechanisms and workplan: workshop on safe and healthy walking and cycling in urban areas. Geneva: United Nations Economic Commission for Europe, WHO Regional Office for Europe; 2009 (<https://www.unece.org/fileadmin/DAM/thepep/en/workplan/urban/documents/Pruhonice-Prague/Pruhonice.Report.e.pdf>, accessed 13 October 2023).
29. The PEP: building forward better by transforming to new, clean, safe, healthy and inclusive mobility and transport. Copenhagen: WHO Regional Office for Europe; 2022 (<https://www.who.int/europe/publications/m/item/building-forward-better-by-transforming-to-new-clean-safe-healthy-and-inclusive-mobility-and-transport>, accessed 14 August 2023).
30. Global status report on physical activity 2022. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/363607>, accessed 23 August 2023).
31. Why infrastructure matters: active mobility, public transport, and economic growth in African cities. Nairobi: UN-Habitat; 2022 (<https://unhabitat.org/why-infrastructure-matters-active-mobility-public-transport-and-economic-growth-in-african-cities>, accessed 18 September 2023).
32. Walking and cycling in Africa: evidence and good practice to inspire action. Nairobi: UN-Habitat and UN Environment Programme; 2022 (<https://unhabitat.org/walking-and-cycling-in-africa-evidence-and-good-practice-to-inspire-action>, accessed 18 September 2023).
33. WHO manifesto for a healthy recovery from COVID-19: prescriptions and actionables for a healthy and green recovery. Geneva: World Health Organization; 2020 (<https://www.who.int/publications/m/item/who-manifesto-for-a-healthy-recovery-from-covid-19>, accessed 13 October 2023).
34. The power of cities: tackling noncommunicable diseases and road traffic injuries. Geneva: World Health Organization; 2019 (<https://iris.who.int/handle/10665/329429>, accessed 23 August 2023).
35. Towards more physical activity in cities: transforming public spaces to promote physical activity – a key contributor to achieving the Sustainable Development Goals in Europe. Copenhagen: WHO Regional Office for Europe; 2017 (<https://iris.who.int/handle/10665/345147>, accessed 23 August 2023).
36. Drowning [website]. Geneva: World Health Organization; 2020 (<https://www.who.int/news-room/fact-sheets/detail/drowning>, accessed 14 May 2020).

37. Injury surveillance guidelines. Geneva/Atlanta (GA): World Health Organization/United States Centers for Disease Control and Prevention; 2001 (<https://apps.who.int/iris/handle/10665/42451>, accessed 15 June 2021).
38. Global report on drowning. Preventing a leading killer. Geneva: World Health Organization; 2014 (<http://apps.who.int/iris/10665/143893>, accessed 29 January 2015).
39. Preventing drowning: an implementation guide. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/255196>, accessed 15 June 2021).
40. Falls [website]. Geneva: World Health Organization; 2018 (<https://www.who.int/news-room/fact-sheets/detail/falls>, accessed 22 May 2020).
41. WHO, UNICEF. World report on child injury prevention. Geneva: World Health Organization; 2008 (<https://apps.who.int/iris/handle/10665/43851>, accessed 15 June 2021).
42. Step safely: strategies for preventing and managing falls across the life-course. Geneva: World Health Organization; 2021 (<https://apps.who.int/iris/handle/10665/340962>, accessed 15 June 2021).
43. TEACH-VIP 2. Geneva: World Health Organization; 2012 (<https://www.who.int/publications/i/item/teach-vip-2-user-s-manual>, accessed 15 June 2021).
44. Burns [website]. Geneva: World Health Organization; 2018 (<https://www.who.int/en/news-room/fact-sheets/detail/burns>, accessed 26 May 2020).
45. Burn prevention: success stories, lessons learned. Geneva: World Health Organization.; 2011 (<https://apps.who.int/iris/handle/10665/97938>, accessed 15 June 2021).
46. Global Burn Registry. Geneva: World Health Organization; 2021 (<https://www.who.int/teams/social-determinants-of-health/safety-and-mobility/burns/global-burn-registry>, accessed 15 June 2021).



10. Safe and healthy food

10.1 Food safety and the environment



A safe food supply contributes to food and nutrition security and supports national economies, trade and tourism, stimulating sustainable development (1). This includes proper food preparation, which can prevent a large share of foodborne diseases. Different governmental departments and agencies, encompassing public health, agriculture, education and trade, need to collaborate and communicate with each other and engage with civil society, including consumer groups, to ensure a safe food supply.

This section only covers aspects of food safety related to the environment, such as household and community hygiene practices and the use of wastewater, excreta and greywater in agriculture.

Comprehensive guidance on this topic beyond health and environment can be found elsewhere.¹¹



Overview

Access to sufficient amounts of safe and nutritious food is key to sustaining life and promoting good health. Safe food is not contaminated with potentially harmful bacteria, parasites, viruses, toxins, chemicals and/or radionuclides. However, food can become contaminated at any point of production and distribution. A large proportion of foodborne disease incidents are caused by foods improperly or unhygienically prepared or mishandled at home, in food service establishments or markets.

¹¹ <https://www.who.int/health-topics/food-safety>

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Food safety in households and the community: awareness raising and capacity building			
1. Promote safe food handling behaviours among all consumers and food handlers (2). Key messages include the following.			
Keep clean			
<ul style="list-style-type: none"> • Wash hands before handling food and often during food preparation. • Wash hands after going to the toilet. • Wash and sanitize all surfaces and equipment used for food preparation. • Protect kitchen areas and food from insects, pests and other animals. 	 Health  Agro-food	Community; workplace Universal health coverage	Information, education and communication
Separate raw and cooked			
<ul style="list-style-type: none"> • Separate raw meat, poultry and seafood from other foods. • Use separate equipment and utensils, such as knives and cutting-boards, for handling raw foods. • Store food in containers to avoid contact between raw and prepared foods. 			
Cook thoroughly			
<ul style="list-style-type: none"> • Cook food thoroughly, especially meat, poultry, eggs and seafood. • Bring foods like soups and stews to boiling to make sure that they have reached 70°C. For meat and poultry, make sure that juices are clear, not pink. Ideally, use a thermometer to ensure proper temperature. • Reheat cooked food thoroughly. 			
Keep food at safe temperatures			
<ul style="list-style-type: none"> • Do not leave cooked food at room temperature for more than 2 hours. • Refrigerate promptly all cooked and perishable food (preferably below 5°C). • Keep cooked food piping hot (more than 60°C) prior to serving. • Do not store food too long even in the refrigerator. • Do not thaw frozen food at room temperature. 			
Use safe water and raw materials			
<ul style="list-style-type: none"> • Use safe water or treat it to make it safe. • Select fresh and wholesome foods. • Choose foods processed for safety, such as pasteurized milk. • Wash fruits and vegetables, especially if eaten raw. • Do not use food beyond its expiry date. 			

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>2. Promote growing safer fruits and vegetables (3). Key messages include the following.</p> <p>Practise good personal hygiene</p> <ul style="list-style-type: none"> • Wash and dry hands with a clean, dry towel after toilet use, diapering a child and contact with animals. • Change clothes and bathe regularly. • Cover cuts, lesions and wounds. • Use a toilet or latrine to urinate or defecate. <p>Protect fields from animal faecal contamination</p> <ul style="list-style-type: none"> • Keep animals from roaming in a growing field. • House livestock downhill from growing fields in a fenced area. • Remove trash from in and around growing fields. <p>Use treated faecal waste</p> <ul style="list-style-type: none"> • Use faecal waste (manure and human excreta) that is properly treated. • Apply treated faecal waste to fields prior to planting. • Maximize the time between the application of treated faecal waste and harvest. <p>Evaluate and manage risks from irrigation water</p> <ul style="list-style-type: none"> • Identify all water sources relevant to the growing field. • Be aware of the risk of microbial contamination of water. • Protect water from faecal contamination. • Apply control measures when using contaminated water or water of unknown quality. <p>Keep harvest and storage equipment clean and dry</p> <ul style="list-style-type: none"> • Wash harvest and storage equipment with clean water and dry before use. • Keep containers off the ground before, during and after harvesting. • Remove visible dirt and debris from fruits and vegetables in the field. • Cool fruits and vegetables quickly after harvest or when intended for storage. • Limit access of animals, children and other non-workers to the harvest and storage areas. 	 Health  Agro-food	Community; workplace Universal health coverage	Information, education and communication

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>3. Promote safer aquaculture products (3). Key messages include the following.</p> <p>Practise good personal hygiene</p> <ul style="list-style-type: none"> • Use a toilet or latrine to urinate or defecate. • Wash and dry hands with a clean, dry towel after toilet use, diapering a child and contact with animals. • Cover cuts, lesions and wounds when working around fishponds. • Wash hands and change clothes after working around the fishponds and harvesting fish. • Locate fishponds away from latrines, livestock and poultry. • Choose a pond site where the chance of contamination with heavy metals or other harmful chemicals is low. • Remove weeds, rubbish chemical containers and old equipment from pond site. • Keep livestock and poultry in an area that prevents access to the fishpond. <p>Manage water quality</p> <ul style="list-style-type: none"> • Select a water source that has a very low chance of contamination with heavy metals, other chemicals and harmful microorganisms. • Prevent people and animals, including ducks, geese and pets, from flying over, wading or swimming in fishponds. • Keep rubbish, food and faecal waste removed from the home away from the fishpond. • Do not pen animals over the fishpond. <p>Keep fish healthy</p> <ul style="list-style-type: none"> • Stock ponds to the proper density with healthy fish seed stock from a certified hatchery or reliable supplier. • Maintain stock at the proper density in the growing pond. • Remove and dispose of sick and dead fish daily. • Avoid using unapproved chemicals to maintain fish health. <p>Use clean harvest equipment and containers</p> <ul style="list-style-type: none"> • Wash harvest containers and equipment with clean water. • Harvest fish early in the day and transport live or cool quickly. • Use clean water to wash harvested fish. • Keep harvested fish in clean containers on non-porous material. 	 Health  Agro-food	Community; workplace Universal health coverage	Information, education and communication
<p>4. Promote healthy and safe food markets (4). Many of the key messages listed in the three sections above apply here. Additional points include the following.</p> <p>Healthy and safe food markets</p> <ul style="list-style-type: none"> • Ensure the provision of safe and nutritious food. • Seek to improve food safety from production to consumption. • Foster partnerships between suppliers, government and consumers. <p>More detailed information on food hygiene can be found in the WHO/FAO Codex Alimentarius basic texts on food hygiene (5).</p>	 Health  Agro-food	Community; workplace Universal health coverage	Information, education and communication; other management and control

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
Use of wastewater, excreta and greywater in agriculture/aquaculture: policies and actions			
<p>5. Develop or update national standards and regulation for the safe use of wastewater, excreta and greywater in agriculture and aquaculture in line with the WHO guidelines (4).</p> <p>This includes the setting of health-based targets that define a level of health protection relevant to each hazard.</p> <p>For setting and achieving the health-based targets the following steps are important.</p> <ul style="list-style-type: none"> • Routinely assess health risks associated with the use of wastewater, excreta and greywater in agriculture or aquaculture, for example through microbial and chemical laboratory analysis, epidemiological studies and quantitative microbial (and chemical) risk assessment. • Identify health protection measures (covered below). • Monitor and assess the system (covered below). <p>Note: The WHO guidelines generally apply to the use of domestic wastewater. Industrial wastewater usually poses greater risks, which may require different precautions and measures (4).</p>	 Water/sanitation  Agro-food  Health	National	Regulation; assessment and surveillance
<p>6. Implement risk management strategies/health protection measures/control strategies for achieving the health-based targets related to the use of wastewater, excreta and greywater in agriculture or aquaculture (4).</p> <p>Often a combination of measures will be needed. Examples of key measures and messages include the following.</p> <p>For the protection of consumers</p> <ul style="list-style-type: none"> • Treat wastewater and excreta used in agriculture/aquaculture. • Use lower quality effluents to irrigate non-vegetable crops or those that are not eaten uncooked (crop restriction). • Apply wastewater application techniques that minimize contamination (e.g. drip irrigation). • Allow pathogen die-off after the last wastewater application. <p>For the protection of workers and their families</p> <ul style="list-style-type: none"> • Treat wastewater and excreta used in agriculture/aquaculture. • Use PPE during handling. • Provide access to safe drinking-water and sanitation facilities. • Implement disease vector and intermediate host control. • Reduce vector contact. <p>For the protection of local communities</p> <ul style="list-style-type: none"> • Treat wastewater and excreta used in agriculture/aquaculture. • Restrict access to irrigated fields, hydraulic structures and aquacultural facilities. • Provide access to safe recreational water, especially for adolescents. • Provide access to safe drinking-water and sanitation facilities. • Implement disease vector and intermediate host control. • Reduce vector contact. 	 Water/sanitation  Agro-food  Health	National; community; workplace Universal health coverage	Other management and control; regulation; infrastructure, technology and built environment

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
<p>7. Consistently monitor and assess health risks of wastewater, excreta and greywater use in agriculture and aquaculture (4).</p> <p>The most effective means of consistently ensuring safety in wastewater, excreta or greywater use in agriculture or aquaculture is through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in the process, from the generation and use of wastewater, excreta or greywater to product consumption.</p> <p>System assessment aims to establish a comprehensive understanding of the system, the range and magnitude of hazards, the magnitude of risk levels and the ability of existing processes and infrastructure to manage actual or potential risks.</p>	 Sector principally involved in planning/implementation  Water/sanitation  Agro-food  Health	National; community; workplace Universal health coverage	Assessment and surveillance
8. Seek community and stakeholder participation early on and in all phases of wastewater, excreta or greywater use in agriculture or aquaculture (4).	 Water/sanitation  Agro-food	National; community; workplace	Governance
<p>9. Implement management strategies for reducing negative environmental impacts of wastewater, excreta and greywater use (e.g. contamination of surface waters, groundwater and increase in soil salinity).</p> <p>Strategies are dependent on the polluting agent and are further detailed in <i>Guidelines for the safe use of wastewater, excreta and greywater in agriculture and aquaculture</i> (4).</p>	 Water/sanitation  Agro-food  Environment	National; community; workplace	Other management and control
10. Communicate and educate communities and other stakeholders about potential health risks and health protection measures related to the use of wastewater, excreta or greywater in agriculture and aquaculture (4).	 Health  Water/sanitation  Agro-food	Community; workplace Universal health coverage	Information, education and communication

Selected tools

WHO 2006: *The Five keys to safer food manual* (2)

This guidance provides key messages, resources and training materials about safer food practices.

FAO/IFAD/UNICEF/WFP/WHO 2020: *The state of food security and nutrition in the world 2020*.

Transforming food systems for affordable healthy diets (6)

10.2 Healthy diets and the environment



Comprehensive guidance on this topic beyond health and environment can be found elsewhere.¹²



Overview

Access, intake and uptake to sufficient amounts of safe and nutritious food is key to sustaining life and promoting good health (1). A healthy diet protects against malnutrition as well as NCDs such as diabetes, IHD, stroke and cancer (7).

With regard to health, much of the food that is consumed contains too little whole plant foods (fruits and vegetables) and too much added sugars and salt, saturated fats and trans-fatty acids. Shifting to more healthy diets would reduce a great disease burden mainly from NCDs (6, 8).

With regard to the environment, current patterns of food production and consumption use much of the world's resources on land and water and contribute significantly to climate and ecosystem change through for example deforestation, loss of biodiversity and GHG emissions (9). This is aggravated by the fact that about one third of food produced for human consumption is wasted (10).

Which diets are sustainable and healthy?

Sustainable healthy diets are diets that promote individuals' health and well-being and have low environmental impact. They are based on a great variety of plant-based, and unprocessed or minimally processed foods. These foods must be made available, accessible, affordable, safe and desirable to the whole population including the most vulnerable (11). They need to be accessible, affordable, safe and culturally acceptable.

SDG 2 "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" includes the following selected targets (12).

- Target 2.1: By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.
- Target 2.2: By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.
- Target 2.4: By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.
- Target 2.5: By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.

¹² <https://www.who.int/health-topics/healthy-diet>

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Policies and actions			
1. Develop or update national food-based dietary guidelines through the full integration of environmental sustainability elements in each of the guideline's recommendations, according to national contexts (11).	 Sector principally involved in planning/implementation	National	Regulation
 Health  Agro-food  Environment			
2. Integrate sustainable healthy diets in existing food systems (11). Possible actions include the following. <ul style="list-style-type: none"> Support the production, processing, distribution, labelling, marketing and consumption of foods that contribute to sustainable healthy diets (such as plant-based foods and unprocessed foods). Align food policies across sectors, such as health, agriculture, education, environment, water and trade. Collect information on current diets across different population groups. Identify availability of different foods, mismatches in food supply and demand, and required changes in the existing food system. Improve access to local healthy food choices (13). Implement restrictions on unhealthy food in and around open public spaces, schools and sports facilities (13). Pay special attention to the poor and their access to healthy and sustainable food. Develop national food-based dietary guidelines that define context-specific sustainable healthy diets. Minimize the use of antibiotics and hormones in food production. Minimize the use of plastics and derivatives in food packaging. 	 Health  Agro-food  Environment	National	Regulation; taxes and subsidies
3. Improve storage, preservation, transport and distribution technologies and infrastructure to reduce seasonal food insecurity, food and nutrient loss and waste (9).	 Agro-food	National; community	Infrastructure, technology and built environment
4. Support the diversification of crops including underutilized traditional crops, applying sustainable food production and natural resource management practices (14, 15).	 Agro-food  Environment	National; community	Taxes and subsidies; other management and control
5. Support agrobiodiversity and the use of integrated pest management to reduce the need for chemical pesticides and herbicides (15).	 Agro-food  Environment	National; community	Infrastructure, technology and built environment
6. Support healthy soils/healthy soil management (15). This can be achieved through the following examples. <ul style="list-style-type: none"> Use cover crops, legumes, composting and agroforestry. Curb land clearing. Prevent further land degradation and loss of soil fertility (e.g. through reduced monocultures and increased crop rotation). 	 Agro-food  Environment	National; community	Infrastructure, technology and built environment

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>7. Support and enhance sustainable local food production and processing, especially by small-holder and family farmers (15).</p>	 Agro-food Environment	National; community	Infrastructure, technology and built environment; taxes and subsidies
<p>8. Preserve fish habitats and support sustainable fisheries (15).</p> <ul style="list-style-type: none"> • Maintain/restore catchment vegetation to reduce runoff erosion. • Reduce water pollution from for example industry and urban areas. • Restrict destructive fishing methods. 	 Agro-food Environment	National; community	Infrastructure, technology and built environment; taxes and subsidies
Awareness raising and capacity building			
<p>9. Educate consumers about healthy and sustainable food (11).</p>	 Agro-food Health Environment	National; community Universal health coverage	Information, education and communication
<p>10. Promote sustainable healthy diets that are high in whole grains, pulses, a variety of fruits and vegetables, and nuts and seeds; low in energy-intensive animal-sourced and discretionary foods (such as sugary beverages); and with a carbohydrate threshold (11, 16).</p>	 Health Food	National; community Universal health coverage	Information, education and communication
<p>11. Promote healthy dietary changes towards less emission-intensive food products (9, 16). Key messages may include the following.</p> <ul style="list-style-type: none"> • Reduce the consumption of meat, other animal-sourced foods and processed foods, while increasing the consumption of unprocessed and plant-based foods such as whole grains, legumes, fruits, vegetables, nuts and seeds. • Buy and consume locally produced food. 	 Health Environment Food	National; community Universal health coverage	Information, education and communication
<p>12. Raise awareness about the benefits of local food production related to community development, climate change and health and provide appropriate training on local food production (15).</p>	 Health Environment Food	National; community Universal health coverage	Information, education and communication

References

1. Food safety. Key facts. Geneva: World Health Organization; 2019 (<https://www.who.int/news-room/fact-sheets/detail/food-safety>, accessed 29 April 2020).
2. Five keys to safer food manual. Geneva: World Health Organization; 2006 (<https://apps.who.int/iris/handle/10665/43546>, accessed 16 April 2020).
3. Five keys to growing safer fruits and vegetables : promoting health by decreasing microbial contamination. Geneva: World Health Organization; 2012 (<https://apps.who.int/iris/handle/10665/75196>, accessed 15 June 2021).
4. A guide to healthy food markets. Geneva: World Health Organization; 2006 (<https://apps.who.int/iris/handle/10665/43393>, accessed 15 June 2021).

5. WHO, FAO. Codex Alimentarius. Basic texts. 4th ed. Rome: Food and Agriculture Organization; 2009 (<http://www.fao.org/3/a1552e/a1552e00.htm>, accessed 15 January 2021).
6. FAO, IFAD, UNICEF, WFP, WHO. The state of food security and nutrition in the world 2020. Transforming food systems for affordable healthy diets. Rome: Food and Agriculture Organization; 2020 (<http://www.fao.org/3/ca9692en/online/ca9692en.html>, accessed 8 June 2021).
7. Healthy diet. Key facts. Geneva: World Health Organization; 2020 (<https://www.who.int/news-room/fact-sheets/detail/healthy-diet>, accessed 29 April 2020).
8. Noncommunicable diseases. Key facts. Geneva: World Health Organization; 2018 (<https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>, accessed 29 April 2020).
9. Climate Change 2014. Mitigation of Climate Change. Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, New York: Intergovernmental Panel on Climate Change; 2014 (https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_full.pdf, accessed 29 April 2020).
10. Global food losses and food waste – Extent, causes and prevention. Rome: Food and Agriculture Organization; 2011 (<http://www.fao.org/3/a-i2697e.pdf>, accessed 29 April 2020).
11. FAO, WHO. Sustainable healthy diets – Guiding principles. Rome: Food and Agriculture Organization; 2019 (<http://www.fao.org/3/ca6640en/ca6640en.pdf>, accessed 29 April 2020).
12. Sustainable Development Goals. Knowledge platform. New York (NY): United Nations.; 2020 (<https://sustainabledevelopment.un.org/sdgs>, accessed 19 March 2020).
13. Global action plan on physical activity 2018–2030: more active people for a healthier world. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/272722>, accessed 14 June 2021).
14. FAO. Second International Conference on Nutrition. Rome, 19–21 November 2014. Conference Outcome Document: Framework for Action. Rome: Food and Agriculture Organization; 2014 (<http://www.fao.org/3/a-mm215e.pdf>, accessed 7 July 2020).
15. Guidance on mainstreaming biodiversity for nutrition and health. Geneva: World Health Organization; 2020 (<https://www.who.int/publications/i/item/guidance-mainstreaming-biodiversity-for-nutrition-and-health>, accessed 15 January 2021).
16. Special report on climate change and land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems Geneva: Intergovernmental Panel on Climate Change; 2019 (<https://www.ipcc.ch/srccl/>, accessed 19 July 2020).

11. Environmental noise



This section addresses exposure of the general population to environmental noise, such as noise from various forms of traffic or industry. It includes amplified music in the framework of leisure activities as well. It does not specifically include occupational noise exposure. Occupational risks, including noise exposure, are covered in [Section 12.3 Workplaces](#).



Overview

In 2011, an estimated one million healthy life years were lost from traffic-related noise in the western part of Europe only (1). Important sources for environmental noise exposure are road, railway and air traffic, or building sites. Noise exposure can also occur through other sources such as wind turbines, and leisure activities such as listening to loud music or other audio content including participation in e-sports (video and computer game competitions). Excessive noise can cause annoyance; in addition research shows it increases the risk for IHD and hypertension, sleep disturbance, hearing impairment, tinnitus and cognitive impairment, with increasing evidence for other health impacts such as adverse birth outcomes and mental health problems (2).

What is the proportion of people impacted by environmental noise in my country?

The noise indicators below are taken from guidelines that were developed for the WHO European Region. In terms of their health implications, the recommended exposure levels can be considered applicable in other regions and suitable for a global audience (2).

Noise indicators are based on the European Union Directive 2002/49/EC (3) in the European Region.

- L_{den} is an average sound pressure level over all days, evenings and nights in a year.
- L_{night} is the equivalent continuous sound pressure level when the reference time interval is the night.
- $L_{Aeq,T}$ is the A-weighted (a frequency weighting to better reflect the human ear), equivalent continuous sound pressure level during a stated time interval starting at t_1 and ending at t_2 , expressed in decibels (dB), at a given point in space.

The first two indicators are used particularly for noise monitoring and exposure assessment. The third is used for measuring leisure noise exposure. For more information on these and other noise indicators consult the *Environmental noise guidelines for the European Region* (2). These noise indicators can be converted to other indicators used in other settings (4).

What is the proportion of people impacted by environmental noise in my country?

Several countries use surveys to assess the perception of noise in the general population. The last European Quality of Life survey, carried out 2016–2017, found that 32% of more than 30 000 participants across Europe reported problems with noise in the immediate neighbourhood of their home (5).

What are the levels of noise exposure we want to achieve?

Based on the systematic review of evidence available at the time of the development of the environmental noise guidelines (2), the following recommended levels for specific noise sources can be defined.

For average noise exposure, the following sound pressure levels are recommended (2, 6):

- < 53 dB L_{den} for road traffic noise
- < 54 dB L_{den} for railway noise
- < 45 dB L_{den} for aircraft noise
- < 45 dB L_{den} for wind turbine noise
- yearly average from all leisure source noises combined to ≤ 70 dB L_{Aeq, 24h}
- weekly average from leisure sources (such as personal listening devices¹³⁾ ≤ 80 dB(A) or 1.6 Pa²h
- short-term average from occasional exposure to leisure source noise ≤ 100 dB L_{Aeq, 15min*}

For night noise exposure, the following sound pressure levels are recommended (2):

- < 45 dB L_{night} for road traffic noise
- < 44 dB L_{night} for railway noise
- < 40 dB L_{night} for aircraft noise.

Different categories of noise mitigation interventions along a continuum from source reduction to behaviour change can be defined. Interventions in the guidance section below are marked with A–E as defined hereafter (2).

A. Source intervention:

- change in emission levels of sources
- time restrictions on source operators.

B. Path intervention:

- change in the path between source and receiver
- path control through insulation of receiver/receiver's dwelling

C. New/closed infrastructure:

- opening of a new infrastructure noise source
- closure of an existing one
- planning controls between (new) receivers and sources.

D. Other physical intervention:

- change in other physical dimensions of dwelling/neighbourhood.

E. Behaviour change intervention:

- change in individual behaviour to reduce exposure
- avoidance of exposure or reduced duration of exposure
- community education and communication.

¹³ A personal listening or audio device is a portable device designed to be worn on the body or in a pocket. It is designed to allow the user to listen to various forms of media.

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Road traffic noise: policies and actions			
Recommended actions are available for specific noise sources and do not cover all potentially important noise exposures.			
1. Improve the choice of appropriate tyres and road surface (A) (2).	 Transport  Land use planning	National; community	Regulation; infrastructure, technology and built environment
2. Reduce traffic flow and restrict truck traffic (A) (2).	 Transport  Land use planning	National; community	Regulation; taxes and subsidies; infrastructure, technology and built environment
3. Insulate dwellings, construct barriers (B) (2).	 Housing  Land use planning	National; community	Regulation; taxes and subsidies; infrastructure, technology and built environment
4. Construct road tunnels (C) (2).	 Transport  Land use planning	National; community	Infrastructure, technology and built environment
5. Design/make available a “quiet side” in the dwelling; create nearby green space (D) (2).	 Housing  Land use planning	National; community	Infrastructure, technology and built environment
Railway noise: policies and actions			
6. Apply rail grinding procedures to remove deformations and corosions on railway tracks (A) (2).	 Transport	National; community	Infrastructure, technology and built environment
Railway noise: awareness raising and capacity building			
7. Inform the community about interventions being implemented to potentially reduce noise annoyance (E) (2).	 Health  Environment  Transport	Community Universal health coverage	Information, education and communication
Railway noise: awareness raising and capacity building			
8. Adapt opening and closing of runways (C) (2).	 Transport	National; community	Regulation; other management and control

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
9. Rearrange flight paths (C) (2).	 Transport	National; community	Regulation; other management and control

Railway noise: awareness raising and capacity building

10. Implement sound exposure monitoring (volume level and time spent listening) in all personal listening devices to allow for self-control with reference to a standard. In every listening device, the user should be allowed to select two different operational modes of reference exposure (6), and track the percentage of exposure used vs the reference exposure for every seven days. The two operational modes include the following. <ul style="list-style-type: none"> Mode 1: WHO standard level for adults Mode 2: WHO standard level for sensitive users (e.g. children). 	  Health Sports and leisure	National	Regulation; infrastructure, technology and built environment
11. Implement options for volume limitation and parental volume control in every device (6).	 Sports and leisure	National	Regulation; infrastructure, technology and built environment
12. Enact and enforce legislation/regulations/policies for limiting sound levels and exposure in entertainment venues and events such as clubs, bars, fitness centres, concerts, etc. (3, 7). Legislation should focus on: <ul style="list-style-type: none"> limiting sounds to 100 dB(A) averaged over 15 minutes; conducting regular sound monitoring to ensure and document compliance; optimizing venue acoustics and sound system design to ascertain optimal listening conditions for all audience members in the venue/event; create quiet zones allowing audience members to rest; ensuring provision of hearing protection (earplugs); ensuring provision of training on noise reduction strategies and information about noise. 	 Sports and leisure	National	Regulation

Leisure noise: awareness raising and capacity building

13. Provide information on personal sound exposure to the user of personal listening devices through the device interface or other means (6).	  Health Sports and leisure	National	Information, education and communication
14. Provide personalized recommendations and cues for action for safe listening through personal listening devices, customized to a user's listening profile through the device interface or other means (6).	  Health Sports and leisure	National	Information, education and communication
15. Provide instructions on how to use safe listening features on the specific device through the device interface or other means (6).	  Health Sports and leisure	National	Information, education and communication

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
16. Provide general information on safe listening and ways to practise it through the device interface or other means (6).	 Health  Sports and leisure	National	Information, education and communication

Selected tools

WHO 2021: *WHO is developing a global standard for safe listening entertainment venues* (7)

This guidance will promote safe listening among attendees of entertainment venues to mitigate their risk of hearing loss.

WHO Regional Office for Europe 2018: *Environmental noise guidelines for the European Region* (2)

Results of the noise guidelines are also available as an executive summary in different languages.

WHO/ITU 2019: *Safe listening devices and systems – a WHO-ITU standard* (6)

This document outlines the key features and requirements that personal audio systems must have in order to facilitate safe listening practices among users.

WHO 2015: *Make listening safe* (8)

This webpage provides access to advocacy material around safe listening such as infographic, poster, banner and brochure.

WHO/ITU 2019: *Toolkit for safe listening devices and systems* (9)

This toolkit provides practical guidance to support countries, industry partners and civil society groups in the use and implementation of the global standard on safe listening devices and systems (ITU-T H.870) (10).

WHO Regional Office for Europe 2012: *Methodological guidance for estimating the burden of disease from environmental noise* (11)

WHO Regional Office for Europe 2011: *Burden of disease from environmental noise. Quantification of healthy life years lost in Europe* (1)

WHO Regional Office for Europe 2009: *Night noise guidelines for Europe* (12)

References

1. Burden of disease from environmental noise: Quantification of healthy life years lost in Europe. Copenhagen: WHO Regional Office for Europe; 2011 (<https://apps.who.int/iris/handle/10665/326424>).
2. Environmental noise guidelines for the European Region. Copenhagen: WHO Regional Office for Europe; 2018 (<https://apps.who.int/iris/handle/10665/279952>).
3. Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise. EUR-Lex; 2002 (<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02002L0049-20210729>).
4. Brink M, Schäffer B, Pieren R, Wunderli JM. Conversion between noise exposure indicators $L_{eq,24h}$, L_{Day} , $L_{Evening}$, L_{Night} , L_{dn} and L_{den} : principles and practical guidance. *Int J Hyg Environ Health*. 2018;221(1):54–63. doi:10.1016/j.ijheh.2017.10.003.
5. Eurofound. European Quality of Life Survey 2016: quality of life, quality of public services, and quality of society. Luxembourg: Publications Office of the European Union; 2017 (<https://www.eurofound.europa.eu/en/publications/2018/european-quality-life-survey-2016>).
6. Safe listening devices and systems: a WHO-ITU standard. Geneva: World Health Organization and International Telecommunication Union; 2019 (<https://www.who.int/publications/i/item/safe-listening-devices-and-systems-a-who-itu-standard>, accessed 2 December 2021).
7. Information session on the upcoming WHO Global standard for safe listening entertainment venues [website]. Geneva: World Health Organization; 2021 (<https://www.who.int/news-room/events/detail/2021/09/21/default-calendar/information-session-on-the-upcoming-who-global-standard-for-safe-listening-entertainment-venues>, accessed 10 December 2021).
8. Making listening safe [website]. Geneva: World Health Organization; 2021 (<https://www.who.int/activities/making-listening-safe>, accessed 2 December 2021).
9. Toolkit for safe listening devices and systems. Geneva: World Health Organization and International Telecommunication Union; 2019 (https://www.itu.int/en/ITU-D/Digital-Inclusion/Pages/Digital_Inclusion_Resources/Strategies,%20policies,%20toolkits/Toolkit_safe_listening_devices/safe_listening.aspx, accessed 2 December 2021).
10. Guidelines for safe listening devices/systems. In: SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: E-health multimedia systems, services and applications – safe listening. Geneva: International Telecommunication Union; 2018 (<https://www.itu.int/rec/T-REC-H.870>, accessed 19 March 2024).
11. Hellmuth T, Classen T, Kim R, Kephalaopoulos S, editors. Methodological guidance for estimating the burden of disease from environmental noise. Copenhagen: WHO Regional Office for Europe; 2012 (https://www.euro.who.int/__data/assets/pdf_file/0008/179117/Methodological-guidance-for-estimating-the-burden-of-disease-from-environmental-noise-ver-2.pdf, accessed 2 December 2021).
12. Night noise guidelines for Europe. Copenhagen: WHO Regional Office for Europe; 2009 (<https://iris.who.int/handle/10665/326486>).

12. Priority settings for action

12.1 Cities and other settlements

Cities and other settlements can bring many opportunities for better health, a cleaner environment and climate action. Strong urban policies must match these goals since health is essential for fostering good urban livelihoods; building a productive workforce; creating sustainable, resilient and vibrant communities; enabling physical mobility; promoting social interactions; and protecting vulnerable populations. The health and well-being of citizens are the most important assets of a city or other settlement.

This section addresses the main principles of and actions for ensuring better integration of health into the built environment and decisions about spatial planning in cities and other types of settlements. The agenda for mutual and cross-cutting support among the built environment, planning and health is long and opportunities are great. It encompasses multiple levels (e.g. local, regional), numerous stakeholders and many sectors (e.g. transport, housing, land use).

Cities and other settlements should also make use of the opportunity presented by a city mayor who is empowered to take cross-sectoral decisions at the local level, for example about urban planning; transportation systems; purchasing; the supply of energy, water and sanitation; and waste management. Strategic urban planning, management and renewal will be the keys to creating supportive and enabling environments for health, and ensuring that health and equity considerations are integrated throughout the planning process and investment period.

Comprehensive guidance on this topic beyond health and the environment can be found elsewhere.¹⁴



Overview

Urbanization is one of the leading global trends of the 21st century and it has a significant impact on health. More than 57% of the world's population lives in urban areas (1), a proportion that is expected to increase to 68% by 2050 (2). As most future urban growth will take place in developing cities (3), this provides policy-makers with a unique opportunity to guide urbanization and other major urban development trends in a way that protects and promotes health.

¹⁴ For additional information, see WHO's guidance on urban health (<https://www.who.int/health-topics/urban-health>).

How do we assess whether a city is healthy?	<p>A healthy city embodies a dynamic process rather than a fixed outcome, displaying a conscious and continual commitment to the well-being of its inhabitants. A healthy city places people at the centre, investing in human and social capital while promoting inclusivity, trust and ethical values. Balancing the needs of people and the planet, a healthy city prioritizes holistic well-being, weaving health considerations into every facet of policy and governance.</p> <p>There exist different indicators that support assessments about whether cities or other settlements are healthy (4–6). However, none of them provides a comprehensive assessment, and using a combination of different indicators should be considered. Despite this, the progress made by cities towards becoming healthier environments can be measured with key Sustainable Development Goals (SDGs) (7) (e.g. SDG 11, Make cities and human settlements inclusive, safe, resilient and sustainable); however, most of the data for the indicators are collected at a national scale and, therefore, provide only an overview of the cities in a particular country, not an individual assessment for each city.</p> <p>Nonetheless, national governments and the international community should be supportive of efforts to localize indicators and should incentivize plans and initiatives to build healthy and resilient cities through empowerment and financing (e.g. by encouraging peer learning and exchanges among cities to collectively address the issues faced by this process or by strengthening financial support for assessing urban indicators of resilience and health). Indicators should better reflect urban realities, cover gaps and promote action (4).</p>
--	---

The Guidance table provides an overview of the most relevant advice from WHO and other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>1. Create economically and socially viable local communities with accessible and well-connected local amenities. This includes citywide access to safer walking, biking, nature and public spaces, with public transport that supports mobility, recreation, access to services and social interactions, all of which reduce the use of energy and resources (8–11).</p> <p>2. Create variety in spatial planning – such as in land parcel size, forms of land tenure and size of housing – to facilitate more socially inclusive public places and green and blue natural spaces (8, 10–12), while considering different population groups (13–15).</p>	 Land use planning	Community; national	Infrastructure, technology and built environment	B
	 Land use planning	Community; national	Infrastructure, technology and built environment	B, C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>3. Plan places that are more resilient to climate change and disasters: create well-designed and accessible green and blue spaces that also act as buffer zones and functional landscapes; use preventive and risk-informed approaches in land-use planning to reduce risk exposure; promote compactness, land-use mix and connectivity throughout the city to help create more healthy and equitable proximity lifestyles and reduced dependencies (8, 16, 17).</p> <p>Urban compactness promotes relatively high density in urban settlements (i.e. the opposite of urban sprawl) through mixed-use developments. This should be accompanied by the promotion of public transport and the provision of services and facilities (e.g. hospitals, schools, parks) nearby that are easily accessible by all residents. This model is related to reductions in car-dependency and energy consumption, which directly support action against climate change. It also promotes economically and socially viable local communities, which increase the quality of life of residents.</p>	 Land use planning	Community; national	Infrastructure, technology and built environment	B
<p>4. Design human settlements that are less demanding of resources: protect and restore urban ecosystems; use nature-based solutions, innovative solutions and good practices in production, consumption, waste reduction and disposal to promote health, protect the environment and improve resilience to climate change (8, 10, 12).</p>	 Land use planning  Industry  Environment  Multiple sectors	Community; national	Infrastructure, technology and built environment; other management and control	B
<p>5. Implement interventions in polluting sectors, such as in transport, energy, production and waste management, and promote cleaner indoor air through access to cleaner fuels and technologies for cooking, heating and lighting (9); see also Chapter 2. Air pollution.</p>	 Transport  Industry  Energy  Multiple sectors	Community; national	Other management and control	B
<p>6. Provide well-managed WASH facilities, adequate waste disposal and housing, and access to healthy food (10) (see relevant sections in this Compendium, such as Chapter 3. WASH, Chapter 4. Solid waste, Chapter 12.2 Housing and Chapter 10. Safe and healthy food.</p>	 Water/sanitation  Waste  Housing  Food	Community; national	Infrastructure, technology and built environment	B
<p>7. Redevelop contaminated sites in urban areas to promote healthier environments, and enable vacant land to be used for sustainable urban development (18); see also Chapter 4. Solid waste.</p>	 Waste  Land use planning	Community; national	Infrastructure, technology and built environment	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>8. Strengthen institutions to provide integrated urban and territorial planning: increase capacity for integration and participation, and inform and integrate decision-making processes for urban policies with other relevant sectorial policies and interventions, including through the Health in All Policies (or HiAP) framework (8, 10, 19, 20).</p>	 Land use planning  Health	Community; national	Governance	B
<p>9. Perform health and economic impact assessments for urban policies, including health equity assessments, and link these to social and environmental impact assessments; involve communities in the assessment of impacts of local interest (8, 10).</p>	 Land use planning  Health	Community; national Universal health coverage	Assessment and surveillance	B
<p>10. Allocate resources across sectors to account for the expected health impacts of sector-based policies. Use fiscal and other financial mechanisms to influence the urban determinants of health through investments in health-enhancing policies as well as taxation of unhealthy products and practices (8, 10).</p>	 Finance  Health  Environment	Community; national	Taxes and subsidies	B
<p>11. Monitor and track risks to health and well-being for different population groups; monitor the adoption of policies and investments that address these health risks by introducing corrective measures, if necessary; and assess cities' health performance using timely data and targeted indicators (4, 10, 20, 21). To the extent possible, disaggregate the data to identify inequalities between population groups and enable targeted policies (22).</p>	 Health  Environment	Community; national Universal health coverage	Assessment and surveillance	B
<p>12. Develop the necessary capacity, skills, standard operating procedures, training procedures and job functions to enable the public health system to integrate health into urban development and deliver on the New Urban Agenda (8, 10).</p>	 Health  Land use planning	National; community Universal health coverage	Information, education and communication	B
<p>13. Develop a common vision for social cohesion and health equity by adopting a person-centred right-to-health framework that includes the right to access, use and sustainably transform urban environments (8, 10, 20, 23).</p>	 Health  Land use planning	National; community Universal health coverage	Other management and control	B

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy
WASH: water, sanitation and hygiene.

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

WHO 2023: Tracking urban health policies: a conceptual framework with special focus on air pollution in African cities (21) – This report from the Urban Health Initiative proposes a framework for tracking urban health policies, with a special focus on the impacts of air quality and energy access on human health and well-being in African countries.

WHO 2023: National programmes for age-friendly cities and communities: a guide (13) – This guide, aimed at national authorities and stakeholders, provides suggestions for developing age-friendly cities and communities.

WHO Regional Office for Europe 2023: Promoting environment and health policies at local level: a policy brief for decision-makers and practitioners (20) – This brief summarizes messages from and lessons learned by local authorities across Europe about how to establish effective policies and interventions to provide healthy, sustainable environments for their citizens.

WHO Regional Office for Europe 2022: Urban planning for resilience and health: key messages – summary report on protecting environments and health by building urban resilience (16) – The Protecting environments and health by building urban resilience project aims to support local authorities to establish safe, healthy and sustainable cities; this report summarizes key findings and messages about how to apply environmental and infrastructural planning as important pathways towards building urban resilience.

UN-Habitat, WHO 2020: Integrating health in urban and territorial planning: a sourcebook (8) – This sourcebook identifies a comprehensive selection of resources and tools to help incorporate health into urban and territorial planning.

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

WHO, UNICEF, UN-Habitat 2024: A guide to creating public space for urban children (24)

Food and Agriculture Organization of the United Nations (FAO) 2023: City region food systems programme [website] (25) – The FAO provides a suite of online guidance, tools and information that offers concrete policy and programme opportunities to support the assessment and improvement of city region food systems to help achieve better economic, social and environmental conditions in both urban and nearby rural areas.

UN-Habitat, WHO 2022: Integrating health in urban and territorial planning: directory of resources for planning healthy environments [online database] (26) – This online repository of more than 100 open access resources and tools provides information about the importance of planning and designing urban areas from a health perspective, as well as concrete guidance about how to do this.

WHO 2022: Strengthening health emergency preparedness in cities and urban settings: guidance for national and local authorities (27) – This guidance document is an operational complement to the WHO Framework for Strengthening Health Emergency Preparedness in Cities and Urban Settings (28) and offers adaptable approaches and actions to support national and local policy-makers working across all sectors relevant to health emergency preparedness at the city or urban level.

WHO 2021: Framework for strengthening health emergency preparedness in cities and urban settings (28) – This framework aims to provide an overview of, and insight into, the key areas that national and subnational authorities might consider focusing on to strengthen health emergency preparedness at the urban level and to guide and support the development of policies and capacity-building activities at both the national and subnational levels to strengthen health emergency preparedness in cities and urban settings, based on the prioritization of risks and addressing existing gaps.

WHO 2021: Local action for health: a repository of WHO resources [online database] (29) – The database is a repository of WHO-generated resources to enhance action on urban health. It includes tools that provide technical support and build capacity, strategic reports and guidelines, Health Impact Assessment tools and other products relevant to urban health and cities. The repository is a living resource, open to modifications and additions, and is automatically updated each time new products become available.

WHO 2020: Urban Health Initiative: improving air quality and health in cities. A model process for catalysing change [website] (30) – The Initiative presents a step-wise approach that can help urban leaders to create demand for action for healthier and more climate-friendly cities by making the best use of local data, knowledge, competencies and processes to include health in the development equation.

WHO 2019: Healthy environments for healthier populations: why do they matter, and what can we do? (31) – This document presents an overview of sectoral actions that can be taken by various actors and the support that is being offered by WHO to create healthier environments, including in priority settings such as workplaces, cities, dwellings, health care facilities and emergency settings. Key risk areas are addressed, such as air pollution; water, sanitation and hygiene (or WASH); chemical safety and radiation; and climate change.

UNICEF 2018: Advantage or paradox? The challenge for children and young people of growing up urban (32) – This report supports the scaling up of urban programming for children to foster equitable and sustainable development.

WHO Regional Office for Europe 2017: Urban green spaces: a brief for action (33) – This briefing presents the key findings of a review of research evidence and practical case studies of urban green space interventions; it also assesses implications for practice.

WHO 2016: Global report on urban health: equitable healthier cities for sustainable development (34) – This report presents evidence that in cities, making progress in health depends on shaping urban environments, and it presents examples of effective actions by cities and nations around the world and their subsequent successes.

WHO 2015: Measuring the age-friendliness of cities: a guide to using core indicators (35) – This guide provides technical information about developing age-friendly cities by selecting and using core indicators to establish baselines, set goals and targets, and monitor and evaluate initiatives.

WHO Regional Office for the Western Pacific 2015: Healthy cities: good health is good politics. Toolkit for local governments to support healthy urban development (36) – This provides tools to support and strengthen the efforts of local leaders in applying the Healthy Cities approach.

UN-Habitat: Global Land Tool Network [website] (37) – The Global Land Tool Network is an alliance of international partners committed to increasing access to land and tenure security for all, with a particular focus on people with limited financial resources and women. It uses a rights-based approach. The network's partners include international civil society organizations, research and training institutions, bilateral and multilateral organizations, and international professional bodies.



12.2 Housing

Improved housing conditions can save lives, prevent disease, increase quality of life, reduce poverty and help mitigate climate change. Housing is becoming increasingly important to health in light of urban growth, ageing populations and climate change.

This section addresses the main principles and areas for action to improve housing conditions and provide healthy and sustainable housing for all. Multiple co-benefits for health, the environment and social equality arise from addressing the key health risks associated with housing. For example, installing adequate thermal insulation and energy efficient heating can improve indoor temperatures that support health, while also lowering expenditure on energy and reducing carbon emissions.

Successful implementation of housing improvements requires the government to work together across the local, regional and national level as well as across different sectors including health, housing and energy. As many interventions need to be realized by homeowners and through the support of the private sector, civil society engagement and collaboration with implementing actors – such as housing managers, architects, urban planners, social housing services, consumer protecting agencies, and the building industry – is crucial.



Overview

According to UN-Habitat estimates, about 3 billion people – or 40% of the world's population – will need access to adequate housing by 2030 (38). This creates a need for 96 000 new, affordable and accessible housing units every day. Access to safe and healthy housing is a human right and one mechanism through which social and economic inequalities translate into health inequality.

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
1. Develop or update strategies to prevent and reduce household crowding (39).	Housing Construction Land use planning	National; community	Regulation
2. Ensure sufficient indoor housing temperatures to protect residents from the harmful health effects of cold. For countries with temperate or colder climates, 18°C has been proposed as a safe and well-balanced indoor temperature to protect the health of general populations during cold seasons (39).	Housing Health Energy	National; community	Regulation
3. In climate zones with a cold season, install efficient and safe thermal insulation in new housing and retrofit it into existing housing (39).	Housing Construction Energy	National; community	Infrastructure, technology and built environment

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>4. In populations exposed to high ambient temperatures, develop or update strategies to protect populations from excess indoor heat (39).</p>	 Housing Health Energy	National; community	Regulation
<p>5. Equip housing with safety devices (such as smoke and carbon monoxide alarms, stair gates and window guards) and take measures to reduce hazards that lead to unintentional injuries (39).</p>	 Housing Health Construction	National; community	Infrastructure, technology and built environment
<p>6. Make an adequate proportion of the housing stock accessible to people with functional impairments, based on the current and projected national prevalence of populations with functional impairments and considering trends of ageing (39).</p>	 Housing Construction Health	National; community	Regulation; governance
<p>7. Fit ceilings, reduce cracks, screen windows, eaves and doors, and reduce aquatic habitats and breeding sources around houses to hinder vectors from entering the house and reduce vector-borne diseases like malaria, dengue or Chagas disease (40).</p>	 Housing Health Construction	National; community Universal health coverage	Infrastructure, technology and built environment
<p>8. Access to healthy housing and tenure security (41):</p> <ul style="list-style-type: none"> • Promote secure tenure and the availability of housing options, including the neutral treatment of tenure options (such as ownership or renting), in order to encourage the development of adequate supplies of affordable housing. • Promote transparent and fair rental markets with a balance of rights and duties between landlords and tenants through adequate legislation and conflict resolution mechanisms in order to facilitate residential and labour mobility. • Contribute to well-functioning, efficient, equitable and transparent housing markets and land markets, which respond to different types of housing demand as well as favouring credit access for socially and economically vulnerable population groups, including through alternative forms of funding, such as housing microfinance. 	 Housing Finance Land use planning	National; community	Regulation; governance
<p>9. Introduce loans and subsidies to support homeowners in implementing housing improvement interventions (39).</p>	 Housing Finance	National; community	Taxes and subsidies
<p>10. Develop or update legislative and regulatory codes to control the design and construction of new dwellings to ensure that the necessary and appropriate precautions and sustainability measures are incorporated to protect against the identified potential threats to health and safety (42).</p>	 Housing Construction Health	National; community	Regulation

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>11. Develop or update national and local policies and programmes with defined, prioritized target areas where the most serious conditions in the existing housing stock are likely to be present (42).</p>	 Housing Construction Health	National; community	Regulation
<p>12. Raise awareness and educate all those involved in the design, construction, management, maintenance and repair/rehabilitation of housing and building-related equipment about the links between housing conditions and health (42).</p>	 Housing Construction Health	National; community Universal health coverage	Information, education and communication
<p>13. Conduct public awareness campaigns to enable householders to make informed decisions such as about adequate room temperatures, by informing them of dangers (such as carbon monoxide and the threats to others from second-hand tobacco smoke) and of important precautions (such as effective ventilation). Householders should also be made aware of any subsidies that may be available, such as financial assistance towards energy efficiency improvements (42).</p>	 Housing Health Energy	National; community Universal health coverage	Information, education and communication
<p>14. Increase involvement of the health sector in the development and implementation of policies and programmes directed at dealing with inadequate housing. Systems should be put in place that enable health professionals to refer patients for housing advice where they present with health conditions and injuries that could be related to housing conditions (42).</p>	 Health	National; community Universal health coverage	Information, education and communication
<p>15. Use integrated slum upgrading strategies to improve the health and well-being of householders in slums, providing them with access to basic services and infrastructure and including them in decision-making processes (43).</p>	 Housing Construction Land use planning Health	National; community Universal health coverage	Infrastructure, technology and built environment
<p>16. Ensure that housing strategies include land use and transport planning for walking, cycling and rapid transit/public transport, as well as access to green areas to enhance health and climate benefits and reduce risks (e.g. urban heat island effect) (42).</p>	 Housing Construction Land use planning Health Transport	National; community Universal health coverage	Infrastructure, technology and built environment; governance
<p>17. Integrate planning and construction of houses into urban development strategies (10).</p>	 Housing Construction Land use planning	National; community	Governance

Selected tools

WHO 2020: Repository and review of policies, regulations and legislation to promote healthy housing (44)

– The repository provides an overview of policies, regulations and legislation from all six WHO regions to improve housing-related health risks such as crowding, indoor air quality, indoor temperature and building materials. The related review analyses implementation barriers and facilitators of example policies and describes case studies of multisectoral implementation projects.

SHERPA for sustainable housing projects (45) – SHERPA is a self-evaluation tool for project managers, communities and other stakeholders involved in the planning, design, construction and assessment of housing projects.

WHO 2018: WHO housing and health guidelines (39) – The WHO housing and health guidelines provide evidence-based and practical recommendations on how to reduce health risks from poor housing conditions. The guidelines summarize all WHO guidance relevant to housing and provide practical implementation considerations such as a list of existing crowding measures or case studies on home modification programmes simultaneously addressing several housing risks.

UN-Habitat 2018: Alternative solutions to forced evictions and slum demolitions (46) – Using four real-life cases, this publication prescribes short-term, medium-term and long-term guidance that has prevented forced evictions and mitigated the risks of evictions that have taken place.

UN-Habitat 2017: The human rights-based approach to housing and slum upgrading (47) – This handbook is a guide for practitioners upgrading housing and slums in using the human rights-based approach in their interventions by applying methods such as causality analysis, role pattern analysis and capacity gap analysis.

UN-Habitat 2014: Accessibility of housing. A handbook of inclusive affordable housing for persons with disabilities and older persons (48) – This handbook aims to bridge the existing gap between the needs and rights of persons with disabilities and older persons through slum upgrading, reconstruction, and large-scale affordable and social housing programmes. Through the provision of concepts, major policy approaches, practical information and technical tools, the handbook intends to build capacity to increase accessibility (such as through design and implementation) in identified contexts. Likewise, it brings to light the implications and the global importance of developing accessibility of sustainable human settlements.

UN-Habitat 2013: Housing and slum upgrading: gender issue guide (49) – This guide's objectives are to: i) increase understanding of gender concerns and needs in housing and slum upgrading; ii) develop capacity to address gender issues in this area; iii) encourage the integration of a gender perspective into policies, projects, and programmes for sustainable urban development; and iv) support the institutionalization of the culture of gender mainstreaming and gender equality, the implementation of gender-sensitive projects and programmes, and the monitoring of gender-mainstreaming progress.

UN-Habitat 2010: A practical guide for conducting housing profiles – revised version (50) – A practical guide to conducting comprehensive national housing profiles with a direct objective of understanding the housing sector, while offering evidence-based data to inform policy reform. The housing profile process also aims to be highly participatory and engage multi-stakeholder groups that influence and are influenced by the housing sector.



12.3 Workplaces



Overview

More than 1.2 million deaths annually (2015 data) are estimated to be caused by occupational risks (51). Large gaps persist with regard to the health status of workers and their exposure to occupational risks. In addition, only a small minority of the global workforce has access to occupational health services. Nevertheless, effective interventions to prevent occupational hazards and to protect and promote health at the workplace are available (52).

Assessment of national occupational health and safety

Workers' health is determined not only by workplace hazards but also by social and individual factors and access to health services (52).

The following SDG indicators are important for national assessment and monitoring of occupational health and safety.

- Indicator 8.8.1: Fatal and non-fatal occupational injuries per 100,000 workers, by sex and migrant status.
- Indicator 8.8.2: Level of national compliance with labour rights (freedom of association and collective bargaining) based on ILO textual sources and national legislation, by sex and migrant status.
- Indicator 1.3.1: Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, newborns, work-injury victims and the poor and the vulnerable.

In addition, there are SDG targets for monitoring the proportion of informal employment, average hourly earnings, unemployment rates, proportion of youth not in education, employment or training and proportion and number of children aged 5–17 years engaged in hazardous child labour.

Workplaces with a high risk for work-related disease and injury include mining, construction, agriculture and manufacturing. Other occupational groups, such as office- or health care workers, are at risk of specific health conditions such as stress and musculoskeletal diseases or overexertion and infections (51).

Special attention needs to be paid to the approximately 2 billion people (61% of the world's employed population) working in the informal economy. The informal economy involves vulnerable groups such as children, pregnant women, older persons and migrant workers. Informal work has usually harmful effects on workers' rights, social protection and working conditions, thus placing informal workers at greater risk of work-related deaths and disease (53).

What is the level of occupational health and safety we want to achieve?

SDG 8 focuses on sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all (60). Relevant targets include the following.

- Target 8.3: Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services.
- Target 8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.
- Target 8.6: By 2020, substantially reduce the proportion of youth not in employment, education or training.
- Target 8.7: Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms.
- Target 8.8: Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment.

The WHO Global Plan of Action on Workers' Health 2008–2017 (52) underlines the importance of:

- all workers being able to enjoy the highest attainable standard of physical and mental health;
- favourable working conditions for all workers;
- the workplace not threatening health and well-being;
- primary prevention of occupational health hazards;
- all components of health systems to be involved in an integrated response to the specific health needs of working populations.

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
Policies and actions			
1. Develop or update national policies and action plans on occupational safety and health (52, 55, 56).	 Labour  Health  Other sectors	National	Regulation
2. Support implementation of essential occupational health interventions for primary prevention of occupational and work-related diseases and injuries (52). Such measures might include: • integrated chemical management; • elimination of second-hand tobacco smoke; • improved occupational safety; • health impact assessment of new technologies, work processes and products at the design stage; • regular assessment of workplace risks and the effectiveness of their control.	 Labour  Health	Workplace Universal health coverage	Other management and control; assessment and surveillance

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>3. Enforce a basic set of occupational health standards to ensure that all workplaces comply with minimum requirements for health and safety protection (52).</p> <p>This includes enacting regulations, workplace health inspections and collaboration between regulatory agencies.</p>	 Labour Health	National	Regulation; assessment and surveillance
<p>4. Increase the capacity of the health sector; develop human resources for workers' health (52).</p> <p>This may be achieved through the following actions:</p> <ul style="list-style-type: none"> • extend postgraduate training in relevant disciplines; • build capacity for basic occupational health services; • incorporate workers' health in the training of primary health care practitioners and other health professionals; • create incentives for attracting and retaining human resources for workers' health; • encourage the establishment of networks of services and professional associations. 	 Labour Health	Health care; workplace Universal health coverage	Information, education and communication
<p>5. Promote inclusion of workers' health in other sectors' policies (52).</p>	 Health	National	Governance
At the workplace			
<p>6. Ensure that workplaces, machinery, equipment and processes are safe and without risks to health (55).</p>	 Health Other sectors	Workplace Universal health coverage	Other management and control
<p>7. Provide appropriate measures of protection, such as protective clothing, when handling chemical, physical and biological substances and agents that pose risks to health (55).</p>	 Health Other sectors	Workplace Universal health coverage	Infrastructure, technology and built environment
<p>8. Provide measures to deal with emergencies and accidents in the workplace, including adequate first-aid arrangements, such as cardiopulmonary resuscitation (CPR) (55).</p>	 Health	Workplace Universal health coverage	Other management and control
<p>9. Strengthen primary prevention of occupational hazards, diseases and injuries through increased resources, training of workers and employers, introduction of healthy work practices, work organization and a health-promoting culture at the workplace (52).</p>	 Health	Workplace Universal health coverage	Information, education and communication; other management and control

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
<p>10. Implement appropriate occupational health services for all workers, including informal, migrant and contractual workers, in consultation with representative employer and worker organizations and groups (57).</p> <p>Functions of occupational health services include the following.</p> <ul style="list-style-type: none"> • Assess occupational risks or hazards. • Monitor worker's health in relation to work. • Monitor factors in the working environment that may affect health such as sanitary installations, canteens and housing. • Advise on healthy work planning/organization including workplace design and work equipment. • Participate in programme development for improving work practices and equipment according to health and safety. • Advise on occupational health, safety and hygiene, on ergonomics and protective equipment. • Contribute to measures of vocational rehabilitation. • Collaborate in providing information, training and education about occupational health/hygiene and ergonomics. • Organize and provide first aid and emergency treatment. • Participate in analysis of occupational accidents and occupational diseases. 	 Health	Workplace Universal health coverage	Assessment and surveillance; information, education and communication; other management and control
<p>11. Inform all workers about health hazards involved in their work and provide information, instruction and training on occupational safety and health (57).</p>	 Health	Workplace Universal health coverage	Information, education and communication
<p>12. Promote health and prevent NCDs at the workplace (52).</p> <p>Action points include the following.</p> <ul style="list-style-type: none"> • Promote a healthy diet. • Introduce balanced working time arrangements. • Support tobacco cessation and ban smoking at the workplace. • Promote physical activity and active workplace arrangements to prevent sedentary work. • Prevent work-related NCDs – occupational cancer and chronic respiratory diseases (asthma, COPD and pneumoconiosis). • Promote mental health at work. 	 Health	Workplace Universal health coverage	Information, education and communication; regulation
<p>13. Implement early detection, surveillance and reporting systems for major occupational risks, occupational accidents and diseases (52).</p>	 Health	Workplace Universal health coverage	Assessment and surveillance
<p>14. Implement strategies to ensure reintegration of sick and injured workers (52).</p>	 Health	Workplace Universal health coverage	Other management and control; regulation
<p>15. Build workplace resilience to public health threats and emergencies, such as chemical and radiological incidents, extreme weather events (heatwaves, floods), periods of severe air pollution and outbreaks of infectious diseases in all economic sectors (58).</p>	 Health  Other sectors	Workplace Universal health coverage	Other management and control

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments
Health care facilities			
<p>16. Establish occupational health policies and programmes in all health care facilities (59, 60).</p> <p>The WHO-ILO Global Framework for National Occupational Health Programmes for Health Workers includes the following building blocks.</p> <ul style="list-style-type: none"> Identify a responsible person with authority for occupational health at both the national and workplace levels. Develop a written policy on safety, health and working conditions for health workforce protection at the national and workplace levels. Ensure access to occupational health services by strengthening the existing, or establishing a new, occupational health programme, and allocate sufficient resources/budget to the programme, occupational health professional services and the procurement of necessary PPE and supplies. Create joint labour-management health and safety committees, with appropriate worker and management representation. Provide ongoing (or periodic) education and training that is appropriate to all parties, including occupational health practitioners, senior executives, front-line managers, health and safety committees, front-line workers and their representatives, and the general public. Identify hazards and hazardous working conditions in order to prevent and control them, and manage risks by applying the occupational health hierarchy of controls, which prioritizes elimination or control at the source. Provide pre-service and ongoing immunization against hepatitis B and other vaccine-preventable diseases in the workplace at no cost to the employee (this includes all three doses of the hepatitis B vaccine for all workers at risk of blood exposure, including cleaners and waste handlers). Promote exposure and incident reporting, eliminating barriers to reporting and providing a blame-free environment. Promote and ensure health worker access to diagnosis, treatment, care and support for HIV/AIDS, tuberculosis and viral hepatitis B and C. Utilize appropriate information systems to assist in the collection, tracking, analysing, reporting and acting upon data to promote health and safety of the health care workplace and health workforce. Ensure that health workers are entitled to compensation for work-related disability in accordance with national laws. 	 Health	Workplace; health care Universal health coverage	Regulation
<p>17. Provide adequate infection prevention and control (IPC) and PPE, such as masks, gloves, goggles, gowns, hand sanitizer, soap and water, cleaning supplies, in sufficient quantities to health care staff and other workers at risk, such as cleaners, that are in contact with potential infectious patients or materials (59–61).</p> <p>Note: Adequate IPC and PPE depend on the procedure performed and on the suspected disease (see Section 12.4 Health care facilities for more information).</p>	 Health	Workplace; health care Universal health coverage	Infrastructure, technology and built environment

Guidance	Sector principally involved in planning/implementation	Level of implementation	Instruments
18. Promote hand hygiene and respiratory hygiene as essential preventive measures (61).	 Health	Workplace; health care Universal health coverage	Information, education and communication
19. Ensure single-use of syringes and injection devices if possible by procuring syringes with a sharps injury protection feature (SIP devices) and with a re-use prevention feature (RUP devices). Provide puncture-resistant sharps' containers for safe sharps disposal (61, 62).	 Health	Workplace; Health care Universal health coverage	Infrastructure, technology and built environment
20. Provide information, instruction and training on occupational safety and health including training on IPC, on the correct use of PPE, and on safe patient handling for prevention of back injuries (61).	 Health	Workplace; health care Universal health coverage	Information, education and communication

Selected tools

WHO 2020: Awareness-raising and educational material on how to hand-wash, how to hand-rub and when and how to perform hand hygiene in health care settings (63)

WHO 2020: Immunization of health care workers – summary of WHO Position Papers (64)

WHO 2020: How to put on and take off personal protective equipment (65)

WHO 2019: WHO guidelines on tuberculosis infection prevention and control – 2019 update (66)

WHO 2019: Minimum requirements for infection prevention and control (IPC) programmes (67)

WHO 2019: How to implement seasonal influenza vaccination of health workers. An introduction manual for national immunization programme managers and policy makers (68)

WHO 2018: Occupational safety and health in public health emergencies: a manual for protecting health workers and responders (69)

WHO 2017: Prevention of HIV transmission in health care settings (70)

WHO 2016: Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level (61)

WHO 2014: Guidelines on infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care (71)

ILO/WHO 2014: HealthWISE – Work Improvement in Health Services (72)

WHO/ILO/UNAIDS 2010: Joint WHO/ILO policy guidelines on improving health worker access to prevention, treatment and care services for HIV and TB (73)

Pan American Health Organization 2009: Aide memoire 2009: hepatitis B immunization of health workers (74)

WHO 2003: Aide-memoire for a strategy to protect health workers from bloodborne viruses (75), which includes a checklist

ILO/International Council of Nurses/WHO/Populations Services International 2002: Framework guidelines for addressing workplace violence in the health sector (76)

ILO 2018: Safety and health in opencast mines. Second (revised) edition (77)

Selected tools

ILO 2013: *Safety and health in the use of machinery* (78)

ILO 2009: *Safety and health in underground coalmines* (79)

ILO 2005: *Code of practice on safety and health in the iron and steel industry* (80)

ILO 2003: *Safety and health in the non-ferrous metals industries* (81)

ILO 2001: *Ambient factors in the workplace* (82)

Factors include radiation, EMF, heat and cold, noise and vibration.

ILO 2001: *Safety in the use of synthetic vitreous fibre insulation wools (glass wool, rock wool, slag wool)* (83)

ILO 2004: *Safety and health in shipbreaking: guidelines for Asian countries and Turkey* (84)

12.4 Health care facilities



Comprehensive guidance for health care facilities beyond health and environment can be found elsewhere.¹⁵



Overview

Health care facilities need to be safe, climate resilient and environmentally sustainable to protect people's health in the short and longer term. Access to a reliable supply of energy is a prerequisite for high-quality health care. Safely managed water and sanitation, access to basic hygiene services and adequate waste management are needed to maintain hygienic environments and prevent health care-associated infections and antimicrobial resistance. Eliminating the use of harmful chemicals and ensuring the sound use of radiation in health care contribute to the safety of patients and communities. Occupational health services need to protect health workers to ensure that health care can be delivered. Health care facilities need to continue to be efficient and responsive in an unstable and changing climate.

Yet about 1 billion people are served by health care facilities without electricity or with unreliable access to it and without water, sanitation and hygiene (WASH) services or with inadequate WASH (85). As many as 1 in 5 health care facilities lack access to basic water services, exposing 1.7 billion people to greater risk of infection. In addition, 1 in 3 health care facilities lack hand hygiene stations at points of care; 1 in 4 do not have a system for segregating waste; and 1 in 10 have no sanitation services (86).

At the same time, the health sector is responsible for 5.2% of global greenhouse gas (GHG) emissions (87, 88). To reduce their environmental impact, health systems can adopt a range of environmentally responsible practices when offering health care and preventive services, and help protect and promote health through those practices. Moreover, environmentally responsible practices in health care facilities can have a considerable number of health co-benefits; responsible practices may include the use of natural ventilation as an energy-saving infection control measure, water conservation and rainwater harvesting to sustainably meet the high demand for water in health care facilities, the improved recapture and reuse of anaesthetic gases to protect both health workers and the climate, and the use of well-designed telehealth schemes to reduce travel and improve health care access for vulnerable groups. Environmentally responsible practices can also increase health equity and access to health care, for example when health care facilities are sited along major public transport routes and low-energy or no-energy medical devices are developed and used in remote areas (89).

Some recommendations in the Guidance tables in other sections of this Compendium may be relevant for health care systems and health care facilities, and those are not necessarily repeated here. Those usually include the term health care in the Level of implementation column.

¹⁵ <https://www.who.int/health-topics/hospitals>

Basic service levels at a health care facility

A basic water service provides water from an improved source on the premises.

Improved water sources include piped water, boreholes or tube wells, protected dug wells, protected springs, rainwater, and packaged or delivered water.

A basic electricity service provides reliable electricity for all of the facility's needs.

A basic sanitation service includes improved sanitation facilities that are usable, with at least one toilet dedicated for staff, at least one sex-separated toilet with menstrual hygiene facilities and at least one toilet accessible to people with limited mobility.

Improved sanitation facilities include flush or pour-flush toilets connected to piped sewer systems, septic tanks or pit latrines; pit latrines with slabs (including ventilated pit latrines); or composting toilets.

A basic hand hygiene service provides functional hand hygiene facilities with water and soap or alcohol-based hand-rub, or a combination of these, at points of care and within 5 m of toilets.

A basic health care waste management service means that waste is safely segregated into at least three bins, and sharps and infectious waste are treated and disposed of safely.

A basic environmental cleaning service means that protocols are established and available, and staff with cleaning responsibilities have all received training in them (86).

Climate resilience and environmental sustainability for health care facilities

Climate-resilient and environmentally sustainable health care facilities anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stresses (90). They do this while minimizing their negative impacts on the environment and by leveraging opportunities to restore and improve it to bring ongoing and sustained health care to their target population and protect the health and well-being of future generations (90).

Occupational health services

These services are entrusted essentially with preventive functions (91). They are responsible for advising employers, staff and their representatives about how to establish and maintain a safe and healthy work environment that will facilitate optimal physical and mental health in relation to work; they are also responsible for adapting work to the capabilities of staff, in the light of their physical and mental health.

Occupational health and safety programmes for health workers

Occupational health and safety programmes for health workers comprise planned and coordinated activities at the national, subnational and health facility levels that include governance, regulations and standards, human resources, financing and services aimed at (92):

- preventing diseases and injuries arising from, linked with or occurring during the course of work;
- building healthier and safer working environments; and
- promoting the health and well-being of health workers.

Health workers

Health workers include all people engaged in work that has the primary intention of improving health. This definition includes not only health service providers – such as doctors, nurses, midwives, public health professionals, laboratory technicians, health technicians, medical and non-medical technicians, personal care workers, community health workers, healers and practitioners of traditional medicine – but also health management and support workers, such as cleaners, drivers, hospital administrators, district health managers and social workers, and other occupational groups in health-related activities as defined by the International Standard Classification of Occupations (known as ISCO-08) (92).

The Guidance table provides an overview of the most relevant advice from WHO and other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category. Because of the cross-cutting nature of the topics addressed in this Guidance table, advice may apply to more than one topic, although it is listed under only one heading.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
General				
1. Ensure the whole population has access to safe, climate-resilient and environmentally sustainable health care facilities that provide high-quality care (85, 90, 92, 93). This includes ensuring that facilities: <ul style="list-style-type: none">• provide access to at least basic WASH services that meet the needs of women and children, people with disabilities and other vulnerable groups;• manage health care waste adequately using environmentally sustainable methods;• have access to reliable electricity services;• use chemicals and radiation safely;• provide a safe and healthy work environment for all staff;• are climate resilient;• are environmentally sustainable and have low carbon emissions.	 Multiple sectors	National; health care Universal health coverage	Governance; regulation; infrastructure, technology and built environment	A, B
2. Integrate WASH, waste and electricity services; the health and safety of health workers; and climate resilience and environmental sustainability into health planning, programming, financing and monitoring at all levels (85, 90, 92, 93).	 Multiple sectors	National; health care Universal health coverage	Governance; regulation; infrastructure, technology and built environment	A, B
3. Use globally harmonized indicators to monitor and review improvements within the health care facility in access to WASH, waste and electricity services; the health and safety of health workers; and climate resilience and environmental sustainability (85, 90, 92–95).	 Multiple sectors	National; health care Universal health coverage	Assessment and surveillance	A, B
4. Build the capacity of the health workforce to care for their own health and safety; practise good hygiene; manage the health risks of climate change; manage WASH, waste and electricity services; and ensure the environmental sustainability of health care facilities (85, 90, 92, 93).	 Multiple sectors	National; health care Universal health coverage	Information, education and communication	A, B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
--	--	--	---	--

5. Implement effective IPC programmes (61, 67). The minimum requirements for these programmes include ensuring, among others: <ul style="list-style-type: none"> there are national IPC guidelines and facility-adapted standard operating procedures; there is a national IPC training policy and training for all front-line clinical staff and cleaners; IPC monitoring and surveillance include surveillance for health care-associated infections at the facility level; there are multimodal strategies for priority IPC interventions, such as to improve hand hygiene, safely deliver injections, decontaminate medical instruments and devices, and for environmental cleaning; there are sufficient WASH, health care waste management and reliable electricity services to perform all basic IPC measures. 	 Health	National; health care Universal health coverage	Regulation; other management and control	A, B
--	--	--	--	------

WASH, waste management and environmental cleaning in health care facilities

While point 6 provides guidance about the whole of WASH, waste management and environmental cleaning, points 7–18 offer specific guidance for each topic separately.

6. Implement at least basic WASH, waste management and environmental cleaning services in all health care facilities, ensuring services are climate resilient, sustainable, safe and accessible to all users (85, 86, 93). Eight practical steps for achieving this include: <ul style="list-style-type: none"> conducting a country-wide situation analysis and baseline assessment of WASH systems and services, including an assessment of climate risks and environmental sustainability (90); developing a time-bound national road map with associated budgets and financing for improving WASH services through multisectoral coordination; establishing and implementing national WASH and waste management standards; improving and then maintaining WASH and waste infrastructure to meet national standards; monitoring progress using integrated WASH indicators in national health monitoring information systems and regularly collecting, analysing, reviewing and disseminating data; providing preservice and inservice training about current WASH and IPC practices to the health workforce; engaging with communities to gather their input during the development and implementation of WASH policies and quality improvement processes in health care facilities; generating and disseminating evidence about WASH in health care facilities through operational research, and sharing it at the local, national and global levels. 	   Health Water/sanitation Waste	National; health care Universal health coverage	Infrastructure, technology and built environment; regulation	A, B
---	---	--	--	------

 Guidance	 Sector principally involved in planning/ implementation	 Level of implementation	 Instruments	 Category of evidence
WASH in health care facilities				
<p>7. Ensure the availability of and access to safe and sufficient water for drinking, cooking, personal hygiene, medical activities, cleaning and laundry in health care settings (93).</p> <p>A few concrete examples include ensuring that:</p> <ul style="list-style-type: none"> drinking-water complies with WHO's Guidelines for drinking-water quality (96); a drinking-water station with safe drinking-water is available and accessible to staff, patients and carers at all times and in main waiting areas or entrances to each ward, or both, and in all rooms where patients stay overnight or receive specialized care; non-potable water is used only for cleaning, laundry and sanitation and is appropriately labelled; functional hand hygiene stations (with water and soap or alcohol-based hand-rub) are available at all points of care and in service areas; handwashing facilities (with water and soap) are available within 5 m of all toilets or latrines, and there is at least one shower or bathing area per 40 inpatients or per ward (whichever has fewer patients) and it is functioning and accessible; sanitary inspection forms are used to ensure that water poses no risk to public health (97); a WASH climate risk management plan is implemented (90); climate hazards are considered during the siting and construction of water and sanitation infrastructure (90). 	  Health Water/sanitation	National; health care Universal health coverage	Infrastructure, technology and built environment; regulation	A, B

Note: Sufficient water refers to the minimum quantities of water required in the health care setting. Required amounts are available for planning and designing water supply systems. The actual quantities required depend on a number of factors, such as the size of the facility, services offered and number of patients accessing services, the climate, level of care provided and local water use practices.

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>8. Provide adequate, accessible and appropriate toilets for patients, staff and caregivers (85, 93, 98).</p> <p>Concrete examples include ensuring:</p> <ul style="list-style-type: none"> • a sufficient number of usable toilets are available, separated by sex and with separate facilities for staff and patients; • toilets are easily accessible, safe to use and are appropriate for local technical, financial, cultural and social conditions; • a functional handwashing facility with soap and water is available within 5 m of the toilets; • toilets are cleaned at least once daily and are adequately maintained and repaired if problems arise; • at least one usable toilet meets menstrual hygiene needs; • at least one toilet can be accessed by those with limited mobility; • excreta and wastewater are safely managed and treated according to WHO's guidelines (98); • toilet siting considers climate hazards to avoid the disruption of services, for example in the case of floods, water scarcity or sea level rise (90). 	 Water/sanitation  Health	National; health care Universal health coverage	Infrastructure, technology and built environment; regulation	A, B
<p>9. Ensure rapid and safe disposal of wastewater, ideally through a safely managed piped sewer system (85, 98, 99).</p> <p>Important aspects to consider include ensuring that:</p> <ul style="list-style-type: none"> • wastewater is safely conveyed from the health care facility to treatment, with minimal leaks and overflows; • wastewater drainage is built and managed to avoid contaminating the health care setting and the broader environment; • a stormwater (i.e. rainwater) and greywater drainage system is in place that diverts water away from the facility into a safe drainage or leach field and does not carry contamination from the health care setting to the surrounding environment; • hazardous chemical and radioactive waste and pharmaceuticals are not discharged into wastewater; • latrines are emptied before flood seasons to avoid overflows (90); • vents on sewers and septic tanks are above expected flood lines (90). 	 Water/sanitation	National; health care Universal health coverage	Infrastructure, technology and built environment; regulation	A, B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>10. Educate and train health care facility staff about the crucial moments for performing hand hygiene and the appropriate techniques for handwashing and using an alcohol-based hand-rub (100, 101). Involve other facility staff, patients and visitors in hand hygiene promotion activities.</p> <p>The five moments when hand hygiene should be performed in health care include:</p> <ul style="list-style-type: none"> • before touching a patient • before a clean, or aseptic, procedure • after risk of exposure to body fluid and after glove removal • after touching a patient • after touching a patient's surroundings. <p>More detailed guidance is available in <i>WHO guidelines on hand hygiene in health care</i> (101).</p>	 Health	Health care Universal health coverage	Information, education and communication	A, B
<p>11. Implement WASH FIT to systematically improve the water, sanitation, hygiene and health care waste practices and electricity services in a health care facility, and to focus on climate resilience (97).</p> <p>WASH FIT is a risk-based improvement tool for health care facilities that covers key aspects of WASH services: water, sanitation, hand hygiene, environmental cleaning, the management of health care waste, as well as selected aspects of energy use, and building and facility management.</p> <p>WASH FIT provides a framework to develop and monitor the implementation of an improvement plan for infrastructure, behaviours, and operations and maintenance, and to prioritize specific WASH actions that are climate resilient, equitable and inclusive.</p> <p>Climate-resilient water safety plans and sanitation safety plans may be used together with WASH FIT to ensure the safety of drinking-water and sanitation services at the health care facility level (96, 97, 102, 103).</p>	  Health Water/sanitation	National; health care Universal health coverage	Infrastructure, technology and built environment; regulation	B
<p>12. Assess climate change risks and map them to the existing water, sanitation and waste infrastructure of health care facilities to identify where services could be disrupted by climate-related hazards, such as floods, droughts, landslides and sea-level rise (90).</p>	  Health Water/sanitation	Health care Universal health coverage	Assessment and surveillance	B
<p>13. Conserve water and reduce water usage, and serve healthy and sustainable menu options in health care facilities (90).</p>	    Health Environment Water/sanitation Food	Health care Universal health coverage	Infrastructure, technology and built environment; other management and control	B

 Guidance	 Sector principally involved in planning/ implementation	 Level of implementation	 Instruments	 Category of evidence
<p>14. Assess the climate vulnerability and environmental sustainability of health care facilities to inform management of climate-related risks to staff, patients and communities from water and sanitation services, chemicals and health care waste (90).</p> <p>Concrete examples include the following:</p> <ul style="list-style-type: none"> • identifying climate-related hazardous events that could lead to significant health risks in terms of the collection, treatment, reuse and disposal of sanitation waste, such as overflowing pit latrines and contaminated water sources; • ensuring sufficient water is stored in the health care facility to meet extra demand in case of an extreme weather event; • using harvested rainwater or greywater to flush toilets, clean outdoor pavements and water plants, when possible. 	 Health  Water/sanitation  Waste	Health care Universal health coverage	Assessment and surveillance	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
Waste management in health care facilities				
<p>15. Ensure safe segregation, collection, transportation, storage, treatment and disposal of health care waste (90, 99, 104).</p> <p>Concrete examples include ensuring that;</p> <ul style="list-style-type: none"> trained waste handlers are available and have sufficient PPE to carry out their duties safely; there are national waste segregation standards that rely on a uniform colour-coding or labelling system and that sharps, infectious and non-infectious waste are separated; general waste and infectious or hazardous waste are collected, transported and stored separately; collection and internal transportation happen at fixed times, and there are fixed waste routes, from the most hygienically sensitive area to the least sensitive area; internal waste storage locations are totally enclosed and well separated from other areas; the storage location for infectious and sharps waste is clearly identifiable, with floors and walls sealed or tiled; external waste storage sites should be fenced, at a minimum; only authorized staff have access to waste storage areas, and waste is not stored for longer than the maximum storage times for infectious waste, which depend on the temperature; in general, health care waste is treated using techniques that minimize the formation and release of chemicals or hazardous emissions, in line with the Stockholm Convention on Persistent Organic Pollutants (105). The management of radioactive waste from nuclear medicine should be in line with the requirements of International Atomic Energy Agency's international basic safety standards (106). Infectious and sharps waste should generally be treated by steam or other non-burn technologies, where these options are locally available and sustainable; the final disposal of waste happens in designated places outside the premises of the health care facility; a functional burial pit or fenced waste dump or municipal pick-up service should be available for the disposal of non-infectious (i.e. non-hazardous or general) waste, and waste disposal areas should be built to withstand climate events and emergencies; pharmaceutical waste is treated and disposed of safely by using an offsite, centrally managed safe treatment and disposal facility; sending it back to the manufacturer; or having it industrially incinerated using a high-temperature kiln. Special provisions should be made for the disposal of radiopharmaceuticals (107). 	 Health  Waste	Health care; national Universal health coverage	Governance; regulation; infrastructure, technology and built environment; other management and control	A, B, C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>16. Ensure that the management of health care waste will be safe during climate-related events, including emergencies and disasters (90).</p>	 Health  Waste	Health care Universal health coverage	Infrastructure, technology and built environment; other management and control	B
<p>17. Implement and monitor a waste reduction programme that includes waste management training for all staff (90, 99, 104).</p> <p>Concrete examples include:</p> <ul style="list-style-type: none"> • training and supporting all staff to practice appropriate waste segregation at all points of care using a three-bin system (i.e. non-hazardous recyclable, non-recyclable and hazardous waste); • raising awareness about and training medical staff in clinical and general practices to use and waste fewer materials, by using techniques such as the first in, first out principle (i.e. what has been purchased first should be used first); • incrementally improving the environmental sustainability of waste treatment technologies by focusing on non-burn technologies that comply with the Stockholm Convention on Persistent Organic Pollutants and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (105, 108); • establishing a recycling programme for all types of non-hazardous waste or sending recyclable waste to municipal recycling facilities. 	 Health  Waste	Health care Universal health coverage	Infrastructure, technology and built environment; other management and control	A, B
Environmental cleaning in health care facilities				
<p>18. Ensure that materials needed for cleaning (e.g. detergents, mops, buckets) are available, appropriate and well-maintained (85, 86, 93).</p>	 Health	Health care Universal health coverage	Infrastructure, technology and built environment	A, B
Electricity in health care facilities				
<p>20. Ensure that all health care facilities have access to reliable sources of electricity to ensure basic health care services can be delivered (109, 110).</p> <p>This requires strong financial commitments from different actors, such as governments, donors and the private sector.</p>	 Energy  Health  Finance	National; health care Universal health coverage	Governance; infrastructure, technology and built environment	B, C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>21. Assess the energy needs of each individual health care facility and, when needed, enable the installation of a suitable energy system that is climate resilient and low carbon (90, 109).</p> <p>Electricity is required in health care facilities for key areas, including for:</p> <ul style="list-style-type: none"> • basic medical equipment; • vaccines and cold chain storage; • maternal and newborn care; • communication, lighting, information technology (or IT), telemedicine; • facility operations; • administration and staff facilities; • access to hot and cold water. 	 Energy  Health	Health care Universal health coverage	Assessment and surveillance	B
<p>22. Follow an “install and maintain” approach to the facility’s energy system to ensure the long-term operation and maintenance of the system (109).</p> <p>Points to consider include:</p> <ul style="list-style-type: none"> • ensuring there is a dedicated allocation of funds for long-term operation and maintenance of the facility’s energy system, including to replace components, such as batteries, and for monitoring, as needed; • building the capacity of local energy technicians and health care staff to sustainably use and maintain the facility’s energy system. 	 Energy  Health  Finance	Health care Universal health coverage	Infrastructure, technology and built environment; other management and control	B
<p>23. Invest in efficient and suitable medical devices and equipment as per the needs of the health care facility and ensure their proper long-term operation and maintenance (90, 109).</p> <p>Points to consider include:</p> <ul style="list-style-type: none"> • whether the devices installed or used are energy efficient, compatible with the available energy supply and suitable for harsh conditions, if needed, such as high temperatures and dusty environments; • how to ensure staff have appropriate training. 	 Energy  Health	Health care Universal health coverage	Infrastructure, technology and built environment	B
<p>24. Consider using decentralized, renewable energy, such as solar photovoltaic (or PV) cells coupled with batteries, to power health care facilities, build climate resilience and reduce GHG emissions (109).</p> <p>This solution may be especially helpful in areas not reached by a central power grid or when used as a backup for unreliable or expensive electric supplies.</p>	 Energy  Health	National; health care Universal health coverage	Infrastructure, technology and built environment; taxes and subsidies	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>25. Manage risks associated with the energy supply (90).</p> <p>Concrete examples include the following.</p> <ul style="list-style-type: none"> • Ensure that energy systems can withstand extreme weather events. • Develop a plan for managing intermittent energy supplies or energy system failures, including ensuring there is an adequate backup energy source (e.g. through solar systems coupled with batteries) if the main source fails during an extreme weather event. 	 Energy  Health	Health care Universal health coverage	Infrastructure, technology and built environment	B
Climate change: climate resilience and the environmental sustainability of health care facilities				
Several guidance points in the sections on WASH, waste and electricity also address climate resilience and environmental sustainability; please refer to those sections for additional guidance.				
<p>26. Ensure health care facilities are climate resilient and environmentally sustainable, including by reducing GHG emissions (90); this can be done by following these five steps.</p> <ul style="list-style-type: none"> • Assemble and train a multisectoral operations team. • Establish a baseline for the current burden of climate-sensitive health outcomes and vulnerabilities to climate change, for instance by conducting a climate change and health vulnerability and adaptation assessment (111) (known as a V&A) to understand the health risks faced by the local population; assess the climate vulnerability of health care facilities; and assess the carbon emissions and the environmental footprint of health care facilities. • Define and prioritize short- and long-term interventions. • Develop and implement an improvement plan. • Monitor and evaluate improvements in climate resilience and environmental sustainability. 	 Health	National; health care Universal health coverage	Governance; infrastructure, technology and built environment; other management and control	B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>27. Ensure climate resilience and environmental sustainability during construction and retrofitting of health care facilities. This can be achieved by adopting new technologies, products and processes with low environmental impact that enhance the sustainability of health care facility operations (90).</p> <p>Concrete examples include the following.</p> <ul style="list-style-type: none"> When constructing new infrastructure, consider a range of climate-related risk scenarios, such as flood, drought, prolonged rainfall, strong winds and heatwaves. Ensure that the health care facility is sufficiently ventilated while being protected against disease vectors. Ensure that the windows are resistant to winds of at least 200–250 km/h, protected from the sun and leak-proof. Install reflective white roofs to reduce heat impact. Conduct and regularly update assessments of climate hazard vulnerability including, for example, evaluations of the potential impact of extreme weather events on health care infrastructure. 	 Construction  Health	Health care Universal health coverage	Infrastructure, technology and built environment; other management and control; regulation	B
<p>28. Procure new technologies and adopt new processes that can provide climate resilience, environmental sustainability and enhanced health service delivery (90).</p> <p>Concrete examples include the following.</p> <ul style="list-style-type: none"> Establish climate-informed health surveillance and early warning systems to facilitate early responses to climate hazards. In case of extreme heat, install equipment for monitoring indoor temperatures, cooling buildings and spaces, blocking direct sun and increasing air flow. Prioritize purchasing equipment and supplies that are sustainable, such as those associated with lower emissions during transport and production, and those that have minimal packaging and are reusable and recyclable; and avoid those containing hazardous chemicals and nondegradable plastics. Avoid procuring products that are not used (89). 				
Chemicals				
The subsection on Waste management may include guidance relevant to Chemicals that is not included in this section.				
<p>29. Establish safe procedures for procuring, storing, dispensing and properly disposing of pharmaceuticals (99, 112).</p>	 Health	Health care Universal health coverage	Regulation; other management and control	B
<p>30. Phase out or replace items that contain mercury, complying with the Minamata Convention on Mercury (99, 113).</p>	 Health	Health care Universal health coverage	Regulation	A, B

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>31. Phase out or replace substances with a high potential for ozone depletion or global warming (112). Concrete examples include the following.</p> <ul style="list-style-type: none"> • Buy equipment that uses minimally polluting refrigerants and has a reduced refrigerant charge. • Ensure regular maintenance of equipment containing refrigerants to avoid leakage or release into the atmosphere. • Phase out ozone-depleting substances in fire-suppression systems. 	 Environment  Health	Health care Universal health coverage	Regulation	A, B
<p>32. Train health care facility staff to correctly manage chemicals and health care waste (90, 114).</p>	 Health	Health care Universal health coverage	Information, education and communication	B
Radiation				
<p>33. Implement procedures and guidelines to ensure that justifying the use of radiological imaging becomes an effective, transparent and accountable part of normal radiological practice (107, 115).</p>	 Health	Health care Universal health coverage	Regulation	B, C
<p>34. Ensure that all relevant staff understand and adhere to the principle of the optimization of protection and safety from radiation (107, 115). Concrete examples include the following.</p> <ul style="list-style-type: none"> • Develop and regularly update evidence-based guidelines for imaging referrals, and make them available at the point of care as decision-support tools to enhance the justification for radiological procedures (116, 117). • Establish and use up-to-date diagnostic reference levels for radiological procedures for adult and paediatric patients, and ensure that quality assurance programmes are also up to date (115). • Implement harmonized criteria and develop detailed guidance for the discharge of patients after radionuclide therapy (118). • Apply technological solutions, such as electronic health records, to harmonize the monitoring of exposure to radiation. • Consider the availability of electricity services when selecting imaging devices (e.g. consider portable battery-operated equipment, if necessary) (119). 	 Health	Health care Universal health coverage	Regulation	B, C
<p>35. Ensure that health care staff are appropriately trained in radiation protection. Pay particular attention to training health professionals in the use of new technologies (e.g. digital radiography, artificial intelligence) (107).</p>	 Health	Health care Universal health coverage	Information, education and communication	C

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>36. Prevent medical radiation incidents and accidents (107, 115).</p> <p>Points to consider include:</p> <ul style="list-style-type: none"> • integrating content about radiation protection into the curricula of medical and dental schools, and into continuing medical education for health professionals using radiation in health care; • creating reporting and learning systems for medical radiation incidents, accidents and near misses; performing root cause analyses and prospective risk assessments to inform preventive actions and enhance safety culture (116); • implementing independent safety surveillance and verification, and performing periodic quality and safety assessments in health facilities that use radiation for diagnostic or therapeutic purposes. 	 Health	Health care Universal health coverage	Assessment and surveillance; other management and control	B, C
<p>37. Increase awareness about the benefits and risks of radiation among health care staff and patients. Train health care staff how to communicate radiation risks. Establish an active and informed decision-making process for patients (107, 115, 117).</p>	 Health	Health care Universal health coverage	Information, education and communication	B, C
Health workers				
<p>Health workers include not only health service providers but also health management and support workers (92).</p> <p>38. Establish occupational health and safety policies and programmes for health workers in all health care facilities (59, 92).</p> <p>Actions for safe and healthy work environments in health care facilities include:</p> <ul style="list-style-type: none"> • developing policies to ensure health and safety at work; • appointing a facility focal point for occupational health and safety; • conducting regular risk assessments and mitigating occupational hazard; • establishing a joint labour-management committee for health and safety at work; • providing facilities for staff welfare (e.g. personal hygiene, clothing, rest and dining); • developing and implementing a training programme about health and safety at work, including how to protect health and safety during climate-related emergencies; • providing occupational health services for the early detection, diagnosis, treatment, care, notification of and support for occupational diseases and injuries; • providing no-cost immunizations to health workers to prevent work-related infections; • recording, investigating and reporting exposure incidents and cases of occupational injuries and diseases; • collecting, analysing, reporting and acting on data to promote health and safety at work. 				

 Guidance	 Sector principally involved in planning/implementation	 Level of implementation	 Instruments	 Category of evidence
<p>39. Provide adequate IPC measures and PPE – such as masks, gloves, goggles, gowns, hand sanitizer, soap and water and cleaning supplies – in sufficient quantities to health care staff and other workers who are at risk, such as cleaners who are in contact with potentially infectious patients or materials (59, 61, 92).</p> <p>Note: The definitions of adequate IPC measures and PPE depend on the procedure performed and the suspected disease.</p>	 Health	Health care Universal health coverage	Infrastructure, technology and built environment; regulation	A, B
<p>40. Ensure that syringes and injection devices are used only once, if possible, by procuring syringes with a sharps injury protection feature or with a re-use prevention feature. Provide puncture-resistant sharps containers for safe sharps disposal (61, 62).</p>	 Health	Health care Universal health coverage	Infrastructure, technology and built environment	A
<p>41. Provide information, instruction and training about occupational safety and health, including training about IPC, the correct use of PPE, and safe patient handling to prevent back injuries (61).</p>	 Health	Health care Universal health coverage	Information, education and communication	A
<p>42. Ensure that health care facilities have a sufficient number of health workers, healthy and safe working conditions, and the required capacity to deal with health risks from climate change (90).</p>	 Health	Health care Universal health coverage	Other management and control	B
<p>43. Build the capacity of the health workforce to respond to climate risks and minimize within the scope of their responsibilities the environmental impacts that occur due to the operation of the health care facility (90).</p> <p>A few concrete examples include:</p> <ul style="list-style-type: none"> • educating and training health care facility staff and the community about the relationship between environmental health and disease prevention; • creating awareness among health care facility staff and the community about environmental factors that contribute to disease burden; • training health care facility staff and the community about how to assess and select environmentally sustainable products and services; • sensitizing health care facility staff to environmentally sustainable practices and ways to reduce carbon emissions from the health care facility. 	 Health	Health care Universal health coverage	Information, education and communication; other management and control	B

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy GHG: greenhouse gas; IPC: infection prevention and control; PPE: personal protective equipment; WASH: water, sanitation and hygiene; WASH FIT: Water and Sanitation for Health Facility Improvement Tool.

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

WHO, United Nations Children's Fund (UNICEF) 2023: Progress on WASH in health care facilities 2000–2021: special focus on WASH and infection prevention and control (86) – This report presents updated national, regional and global estimates of the availability of WASH in health care facilities, with a special focus on the linkages between WASH and IPC.

WHO 2023: Energizing health: accelerating electricity access in health-care facilities (109) – This publication provides a comprehensive update on the electrification status of and key actions needed to provide reliable, modern energy services to health care facilities in low- and middle-income countries.

WHO 2022: WASH FIT: a practical guide for improving quality of care through water, sanitation and hygiene in health care facilities (97) – WASH FIT is a risk-based management approach developed by WHO and UNICEF to assist health care facilities in improving their quality of care through improved WASH. The publication includes a set of training materials, fact sheets and templates that can be used to assess and improve facilities.

WHO, International Labour Organization (ILO) 2022: Caring for those who care: guide for the development and implementation of occupational health and safety programmes for health workers (92) – This guide provides an overview of the key elements of occupational health and safety programmes for health workers at the national, subnational and facility levels, as well as advice about how to develop and implement such programmes.

WHO 2020: WHO guidance for climate-resilient and environmentally sustainable health care facilities (90) – The aim of this guidance is to enhance the capacity of health care facilities to protect and improve the health of their target communities in an unstable and changing climate, and to empower health care facilities to be environmentally sustainable by optimizing their use of resources and minimizing the release of waste into the environment.

WHO 2017: Chemicals road map: road map to enhance health sector engagement in the Strategic Approach to International Chemicals Management towards the 2020 goal and beyond (114) – The road map identifies concrete actions for which the health sector has either a lead or important supporting role to play in the sound management of chemicals, while also recognizing the need for multisectoral cooperation.

WHO 2017: Safe management of wastes from health-care activities: a summary (99) – This handbook provides comprehensive guidance about safe, efficient and environmentally sound methods for handling and disposing of health care waste under normal conditions and also during emergencies.

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

WASH in health care facilities

WHO, UNICEF 2023: WASH in health care facilities [online knowledge portal] (120) – This portal includes global and national guidance and tools, national guidelines, standards and training reports. It also includes the WASH FIT portal, which provides a range of WASH FIT resources and information (121).

WHO 2023: Core components for IPC [website] (122) – This website provides various implementation tools and resources for WHO's core IPC components, including guidelines and other key publications, as well as tools for training and monitoring.

WHO 2022: Environmental cleaning and infection prevention and control in health care facilities in low- and middle-income countries: trainer's guide (123) – This trainer's guide takes the user through how to prepare, deliver and sustain effective training for those who clean health care facilities. The accompanying modules and resources provide instructions, definitions, photographs, posters and specific illustrations of recommended practices.

WHO Regional Office for Europe 2022: Water, sanitation and hygiene in health-care facilities: a practical tool for situation assessment and improvement planning (124) – This tool has been developed for health authorities and other stakeholders to support the design and implementation of comprehensive assessments of WASH conditions in health care facilities at the national and subnational levels.

WHO, UNICEF 2021: Understanding barriers to quality of care: an approach for conducting a situational analysis of water, sanitation and hygiene (WASH) and quality in health care facilities (125) – This document describes one approach to conducting a national situational analysis of WASH as a basis for improving the quality of care.

WHO, UNICEF 2019: Water, sanitation and hygiene in health care facilities: practical steps to achieve universal access to quality care (126) – The purpose of this document is to present eight practical actions that Member States can take at the national and subnational levels to improve WASH in health care facilities.

WHO, UNICEF 2019: Monitoring water, sanitation and hygiene (WASH) and related infection prevention and control (IPC) in delivery rooms (127) – This document identifies a draft set of indicators and questions for monitoring WASH and IPC measures during childbirth in the delivery room.

Health care waste management

WHO 2019: Overview of technologies for the treatment of infectious and sharp waste from health care facilities (128) – This report provides technical guidance about technologies for the safe management of health care waste.

Electricity in health care facilities

WHO 2023: Health and Energy Platform of Action: building connections for better health [website] (129) – This platform aims to strengthen cooperation between the health and energy sectors

Climate change: climate resilience and environmental sustainability in health care facilities

Health Care Without Harm 2023: Sustainable Health in Procurement Project [website] (130) – The Sustainable Health in Procurement Project was developed by the United Nations Development Programme in collaboration with Health Care Without Harm, and it aims to reduce the harm to people and the environment caused by the manufacture, use and disposal of medical products and the environmental impact of health programmes.

WHO 2022: Measuring the climate resilience of health systems (131) – This report provides a framework and suggested approach for measuring the climate resilience of health systems.

WHO 2021: Checklists to assess vulnerabilities in health care facilities in the context of climate change (132) – This is a complementary tool to the *WHO guidance for climate-resilient and environmentally sustainable health care facilities* (6), and the checklists are aimed at helping health care facility managers and other health workers identify and act to address the specific climate risks that a facility may face.

Health workers

WHO 2023: Occupational hazards in the health sector [online tool] (133) – This e-tool is intended to be used by people in charge of occupational health and safety for health workers, and it is also for health workers who want to know what WHO and the ILO recommend to protect their own health and safety.

WHO 2022: Implementation guide for vaccination of health workers (134) – This guide will be useful for countries that do not yet have a policy and programme in place to vaccinate health workers, as well as for those seeking to expand or improve their vaccination activities for health workers.

WHO 2020: Protection of health and safety of health workers: checklist for health care facilities (135) – This checklist is the first step in identifying and prioritizing areas of action for improving the health and safety of health workers, in line with WHO–ILO Global Framework for National Occupational Health Programmes for Health Workers (39).

WHO 2020: COVID-19: how to put on and remove personal protective equipment (PPE) [online course] (136) – This short online course aims to show the type of PPE needed to correctly protect oneself.

WHO 2018: Occupational safety and health in public health emergencies: a manual for protecting health workers and responders (137) – This manual provides an overview of the main occupational safety and health risks faced by emergency responders during disease outbreaks and other emergencies, such as natural disasters, chemical incidents, radiological emergencies and emergencies involving conflicts.

References

1. Urban population (% of total population). In: World Bank Open Data [online database]. Washington (DC): World Bank; 2022 (<https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS>, accessed 10 August 2023).
2. World urbanization prospects: the 2018 revision. New York (NY): United Nations; 2019 (<https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf>, accessed 17 October 2023).
3. Setting global research priorities for urban health. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/363443>, accessed 9 August 2023).
4. Review of indicator frameworks supporting urban planning for resilience and health: third report on protecting environments and health by building urban resilience. Copenhagen: WHO Regional Office for Europe; 2022 (<https://apps.who.int/iris/handle/10665/355763>, accessed 7 August 2023).
5. Healthy cities: effective approach to a rapidly changing world. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/331946>, accessed 9 August 2023).
6. City-level monitoring guidance for the prevention and control of noncommunicable diseases and injuries Geneva: World Health Organization, Partnership for Healthy Cities; 2023 (<https://iris.who.int/handle/10665/374874>, accessed 24 May 2024).
7. THE 17 Sustainable Development Goals [website]. New York: United Nations Department of Economic and Social Affairs; 2023 (<https://sdgs.un.org/goals>, accessed 26 September 2023).
8. Integrating health in urban and territorial planning: a sourcebook. Geneva: UN-Habitat, World Health Organization; 2020 (<https://iris.who.int/handle/10665/331678>, accessed 17 October 2023).
9. The power of cities: tackling noncommunicable diseases and road safety. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/329429>, accessed 17 October 2023).
10. Health as the pulse of the new urban agenda: United Nations Conference on housing and sustainable urban development, Quito, October 2016. Geneva: World Health Organization; 2016 (<https://apps.who.int/iris/handle/10665/250367>, accessed 17 October 2023).
11. Cities: urban planning and health. Fact sheet 2. Copenhagen: WHO Regional Office for Europe; 2017 (https://who-sandbox.squiz.cloud/__data/assets/pdf_file/0020/341129/Fact-Sheet-2-Cities-Urban-planning-and-health.pdf, accessed 18 October 2023).
12. Urban green space interventions and health: a review of impacts and effectiveness. Copenhagen: WHO Regional Office for Europe; 2017 (<https://apps.who.int/iris/handle/10665/366036>, accessed 9 August 2023).
13. National programmes for age-friendly cities and communities: a guide. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/366634>, accessed 8 August 2023).
14. Her city: a guide for cities to sustainable and inclusive urban planning and design together with girls, second edition. Nairobi: UN-Habitat; 2021 (<https://unhabitat.org/her-city-a-guide-to-cities-to-sustainable-and-inclusive-urban-planning-and-design-together-with>, accessed 8 August 2023).
15. Shaping urbanization for children: a handbook on child-responsive urban planning [Internet]. New York: United Nations Children's Fund; 2018 (<https://www.unicef.org/reports/shaping-urbanization-children>, accessed 18 October 2023).
16. Urban planning for resilience and health: key messages – summary report on protecting environments and health by building urban resilience. Copenhagen: WHO Regional Office for Europe; 2022 (<https://iris.who.int/handle/10665/355760>, accessed 7 August 2023).
17. BlueHealth: Decision Support Tool [online tool]. Copenhagen: WHO Regional Office for Europe, Euro-Mediterranean Centre on Climate Change, University of Exeter, National Institute of Health; 2021 (<https://bluehealth2020.eu/projects/decision-support-tool/>, accessed 10 August 2023).
18. Protecting health through urban redevelopment of contaminated sites: planning brief [Internet]. Copenhagen: WHO Regional Office for Europe; 2021 (<https://apps.who.int/iris/handle/10665/349922>, accessed 8 August 2023).
19. Health in All Policies: training manual. Geneva: World Health Organization; 2015 (<https://apps.who.int/iris/handle/10665/151788>, accessed 18 October 2023).
20. Promoting environment and health policies at local level: a policy brief for decision-makers and practitioners. Copenhagen: WHO Regional Office for Europe; 2023 (<https://iris.who.int/handle/10665/369596>, accessed 8 August 2023).
21. Mudu P, Adair-Rohani H, deSouza P, Gumi S, Hérick de Sá T, Lewis J, et al Tracking urban health policies: a conceptual framework with special focus on air pollution in African cities. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/366450>, accessed 8 August 2023).
22. Environmental health inequalities resource package: a tool for understanding and reducing inequalities in environmental risk. Copenhagen: WHO Regional Office for Europe; 2019 (<https://apps.who.int/iris/handle/10665/346223>, accessed 15 September 2023).
23. Just societies: health equity and dignified lives. Report of the Commission of the Pan American Health Organization on Equity and Health Inequalities in the Americas. Washington (DC): Pan American Health Organization; 2019 (<https://iris.paho.org/handle/10665.2/51571>, accessed 18 October 2023).
24. A guide to creating public space for urban children. Geneva: World Health Organization, UN Children's Fund; UN-Habitat; to be published in 2024.
25. City region food systems programme [website]. Rome: Food and Agriculture Organization of the United Nations; 2023 (<http://www.fao.org/in-action/food-for-cities-programme/approach/need-for-sustainable-and-resilient-crfs/en/>, accessed 17 October 2023).
26. Integrating health in urban and territorial planning: directory of resources for planning healthy environments [online database]. Geneva: World Health Organization; 2023 (<https://www.who.int/tools/integrating-health-in-urban-and-territorial-planning--the-directory>, accessed 8 August 2023).

27. Strengthening health emergency preparedness in cities and urban settings: guidance for national and local authorities. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/351721>, accessed 20 September 2023).
28. Framework for strengthening health emergency preparedness in cities and urban settings. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/348351>, accessed 20 September 2023).
29. Local action for health: a repository of WHO resources [online database]. Geneva: World Health Organization; 2021 (<https://urbanhealth-repository.who.int>, accessed 4 August 2023).
30. Urban Health Initiative: improving air quality and health in cities. A model process for catalysing change [website] Geneva: World Health Organization; 2023 (<https://www.who.int/initiatives/urban-health-initiative>, accessed 8 August 2023).
31. Healthy environments for healthier populations: why do they matter, and what can we do? Geneva: World Health Organization; 2019 (<https://iris.who.int/handle/10665/325877>, accessed 5 September 2023).
32. Advantage or paradox? The challenge for children and young people of growing up urban. New York: UNICEF; 2018 (<https://www.unicef.org/reports/advantage-or-paradox>, accessed 18 September 2023).
33. Urban green spaces: a brief for action. Copenhagen: WHO Regional Office for Europe; 2017 (<https://iris.who.int/handle/10665/344116>, accessed 17 October 2023).
34. Global report on urban health: equitable healthier cities for sustainable development. Geneva: World Health Organization, UN-Habitat; 2016 (<https://iris.who.int/handle/10665/204715>, accessed 20 September 2023).
35. Measuring the age-friendliness of cities: a guide to using core indicators. Kobe: World Health Organization; 2015 (<https://iris.who.int/handle/10665/203830>, accessed 17 October 2023).
36. Healthy cities: good health is good politics. Toolkit for local governments to support healthy urban development. Manila: WHO Regional Office for the Western Pacific; 2015 (<https://iris.who.int/handle/10665/208242>, accessed 1 September 2023).
37. Global Land Tool Network [website]. Nairobi: UN-Habitat; 2023 (<https://gltn.net/>, accessed 17 October 2023).
38. Housing [website]. Nairobi: United Nations Human Settlements Programme; 2021 (<https://unhabitat.org/topic/housing>, accessed 2 June 2021).
39. WHO Housing and health guidelines. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/276001>, accessed 15 June 2021).
40. Keeping the vector out: housing improvements for vector control and sustainable development. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/259404>, accessed 15 June 2021).
41. The Geneva UN Charter on Sustainable Housing. Geneva: United Nations Economic Commission for Europe; 2015 (<https://apps.who.int/iris/handle/10665/276001>, accessed
42. Environmental burden of disease associated with inadequate housing. Copenhagen: WHO Regional Office for Europe; 2011 (<https://www.euro.who.int/en/publications/abstracts/environmental-burden-of-disease-associated-with-inadequate-housing.-summary-report>, accessed 15 January 2021).
43. Health equity benefits of integrated slum upgrading. Geneva: World Health Organization; 2020.
44. Policies, regulations & legislation promoting healthy housing: a review. Geneva: World Health Organization; 2021 (<https://www.who.int/publications/i/item/9789240011298>, accessed 15 June 2021).
45. SHERPA for sustainable housing projects [website]. Nairobi: SHERPA; 2017 (<https://www.sherpa4housing.org/>, accessed 8 April 2020).
46. Alternative solutions to forced evictions and slum demolition. Nairobi: United Nations Human Settlements Programme; 2018 (https://unhabitat.org/sites/default/files/download-manager-files/forced%20evictions_final.pdf, accessed 8 April 2020).
47. The human rights-based approach to housing and slum upgrading. Nairobi: United Nations Human Settlements Programme; 2017 (<https://unhabitat.org/sites/default/files/download-manager-files/The%20Human%20Rights-Based%20Approach%20to%20Housing%20and%20Slum%20Upgrading.pdf>, accessed 8 April 2020).
48. Accessibility of housing. A handbook of inclusive affordable housing for persons with disabilities and older persons. Nairobi: United Nations Human Settlements Programme; 2014 (<https://unhabitat.org/accessibility-of-housing>, accessed 15 January 2021).
49. Housing and slum upgrading: gender issue guide. Nairobi: United Nations Human Settlements Programme; 2013 (<https://unhabitat.org/housing-and-slum-upgrading-gender-issue-guide>, accessed 15 January 2021).
50. A practical guide for conducting: housing profiles. Supporting evidence-based housing policy and reform. Nairobi: United Nations Human Settlements Programme; 2011 (<https://unhabitat.org/a-practical-guide-for-conducting-housing-profiles-revised-version>, accessed 15 January 2021).
51. Wolf J, Prüss-Ustün A, Ivanov I, Mugdal S, Corvalán C, Bos R et al. Preventing disease through a healthier and safer workplace. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/272980>, accessed 15 June 2021).
52. Resolution WHA60.26. Workers' health: global plan of action. In: Sixtieth World Health Assembly, Geneva, 14–23 May 2007. Resolutions and decisions, annexes. Geneva: World Health Organization; 2007 (https://www.who.int/occupational_health/WHO_health_assembly_en_web.pdf?ua=1, accessed 12 October 2021).
53. Women and men in the informal economy: a statistical picture. Geneva: International Labour Organization; 2018 (https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_626831.pdf, accessed 22 April 2020).
54. Sustainable Development Goals. The 17 goals [website]. New York (NY): United Nations; 2020 (<https://sustainabledevelopment.un.org/sdgs>, accessed 19 March 2020).
55. C155 – Occupational Safety and Health Convention (No. 155). Geneva: International Labour Organization; 1981 (https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::p12100_instrument_id:312300, accessed 22 April 2020).

56. C187 – Promotional Framework for Occupational Safety and Health Convention (No. 187). Geneva: International Labour Organization; 2006 (https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C187, accessed 22 April 2020).
57. C161 – Occupational Health Services Convention (No. 161). Geneva: International Labour Organization; 1985 (https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C161, accessed 22 April 2020).
58. Political declaration of the high-level political forum on sustainable development convened under the auspices of the General Assembly. New York (NY): United Nations; 2019 (<https://undocs.org/en/A/RES/74/4>, accessed 25 June 2020).
59. WHO–ILO Global Framework for National Occupational Health Programmes for Health Workers. Geneva: World Health Organization; 2020 (<https://www.who.int/news-room/detail/10-06-2020-who-ilo-global-framework-for-national-occupational-health-programmes-for-health-workers>, accessed 2 November 2023).
60. Caring for those who care. National programmes for occupational health for health workers. Geneva: World Health Organization/International Labour Organization; 2020 (<https://apps.who.int/iris/handle/10665/336479>, accessed 4 October 2021).
61. Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level. Geneva: World Health Organization; 2016 (<https://apps.who.int/iris/handle/10665/251730>, accessed 2 November 2023).
62. WHO guideline on the use of safety-engineered syringes for intramuscular, intradermal and subcutaneous injections in health care settings. Geneva: World Health Organization; 2016 (<https://apps.who.int/iris/handle/10665/250144>, accessed 2 November 2023).
63. My 5 Moments for Hand Hygiene. Geneva: World Health Organization; 2020 (<https://www.who.int/campaigns/world-hand-hygiene-day>, accessed 5 June 2021).
64. Table 4: Summary of WHO position papers – immunization of health care workers. Geneva: World Health Organization; 2020 (https://www.who.int/immunization/policy/Immunization_routine_table4.pdf, accessed 4 November 2020).
65. How to put on and take off personal protective equipment (PPE). Geneva: World Health Organization; 2020 (<https://apps.who.int/iris/handle/10665/70066>, accessed 15 June 2021).
66. WHO guidelines on tuberculosis infection prevention and control – 2019 update. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/311259>, accessed 23 April 2019).
67. Minimum Requirements for infection prevention and control (IPC) programmes. Geneva: World Health Organization; 2019 (<https://www.who.int/publications/i/item/9789241516945>, accessed 7 August 2023).
68. How to implement seasonal influenza vaccination of health workers: An introduction manual for national immunization programme managers and policy makers. Geneva: World Health Organization; 2019 (<https://www.who.int/publications/i/item/9789241515597>, accessed 27 February 2024).
69. Occupational safety and health in public health emergencies: a manual for protecting health workers and responders. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/275385>, accessed 15 June 2021).
70. Prevention of HIV transmission in health care settings. Geneva: World Health Organization; 2017 (<https://www.who.int/hiv/pub/toolkits/HIV%20transmission%20in%20health%20care%20settings.pdf>, accessed 15 June 2021).
71. Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care. Geneva: World Health Organization; 2014 (<http://apps.who.int/iris/10665/112656>, accessed 29 October 2015).
72. HealthWISE – Work Improvement in Health Services. Geneva: International Labour Organization/World Health Organization 2014 (https://www.ilo.org/sector/Resources/training-materials/WCMS_250540/lang--en/index.htm, accessed 25 June 2021).
73. Joint WHO-ILO-UNAIDS policy guidelines on improving health workers' access to HIV and TB prevention, treatment, care and support services: a guidance note. Geneva: International Labour Organization/Joint United Nations Programme on HIV/AIDS/World Health Organization; 2011 (https://www.ilo.org/global/topics/hiv-aids/publications/WCMS_149714/lang--en/index.htm, accessed 15 June 2021).
74. Aide memoire – hepatitis B immunization of health workers. Washington (DC): Pan American Health Organization; 2009 (<https://www.paho.org/en/documents/aide-memoire-hepatitis-b-immunization-health-workers>, accessed 4 November 2020).
75. Aide-memoire for a strategy to protect health workers from bloodborne viruses. Geneva: World Health Organization; 2003 (<https://apps.who.int/iris/handle/10665/68354>, accessed 15 June 2021).
76. Framework guidelines for addressing workplace violence in the health sector. Geneva: International Labour Organization/International Council of Nurses/World Health Organization/Public Services International; 2002 (<https://apps.who.int/iris/handle/10665/42617>, accessed 13 October 2021).
77. Safety and health in opencast mines. Second (revised) edition. Geneva: International Labour Organization; 2018 (https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/normativeinstrument/wcms_617123.pdf, accessed 8 February 2021).
78. Safety and health in the use of machinery. Geneva: International Labour Organization; 2013 (https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/normativeinstrument/wcms_164653.pdf, accessed 8 February 2021).
79. Safety and health in underground coalmines. Geneva: International Labour Organization; 2009 (https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/normativeinstrument/wcms_110254.pdf, accessed 8 February 2021).

80. Code of practice on safety and health in the iron and steel industry. Geneva: International Labour Organization; 2005 (https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/normativeinstrument/wcms_112443.pdf, accessed 8 February 2021).
81. Safety and health in the non-ferrous metals industries. Geneva: International Labour Organization; 2003 (https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/normativeinstrument/wcms_107713.pdf, accessed 8 February 2021).
82. Ambient factors in the workplace. Geneva: International Labour Organization; 2003 (https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/normativeinstrument/wcms_107729.pdf, accessed 8 February 2021).
83. Safety in the use of synthetic vitreous fibre insulation wools (glass wool, rock wool, slag wool). Geneva: International Labour Organization; 2001 (https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/normativeinstrument/wcms_107790.pdf, accessed 8 February 2021).
84. Safety and health in shipbreaking: Guidelines for Asian countries and Turkey. Geneva: International Labour Organization; 2004 (https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/normativeinstrument/wcms_107689.pdf, accessed 8 February 2021).
85. Water, sanitation, hygiene, waste and electricity services in health care facilities: progress on the fundamentals. 2023 global report. Geneva: World Health Organization, United Nations Children's Fund; 2023 (<https://iris.who.int/handle/10665/368975>, accessed 7 August 2023).
86. Progress on WASH in health care facilities 2000–2021: special focus on WASH and infection prevention and control. Geneva: World Health Organization, United Nations Children's Fund; 2023 (<https://apps.who.int/iris/handle/10665/366657>, accessed 7 August 2023).
87. Climate change: key facts [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health>, accessed 2 November 2023).
88. Romanello M, Di Napoli C, Drummond P, Green C, Kennard H, Lampard P, et al. The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels. *Lancet.* 2022;400:1619–54. doi:10.1016/S0140-6736(22)01540-9.
89. Health in the green economy: health care facilities. Geneva: World Health Organization; 2011 (<https://www.who.int/publications/m/item/health-in-the-green-economy-health-care-facilities>, accessed 2 November 2023).
90. WHO guidance for climate-resilient and environmentally sustainable health care facilities. Geneva: World Health Organization; 2020 (<https://apps.who.int/iris/handle/10665/335909>, accessed 1 November 2023).
91. Convention C161 – Occupational Health Services Convention, 1985 (No. 161). Geneva: International Labour Organization; 2017 (https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C161, accessed 27 September 2023).
92. Caring for those who care: guide for the development and implementation of occupational health and safety programmes for health workers. Geneva: World Health Organization, International Labour Organization; 2022 (<https://iris.who.int/handle/10665/351436>, accessed 1 November 2023).
93. Adams J, Bartram J, Chartier Y, editors. Essential environmental health standards in health care [Internet]. Geneva: World Health Organization; 2008 (<https://apps.who.int/iris/handle/10665/43767>, accessed 2 November 2023).
94. Operational framework for building climate resilient and low carbon health systems. Geneva: World Health Organization; 2023 (<https://iris.who.int/handle/10665/373837>, accessed 13 November 2023).
95. Core questions and indicators for monitoring WASH in health care facilities in the Sustainable Development Goals. Geneva: World Health Organization, United Nations Children's Fund; 2018 (<https://apps.who.int/iris/handle/10665/275783>, accessed 2 November 2023).
96. Guidelines for drinking-water quality: fourth edition incorporating the first and second addenda. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/352532>, accessed 24 May 2024).
97. WASH FIT: a practical guide for improving quality of care through water, sanitation and hygiene in health care facilities, second edition. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/353411>, accessed 31 October 2023).
98. Guidelines on sanitation and health. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/274939>, accessed 1 November 2023).
99. Safe management of wastes from health-care activities: a summary. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/259491>, accessed 1 November 2023).
100. World Hand Hygiene Day. Save lives: clean your hands [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/campaigns/world-hand-hygiene-day>, accessed 31 October 2023).
101. WHO guidelines on hand hygiene in health care. Geneva: World Health Organization; 2009 (<https://apps.who.int/iris/handle/10665/44102>, accessed 31 October 2023).
102. Climate-resilient water safety plans: managing health risks associated with climate variability and change. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/258722>, accessed 7 August 2023).
103. Sanitation safety planning: manual for safe use and disposal of wastewater, greywater and excreta. Geneva: World Health Organization; 2015 (<http://apps.who.int/iris/handle/10665/171753>, accessed 2 November 2023).
104. Global analysis of health care waste in the context of COVID-19. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/351189>, accessed 7 August 2023).
105. Stockholm Convention on Persistent Organic Pollutants (POPs) [website]. Stockholm: United Nations Environment Programme; 2019 (<https://www.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx>, accessed 26 October 2023).

106. Radiation protection and safety of radiation sources: international basic safety standards. Vienna: International Atomic Energy Agency; 2014 (https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1578_web-57265295.pdf, accessed 22 September 2023).
107. Radiation protection and safety in medical uses of ionizing radiation. Vienna: International Atomic Energy Agency; 2018 (<https://www.iaea.org/publications/11102/radiation-protection-and-safety-in-medical-uses-of-ionizing-radiation>, accessed 1 November 2023).
108. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal [website]. Basel: United Nations Environment Programme; 2019 (<https://www.basel.int/TheConvention/Overview/TextoftheConvention/tabcid/1275/Default.aspx>, accessed 31 October 2023).
109. Energizing health: accelerating electricity access in health-care facilities. Geneva: World Health Organization, World Bank, Sustainable Energy for All, International Renewable Energy Agency; 2023 (<https://iris.who.int/handle/10665/365657>, accessed 7 August 2023)/
110. Action brief 2: global energy and health platform of action. Accelerating SDG 7 achievement. New York: United Nations; 2019 (https://sustainabledevelopment.un.org/content/documents/24066ab2_cover.pdf, accessed 2 November 2023).
111. Climate change and health: vulnerability and adaptation assessment. Geneva: World Health Organization; 2021 (<https://apps.who.int/iris/handle/10665/345968>, accessed 16 August 2023).
112. Smart hospitals toolkit. Washington (DC): Pan American Health Organization, World Health Organization; 2017 (<https://iris.paho.org/handle/10665.2/34977>, accessed 7 August 2023).
113. Minamata Convention on Mercury [website]. Geneva: United Nations Environment Programme; 2013 (<http://www.mercuryconvention.org/Convention/Text/tabcid/3426/language/en-US/Default.aspx>, accessed 1 November 2023).
114. Chemicals road map: road map to enhance health sector engagement in the Strategic Approach to International Chemicals Management towards the 2020 goal and beyond. Geneva: World Health Organization; 2017 (<https://iris.who.int/handle/10665/273137>, accessed 8 August 2023).
115. Bonn call for action: 10 actions to improve radiation protection in medicine in the next decade. Joint position statement by the IAEA and WHO. Vienna: International Atomic Energy Agency, World Health Organization; 2012 (<https://www.iaea.org/sites/default/files/17/12/bonn-call-for-action.pdf>, accessed 1 November 2023).
116. Use of chest imaging in COVID-19: a rapid advice guide, 11 June 2020. Geneva: World Health Organization; 2020 (<https://apps.who.int/iris/handle/10665/332336>, accessed 2 November 2023).
117. Ethics and medical radiological imaging: a policy brief for health-care providers. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/353046>, accessed 22 September 2023).
118. Release of patients after radionuclide therapy. Vienna: International Atomic Energy Agency; 2009 (<https://www.iaea.org/publications/8179/release-of-patients-after-radionuclide-therapy>, accessed 2 November 2023).
119. Portable digital radiography system: technical specifications. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/344514>, accessed 22 September 2023).
120. WASH in health care facilities [online knowledge portal]. Geneva: World Health Organization, United Nations Children's Fund; 2023 (<https://www.washinhcfc.org/>, accessed 1 November 2023).
121. WASH FIT portal. In: WASH in health care facilities [online knowledge portal] Geneva: World Health Organization, United Nations Children's Fund; 2023 (<https://www.washinhcfc.org/wash-fit/>, accessed 1 November 2023).
122. Core components for IPC [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/teams/integrated-health-services/infection-prevention-control/core-components>, accessed 1 November 2023).
123. Environmental cleaning and infection prevention and control in health care facilities in low- and middle-income countries: trainer's guide. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/366379>, accessed 7 August 2023).
124. Water, sanitation and hygiene in health-care facilities: a practical tool for situation assessment and improvement planning. Copenhagen: WHO Regional Office for Europe; 2022 (<https://iris.who.int/handle/10665/363511>, accessed 1 November 2023).
125. Understanding barriers to quality of care: an approach for conducting a situational analysis of water, sanitation and hygiene (WASH) and quality in health care facilities. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/340297>, accessed 7 August 2023).
126. Water, sanitation and hygiene in health care facilities: practical steps to achieve universal access to quality care. Geneva: World Health Organization, United Nations Children's Fund; 2019 (<https://iris.who.int/handle/10665/311618>, accessed 22 September 2023).
127. Monitoring water, sanitation and hygiene (WASH) and related infection prevention and control (IPC) in delivery rooms: final draft. Geneva: World Health Organization, United Nations Children's Fund; 2019 (<https://washdata.org/reports/jmp-2019-core-questions-and-indicators-wash-delivery-rooms-draft>, accessed 1 November 2023).
128. Overview of technologies for the treatment of infectious and sharp waste from health care facilities. Geneva: World Health Organization; 2019 (<https://iris.who.int/handle/10665/328146>, accessed 1 November 2023).
129. Health and Energy Platform of Action: building connections for better health [website]. Geneva: World Health Organization; 2023 (<https://www.who.int/initiatives/health-and-energy-platform-of-action>, accessed 22 September 2023).
130. Sustainable health in procurement project [website]. Brussels: Health Care Without Harm; 2023 (<https://noharm-global.org/issues/global/sustainable-health-procurement-project#what>, accessed 1 November 2023).
131. Measuring the climate resilience of health systems. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/354542>, accessed 22 September 2023).

132. Checklists to assess vulnerabilities in health care facilities in the context of climate change. Geneva: World Health Organization; 2021 (<https://iris.who.int/handle/10665/340656>, accessed 8 August 2023).
133. Occupational hazards in the health sector [online tool]. Geneva: World Health Organization; 2023 (<https://www.who.int/tools/occupational-hazards-in-health-sector>, accessed 22 September 2023).
134. Implementation guide for vaccination of health workers. Geneva: World Health Organization; 2022 (<https://iris.who.int/handle/10665/360603>, accessed 22 September 2023).
135. Protection of health and safety of health workers: checklist for health care facilities. Geneva: World Health Organization; 2020 (<https://iris.who.int/handle/10665/334371>, accessed 22 September 2023).
136. COVID-19: how to put on and remove personal protective equipment (PPE) [online course]. Geneva: World Health Organization; 2020 (<https://openwho.org/courses/IPC-PPE-EN>, accessed 26 October 2023).
137. Occupational safety and health in public health emergencies: a manual for protecting health workers and responders. Geneva: World Health Organization; 2018 (<https://iris.who.int/handle/10665/275385>, accessed 1 November 2023).



13. Cross-cutting topics

13.1 Children's environmental health



Overview

Children are exposed to many different environments that have a profound influence on their growth and development. Environmental exposures, both adverse and health-promoting, do not work in isolation but interact with social and nutritional determinants of health to influence children's health and well-being. Adverse environmental exposures include among others polluted indoor and outdoor air, contaminated water, lack of adequate sanitation, household and community environmental hazards, toxic hazards, disease vectors, UV radiation and degraded ecosystems (1, 2).

Children are especially vulnerable to environmental threats due to their developing organs and immune systems, smaller bodies and airways. Proportionate to their size, children ingest more food, drink more water and breathe more air than adults. In addition, certain modes of behaviour, such as putting hands and objects into the mouth and playing outdoors can increase children's exposure to environmental contaminants. Furthermore, children as young as five years old sometimes work in hazardous settings (2, 3).

Health-damaging exposure to environmental risks often begins before birth. Lead in air, mercury in food and other chemicals can result in long-term, often irreversible, effects such as infertility, miscarriage and birth defects. Women's exposure to pesticides, solvents and persistent organic pollutants may potentially affect the health of the fetus. In addition, while the overall benefits of breastfeeding are recognized, high levels of contaminants in breast milk may affect the health of the newborn. Health impacts resulting from exposures at young ages may only emerge later in life (2).

An estimated 1.6 million deaths in children aged under 5 years in 2016 were due to environmental risks, which means 28% of all deaths in children that year could have been prevented through a cleaner and safer environment. Especially in low-income countries, environmental health risks are important contributors to childhood death and disease (4). More than 90% of children breathe toxic air every day (5). Up to 800 million children (or around 1 in 3) have blood lead levels at or above 5 µg/dl (6). Improving children's environmental health presents an essential contribution towards the achievement of the SDGs.

Selected tools

WHO 2020: *WHO training package on children's environmental health for the health sector (2)*

This package contains introductory modules in children's environmental health as well as modules on many of the sections of this compendium including on sanitation, hygiene, e-waste, chemicals, mercury, second-hand tobacco smoke, air pollution and climate change.

WHO 2020: *The paediatric environmental health history: Recording children's exposure to environmental health threats: a "green page" in the medical record (7)*

This page contains a series of basic, concise questions that enables health professionals to identify children's potential exposure to environmental factors and special vulnerabilities.

WHO 2017: *Inheriting a sustainable world? Atlas on children's health and the environment (1)*

This WHO publication is a detailed review that presents continuing and emerging challenges to children's environmental health.

WHO 2010: *Children's environmental health units (8)*

This document provides an overview of the services that a Children's Environmental Health Unit may provide to children, parents, the community, health professionals and governmental officials working towards preventing environmentally related diseases among children.

13.2 Health in All Policies



Overview

HiAP is a framework for action with the aim of collaborating across sectors to systematically consider health in policy-making. It is an approach to public policy that considers the health implications of decisions, seeks synergies and avoids harmful health impacts in order to improve population health and health equity (9, 10).

Many risks to health are influenced or even determined by policies in sectors other than the health sector. Examples are transitions in energy and transport that have multiple health co-benefits for environmental protection. Other key sectors responsible for policies that offer win-win situations for health and the environment include WASH, agriculture and food items, land use planning, labour, housing, industry and the energy sector.

The health sector needs a policy mandate, space and competencies to work with other sectors to understand their constraints and interests, and to identify challenges and opportunities to include the health and co-benefit argument in relevant policies. In addition, the health sector needs to increase its efforts to engage with other sectors to promote health protection, ensure essential environmental services and healthy workplaces, and work towards making the health sector more environmentally sustainable (10, 11). The WHO HiAP manual provides some information on needed skills and competencies (12).

13.3 Health Impact Assessment



Overview

The Health Impact Assessment (HIA) uses a combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population. The HIA involves working with a range of decision-makers and stakeholders to support the building of healthy public policy. It uses both quantitative and qualitative methods to describe the expected health impacts. It can be included in environmental impact assessments, strategic environmental assessments, social impact assessments or integrated impact assessments (13, 14).

Policy decisions made outside of the health sector influence many determinants of health. The HIA evaluates the likely positive and negative health impacts from proposed policies, programmes or projects from different sectors and makes recommendations on how to improve health. It is typically a prospective assessment before implementation, although it may be carried out concurrently or retrospectively.

The HIA includes the following steps.

- Screening – determine whether an HIA is required by determining potential health implications of a policy, programme or project.
- Scoping – identify key health issues and public concerns to be covered in the assessment. Potential health determinants may include factors such as the social and physical environment (i.e. housing quality, crime rates and social networks), personal or family circumstances (i.e. diet, exercise, risk-taking behaviour and employment) and access to public services.
- Appraisal – estimate potential health gains or losses, including assessment of population groups affected, baseline health status and predictions about likely changes of health status through the programme, policy or intervention and from possible strategies to prevent negative health impacts.
- Reporting – draw conclusions and make recommendations.
- Monitoring – monitor the actual health impacts.

Selected tools

WHO 2019: *Healthy environments for healthier populations: Why do they matter, and what can we do?* (10)

UNEP 2016: *Healthy environment, healthy people. Thematic report. Ministerial policy review session* (15)

WHO 2020: *WHO global strategy on health, environment and climate change: the transformation needed to improve lives and wellbeing sustainably through healthy environments* (11)

UNEP 2018: *Implementation plan ‘towards a pollution-free planet’* (16)

UNEP 2020: *Working with the environment to protect people. UNEP’s COVID-19 response* (17)

The landing page on which the report is located also contains factsheets on waste management, green jobs, resource efficiency among others.

UNEP 2020: *Preventing the next pandemic: zoonotic diseases and how to break the chain of transmissions* (18)

UNEP 2017: *Towards a pollution-free planet background report* (19)

References

1. Inheriting a sustainable world? Atlas on children's health and the environment. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/254677>, accessed 15 June 2021).
2. WHO (2019). Children are not little adults. In: WHO training package for the health sector: children's health and the environment. Geneva: World Health Organization.
3. Don't pollute my future! The impact of the environment on children's health. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/handle/10665/254678>, accessed 5 May 2020).
4. Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks. Updated 2016 data tables. Geneva: World Health Organization; 2019 (<https://www.who.int/publications/i/item/9789241565196>, accessed 5 May 2020).
5. Air pollution and child health: prescribing clean air. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/275545>, accessed 15 January 2021).
6. UNICEF, Pure Earth. The Toxic Truth: Children's exposure to lead pollution is hindering a generation of potential. New York: UNICEF; 2020 (<https://www.unicef.org/media/73246/file/The-toxic-truth-children%280%99s-exposure-to-lead-pollution-2020.pdf>, accessed 15 January 2021).
7. The paediatric environmental history. Recording children's exposure to environmental health threats: A "green page" in the medical record. Geneva: World Health Organization; 2020 (<https://www.who.int/news-room/q-a-detail/q-a-the-paediatric-environmental-history>, accessed 15 June 2021).
8. Children's environmental health units. Geneva: World Health Organization; 2010 (<http://apps.who.int/iris/handle/10665/327187>, accessed 15 June 2021).
9. WHO, Finland Ministry of Social Affairs and Health. Health in all policies: Helsinki statement. Framework for country action. 2014 (<https://apps.who.int/iris/handle/10665/112636>, accessed 5 June 2020).
10. Healthy environments for healthier populations: Why do they matter, and what can we do? Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/handle/10665/325877>, accessed 14 June 2021).
11. WHO global strategy on health, environment and climate change. Geneva: World Health Organization; 2020 (<https://www.who.int/publications/i/item/9789240000377>, accessed 14 June 2021).
12. Health in All Policies: training manual. Geneva: World Health Organization; 2015 (<https://apps.who.int/iris/handle/10665/151788>, accessed 15 June 2021).
13. Definition of health impact assessment. Copenhagen: World Health Organization Regional Office for Europe; 2020 (<https://www.euro.who.int/en/health-topics/environment-and-health/health-impact-assessment/definition-of-health-impact-assessment-hia>, accessed 5 August 2020).
14. WHO, UNEP. Health Impact Assessment. Geneva: World Health Organization; 2020 (<https://www.who.int/heli/impacts/hiabrief/en/>, accessed 5 August 2020).
15. Healthy environment, healthy people. Thematic report. Ministerial policy review session. Nairobi: United Nations Environment Programme; 2016 (<https://www.unep.org/news-and-stories/story/healthy-environment-healthy-people>, accessed 9 June 2021).
16. Implementation plan 'towards a pollution-free planet' Nairobi: United Nations Environment Programme; 2018 (<https://wedocs.unep.org/handle/20.500.11822/28484>, accessed 2 June 2021).
17. Working with the environment to protect people. UNEP's COVID-19 response. Nairobi: United Nations Environment Programme; 2020 (https://wedocs.unep.org/bitstream/handle/20.500.11822/32218/UNEP_COVID.pdf?sequence=1&isAllowed=y, accessed 15 January 2021).
18. Preventing the next pandemic: Zoonotic Diseases and how to break the chain of transmissions. Nairobi: UN Environment Programme; 2020 (<https://www.unenvironment.org/resources/report/preventing-future-zoonotic-disease-outbreaks-protecting-environment-animals-and>, accessed 15 January 2021).
19. Towards a pollution-free planet: background report. Nairobi: UN Environment Programme; 2017 (<https://www.unep.org/resources/report/towards-pollution-free-planet-background-report>, accessed 2 June 2021).

Annex 1: Messages on health and environment for the general public

This Annex provides tips and information on environmental health for the general public. It is adapted from the global guidance in this compendium for people having completed at least primary education. The information in this Annex is part of WHO's Your Life, Your Health: Tips and information for health and well-being, a WHO online resource for the public (<https://www.who.int/tools/your-life-your-health>). The resource provides tips and information for people's health and wellbeing at all ages. It also has advice on specific topics, such as environmental health. The information in the resource is easy to access, understand and act upon.

The audience of this compendium can use the messages below to promote health among the general public.

Main messages

WHO tips and information for protecting nature, the environment and our climate

WHO tips and information on breathing clean air

WHO tips and information on accessing safe water and safe toilets

WHO tips and information on washing hands

WHO tips and information on ensuring the safe handling of chemicals

WHO tips and information on keeping safe from ultraviolet rays

WHO tips and information on protecting yourself from radon

WHO tips and information on protecting yourself from health risks at work

WHO tips and information on avoiding injuries

WHO tips and information on protecting nature, the environment and our climate

People need a healthy environment in which to live. The planet we live on is under pressure. Too many resources are being taken from the planet. These actions and pollution lead to climate change. They also destroy nature. There are some actions you can take to protect nature and reduce pollution.

- Eat food grown locally such as vegetables, fruits, nuts and grains.
- Choose to cycle, walk and use public transport rather than drive a car or motorbike.
- Build houses that are good for your health, with insulation, ventilation and heating where needed.
- Use clean energy, and safe and energy saving devices, to cook and to light and to heat the home.
- Avoid using fossil fuels.
- Avoid the use of pesticides and herbicides.
- Avoid using plastics only once, such as plastic bags and food packaging.

Resource links

- WHO webpage on climate change including fact sheets on climate change and health, and biodiversity and health: <https://www.who.int/health-topics/climate-change>
- The WHO Manifesto for a Healthy and Green Recovery from COVID-19 – six steps to take: <https://www.who.int/multi-media/details/six-prescriptions-to-who-manifesto-for-healthy-recovery>

WHO tips and information on breathing clean air

Most people breathe air that is harmful to their health. Air becomes polluted in many ways. Pollution can come from cars and other vehicles. It can come from fires, factories, and by burning waste. Cooking on open fires and unsafe cook-stoves creates smoke. This smoke can make people sick as well. There are some actions you can take to reduce air pollution.

- Cycle, walk and use public transport rather than drive a car or a motorbike.
- Use cook-stoves that vent outside and that do not burn wood or coal.
- Build homes with insulation so they do not get too hot or too cold.
- Build homes with ventilation so that the air gets changed.
- Ensure waste is safely disposed, such as trash from the household or from agriculture.
- Avoid burning waste.

Resource links

- WHO webpage on air pollution including fact sheets on ambient and household air pollution and health:
<https://www.who.int/health-topics/air-pollution>

WHO tips and information on accessing safe water and safe toilets

People who drink safe water and use safe toilets are less likely to fall ill. Such as with diarrhoea and other diseases. Safe water comes from a water tap, a borehole or other safe sources. Safe toilets are those where people are not in contact with excreta. There are some actions you can take to access safe water and safe toilets.

- Drink water from a safe source.
- Make your water safer for drinking if needed, by boiling or filtering water.
- Add chlorine to drinking water to kill germs and bacteria if needed.
- Know that solar disinfection uses the sun to make water safer for drinking if needed.
- Use safe toilets and keep them clean.
- Ensure children have access to safe drinking-water and toilets.
- Use a potty (small bowl) for small children and empty it into a safe toilet.
- Stop animals from leaving their droppings where people live or play.
- Remove any droppings immediately.

Resource links

- WHO webpage on water, sanitation and hygiene including fact sheets on drinking water and sanitation:
<https://www.who.int/health-topics/water-sanitation-and-hygiene-wash>

WHO tips and information on washing hands

Washing hands with soap is an easy way to stay healthy. There are some actions you can take for handwashing.

- Wash hands with soap often as this is an easy way to stay healthy.
- Wash hands before eating and before preparing food.
- Wash hands after going to the toilet and after cleaning a child's bottom.
- Ensure that your children wash their hands with soap.
- For small children, help them to wash their hands with soap and water often.

Resource links

- WHO webpage on water, sanitation and hygiene:
<https://www.who.int/health-topics/water-sanitation-and-hygiene-wash>

WHO tips and information on ensuring the safe handling of chemicals

People get in contact with many different chemicals every day. Examples are products used to clean, bleach, or disinfect, such as in the home or workplace. Many chemicals are harmless or even good for you. Others such as pesticides are dangerous and can harm your health. There are some actions you can take to handle chemicals safely.

- Store chemicals and medicines in a safe way.
- Store chemicals where children cannot reach them or open them.
- Add clear labels to packages of chemicals.
- Avoid storing chemicals in drinking bottles.
- Dispose of chemicals and medicines in a safe way.
- Avoid disposing chemicals and medicine on the ground, in rivers, or into sinks, drains or toilets.
- Avoid the use of pesticides for killing plant pests or pests in homes.
- Wear special clothes for protection if using pesticides.
- Know where to get help in case of an emergency, such as for a suspected chemical poisoning.
- Know the telephone number of the nearest poison centre.

Resource links

- WHO webpage on chemical safety, including fact sheets and further information on chemicals of major public health concern: <https://www.who.int/health-topics/chemical-safety>

WHO tips and information on keeping safe from ultraviolet rays

Different kinds of radiation can impact your health. Ultraviolet radiation is one type. It comes from the sun or sunbeds. Too much ultraviolet radiation harms the skin. It can also cause cancer. Too little is also not good. The body needs some ultraviolet radiation to keep in good health. There are some actions you can take to keep safe.

- Be aware of your time exposed to the sun, especially around the hours either side of the middle of the day.
- Know that some people need extra protection from the sun such as young children and fair-skinned people.
- Wear clothing with long sleeves.
- Apply sunscreen regularly when outside to protect your skin.
- Use hats with broad brims and sunglasses to protect your eyes.
- Avoid using sunbeds or other tanning devices.

Resource links

- WHO webpage on UV-radiation:
<https://www.who.int/health-topics/ultraviolet-radiation>

WHO tips and information on protecting yourself from radon

Radon is a radioactive gas that comes out of the ground. It may be found in high concentrations in buildings, such as homes and workplaces. High concentrations of radon are mainly found on the lower floors of a building. For example, it can be found on the ground floor or below, but it can also be found on upper levels. Radon can be dangerous for your health and is one of the leading causes of lung cancer. There are actions you can take to protect yourself from radon.

- Measure the radon level in your home, which is easy and cheap by using radon detectors.
- Depending on the country, obtain a radon detector from a radon testing service.
- Or check with the local government for radon detectors.
- Alternatively check with the national agency in charge of radiation safety.
- Ask a radon expert or consultant how to prevent radon when building a new home.

Resource links

- WHO webpage on radon including fact sheets on radon and ionizing radiation:
<https://www.who.int/health-topics/radon>

WHO tips and information on protecting yourself from health risks at work

People may spend many hours each day at work. There are many types of workplaces. A workplace can be an office, factory, restaurant or farm and many others. You can experience different risks in the workplace. Risks can be loud noise, ultraviolet rays, chemicals or germs. Other risks relate to movement. These risks can be to lift heavy items, sit for a long time or awkward postures like twisting or bending. There are some actions you can take to protect yourself at work.

- Follow the rules on safety at your workplace which are set by your employer.
- Use special clothing and equipment to protect from risks.
- Take training on safe work practices, how to prevent accidents and stress at work.
- Keep the workplace tidy, clean and comfortable.
- Report any situation at work you believe may be harmful to you or co-workers.
- Get to know where to find first aid and how to help co-workers in case of emergency.
- Keep a healthy balance between work and private life.
- Avoid always working long hours.
- Help and respect co-workers and to be positive in the workplace.
- Avoid sitting for a long time and adopt healthy eating habits at work.

Resource links

- WHO webpage on occupational health including different fact sheets on workers' health:
<https://www.who.int/health-topics/occupational-health>

WHO tips and information on avoiding injuries

Many people get injured or die from drowning, falls and burns and other accidents. Most of these deaths and injuries can be prevented. Children and older people are at special risk. There are some actions you can take to prevent injuries.

- Make your home safe including for children.
- Put in smoke detectors and bars or locks on windows so a young child cannot open them.
- Put in guards or gates for stairs to prevent a child from climbing the stairs.
- Secure open waters such as pools, wells and ponds so children cannot access them.
- Teach all school-aged children how to swim.
- Support older people with ways to prevent falls and other accidents.
- Prevent fires in the home, such as to not smoke, use a cook-stove that is safe and use electrical appliances in a good condition.
- Keep safe by preventing injuries, such as cycle with a helmet, use seatbelts in cars and drink less alcohol.
- Learn first aid skills.

Resource links

- WHO fact sheets:
 - o Burns:
<https://www.who.int/news-room/fact-sheets/detail/burns>
 - o Drowning:
<https://www.who.int/news-room/fact-sheets/detail/drowning>
 - o Falls:
<https://www.who.int/news-room/fact-sheets/detail/falls>
 - o Road traffic injuries:
<https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>.

World Health Organization

Department of Environment, Climate Change and Health
Division of Universal Health Coverage / Healthier Populations
20, Avenue Appia
CH-1211 Geneva 27
Switzerland

www.who.int/teams/environment-climate-change-and-health

9789240095380



A standard linear barcode representing the ISBN 9789240095380. The barcode is composed of vertical black bars of varying widths on a white background.

9 789240 095380