Indicators of climate resilience and GHG emissions in health systems

World Health Organization

Advanced draft version

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Contents

Acknowledgements ..... **iv**

Abbreviations ..... **v**

Executive summary ..... **vi**

1

Indicator development process **1**

Introduction 2

WHO's Fourteenth General Programme of Work 3

Framework to map indicators 5

Climate-resilient health systems 7

Low-carbon health systems 8

Objectives and target audience 9

Alignment of the proposed indicators with WHO's work 10

Structure of the indicator sets 11

Method for calculating the index 12

2

The 10 climate-resilience indicators **13**

Summary of climate-resilience indicators proposed in this document 14

Selecting targets 16

Climate resilience indicators for health systems 18

3

The 10 GHG emissions indicators **43**

Summary of additional GHG indicators proposed in this document 45

Selecting targets 47

Health sector GHG emission indicators 49

Conclusions 59

References 61

Acknowledgements

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The authors thank the following reviewers for their comments: Hyunju Lee and Amy Savage, WHO; Peter Berry, Jessie Hamon, Katie Hayes and Erin McLean, Health Canada.

WHO thanks Health Canada for the financial and technical support provided to develop this report.

Abbreviations

ATACH	Alliance for Transformative Action on Climate and Health
DRR	disaster risk reduction
EWS	early warning systems
GHG	greenhouse gas
GPW-14	Fourteenth General Programme of Work (WHO)
HNAP	health national adaptation plan
IHR (2005)	International Health Regulations (*2005*)
NAP	national adaptation plan
PHC	primary health care
PM	measurement of fine particulate matter
SDG	Sustainable Development Goal
UHC	universal health coverage
V&A	vulnerability and adaptation assessment
WASH	water, sanitation and hygiene
WHO	World Health Organization

Executive summary

In 2024, the World Health Assembly approved the World Health Organization's (WHO) Fourteenth General Programme of Work (GPW-14). The overarching goal of the GPW-14 is to promote, provide and protect health and well-being for all people, everywhere. The GPW-14 comprises six strategic objectives, one of which focuses on climate change and health, and specifically addresses the escalating health threat posed by climate change in the 21st century. This strategic objective has two joint outcomes, ensuring that:

- more climate-resilient health systems are addressing health risks and impacts, to be measured as an index of national climate change and health capacity; and
- lower-carbon health systems and societies are contributing to health and well-being, to be measured as health care sector greenhouse gas emissions.

The indicators proposed in this document are specifically designed to monitor the two climate change and health outcomes of the GPW-14. Meeting the strategic objective for climate change and health necessitates the development of a comprehensive set of indicators that can be utilized by all countries to report on their progress towards the outcomes of the GPW-14.

The primary goal was to develop and implement a tool that can measure progress towards the two GPW-14 outcomes. The indicator sets provided in this document will assist countries and jurisdictions in evaluating their efforts to enhance climate resilience and reduce greenhouse gas emissions within their health systems. These proposed indicators can then be used to compute an index of climate resilience and actions to reduce carbon emissions.

The identification and development of the indicators proposed in this document were based on reviews of several WHO reports. Furthermore, the indicators proposed in this document align with those in WHO's 2025 climate and health survey, indicators to monitor progress in the Alliance for Transformative Action on Climate and Health (known as ATACH), and indicators proposed in the Operational framework for building climate resilient and low carbon health systems.

1

Indicator development process

Introduction

During the past decade, many of the World Health Organization's (WHO) initiatives addressing climate change and health have included examples of indicators or measurable outputs. Vulnerability and adaptation assessments (V&As) *(1, 2)*, for example, support countries in identifying and using indicators that can help them recognize hazards, exposures, vulnerabilities and health impacts, as well as options for adaptation. Similarly, health national adaptation plans (HNAPs) include indicators related to health system capacities and responses. Indicators are also collected through WHO's health and climate change survey, previously published in 2021 *(3)*, with the latest is currently being conducted. WHO's health and climate change country profiles report on the most relevant indicators to summarize evidence about the climate hazards and health risks facing countries, track national progress and highlight areas for action *(4)*. There are also indicators for health facilities, for example both the *WHO guidance for climate-resilient and environmentally sustainable health care facilities (5)* and *Checklists to assess vulnerabilities in health care facilities in the context of climate change (6)* provide extensive lists of actions that can be measured by indicators.

In 2022, WHO published *Measuring the climate resilience of health systems (7)*, which emphasized that measuring the climate resilience of a health system is most effectively done with information and indicators that are tailored to the needs of the health authority using them. This means that indicators should be flexible, not prescriptive, and identified by local or national health authorities. Importantly, the report proposed a framework for identifying or developing indicators.

The *Operational framework for building climate resilient health systems*, published in 2015 *(8)*, proposed indicators and measurable outcomes, although not systematically. In 2023, WHO updated the first Framework, publishing the *Operational framework for building climate resilient and low carbon health systems (9)*, which includes actions and indicators to assess both resilience and carbon emissions by health systems.

WHO's Fourteenth General Programme of Work

In 2024, the World Health Assembly approved WHO's Fourteenth General Programme of Work (GPW-14). The overarching goal of the GPW-14 is to promote, provide and protect health and well-being for all people, everywhere *(10)*.

The GPW-14 has six strategic objectives (Table 1).

Table 1. Strategic objectives of WHO's Fourteenth General Programme of Work *(10)*

GPW-14 goal mapping	Strategic objectives
To **promote** health	Respond to **climate change**, an escalating health threat in the 21st century
	Address **health determinants and the root causes of ill health** in key policies across sectors
To **provide** health	Advance the **primary health care approach and essential health system capacities** for universal health coverage
	Improve health **service coverage and financial protection** to address inequity and gender inequalities
To **protect** health	**Prevent, mitigate and prepare** for risks to health from all hazards
	Rapidly detect and sustain an effective response to all health emergencies

Strategic objective 1 (respond to climate change, an escalating health threat in the 21st century) has two joint outcomes:

- Outcome 1.1 – More climate-resilient health systems are addressing health risks and impacts, to be measured as an index of national climate change and health capacity; and
- Outcome 1.2 – Lower-carbon health systems and societies are contributing to health and well-being, to be measured as health care sector greenhouse gas (GHG) emissions.

The strategic objectives and joint outcomes in the GPW-14 are interrelated, and many of the indicators are associated with the environment, climate change and health (Table 2).

Table 2. Selected indicators from the Fourteenth General Programme of Work related to the environment, climate change and health *(10)*

Strategic objectives and joint outcomes for 2025–2028	Sample of indicators related to the environment, climate change and health
1. Respond to **climate change**, an escalating health threat in the 21st century	• Index of national climate change and health capacity • Health care sector greenhouse gas emissions
2. Address **health determinants** and the **root causes of ill health** in key policies across sectors	• Proportion of urban population living in slums, informal settlements or inadequate housing • Mortality rate attributed to household and ambient air pollution • Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene • Proportion of population with primary reliance on clean fuels and technology • Annual mean levels of fine particulate matter (e.g. $PM_{2.5}$ and PM_{10}) in cities (population weighted) • Proportion of a country's population living in a healthy municipality, city or region
3. Advance the **primary health care approach and essential health system** capacities for universal health coverage	• Health facility density and distribution (by type and level of care) • Health worker density and distribution (by occupation, subnational, facility ownership, facility type, age group, sex)
4. Improve **health service coverage and financial protection** to address inequity and gender inequalities	• Vector-borne disease incidence • Malaria incidence per 1 000 population • Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease
5. **Prevent, mitigate and prepare** for risks to health from all hazards	• Coverage of WASH in communities and health care facilities
6. Rapidly **detect and sustain an effective response** to all health emergencies	• Proportion of vulnerable people in fragile settings provided with essential health services

PM: measurement of fine particulate matter; WASH: water, sanitation and hygiene.

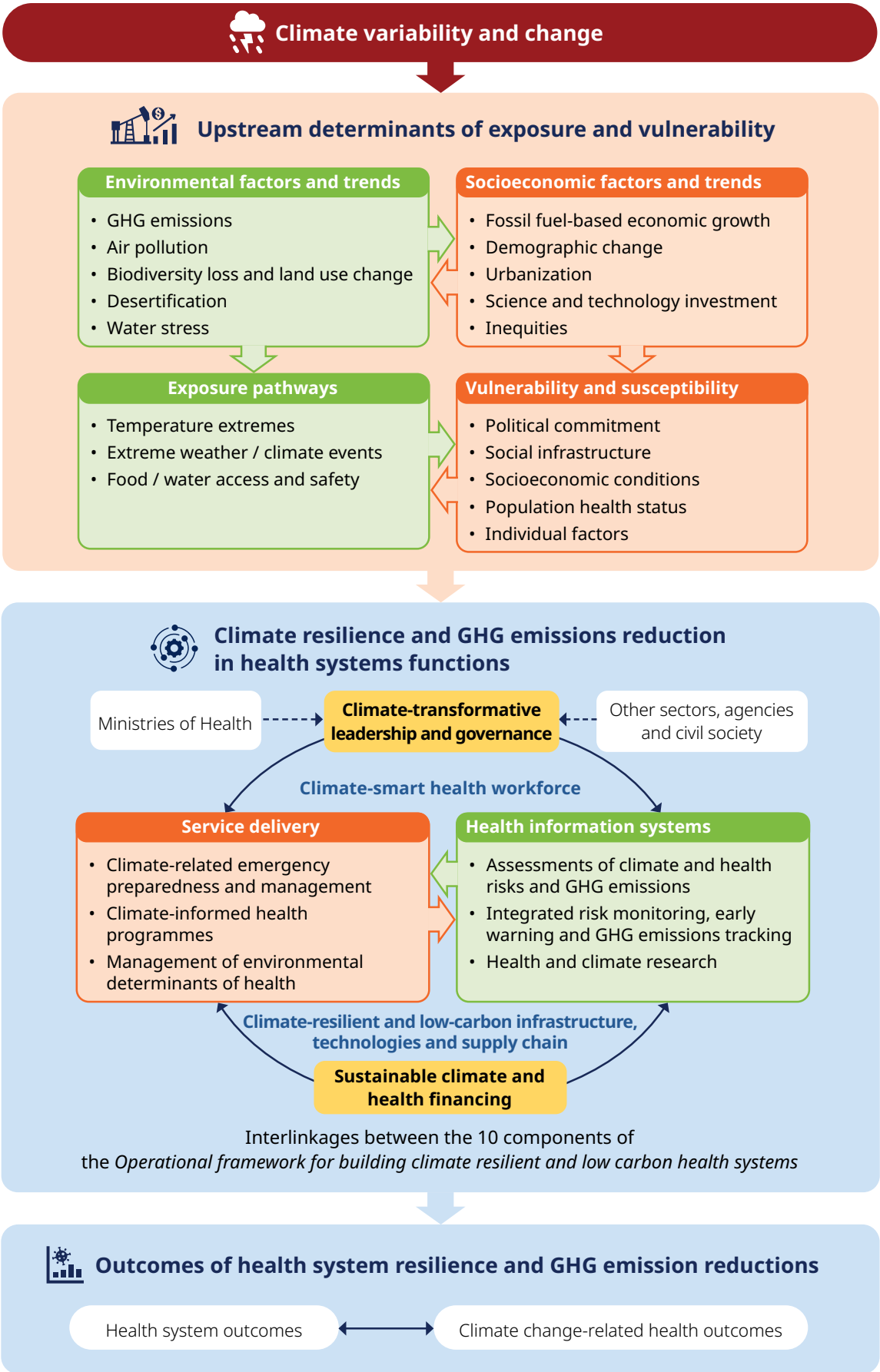
Framework to map indicators

The indicators proposed in this document are designed specifically to monitor the two climate change and health outcomes in the GPW-14. These proposed indicators form a coherent set that could be used by all countries to report on advances towards meeting Strategic objective 1, which addresses climate change and health.

The indicators follow the Framework proposed in *Measuring the climate resilience of health systems (7)* that was updated to include GHG emissions *(9)* (Fig. 1). The Framework starts with climate variability and change and illustrates the connection among three distinct parts that require measurement *(7)*.

- Upstream determinants of exposure and vulnerability: The goal is to identify and measure environmental factors and trends, and the exposure pathways that are important to health outcomes in a specific country or jurisdiction. It is also relevant to identify and measure key socioeconomic factors and trends, and the existing vulnerabilities and susceptibilities of broader systems. Importantly, upstream determinants should also include overall GHG emissions, in addition to health sector emissions, as precursors to climate change.
- Climate resilience and reducing GHG emissions in health system functions: The goal is to measure current health system capacities and adaptation efforts based upon the 10 components of WHO's *Operational framework for building climate resilient and low carbon health systems (9)* that are most relevant to a specific jurisdiction by accessing data in collaboration with partners within and outside of the health sector.
- Outcomes measured as the climate resilience of health systems and reductions in GHG emissions: These are measured with two sets of indicators to gauge progress towards resilience and decarbonization.

Fig. 1. Proposed framework to monitor the two climate change and health outcomes in WHO's Fourteenth General Programme of Work, based on references *(7, 9)*



GHG: greenhouse gas.

Climate-resilient health systems

The Intergovernmental Panel on Climate Change *(11)*, defines resilience as "the capacity of social, economic and environmental systems to cope with a hazardous event, trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation". WHO defines climate-resilient health systems as those that are "capable to anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stress, so as to bring sustained improvements in population health, despite an unstable climate" *(8)*.

There is not one simple or direct way to measure resilience in the context of health systems. This document provides indicators and a method for obtaining an index to measure health system capacity to estimate and increase its resilience. The indicators are listed in Part 2.

Low-carbon health systems

Low-carbon health systems are those capable of implementing transformative strategies to reduce GHG emissions in their operations, thus also reducing short- and long-term negative impacts on the local and global environments *(9)*. Carbon emissions from health systems can be and have been calculated for selected countries in peer-reviewed studies. However, there are no simple methods available for making these calculations and, therefore, there is not one simple or direct way to measure reductions in GHG emissions in the context of health systems.

The GPW-14 indicator for low-carbon health systems is health care sector GHG emissions. The majority of health systems do not have the tools or resources to accurately estimate their emissions. Some constraints to measuring this outcome include the lack of detailed data to enable whole system assessments and a lack of data for assessing and adding up the contributions of separate health facilities in a country. However, this situation is improving rapidly. The 2025 Lancet Countdown report *(12)* and data provide estimates of health sector GHG emissions for every country. It is the most comprehensive data set to date.

Part 3 of this report proposes process indicators that can provide an index to measure a health system's capacity to reduce GHG emissions and although this is not part of the GPW-14, it provides information about actions being implemented in countries.

Objectives and target audience

The main objective of this work was to develop a tool to measure progress towards the two climate change outcomes in the GPW-14. The indicator sets provided here can assist countries and jurisdictions in assessing the actions taken towards developing climate resilience and reducing GHG emissions in their health systems.

The target audience includes a wide range of actors, from health decision-makers at the national and subnational levels, to health care facility managers and health workers at the local level. Although the indicators are designed with a national focus, they are equally applicable to subnational jurisdictions at different levels.

Alignment of the proposed indicators with WHO's work

The identification and development of the proposed indicators were based on several climate change and health reports (e.g. *2, 3, 5–9*), and in consultation with experts from within and outside WHO. In addition, the indicators proposed are aligned with WHO's *Operational framework for building climate resilient and low carbon health systems (9)*, indicators from WHO's climate and health survey *(3)*, and WHO's GPW-14 *(10)*, which is the main target of these indicators.

To ensure the indicators aligned with countries' needs, they were assessed by a selected number of countries. In general, countries found that the set was useful and easy to understand, and the method to compute an index was assessed as appropriate, with minor modifications to make it simpler. Most countries found it would be feasible to report indicators at the national level, but this was not the case for every country. Some countries with a decentralized health system may not be able to report at the national level. In these cases, it would be feasible to collect data from only subnational-level indicators, not nationally aggregated data; the proposed set can, therefore, also be applied at the subnational level.

Structure of the indicator sets

Indicator templates for each of the components of the Operational Framework *(9)* were constructed by developing:

(i) a rationale;

(ii) the indicator for the climate-resilience component (or the indicator for the GHG emissions component);

(iii) related sets of indicators;

(iv) notes with links to further information.

Not included in the templates are the data needed and the sources of information. This is because no specific data sets are required. The proposed indicators are based on quantitative and qualitative information obtainable from the health system, either at a national or subnational level. Similarly, the method of calculation is not included in the templates because it is common to all indicators, as explained in the next section. For the section on GHG emissions indicators, parts iii and iv above are included in the section on Climate-resilience indicators to avoid duplication.

Method for calculating the index

The method follows the one used by the International Health Regulations 2005 (IHR, 2005), in which levels are allocated values from 0 to 100. In this case, all indicators follow the same format to track the progress made in developing climate resilience and reducing GHG emissions: there are six levels, ranging from "no action" (Level 0) to "very high" (Level 5), as shown in Table 3.

Table 3. Levels and values used to calculate the index of climate resilience and reduction in greenhouse gas emissions

Level of health system resilience (or level of reduction in GHG emissions)	Value	Level
No action	0	**0**
Very low	20	**1**
Low	40	**2**
Medium	60	**3**
High	80	**4**
Very high	100	**5**

GHG: greenhouse gas.

To calculate the value of each indicator, add the points associated with each level; for example, for an action assessed as Level 0, add 0 points; for Level 1, add 20 points; for Level 2, 40 points; for Level 3, 60 points; for Level 4, 80 points; and for Level 5, 100 points. All indicators are assumed to have equal weighting, thus avoiding the complexity and subjectivity of allocating weights. The overall index of climate resilience or reductions in GHG emissions is calculated as the mean of the 10 indicators for the components, as follows:

Resilience (or GHG) index =

(Component indicator 1 + Component indicator 2 +... + Component indicator 10)/10.

2

The 10 climate-resilience indicators

GPW-14 Outcome 1.1: More climate-resilient health systems are addressing health risks and impacts, to be measured as an index of national climate change and health capacity

Summary of climate-resilience indicators proposed in this document

The proposed set of indicators for health system climate resilience follows the 10 components of WHO's *Operational framework for building climate resilient and low carbon health systems (9)* and the overall framework in Fig. 1. The indicators build and expand on those described in *Measuring the climate resilience of health systems,* adding new indicators for resilience *(7)*. The core set consists of the 10 indicators for climate resilience shown in Table 4.

Table 4. Indicators of climate resilience proposed in this document and their corresponding component in WHO's Operational Framework *(9)*

Component of WHO's Operational Framework	Indicator for climate resilience in health systems
1 Climate-transformative leadership and governance	Health component of the national adaptation plan has been developed
2 Climate-smart health workforce	The Ministry of Health's workforce has received training on climate change and health within the past 2 years
3 Assessments of climate and health risks, and GHG emissions	Climate change and health vulnerability and adaptation assessment conducted within the past 5 years
4 Integrated risk monitoring, early warning and GHG emissions tracking	Climate-informed health early warning system allows prediction of the risk of specific outbreaks and is available
5 Health and climate research	National research plan on climate change and health has been developed and implemented
6 Climate-resilient and low-carbon infrastructure, technologies and supply chain	Percentage of health facilities built or retrofitted to be climate resilient based on national, regional or global guidance
7 Management of environmental determinants of health	Mechanism established within the health system for collecting and analysing data to inform the management of climate-related environmental determinants of health

8 Climate-informed health programmes	Information about weather and climate conditions has been integrated into the implementation of health programmes addressing climate-sensitive health risks
9 Climate-related emergency preparedness and management	Climate-related health emergency, and disaster preparedness and management actions are integrated into disaster risk reduction plans
10 Sustainable climate and health financing	Financing to implement interventions addressing climate change and health is available

GHG: greenhouse gas.

The indicator structure is similar to that used in the *International Health Regulations (2005): states parties self-assessment annual reporting tool (13)*. Each indicator has six possible levels, as shown in the example in Table 5.

Table 5. Component 1 indicator: health component of national adaptation plan has been developed

Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ No HNAP developed	0
☐ An HNAP is being developed	1
☐ An HNAP has been developed and endorsed by the Ministry of Health	2
☐ An HNAP has an allocated budget and human resources to begin implementation	3
☐ Initial action is being taken on some HNAP priorities	4
☐ All actions identified in the HNAP are being implemented	5

HNAP: health national adaptation plan.

Only one of the six levels can be selected. When a level is selected, it implies that attributes for all of the previous levels have been achieved. For example, if a jurisdiction concluded that Level 4 has been achieved because action is being taken on some HNAP priorities, this is valid only if all previous steps have been completed (e.g. Level 3 was achieved because there is a budget and human resources and Level 2 was achieved because the Ministry of Health endorsed the HNAP). Only the highest level of actual implementation should be indicated.

Selecting targets

There are no agreed targets for the proposed indicators. It is suggested that targets can be obtained by using the highest level achievable for each indicator. Table 6 provides examples of the targets.

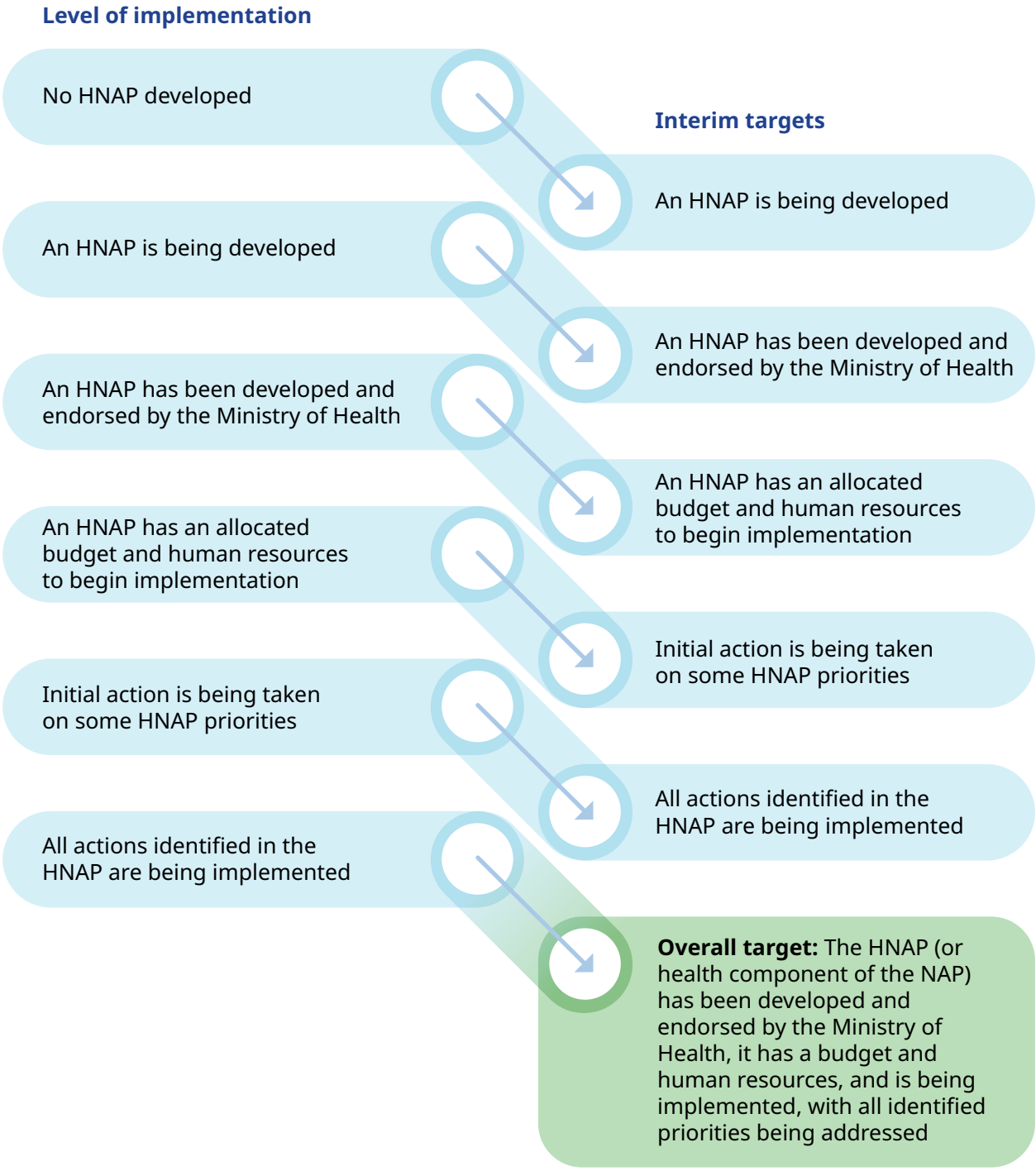
Table 6. Examples of climate-resilience targets for health systems

Component	Climate resilience target
1 Climate-transformative leadership and governance	The HNAP (or health component of the NAP) has been developed and endorsed by the Ministry of Health; it has a budget and human resources, is being implemented and all priorities are being considered.
2 Climate-smart health workforce	The health workforce in all health programmes has received training in climate change and health.
3 Assessments of climate and health risks, and GHG emissions	Results of V&As have been endorsed by the Ministry of Health and are used when developing policies and programmes addressing climate change and health.
4 Integrated risk monitoring, early warning and GHG emissions tracking	A climate-informed health early warning system is fully functional, enabling risks to be predicted for all climate-sensitive health outcomes.
5 Health and climate research	A national research plan for climate change and health has been developed, endorsed by the Ministry of Health and fully integrated into health policy.
6 Climate-resilient and low-carbon infrastructure, technologies and supply chain	All health facilities are built or have been retrofitted to be climate resilient based on national, regional or global guidance.
7 Management of environmental determinants of health	All relevant, climate-related environmental determinants of health are being monitored and managed through an established mechanism for data collection and analysis.
8 Climate-informed health programmes	Information about weather and climate conditions has been integrated into the implementation of health programmes addressing climate-sensitive health risks.
9 Climate-related emergency preparedness and management	Disaster risk reduction plans have been implemented and include climate-related health emergencies and disaster preparedness and management actions.
10 Sustainable climate and health financing	The whole health system is fully financed to build climate resilience.

GHG: greenhouse gas; HNAP: health national adaptation plan; V&A: vulnerability and adaptation assessment.

Interim targets can be established based on an agreed timescale that aim to achieve a level higher than the country or jurisdiction has currently attained; Fig. 2 provides an example.

Fig. 2. Examples of interim targets for the Component 1 indicator: health component of the national adaptation plan has been developed



HNAP: health national adaptation plan.

Climate resilience indicators for health systems

Tables 7–16 describe the proposed indicators for climate resilience in the health sector.

Table 7. Climate-resilience indicator for Component 1: climate transformative leadership and governance

	Component 1 *Climate-transformative leadership and governance*
Rationale	The proposed indicators for climate resilience and GHG emissions in health systems are proxies for the levels of commitment of and action taken by health sector leadership on climate change. At the health system level, it is essential to have strong political leadership and willingness at the highest levels of government to address the health risks of climate change and to reduce emissions to ensure that the effects of climate change are integrated into all health programmes. At the same time, effective responses to climate change imply the need for assessment, monitoring, regulation and management of climate-related health risks that originate in other sectors. Cross-sectoral collaboration is necessary to ensure that the partnerships required to enact whole-of-society actions on climate change and health are implemented. Cross-sectoral collaboration can be supported by ensuring that members of the health sector participate in national or subnational committees addressing climate change or by officials from health-determining sectors participating in climate change and health V&As. To support the process of managing the health risks of climate change, countries can integrate a health component into their overall NAP. An HNAP should include a detailed process for health adaptation, including assessing risks; identifying, prioritizing and implementing adaptation options; and monitoring and evaluating the adaptation process.
Indicator for climate-resilience component	**Health component of national adaptation plan has been developed***

Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ No HNAP developed	0
☐ An HNAP is being developed	1
☐ An HNAP has been developed and endorsed by the Ministry of Health	2
☐ An HNAP has an allocated budget and human resources to begin implementation	3
☐ Initial action is being taken on some HNAP priorities	4
☐ All actions identified in the HNAP are being implemented	5

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

* The HNAP can stand alone or be a component of the NAP.

Related indicator sets	• IHR (2005) area C1: Policy, legal and normative instruments to implement IHR (2005) Indicator C1.1: Policy, legal and normative instruments • IHR (2005) area C2: IHR (2005) coordination and national IHR focal point Indicator C2.1: National IHR focal point functions Indicator C2.2: Multisectoral coordination mechanisms • SDG Target 3.8: Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all • SDG Target 13.2: Integrate climate change measures into national policies, strategies and planning Indicator 13.2.1: Number of countries with nationally determined contributions, long-term strategies, national adaptation plans and adaptation communications, as reported to the Secretariat of the United Nations Framework Convention on Climate Change • PHC governance area: Institutional capacity to meet essential public health functions and operations; coordination mechanisms with multistakeholder participation and community engagement
Notes	Further information can be found in the following resources. • *Climate change and health: vulnerability and adaptation assessment (2)* • *WHO guidance for climate-resilient and environmentally sustainable health care facilities (5)* • *Checklists to assess vulnerabilities in health care facilities in the context of climate change*; *(6)* • *Measuring the climate resilience of health systems (7)* • *Operational framework for building climate resilient and low carbon health systems (9)* • The 2025 report of the *Lancet Countdown on health and climate change (12)* • *International Health Regulations (2005): states parties self-assessment annual reporting tool (13)* • *Quality criteria for health national adaptation plans (14)* • *WHO guidance to protect health from climate change through health adaptation planning (15)* • The 2024 report of the *Lancet Countdown on health and climate change: facing record-breaking threats from delayed action (16)* • The Sustainable Development Goals *(17)* • *Primary health care measurement framework and indicators: monitoring health systems through a primary health care lens (18)* • ATACH community of practice: building climate resilient and low carbon sustainable health systems *(19)* • The 2022 report of the *Lancet Countdown on health and climate change: health at the mercy of fossil fuels (20)* • *Delivering a 'net zero' National Health Service (21)*

ATACH: Alliance for Transformative Action on Climate and Health; GHG: greenhouse gas; IHR (*2005*): International Health Regulations (2005); HNAP: health national adaptation plan; NAP: national adaptation plan; PHC: primary health care; SDG: Sustainable Development Goal; V&A: vulnerability and adaptation assessment.

Table 8. Climate-resilience indicator for Component 2: climate-smart health workforce

	Component 2 *Climate-smart health workforce*
Rationale	A health system relies upon an effective health workforce to achieve the best health outcomes possible, given the available resources and circumstances. Climate change may increase local demand for health services, thus potentially altering the number of health workers required, the skill mix of needed health workers, as well as their competencies. The availability of the required health and care workforce with the capacity to act on climate change and health is a fundamental determinant of overall climate resilience as it strongly predicts the capacity of health systems to provide health services in a changing climate.
Indicator for climate-resilience component	**The Ministry of Health's workforce has received training on climate change and health within the past 2 years** Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ No curricula have been developed to build the capacities of the Ministry of Health's workforce for climate change resilience	0
☐ Curricula and training courses to build the capacities of the Ministry of Health's workforce for climate change response are being developed or updated	1
☐ Training courses are being implemented in at least one health programme	2
☐ Training courses are being implemented in two or more health programmes	3
☐ Most of the health workforce in most health programmes has received training	4
☐ All of the health workforce in all health programmes has received training	5

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

The following list provides examples of topics on climate change and health that may be included in training courses. Mark all that apply in your setting.

- ☐ Basic concepts of climate change and health risks
- ☐ Air quality/air pollution and respiratory illnesses
- ☐ Heat-related illnesses
- ☐ Cold-related illnesses
- ☐ Water quality, water availability, waterborne diseases and other water-related health outcomes
- ☐ Vector-borne diseases
- ☐ Zoonoses
- ☐ Food insecurity and foodborne diseases and malnutrition
- ☐ Other infectious diseases
- ☐ Injury and mortality from extreme weather events
- ☐ Mental and psychosocial health outcomes
- ☐ Noncommunicable diseases: cardiovascular diseases, respiratory illnesses, stroke, chronic obstructive pulmonary disease, diabetes
- ☐ Risks of climate change to health facilities and disruption of health services
- ☐ Climate-informed health early warning system
- ☐ Climate-informed health surveillance systems
- ☐ Climate-resilient health systems and facilities
- ☐ Climate change and health assessment and planning (e.g. HNAP and V&A)
- ☐ Environmental sustainability
- ☐ Low-carbon and sustainable health systems and facilities
- ☐ Climate change and health communication
- ☐ Climate change and disaster risk reduction
- ☐ One Health
- ☐ Other (specify):

	The following list provides examples of health programmes in which staff may have received training on climate change and health. Mark all that apply in your setting. ☐ Communicable diseases (including vector-, water- and food-borne) ☐ Epidemiology and health surveillance ☐ Environmental health ☐ Food and nutrition ☐ Health system planning ☐ Indigenous health ☐ Mental health ☐ Noncommunicable diseases ☐ Occupational health ☐ Public health emergencies and disasters ☐ Travel medicine ☐ Health promotion and communication ☐ Primary health care ☐ Older adult health ☐ Maternal, newborn and child health ☐ Other (specify): The following list provides examples of personnel who may have received training on climate change and health. Mark all that apply in your setting. ☐ Clinicians (e.g. doctors, nurses, psychologists, others) ☐ Community health workers ☐ Environmental health personnel ☐ Epidemiology/surveillance personnel ☐ Occupational health personnel ☐ Health emergency and disaster personnel ☐ Health facility managers and administrators ☐ Policy and planning personnel ☐ Other (specify):
Related indicator sets	• UHC tracer area: Service capacity and access Indicator: Health worker density • IHR (2005) area C6: Human resources Indicator C6.1: Human resources for implementation of IHR(2005) Indicator C6.2: Workforce surge during a public health event • SDG Target 3.c: Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States Indicator 3.c.1: Health worker density and distribution • PHC health workforce: National systems for continuing professional development

Notes	Further information can be found in the following resources. • *Climate change and health: vulnerability and adaptation assessment (2)* • *WHO guidance for climate-resilient and environmentally sustainable health care facilities (5)* • *Checklists to assess vulnerabilities in health care facilities in the context of climate change (6)* • *Measuring the climate resilience of health systems (7)* • *Operational framework for building climate resilient and low carbon health systems (9)* • *International Health Regulations (2005): states parties self-assessment annual reporting tool (13)* • The Sustainable Development Goals *(17)* • *Primary health care measurement framework and indicators: monitoring health systems through a primary health care lens (18)* • *Communicating on climate change and health: toolkit for health professionals (22)* • *Tracking universal health coverage: 2023 global monitoring report (23)* • *Health care's climate footprint: how the health sector contributes to the global climate crisis and opportunities for action (24)*

HNAP: health national adaptation plan; PHC: primary health care; SDG: Sustainable Development Goal; UHC: universal health coverage; V&A: vulnerability and adaptation assessment.

Table 9. Climate-resilience indicator for Component 3: assessments of climate and health risks, and GHG emissions

<table>
<tr><td></td><td>Component 3
Assessments of climate and health risks, and GHG emissions</td></tr>
<tr><td>Rationale</td><td>This proxy indicator includes a range of assessments that can be used to generate policy-relevant evidence about the scale and nature of climate-related risks to health and health systems, and the impact of health systems' operations and GHG emissions on communities and the environment. It also generates information about health-promoting mitigation actions and policies in sectors responsible for the most GHG emissions. Climate change V&As provide evidence about current and future health risks from climate variability and change.</td></tr>
<tr><td>Indicator for climate-resilience component</td><td>Climate change and health vulnerability and adaptation assessment conducted within the past 5 years

Select the level that most closely reflects implementation in your setting.

<table>
<tr><th>Criteria</th><th>Level</th></tr>
<tr><td>☐ V&A not conducted within the past 5 years</td><td>0</td></tr>
<tr><td>☐ V&A initiated or being updated</td><td>1</td></tr>
<tr><td>☐ V&A developed or supported by the Ministry of Health</td><td>2</td></tr>
<tr><td>☐ V&A conducted within the past 5 years and results endorsed by the Ministry of Health</td><td>3</td></tr>
<tr><td>☐ V&A results inform climate change and health processes (e.g. in the HNAP, health in Nationally Determined Contributions)</td><td>4</td></tr>
<tr><td>☐ V&A results are used when developing policies and programmes to address climate change and health</td><td>5</td></tr>
</table>

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).</td></tr>
<tr><td>Related indicator sets</td><td>• SDG Target 13.2: Integrate climate change measures into national policies, strategies and planning
Indicator 13.2.2: Total GHG emissions per year</td></tr>
</table>

Notes	Further information can be found in the following resources. • *Climate change and health: vulnerability and adaptation assessment (2)* • *WHO guidance for climate-resilient and environmentally sustainable health care facilities (5)* • *Checklists to assess vulnerabilities in health care facilities in the context of climate change (6)* • *Measuring the climate resilience of health systems (7)* • *Operational framework for building climate resilient and low carbon health systems (9)* • The Sustainable Development Goals *(17)* • *Health care's climate footprint: how the health sector contributes to the global climate crisis and opportunities for action (24)* • *Progress on WASH in health care facilities 2000–2021: special focus on WASH and infection prevention and control (25)* • *Expert meeting on measuring greenhouse gas emissions and other environmental sustainability concerns in health care facilities: 24 February 2021 meeting report (26)* • Greenhouse Gas Protocol *(27)* • Health care's response to climate change: a carbon footprint assessment of the NHS in England *(28)* • The environmental footprint of health care: a global assessment *(29)* • *Climate services for health: improving public health decision-making in a new climate (30)*

GHG: greenhouse gas; HNAP: health national adaptation plan; SDG: Sustainable Development Goal; V&A: vulnerability and adaptation assessment; WASH: water, sanitation and hygiene.

Table 10. Climate-resilience indicator for Component 4: integrated risk monitoring, early warning and GHG emissions tracking

<table>
<tr><td></td><td>Component 4
Integrated risk monitoring, early warning and GHG emissions tracking</td></tr>
<tr><td>Rationale</td><td>The aim of integrated risk monitoring is to generate a holistic perspective on health risks using real-time information. This indicator uses a set of diverse instruments to bring together information about health, climatic and environmental conditions, and response capacity. Integrated risk monitoring is the basis for establishing EWS to identify, forecast and communicate about high-risk conditions. Health systems should also build their capacity to monitor GHG emissions and track their progress on reducing emission, beginning by measuring current emissions using existing approaches. Data collected through the GHG emission assessment will need to be integrated into the health monitoring system.</td></tr>
<tr><td>Indicator for climate-resilience component</td><td>Climate-informed health early warning system allows prediction of the risk of specific outbreaks and is available

Select the level that most closely reflects implementation in your setting.

<table>
<tr><th>Criteria</th><th>Level</th></tr>
<tr><td>☐ No climate-informed health EWS in place</td><td>0</td></tr>
<tr><td>☐ Memoranda of understanding (or other agreements) have been established between the Ministry of Health and the meteorological services to share data and information products</td><td>1</td></tr>
<tr><td>☐ Climate-informed health EWS has been developed but is not yet operational</td><td>2</td></tr>
<tr><td>☐ Climate-informed health EWS delivers timely* alerts for some, but not all, relevant climate-sensitive health outcomes</td><td>3</td></tr>
<tr><td>☐ Climate-informed health EWS fully operational for all climate-sensitive health outcomes</td><td>4</td></tr>
<tr><td>☐ Climate-informed health EWS is fully operational, enabling prediction of and health system response to the risk of climate-sensitive health outcomes</td><td>5</td></tr>
</table>

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

*A timely alert should be defined by the country, ensuring that the system provides sufficient time to act.</td></tr>
</table>

The following list provides examples of extreme weather or climate events and climate-sensitive health outcomes. Mark all that apply in your setting.

Extreme weather or climate events	Climate-sensitive health outcomes
☐ Extreme heat	☐ Vector-borne diseases
☐ Cold waves	☐ Waterborne diseases
☐ Storms	☐ Foodborne diseases
☐ Flooding	☐ Diarrhoeal diseases
☐ Landslides/mudslides	☐ Respiratory illnesses
☐ Sea level rise	☐ Heat-related illnesses
☐ Droughts	☐ Zoonoses
☐ Wildfires	☐ Malnutrition
☐ Air pollution ($PM_{2.5}$ and PM_{10}, ozone)	☐ Cardiovascular diseases
☐ Sand or dust storm	☐ Other (specify):
☐ Other (specify):	

Related indicator sets

- SDG Target 3.d: Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks
- SDG Indicator 7.2.1: Renewable energy share in total final energy consumption
- IHR (2005) area C5: Surveillance
  Indicator C5.1: Early warning surveillance function
  Indicator C5.2: Event management
- PHC Monitoring and Evaluation: Priority setting is informed by data and evidence
- PHC Surveillance: Existence of effective surveillance system

Notes	Further information can be found in the following resources. • *Climate change and health: vulnerability and adaptation assessment (2)* • *WHO guidance for climate-resilient and environmentally sustainable health care facilities (5)* • *Checklists to assess vulnerabilities in health care facilities in the context of climate change (6)* • *Measuring the climate resilience of health systems (7)* • *Operational framework for building climate resilient and low carbon health systems (9)* • *International Health Regulations (2005): states parties self-assessment annual reporting tool (13)* • The Sustainable Development Goals *(17)* • *Primary health care measurement framework and indicators: monitoring health systems through a primary health care lens (18)* • *Progress on WASH in health care facilities 2000–2021: special focus on WASH and infection prevention and control (25)* • *Expert meeting on measuring greenhouse gas emissions and other environmental sustainability concerns in health care facilities: 24 February 2021 meeting report (26)* • *Quality criteria for the evaluation of climate-informed early warning systems for infectious diseases (31)* • *Global road map for health care decarbonization: a navigational tool for achieving zero emissions with climate resilience and health equity (32)*

EWS: early warning systems; GHG: greenhouse gas; IHR (2005): International Health Regulations (2005); PHC: primary health care; PM: particulate matter; SDG: Sustainable Development Goal.

Table 11. Climate-resilience indicator for Component 5: health and climate research

<table>
<tr><td></td><td>Component 5
Health and climate research</td></tr>
<tr><td>Rationale</td><td>Building climate resilience calls for both basic and applied research to reduce uncertainty about how local conditions may be affected, to gain insight into local solutions and capacities, and to build evidence to strengthen decision-making. To implement strategies for sustainable, low-carbon health systems also requires support for research and development of assessment methods to help countries measure their carbon footprint. This indicator provides the evidence base to move towards developing relevant policy norms as well as innovative solutions that use multidisciplinary partnerships to address climate change and health.</td></tr>
<tr><td>Indicator for climate-resilience component</td><td>National research plan on climate change and health has been developed and implemented

Select the level that most closely reflects implementation in your setting.

<table>
<tr><th>Criteria</th><th>Level</th></tr>
<tr><td>☐ No national research plan on climate change and health is in place</td><td>0</td></tr>
<tr><td>☐ The national research plan on climate change and health is being developed</td><td>1</td></tr>
<tr><td>☐ The national research plan on climate change and health has been developed and endorsed by the Ministry of Health</td><td>2</td></tr>
<tr><td>☐ The national research plan on climate change and health has established data-sharing agreements within and outside the health sector to support research</td><td>3</td></tr>
<tr><td>☐ The national research plan on climate change and health has been implemented and research has been conducted in relevant areas of climate and health that are informed by V&As and the HNAP</td><td>4</td></tr>
<tr><td>☐ Results of the national research plan on climate change and health have been integrated into health policy</td><td>5</td></tr>
</table>

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).</td></tr>
<tr><td>Related indicator sets</td><td>• SDG Target 9.5: Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending
Indicator 9.5.1: Research and development expenditure as a proportion of gross domestic product
Indicator 9.5.2: Researchers (in full-time equivalent) per million inhabitants
• SDG Target 17.6: Enhance North–South, South–South and triangular regional and international cooperation on and access to science, technology and innovation, and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism</td></tr>
</table>

Notes	Further information can be found in the following resources. • *Climate change and health: vulnerability and adaptation assessment (2)* • *WHO guidance for climate-resilient and environmentally sustainable health care facilities (5)* • *Checklists to assess vulnerabilities in health care facilities in the context of climate change (6)* • *Measuring the climate resilience of health systems (7)* • *Operational framework for building climate resilient and low carbon health systems (9)* • The Sustainable Development Goals *(17)* • *Progress on WASH in health care facilities 2000–2021: special focus on WASH and infection prevention and control (25)* • *Expert meeting on measuring greenhouse gas emissions and other environmental sustainability concerns in health care facilities: 24 February 2021 meeting report (26)*

HNAP: health national adaptation plan; SDG: Sustainable Development Goal; V&A: vulnerability and adaptation assessment; WASH: water, sanitation and hygiene.

Table 12. Climate-resilience indicator for Component 6: climate-resilient and low-carbon infrastructure, technologies and supply chains

<table>
<tr><td></td><td>Component 6
Climate-resilient and low-carbon infrastructure, technologies and supply chain</td></tr>
<tr><td>Rationale</td><td>Strengthening the climate resilience of health systems includes addressing health infrastructure and services, including how essential preventive and curative health products are provided, from vaccines against climate-sensitive diseases to surgical equipment. These considerations include ensuring that the siting of health facilities and related building codes account for current and projected climate risks. Climate resilience can also be enhanced using new technologies or approaches to better deliver health interventions. While ensuring climate resilience, health systems and health care facilities can significantly reduce their overall environmental impacts and GHG emissions.</td></tr>
<tr><td>Indicator for climate-resilience component</td><td>Percentage of health facilities built or retrofitted to be climate resilient based on national, regional or global guidance

Select the percentage that is most appropriate for your setting.

<table>
<tr><th colspan="2">Criteria</th><th>Level</th></tr>
<tr><td>☐</td><td>0</td><td>0</td></tr>
<tr><td>☐</td><td>1–20%</td><td>1</td></tr>
<tr><td>☐</td><td>21–40%</td><td>2</td></tr>
<tr><td>☐</td><td>41–60%</td><td>3</td></tr>
<tr><td>☐</td><td>61–80%</td><td>4</td></tr>
<tr><td>☐</td><td>81–100%</td><td>5</td></tr>
</table>

Climate-resilient health facilities require essential elements to provide safe and quality care and to protect the health and well-being of their target population. These elements include infrastructure, technologies, the health workforce, energy, water, and means to address sanitation and health care waste.</td></tr>
<tr><td>Related indicator sets</td><td>• SDG Target 9.1: Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
• SDG Target 9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
Indicator 9.4.1: CO_2 emission per unit of value added
• PHC Resilient health facilities and services area: Percentage of facilities meeting criteria for resilient health facilities and services
• PHC Digital Technologies for Health area: National e-health strategy
• WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene</td></tr>
</table>

Notes	Further information can be found in the following resources. • *Climate change and health: vulnerability and adaptation assessment (2)* • *WHO guidance for climate-resilient and environmentally sustainable health care facilities (5)* • *Checklists to assess vulnerabilities in health care facilities in the context of climate change (6)* • *Measuring the climate resilience of health systems (7)* • *Operational framework for building climate resilient and low carbon health systems (9)* • The Sustainable Development Goals *(17)* • *Primary health care measurement framework and indicators: monitoring health systems through a primary health care lens (18)* • *Progress on WASH in health care facilities 2000–2021: special focus on WASH and infection prevention and control (25)* • *Smart hospitals toolkit (33)* • The green checklist and discussion guide from the *Smart hospitals toolkit (34)* • *Energizing health: accelerating electricity access in health-care facilities (35)* • *Effectiveness of greenhouse gas mitigation intervention for health-care systems: a systematic review (36)* • *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 (37)*

GHG: greenhouse gas; PHC: primary health care; SDG: Sustainable Development Goal; WASH: water, sanitation and hygiene.

Table 13. Climate-resilience indicator for Component 7: management of environmental determinants of health

	Component 7 *Management of environmental determinants of health*
Rationale	Climate change threatens health through environmental determinants, which are strongly mediated by social conditions. For this reason, some of the most effective actions that can be taken by health systems are in collaboration with other sectors. Scaling up multisectoral public health prevention programmes can stop negative health outcomes at their source and facilitate timely and increasingly effective responses to changing environmental and climate-related risk conditions. While the health sector does not have substantial direct control over environmental determinants, it has essential roles to play at both the policy and programmatic levels by providing evidence about links between risk factors and disease, implementing effective preventive measures, raising awareness, jointly monitoring environmental exposures and health outcomes with other sectors, and defining regulatory standards and how health risks should be managed.
Indicator for climate-resilience component	**Mechanism established within the health system for collecting and analysing data to inform the management of climate -related environmental determinants of health** Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ No mechanisms for data collection and analysis have been established	0
☐ Protocols for data collection and analysis are being developed	1
☐ Protocols for data collection and analysis have been developed but are not yet implemented	2
☐ Data collection and analysis are being used to manage at least one climate -related environmental determinant of health	3
☐ Data collection and analysis are being used to manage two or more climate -related environmental determinants of health	4
☐ All relevant climate -related environmental determinants of health are being monitored and managed	5

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

	The following list provides examples of climate-related environmental determinants of health for which data may be included in surveillance systems. Mark all that apply in your setting. ☐ Water quality ☐ Water access ☐ Sanitation ☐ Food safety ☐ Food security ☐ Air quality ☐ Extreme temperatures ☐ Extreme weather and weather-related events ☐ Climate-related emergencies and disasters ☐ Other (specify):
Related indicator sets	• UHC Tracer area: Infectious diseases Indicator: Population with access to at least basic sanitation • IHR (2005) area C9: Infection prevention and control Indicator C9.1: Infection prevention and control programmes Indicator C9.2: Health care-associated infections surveillance Indicator C9.3: Safe environment in health facilities
Notes	Further information can be found in the following resources. • *Climate change and health: vulnerability and adaptation assessment (2)* • *WHO guidance for climate-resilient and environmentally sustainable health care facilities (5)* • *Checklists to assess vulnerabilities in health care facilities in the context of climate change (6)* • *Measuring the climate resilience of health systems (7)* • *Operational framework for building climate resilient and low carbon health systems (9)* • *International Health Regulations (2005): states parties self-assessment annual reporting tool (13)* • *Tracking universal health coverage: 2023 global monitoring report (23)* • *Progress on WASH in health care facilities 2000–2021: special focus on WASH and infection prevention and control (25)* • *Energizing health: accelerating electricity access in health-care facilities (35)* • *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 (37)* • *Water, sanitation and hygiene in health care facilities: practical steps to achieve universal access to quality care (38)*

IHR (*2005*): International Health Regulations (*2005*); UHC: universal health coverage; WASH: water, sanitation and hygiene.

Table 14. Climate-resilience indicator for Component 8: climate-informed health programmes

<table>
<tr><td></td><td>Component 8
Climate-informed health programmes</td></tr>
<tr><td>Rationale</td><td>Emerging climate and environmental risks to health require updating existing health programmes and their management to strengthen their response capacity with adequate, effective and sustainable interventions. Such programmes can become climate resilient by using information about current and projected climate conditions to assess risks against gaps in operating capacity and to inform decisions about policy, strategic investment and planning. Simultaneously, health programmes should assess their environmental sustainability, ensuring that no adverse health and environmental consequences result from their operations. This implies that health programming and operations should increasingly be designed and implemented by considering both current and projected hazards from climate change. Assessments should consider how health programmes are impacted by climate change now and will be impacted in the future, how programmes can better prepare for and respond to the hazards, to what extent the health programme contributes GHG emissions directly or indirectly, and how health programme operations may also release environmental contaminants.</td></tr>
<tr><td>Indicator for climate-resilience component</td><td>Information about weather and climate conditions has been integrated into the implementation of health programmes addressing climate-sensitive health risks

Select the level that most closely reflects implementation in your setting.

<table>
<tr><th>Criteria</th><th>Level</th></tr>
<tr><td>☐ Weather and climate information is not integrated into health programmes</td><td>0</td></tr>
<tr><td>☐ A mechanism is being developed to integrate weather and climate information into health programmes</td><td>1</td></tr>
<tr><td>☐ Weather and climate information has been integrated into at least one health programme</td><td>2</td></tr>
<tr><td>☐ Weather and climate information has been integrated into two or more health programmes</td><td>3</td></tr>
<tr><td>☐ The integration of weather and climate information into health programmes is being evaluated</td><td>4</td></tr>
<tr><td>☐ Weather and climate information has been integrated into all relevant health programmes</td><td>5</td></tr>
</table>

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).</td></tr>
</table>

	The following list provides examples of health programmes into which information about weather and climate conditions may be integrated. Mark all that apply in your setting. ☐ Communicable/infectious diseases ☐ Epidemiology and health surveillance ☐ Environmental health ☐ Food and nutrition ☐ Health systems planning ☐ Indigenous health ☐ Mental health ☐ Noncommunicable diseases ☐ Occupational health ☐ Public health emergencies and disasters ☐ Primary health care ☐ Older adult health ☐ Maternal, newborn and child health ☐ Other relevant in your setting (specify):
Related indicator sets	• IHR (2005) area C8: Health services provision Indicator C8.1: Case management Indicator C8.2: Utilization of health services Indicator C8.3: Continuity of essential health services
Notes	Further information can be found in the following resources. • *Climate change and health: vulnerability and adaptation assessment (2)* • *WHO guidance for climate-resilient and environmentally sustainable health care facilities (5)* • *Checklists to assess vulnerabilities in health care facilities in the context of climate change (6)* • *Measuring the climate resilience of health systems (7)* • *Operational framework for building climate resilient and low carbon health systems (9)* • *International Health Regulations (2005): states parties self-assessment annual reporting tool (13)*

GHG: greenhouse gas; IHR (*2005*): International Health Regulations (2005).

Table 15. Climate-resilience indicator for Component 9: climate-related emergency preparedness and management

<table>
<tr><td></td><td>Component 9
Climate-related emergency preparedness and management</td></tr>
<tr><td>Rationale</td><td>Outbreaks and health emergencies triggered by extreme weather events are the primary concerns related to climate change. As climate change intensifies, climate-related emergencies and disasters will continue to increase, causing cascading damage to ecological and human systems and resulting in unprecedented losses. National emergency operation plans that apply an all-hazards strategy, comprehensive emergency management principles and whole-of-society approaches are necessary. Climate-informed preparedness plans, emergency response systems, and community-based disaster and emergency management are essential for building climate resilience in health systems and communities, both of which are vulnerable to a wide range of hazardous events. Thus, health systems and communities should aim to holistically manage the overall risks to public health and emphasize preparedness and prevention in addition to the usual focus on response capacity.</td></tr>
<tr><td>Indicator for climate-resilience component</td><td>Climate-related health emergency, and disaster preparedness and management actions are integrated into disaster risk reduction plans

Select the level that most closely reflects implementation in your setting.

<table>
<tr><th>Criteria</th><th>Level</th></tr>
<tr><td>☐ No preparedness and management actions addressing climate-related health emergencies and disasters are included in current DRR plans</td><td>0</td></tr>
<tr><td>☐ Preparedness and management actions addressing climate-related health emergencies and disasters are being developed to be included in DRR plans</td><td>1</td></tr>
<tr><td>☐ Climate-related health preparedness and management actions have been developed and included in DRR plans</td><td>2</td></tr>
<tr><td>☐ DRR plans provide capacity-building for staff that addresses preparedness for and management of climate-related health emergencies and disasters</td><td>3</td></tr>
<tr><td>☐ DRR plans allocate human and financial resources for implementation of preparedness for and management of climate-related health emergencies and disasters</td><td>4</td></tr>
<tr><td>☐ DRR plans are being implemented that include preparedness for and management of climate-related health emergencies and disasters</td><td>5</td></tr>
</table>

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).</td></tr>
</table>

	The following list provides examples of actions for preparedness and management of climate-related health emergencies and disasters that may be included in DRR plans, such as ensuring: • efficient equipment and sustainable medicines procurement, transportation and storage; • sustainable food procurement, transportation and storage; • efficient transportation for patients and health personnel; • sustainable low-carbon supply chain (if possible); • access to affordable, reliable and sustainable energy supplies, and efficient use and conservation of energy; • sustainable and efficient management of water consumption and of conservation; • safe, sustainable, efficient and climate-resilient infrastructure; • trained and prepared health workforce; • informed communities.
Related indicator sets	• SDG Indicator 13.1.1: Number of deaths, missing persons and directly affected persons attributed to disasters per 100 000 population • Sendai Framework for Disaster Risk Reduction global target (d): Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030 Indicator D-2: Number of destroyed or damaged health facilities attributed to disasters Indicator D-7: Number of disruptions to health services attributed to disasters • Sendai Framework for Disaster Risk Reduction global target (g): Substantially increase the availability of and access to multihazard early warning systems and disaster risk information and assessments to the people by 2030 Indicator G-4: Percentage of local governments having a plan to act on early warnings Indicator G-6: Percentage of population exposed to or at risk from disasters protected through pre-emptive evacuation following early warning • IHR (2005) area C1: Policy, legal and normative instruments to implement IHR (2005) Indicator C1.2: Gender equality in health emergencies • IHR (2005) area C7: Health emergency management Indicator C7.1: Planning for health emergencies Indicator C7.2: Management of health emergency response Indicator C7.3: Emergency logistic and supply chain management • IHR (2005) area C10: Risk communication and community engagement Indicator C10.2: Risk communication Indicator C10.3: Community engagement • PHC Community linkages and engagement: Proactive population outreach

Notes	Further information can be found in the following resources. • *Climate change and health: vulnerability and adaptation assessment (2)* • *WHO guidance for climate-resilient and environmentally sustainable health care facilities (5)* • *Checklists to assess vulnerabilities in health care facilities in the context of climate change (6)* • *Measuring the climate resilience of health systems (7)* • *Operational framework for building climate resilient and low carbon health systems (9)* • *International Health Regulations (2005): states parties self-assessment annual reporting tool (13)* • The Sustainable Development Goals *(17)* • *Primary health care measurement framework and indicators: monitoring health systems through a primary health care lens (18)* • *Smart hospitals toolkit (33)* • *Health emergency and disaster risk management framework (39)* • Sendai Framework indicators *(40)* • *Hospital Safety Index: guide for evaluators (41)* • *Occupational safety and health in public health emergencies: a manual for protecting health workers and responders (42)*

DRR: disaster risk reduction; IHR (2005): International Health Regulations (2005); PHC: primary health care; SDG: Sustainable Development Goal.

Table 16. Climate-resilience indicator for Component 10: sustainable climate and health financing

<table>
<tr><td></td><td>Component 10
Sustainable climate and health financing</td></tr>
<tr><td>Rationale</td><td>Effectively protecting health from climate change will incur financial costs for health systems. Given the dynamics of the risks from climate change and their likely effects on societal and human systems, governments will be required to act in a timely and appropriate manner by using strategies that enable them to gain access to, release and use financial resources. Investing in health will create benefits by reducing the economic impacts of climate change, such as the direct and indirect costs from climate-related diseases and their impacts on health systems. Implementing measures that can increase climate resilience and sustainably reduce carbon from health systems can generate a high cost–benefit return, especially in the long term, reflecting both environmental and social goods, and improving the health and well-being of populations.</td></tr>
<tr><td>Indicator for climate-resilience component</td><td>Financing to implement interventions addressing climate change and health is available

Select the level that most closely reflects implementation in your setting.

<table>
<tr><th>Criteria</th><th>Level</th></tr>
<tr><td>☐ No financing for climate change and health is available or being sought, from either domestic or international sources</td><td>0</td></tr>
<tr><td>☐ The Ministry of Health has estimated the amount of financing needed for relevant climate change and health interventions</td><td>1</td></tr>
<tr><td>☐ Domestic or international financing, or both, is being sought by the Ministry of Health</td><td>2</td></tr>
<tr><td>☐ Partial financing from the domestic health budget (or international financing) has been allocated to the Ministry of Health</td><td>3</td></tr>
<tr><td>☐ Available financing is being used by the Ministry of Health for selected climate change and health interventions</td><td>4</td></tr>
<tr><td>☐ The complete health system is fully financed to build climate resilience</td><td>5</td></tr>
</table>
The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

The following list provides examples of sources of international financing:

• Adaptation Fund;
• Global Environment Facility;
• Green Climate Fund;
• The Global Fund;
• other multilateral donors;
• bilateral donors.</td></tr>
</table>

Related indicator sets	• SDG Target 11.5: By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations. Indicator 11.5.2: Direct economic loss attributed to disasters in relation to global domestic product Indicator 11.5.3: (a) Damage to critical infrastructure and (b) number of disruptions to basic services, attributed to disasters • Sendai Framework for Disaster Risk Reduction global target (c): Reduce direct disaster economic loss in relation to global gross domestic product by 2030 Indicator C-5: Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters • IHR (2005) area C.3: Financing Indicator C3.1: Financing for IHR (2005) implementation Indicator C3.2: Financing for public health emergency response
Notes	Further information can be found in the following resources. • *Operational framework for building climate resilient and low carbon health systems (9)* • *International Health Regulations (2005): states parties self-assessment annual reporting tool (13)* • The Sustainable Development Goals *(17)* • Sendai Framework indicators *(40)* • Climate change and health: finance for health and climate change *(43)*

IHR (2005): International Health Regulations (2005); SDG: Sustainable Development Goal.

3

The 10 GHG emissions indicators

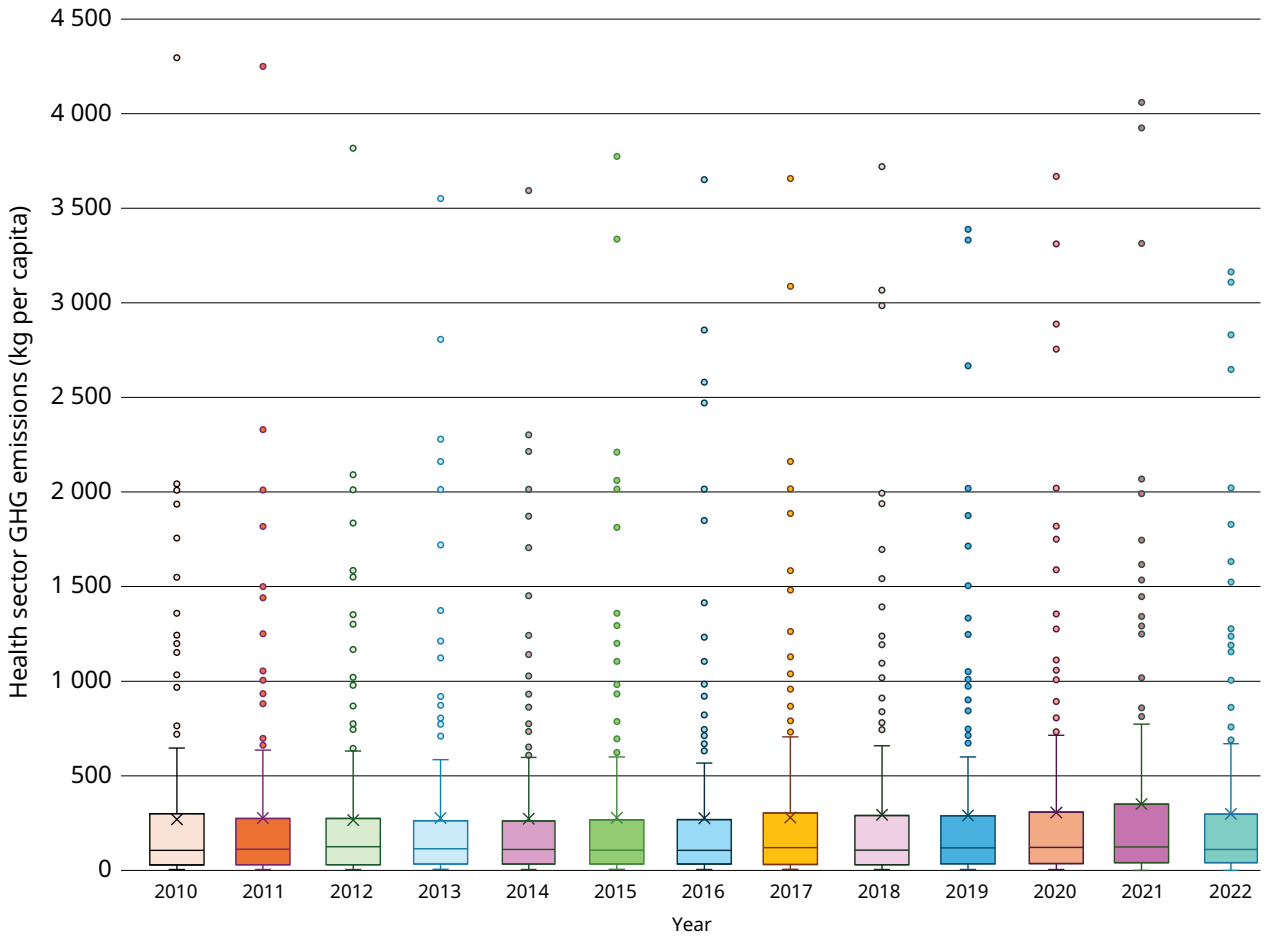
GPW-14 Outcome 1.2: Lower-carbon health systems and societies are contributing to health and well-being, to be measured as health care sector greenhouse gas emissions

Few countries have nationally established estimates of their health sector's GHG emissions. Methods are not yet fully developed, and there is no agreement on which method provides the most accurate estimates. For example, bottom-up approaches are based on counting activities across a health system and assigning an average GHG value to each activity. The sum of these values can be used to calculate a total footprint. Top-down approaches estimate the carbon footprint of the whole health sector, with estimates based on aggregate measures, such as health care expenditure. Hybrid approaches can combine top-down and bottom-up methods, and these may be the most suitable for assessing and reducing health system emissions.

The Lancet Countdown on health and climate change maintains a database of health sector GHG emissions for 192 countries *(12)*. The indicator follows a top-down approach by combining an environmentally extended multiregion input–output model that includes data about national health care expenditure (see indicator 3.5, healthcare sector emissions at https://lancetcountdown.org/explore-our-data/). The database includes data from 2010 to 2022. Fig. 3 shows the distribution of GHG emissions over 12 years. While most countries have health sector emissions below 500 kg per capita, over the whole period some countries contributed disproportionately to global health sector emissions, driving overall averages upwards and widening the gap between countries.

Because of the difficulties in making accurate estimates, this document proposes additional indicators to assist countries in monitoring their actions to reduce GHG emissions in health facilities and in the whole health sector.

Fig. 3. Box plots of health sector greenhouse gas emissions, 2010 to 2022



GHG: greenhouse gas.

Source: Figure derived from data from the Lancet Countdown database *(12)*.

Summary of additional GHG indicators proposed in this document

The proposed set of indicators to monitor GHG emissions from health systems follows the 10 components of WHO's *Operational framework for building climate resilient and low carbon health systems (9)*, and the overall framework in Fig. 1. The indicators build and expand on those described in *Measuring the climate resilience of health systems,* adding new indicators for GHG emissions by the health sector *(7)*. The core set consists of the 10 indicators for health system GHG emissions shown in Table 17.

Table 17. Indicators of GHG emissions proposed in this document and their corresponding component in WHO's Operational Framework *(9)*

Component of WHO's Operational Framework	Indicators for GHG emissions by health systems
1 Climate-transformative leadership and governance	A GHG emissions reduction plan or roadmap has been developed for the national health system
2 Climate-smart health workforce	The Ministry of Health's workforce has been trained on reducing GHG emissions in health sector operations
3 Assessments of climate and health risks, and GHG emissions	Health sector GHG emissions have been reduced in identified hotspots
4 Integrated risk monitoring, early warning and GHG emissions tracking	Monitoring process for tracking reductions in GHG emissions has been established
5 Health and climate research	Research about climate change and health has been developed so the health system can assess GHG emissions
6 Climate-resilient and low-carbon infrastructure, technologies and supply chain	Low-carbon technologies have been adopted by health facilities
7 Management of environmental determinants of health	Public health facilities have a mechanism to reduce GHG emissions that come from the management of environmental determinants of health
8 Climate-informed health programmes	Climate change mitigation actions have been integrated into health programmes
9 Climate-related emergency preparedness and management	Actions to reduce GHG emissions have been integrated into national health emergency and disaster risk reduction plans
10 Sustainable climate and health financing	Financing has been allocated to reduce GHG emissions by health facilities

GHG: greenhouse gas.

Each indicator has six possible levels, as shown in the example in Table 18.

Table 18. Component 1 indicator: a GHG emissions reduction plan or roadmap has been developed for the national health system

Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ No emissions reduction plan or roadmap is in place	0
☐ An emissions reduction plan or roadmap is being developed	1
☐ An emissions reduction plan or roadmap has been developed and endorsed by the Ministry of Health	2
☐ An emissions reduction plan or roadmap has been developed and targets have been defined and agreed among all relevant partners and stakeholders at the national level	3
☐ Initial action is being taken on the emissions reduction plan or roadmap, including covering supply chains	4
☐ Action is being taken on all components of the emissions reduction plan or roadmap	5

Only one of the six levels can be selected. When a level is selected, it implies that attributes for all of the previous levels have been achieved. For example, if a jurisdiction concluded that Level 4 has been achieved because action is being taken on some of the GHG emission priorities, this is valid only if all previous steps have been completed (e.g. Level 3 was achieved because there are agreed targets and Level 2 was achieved because the Ministry of Health endorsed the roadmap). Only the highest level of actual implementation should be indicated.

Selecting targets

There are no agreed targets for the proposed indicators. It is suggested that targets can be obtained by using the highest level achievable for each indicator. Table 19 provides examples of the targets.

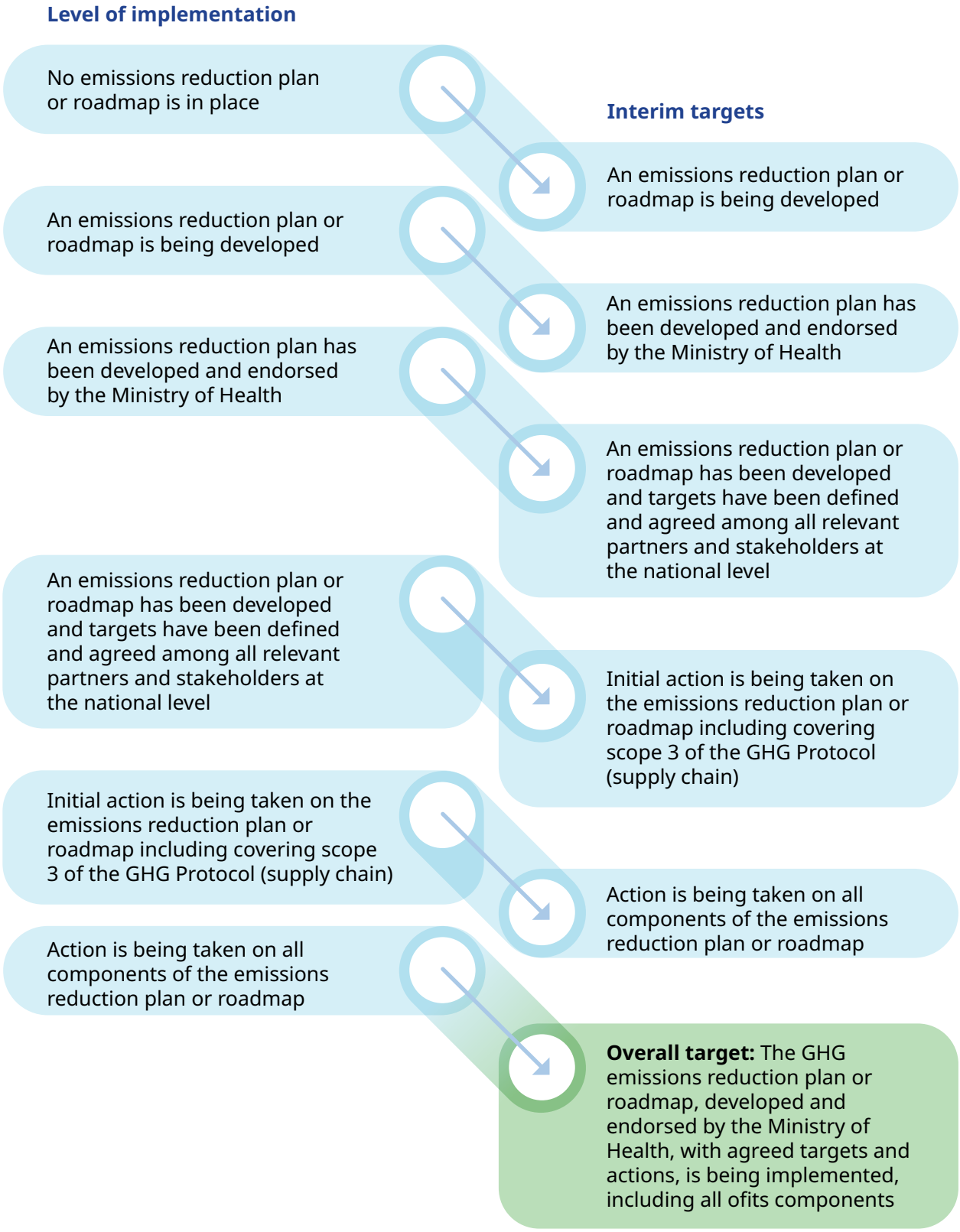
Table 19. Examples of targets for greenhouse gas emissions

Component	Climate resilience target
1 Climate-transformative leadership and governance	A GHG emissions reduction plan or roadmap has been developed and endorsed by the Ministry of Health, targets have been agreed and actions are being taken on all components
2 Climate-smart health workforce	The health workforce in all health programmes has received training on reducing GHG emissions in health systems operations
3 Assessments of climate and health risks, and GHG emissions	A GHG strategy or emissions reduction plan has been implemented in all identified hotspots at both the health facility and health system levels
4 Integrated risk monitoring, early warning and GHG emissions tracking	A monitoring process for tracking reductions in GHG emissions has been established and is fully integrated into health systems operations
5 Health and climate research	Research to assess GHG emissions in the health sector has been endorsed by the Ministry of Health and conducted, and results have been incorporated into health planning
6 Climate-resilient and low-carbon infrastructure, technologies and supply chain	All new technologies adopted by health facilities are low carbon or have zero GHG emissions
7 Management of environmental determinants of health	Management of GHG emissions for all relevant, climate-related environmental determinants of health within the health system are fully functional and allow improvement to be observed
8 Climate-informed health programmes	Climate change mitigation actions are being implemented by all relevant health programmes
9 Climate-related emergency preparedness and management	Actions to reduce GHG emissions have been implemented in all operational areas of national health emergency and disaster risk reduction plans
10 Sustainable climate and health financing	Interventions to reduce GHG emissions are fully financed and have been implemented in all health facilities

GHG: greenhouse gas.

Interim targets can be established based on an agreed timescale that aim to achieve a level higher than the country or jurisdiction has currently attained; Fig. 4 provides an example.

Fig. 4. Examples of interim targets for the Component 1 indicator: a GHG emissions reduction plan or roadmap has been developed for the national health system



GHG: greenhouse gas.

Health sector GHG emission indicators

Tables 20–29 describe the proposed indicators for GHG emissions by the health sector.

Table 20. GHG emissions indicator for Component 1: climate-transformative leadership and governance

	Component 1 *Climate-transformative leadership and governance*
Indicator for GHG emissions component	**A GHG emissions reduction plan or roadmap has been developed for the national health system** Select the level that most closely reflects implementation in your setting. ☐ No emissions reduction plan or roadmap is in place — **0** ☐ An emissions reduction plan or roadmap is being developed — **1** ☐ An emissions reduction plan or roadmap has been developed and endorsed by the Ministry of Health — **2** ☐ An emissions reduction plan or roadmap has been developed and targets have been defined and agreed among all relevant partners and stakeholders at the national level — **3** ☐ Initial action is being taken on the emissions reduction plan or roadmap, including covering supply chains — **4** ☐ Action is being taken on all components of the emissions reduction plan or roadmap — **5** The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

GHG: greenhouse gas.

Table 21. GHG emissions indicator for Component 2: climate-smart health workforce

	Component 2 *Climate-smart health workforce*
Indicator for GHG emissions component	**The Ministry of Health's workforce has been trained on reducing GHG emissions in health sector operations** Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ No curricula are available to build the capacities of the Ministry of Health's workforce to reduce health sector GHG emissions	0
☐ Curricula and training courses on reducing GHG emissions in the health sector are being developed or updated	1
☐ Training courses are being implemented in at least one health programme*	2
☐ Training courses are being implemented in two or more health programmes	3
☐ Most of the health workforce in all health programmes has received training	4
☐ All of the health workforce in all health programmes has received training	5

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

*See the list of health programmes under resilience in Component 2, Part 2.

GHG: greenhouse gas.

Table 22. GHG emissions indicator for Component 3: assessments of climate and health risks, and GHG emissions

Component 3

Assessments of climate and health risks, and GHG emissions

Indicator for GHG emissions component

Health sector GHG emissions have been reduced in identified hotspots

Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ Assessment of GHG emissions hotspots has not started	0
☐ Assessment of GHG emissions hotspots has been initiated at either the health system or health facility level	1
☐ Assessment of GHG emissions hotspots is being conducted at both the health system and health facility levels	2
☐ Data on GHG emissions from assessed hotspots are used to identify interventions to reduce emissions	3
☐ The Ministry of Health has implemented interventions to reduce GHG emissions in selected hotspots	4
☐ A national strategy or GHG emissions reduction plan has been implemented in all hotspots in the health system	5

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

The following list provides examples of GHG emissions hotspots *(24)*. Mark all that apply in your setting.

Scope 1 (direct; controlled)	Scope 2 (indirect; purchased electricity)	Scope 3 (indirect; supply chain)
☐ On-site burning of fossil fuels	☐ Electricity	☐ Health care delivery–related travel and fleet
☐ Anaesthetic products	☐ Water heating and cooling	☐ Water use
☐ On-site waste treatment and disposal	☐ Space heating and cooling	☐ Waste disposal
☐ Other (specify):	☐ Energy-efficient technologies	☐ Medical devices
	☐ Other (specify):	☐ Non-medical equipment
		☐ Metered dose inhalers
		☐ Medicines
		☐ Food procurement
		☐ Construction
		☐ Other (specify):

GHG: greenhouse gas.

Table 23. GHG emissions indicator for Component 4: integrated risk monitoring, early warning and GHG emissions tracking

	Component 4 *Integrated risk monitoring, early warning and GHG emissions tracking*
Indicator for GHG emissions component	**Monitoring process for tracking reductions in GHG emissions has been established** Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ No monitoring process for tracking reductions in GHG emissions has been established	0
☐ Mechanism for monitoring progress in reducing GHG emissions in health systems and facilities is being developed	1
☐ A mechanism to track reductions in GHG emissions is being tested	2
☐ Reductions in GHG emissions are tracked in some health facilities	3
☐ Reductions in GHG emissions are tracked in most health facilities	4
☐ Reductions in GHG emissions are tracked in all health facilities	5

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

GHG: greenhouse gas.

Table 24. GHG emissions indicator for Component 5: health and climate research

	Component 5 *Health and climate research*
Indicator for GHG emissions component	**Research about climate change and health has been developed so the health system can assess GHG emissions** Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ No research has been developed to assess GHG emissions	0
☐ Research into assessing GHG emissions is being developed	1
☐ Research into assessing GHG emissions has been developed and endorsed by the Ministry of Health	2
☐ Research into assessing GHG emissions is being used to inform action at the health facility level	3
☐ Research into assessing GHG emissions is being used to inform action for the whole health system	4
☐ The results of research into assessing GHG emissions have been incorporated into health planning	5

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

GHG: greenhouse gas.

Table 25. GHG emissions indicator for Component 6: climate-resilient and low-carbon infrastructure, technologies and supply chain

Component 6

Climate-resilient and low-carbon infrastructure, technologies and supply chain

Indicator for GHG emissions component

Low-carbon technologies have been adopted by health facilities

Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ No plans to introduce low-carbon technologies are available	0
☐ Plans to introduce low-carbon technologies have been developed but not adopted	1
☐ Plans to introduce low-carbon technologies have been adopted by selected health facilities	2
☐ Low-carbon technologies have been implemented in selected health facilities	3
☐ Implementation of low-carbon technologies has been assessed to aid in scale up	4
☐ All new adopted technologies are low carbon or zero GHG emission	5

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

GHG: greenhouse gas.

Table 26. GHG emission indicator for Component 7: management of environmental determinants of health

Component 7

Management of environmental determinants of health

Indicator for GHG emissions component

Public health facilities have a mechanism to reduce GHG emissions that come from the management of environmental determinants of health

Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ No mechanism has been established	0
☐ A mechanism is being developed	1
☐ A mechanism has been developed and tested	2
☐ Public health facilities are implementing actions to reduce GHG emissions from the management of at least one environmental determinant of health	3
☐ Public health facilities are implementing actions to reduce GHG emissions from the management of two or more environmental determinants of health	4
☐ Public health facilities are implementing actions to reduce GHG emissions from the management of all relevant environmental determinants of health	5

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

The following list provides examples of topics on climate-related environmental determinants of health. Mark all that apply in your setting.

- ☐ Water
- ☐ Sanitation
- ☐ Health care waste
- ☐ Energy
- ☐ Food
- ☐ Emergencies and disasters
- ☐ Other (specify):

GHG: greenhouse gas.

Table 27. GHG emissions indicator for Component 8: climate-informed health programmes

Component 8

Climate-informed health programmes

Indicator for GHG emissions component

Climate change mitigation actions have been integrated into health programmes

Select the level that most closely reflects implementation in your setting.

	Criteria	Level
☐	No climate change mitigation actions have been integrated into health programmes at either the national or health facility level	0
☐	A mechanism to integrate climate change mitigation actions into health programmes is being developed at the national level	1
☐	A nationally developed mechanism to integrate climate change mitigation actions into health programmes is being implemented at the health facility level	2
☐	Climate change mitigation actions are being implemented in at least one health programme	3
☐	Climate change mitigation actions are being implemented in two or more health programmes	4
☐	Climate change mitigation actions are being implemented in all relevant health programmes (see examples below)	5

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

Some examples of mitigation actions include:

- using efficient equipment for storing medicines and efficient processes for procurement;
- ensuring sustainable food procurement and transportation;
- using low-carbon transport for patients and health personnel;
- ensuring a sustainable, low-carbon supply chain;
- ensuring sustainable energy supplies, and energy efficiency and conservation (e.g. in buildings, use of digital technologies).

	The following list provides examples of health programmes into which actions to reduce GHG emissions may be integrated. Mark all that apply in your setting. ☐ Communicable/infectious diseases ☐ Epidemiology and health surveillance ☐ Environmental health ☐ Food and nutrition ☐ Health systems planning ☐ Indigenous health ☐ Mental health ☐ Noncommunicable diseases ☐ Occupational health ☐ Public health emergencies and disasters ☐ Primary health care ☐ Older adult health ☐ Maternal, newborn and child health ☐ Other relevant in your setting (specify):

GHG: greenhouse gas.

Table 28. GHG emissions indicator for Component 9: climate-related emergency preparedness and management

Component 9

Climate-related emergency preparedness and management

Indicator for GHG emissions component

Actions to reduce GHG emissions have been integrated into national health emergency and disaster risk reduction plans

Select the level that most closely reflects implementation in your setting.

Criteria	Level
☐ Actions to reduce GHG emissions are not included in national health emergency and DRR plans	0
☐ National health emergency and disaster risk reduction plans have been reviewed and steps taken to integrate actions to reduce GHG emissions	1
☐ Revised national health emergency and DRR plans identify actions to reduce GHG emissions	2
☐ Health emergency and DRR plans have implemented actions to reduce GHG emissions in at least one selected operational area of work (see examples below)	3
☐ Health emergency and DRR plans have implemented actions to reduce GHG emissions in two or more operational areas of work (see examples below)	4
☐ Actions to reduce GHG emissions have been implemented in all operational areas of work in the national health emergencies and DRR plans	5

The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

Examples of operational areas of health emergency and DRR plans include infrastructure, logistics, procurement, supply chain, travel and transport.

DRR: disaster risk reduction; GHG: greenhouse gas.

Table 29. GHG emissions indicator for Component 10: sustainable climate and health financing

	Component 10 *Sustainable climate and health financing*
Indicator for GHG emissions component	**Financing has been allocated to reduce GHG emissions by health facilities** Select the level that most closely reflects implementation in your setting. The indicator has a unitless scale of 0 to 100 (corresponding to one of the six levels).

Criteria	Level
☐ No financing is available for actions addressing GHG emissions	0
☐ The Ministry of Health has estimated the amount of financing needed to monitor and reduce GHG emissions	1
☐ Based on estimated financing needs, domestic or international financing is being sought by the health sector to act on GHG emissions	2
☐ Partial domestic or international financing has been allocated to reduce GHG emissions in health facilities but interventions have not yet been implemented	3
☐ Interventions to reduce GHG emissions have financing for implementation in priority health facilities	4
☐ Interventions to reduce GHG emissions are fully financed and have been implemented in all health facilities	5

GHG: greenhouse gas.

Conclusions

Climate change requires the health sector to adapt, reduce vulnerabilities, increase resilience and reduce GHG emissions. There are several ways to assess these (e.g. 2, 5, 6, 7, 9, 12, 14). For example, a recent report that mapped indicators being used by countries *(44)* identified more than 1 600 indicators, after removing repetitions and merging similar indicators (based on reviews of 31 country V&A and HNAP reports). Currently, there are no simple ways to assess climate resilience. Therefore, the indicators proposed in this document aim to support countries in assessing their health sector's climate resilience and adaptation to climate change.

Although there are methods to estimate GHG emissions by sector, there are no agreed methods, or methods that are simple for countries to implement. The additional GHG indicators proposed in this document should be useful complements to current methods for estimating GHG emissions by the health sector. A recent WHO report titled Measuring GHG emissions on health systems" – Discussion draft *(45),* aims to support countries in these assessments.

In summary, Fig. 5 shows the proposed indicators linked to the *Operational framework for climate resilient and low carbon health systems (9).*

Fig. 5. Summary of the indicator sets aligned to the 10 components of the *Operational framework for building climate resilient and low carbon health systems (9)*

GHG: greenhouse gas.

Legend: indicators for climate resilience components; indicators for GHG emissions components.

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