Health National Adaptation Plan (H-NAP) for building climate resilient health systems in Lao People's Democratic Republic

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Foreword by the Minister of Health

Climate change is one of our most significant global health threats. For the Lao People's Democratic Republic (PDR), the impacts of climate change are becoming increasingly severe, with projections indicating a temperature rise of 2–3 degrees Celsius by 2050 and a 10–30% increase in rainfall. This shift is expected to bring many health challenges, including a higher risk of vector-borne diseases such as dengue fever and increased incidence of diarrhoeal diseases, heat stress, and malnutrition due to the destruction of crops and ecosystems, exacerbated by poor water and sanitation infrastructure.

In response to these mounting challenges, the Ministry of Health has been actively implementing initiatives to mitigate and adapt to the health impacts of climate change. At the United Nations Climate Change Conference (COP26) which was hosted by the United Kingdom in 2021, Lao PDR reaffirmed its commitment to strengthening health adaptation capacity and promoting low-carbon health systems. Further solidifying its leadership on this issue, Lao PDR endorsed the COP28 Declaration on Climate and Health in 2023, joining 155 other countries in expressing grave concern over the adverse impacts of climate change on health.

Lao PDR has taken a leading role in international efforts to address the health-climate nexus, co-chairing the working group on low-carbon sustainable health systems under the World Health Organization's Alliance for Transformative Action on Climate and Health. As a nation, we are proud to collaborate with high-income countries in leading this response, recognizing that low- and middle-income countries like ours are among the most impacted by climate change, despite having contributed the least to global greenhouse gas emissions.

The Health National Adaptation Plan (H-NAP) is a testament to our unwavering commitment to tackling these health risks. Developed in alignment with our broader Climate Change and Health Adaptation Strategy, the H-NAP will be a critical tool for implementing our high-level climate and health goals and continuing the expansion of our exisiting initiatives, such as the Safe Clean Green and Climate Resilient Healthcare Facilities Initiative, to safeguard the health of our people.

The H-NAP aims to reduce the vulnerability of our people to both current and future health effects of climate change, while enhancing our health system's capacity to adapt through the integration of climate measures into sectoral planning. It focuses on six priority health risks in Lao PDR: water-borne diseases; water, sanitation and hygiene (WASH); food insecurity and under-nutrition; heat-related illnesses; the sudden increase in demand for health services due to extreme weather events; and vector-borne diseases such as dengue.

As the Minister of Health, I call upon all sectors, government agencies, local communities, civil society, and our international partners to implement this plan. Together, we can build a resilient health system that protects the health and well-being of the Lao people in the face of a changing climate.

Prof. Dr Bounfeng Phoummalaysith
Minister of Health
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Abbreviations

DHIS2	District Health Information System 2
HCF	Health care facility
H-NAP	Health National Adaptation Plan
HSDP	Health Sector Development Plan
Lao PDR	Lao People's Democratic Republic
MDG	Millenium Development Goal
NDC	Nationally Determined Contribution
SDG	Sustainable Development Goal
SOP	Standard operating procedure
UNFCCC	United Nations Framework Convention on Climate Change
WASH	Water, sanitation, and hygiene
WASH FIT	Water and Sanitation for Health Facility Improvement Tool
WHO	World Health Organization

Executive summary

The Lao People's Democratic Republic (PDR) Health National Adaptation Plan (H-NAP) is a comprehensive document designed to guide the country toward building a health system that will be resilient in the face of climate change impacts. This will be achieved by empowering communities and individuals through an adaptive and sustainable health system in the country.

This document is aimed at increasing health sector adaptation capacity for the medium and long term. It is intended to provide climate change and health adaptation actions and recommendations for health planners, policy-makers, programme managers and public health specialists.

Lao PDR is one of the most vulnerable countries to climate change in the world with high exposure to extreme weather events such as storms, droughts, and floods. The health effects of climate change are already occurring in the country and vulnerable areas are projected to be more severely impacted in the coming decades. Vulnerability and adaptation assessments conducted in 2010[1], 2017–2019[2], and 2020–2021[3] helped to further define the health risks of climate change in the country. Priority climate-sensitive health outcomes explored included:

- impacts from extreme weather events including under-nutrition, food insecurity, and sudden increase of health service demand
- effects on water, sanitation and hygiene
- water-borne diseases (diarrhoea, typhoid)
- vector-borne diseases (dengue)
- heat-related medical conditions

The H-NAP aims to give strategic guidance to the health sector for establishing a climate resilient health system, including increased capacity to plan health adaptation measures to prevent and/or overcome existing and future risks, and to respond promptly to climate change risks for health and well-being. In the upcoming years, the H-NAP will be complemented with mitigation guidelines. The over-arching purpose of the H-NAP is to ensure the health sector works with the multisectoral stakeholders and development partners.

The H-NAP was developed in collaboration with the Department of Hygiene and Health Promotion at the Ministry of Health, the Ministry of Natural Resources and Environment and key stakeholders, with technical support from the World Health Organization (WHO). Its development was guided by previous climate change and health vulnerability and adaptation assessments, the National

[1] Climate Change and Health Adaptation Strategy in Lao PDR (draft report). Ministry of Health of Lao PDR. 2011.
[2] National & provincial vulnerability and adaptation assessments in Lao PDR as part of TA 8898: Technical assistance for strengthening resilience to climate change in the health sector in the greater Mekong subregion (offline report). Faculty of Postgraduate Studies, National University of Health Sciences Lao PDR. 2019.
[3] Vulnerability Assessment of Climate Change Report. Ministry of Natural Resources and Environment of Lao PDR. 2020.

Climate Change Strategy and Action Plan (2010), the Climate Change and Health Adaptation Strategy (2017), the 9th Health Sector Development Plan, the Health Sector Reform Policy, the Primary Health Care Policy (2019 revised version) as well as other relevant policies. In addition, national and local consultation workshops with stakeholders were held in 2018 to consult and gather input from stakeholders on key components of the H-NAP, adaptation measures, action plans, and evaluation and monitoring indicators, and to validate the final document.

The H-NAP's objectives and adaptation actions are organized around the 10 components of the WHO *Operational framework for building climate resilient health systems*.[4] Under each component, strategic objectives, current status, key barriers, and adaptation options are provided. This framework provides a systematic and comprehensive approach to addressing the health effects of climate change.

The Lao PDR H-NAP is structured in six parts:

- Part 1 provides an introduction to the H-NAP's development and objectives;
- Part 2 describes some of the key health and climate change considerations for the country;
- Part 3 outlines the institutional and policy framework in which the H-NAP process is situated;
- Part 4 addresses each of the 10 components of the operational framework;
- Part 5 specifies the implementation strategy of the H-NAP; and
- Part 6 establishes the monitoring and evaluation plan and the ongoing reporting requirements.

[4] The 10 components are (i) leadership and governance; (ii) health workforce; (iii) vulnerability, capacity and adaptation assessment; (iv) integrated risk monitoring and early warning; (v) health and climate research; (vi) climate resilient and sustainable technologies and infrastructure; (vii) management of environmental determinants of health; (viii) climate-informed health programmes; (ix) emergency preparedness and management; and (x) climate and health financing.

Operational framework for building climate resilient health systems. World Health Organization. 2015.

PART 1. Introduction

Lao People's Democratic Republic (PDR) is a sparsely populated, ethnically diverse, mountainous, landlocked country with an estimated population of 7.4 million and a total area of 236 800 km^2 [1]. Lao PDR has a fast-growing economy that is heavily based on natural resource extraction [1]. However, economic growth in the country has predominantly benefited wealthy groups, with the gap between rich and poor increasing over recent years.

Over the last 10 years the health of the Lao population improved significantly, with life expectancy at birth rising steadily to reach 68 years in 2021 [2]. Lao PDR achieved the Millenium Development Goal (MDG) target of reducing the maternal mortality ratio by more than 75% and its own national target on reducing child mortality [3]. Reported vaccination coverage has continued to improve, and a wide range of vaccines are available through government and donor support. Lao PDR achieved the MDG target related to malaria deaths before 2015 and the prevalence of all forms of tuberculosis has been halved from 1990 levels. The MDG target on access to improved sanitation and drinking water has also been achieved.

Despite the health-related improvements, Lao PDR rates poorly on the Human Development Index, with poverty reduction and consumption growth both lagging behind the country's growth in gross domestic product. This may be linked to public spending on health in Lao PDR remaining low compared to other countries. Financial sustainability is also a continuing problem, with service delivery being heavily dependent on out-of-pocket expenditures.

There is a need for more explicit and targeted policies and measures to ensure that the most vulnerable groups gain increased access to necessary services, livelihoods and critical resources. These targeted policies and measures are critical to achieving the global agenda, in Lao PDR, of leaving no one behind.

Additional investments in the health sector including in primary health care at the local level, will be necessary to ensure that nobody is left behind. Addressing cultural, financial, and geographical barriers encountered by vulnerable groups to access health services will be crucial to reaching a more equitable health system. At the same time, quality of services at the local level and population trust in the system need to be improved.

Climate change has already begun to affect livelihoods and economic growth in Lao PDR. Particular issues of concern relating to climate change impacts are food security, water supply and population health [4]. The key reasons for these impacts are that dry seasons are becoming longer with less total rainfall while wet seasons are becoming shorter but with more total rainfall, including more extreme precipitation events. This leads to both more floods and more droughts, which both impact on human health outcomes. For example, floods in Lao PDR during 2018 damaged health service

infrastructure while at the same time increasing the demand on health services. Droughts also negatively affect human health, with nearly half of Lao PDR's population classified as vulnerable to drought [5].

The Government of Lao PDR acknowledges the impacts of climate change and has had long-term engagement in climate change negotiations and accords. For example, Lao PDR ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 and ratified the Kyoto Protocol in 2003 [5]. Acknowledging the importance of addressing the impacts of climate change on human health, the government began working in 2020, with support from the World Health Organization (WHO) (and as part of the United Nations Development Programme/Global Environment Facility Project – *Building resilience of health systems in Asian LDCs to climate change),* to develop a Health National Adaptation Plan (H-NAP). The development process for the H-NAP has included a series of consultations with relevant stakeholders, from both within and outside the Ministry of Health. The H-NAP integrates with existing national health programmes and activities in Lao PDR and builds on these to address emerging climate-related health risks.

1.1 Need for the H-NAP

The goal of an H-NAP is to strengthen health systems to protect health from climate variability and change; this includes addressing upstream drivers of health risks.

The Lao H-NAP supports a) defining health adaptation needs based on current and future health effects of climate change, and b) developing medium- and long-term health adaptation plans for increasing climate resilience capacity and assessing and managing climate-related health outcomes. The Lao PDR H-NAP will also contribute to the implementation of Lao PDR's Health Sector Reform Strategy and Framework until 2025 [6].

1.2 Objectives of the H-NAP

The main objectives of the Lao H-NAP are to:

1. Reduce vulnerability to current and future health effects of climate change-related health risks in the country, and
2. Increase health adaptation capacity by mainstreaming climate change adaptation measures into health sector development planning including the 9th Health Sector Development Plan (HSDP) 2021–2025 and other programmes and activities.

The climate change and adaptation measures are recommended to be reflected in central, provincial, district and health care facility (HCF) level action plans for medium- and long-term capacity building.

Objective 2 includes actions to increase cross programme coordination and incorporate climate variables and adaptation measures into ongoing climate-sensitive disease programmes, the Environmental Health Strategic Action Plan, and water, sanitation and hygiene (WASH) and disaster/emergency preparedness strategies and action plans.

PART 2. Climate-related health risks in Lao PDR

2.1 Vulnerability assessment

Climate-related current health outcomes and climate risks were identified by several key vulnerability assessments. In 2010, the Ministry of Health, with the support of WHO, conducted a health vulnerability assessment during the development of the Climate Change and Health Adaptation Strategy in Lao PDR, which was approved in 2017 [7] [8]. The Faculty of Postgraduate Studies, National University of Health Sciences, with support from the Asian Development Bank, then conducted the National & Provincial Vulnerability and Adaptation Assessment in 2017–2019 [9]. The assessment listed prioritized climate change adaptation options based on the Climate Change and Health Adaptation Strategy. Provincial assessments included five provinces, Oudomxai, Luangprabang, Khammuane, Saravan and Attapeu. This was followed by a more comprehensive assessment by the Ministry of Natural Resources and Environment in 2020–2021, which assessed 148 districts across 17 provinces and a capital identifying vulnerability by provincial and district levels [10]. WHO also developed a climate and health country profile in 2015 which identified key climate-related health risks in Lao PDR [11].

2.1.1 Current climate-related health outcomes in the country

The 2010 health vulnerability assessment conducted simple correlations and time series analyses of meteorological variables and health data. However, this analysis was limited by missing weather data and health data. In addition to that, the absence of a death certificate system in Lao PDR prevented the calculation of excess deaths due to extreme weather events.

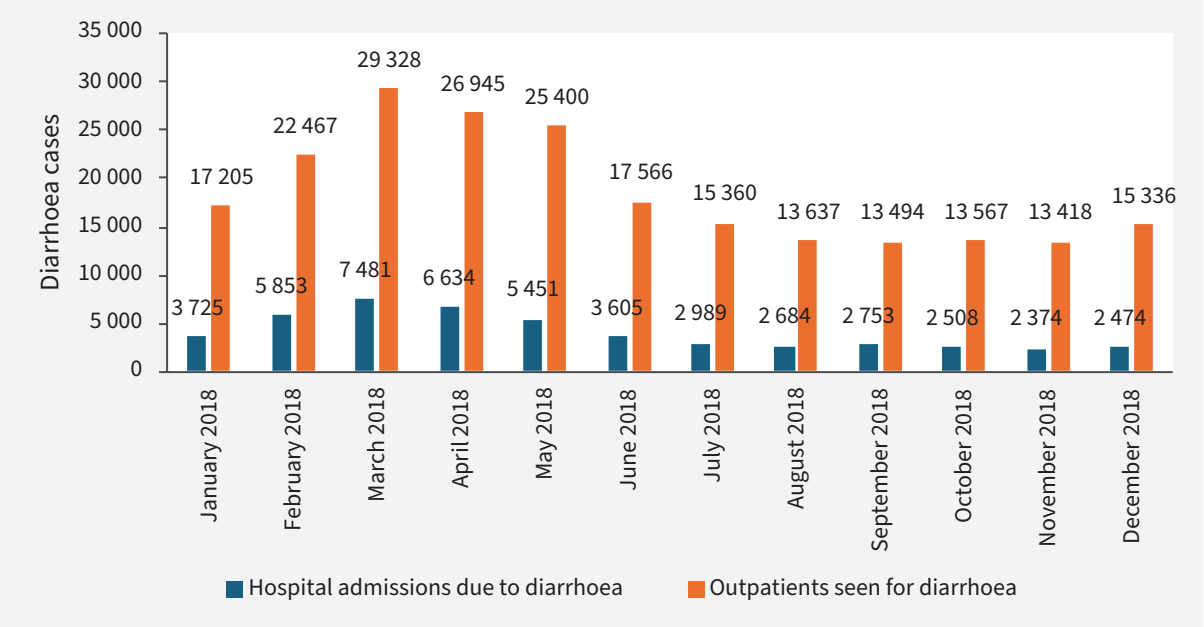
Water-borne diseases

Findings of the 2010 health vulnerability assessment showed clear seasonal variations of several water-borne diseases. For example, the incidence of severe diarrhoea was greater in the dry season than in the rainy season. Typhoid fever incidence peaked in the rainy season and there was positive association between mean temperature, humidity, and rainfall and typhoid incidence in all regions, except for the south. Dysentery incidence was positively associated with mean temperature at the national level and in the northern and central regions. The vulnerability and adaptation assessment conducted in 2017–2019 concluded that Lao PDR is likely to experience more water-borne and neglected tropical diseases and incidence of severe diarrhoea and dysentery given the longer dry seasons, inadequate access to safe water and factors such as poor hygiene practices and limited food safety measures.

There is clear seasonal variation in the number of diarrhoea cases presenting to HCFs as shown in Figure 1. Cases peak during the dry season in March/April and gradually reduce once the rains

set in. Reasons could include that during the dry season a) safe sources of drinking water dry up and people turn to unsafe water sources; b) food spoils faster, which corresponds with the festive season where a lot of uncooked food is consumed.

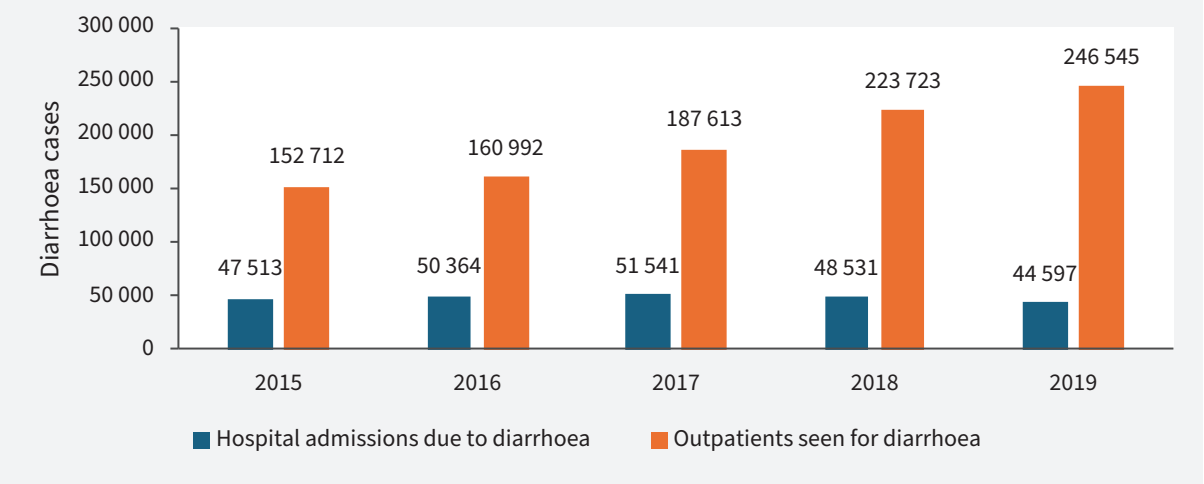
FIGURE 1. Trends in diarrhoea cases and hospital admissions: January to December 2018



Source: Health Management Information System, Ministry of Health, Lao PDR

In 2019, climate-related health outcomes were assessed by the WHO Health Information and Statistics team based on up-to-date data collected by the District Health Information System 2 (DHIS2) and similar seasonal variations were found (see Figure 2).

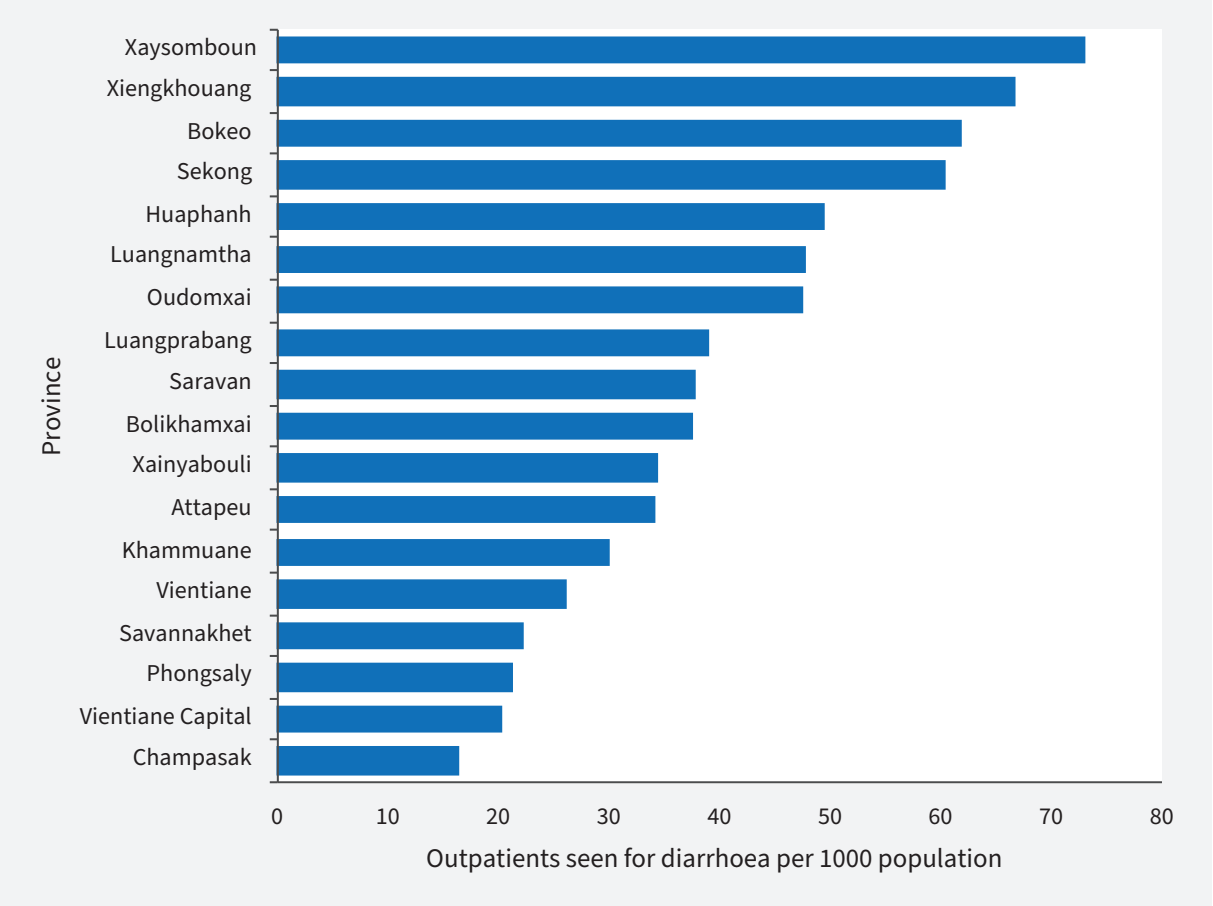
FIGURE 2. Yearly variance in diarrhoea prevalence



Source: Health Management Information System, Ministry of Health, Lao PDR

Figure 2 shows there was a steady increase in incidences of diarrhoea from 2015 to 2019, along with a steady increase in the mean number of dry days per year. Figure 3 illustrates the higher numbers of diarrhoea cases per 1000 population reported in 2018 from Xaysomboun, Xiengkhouang, Bokeo and Sekong provinces, which are all mountainous. According to the 2015 Census, the primary source of drinking water in these provinces is mountain springs [12].

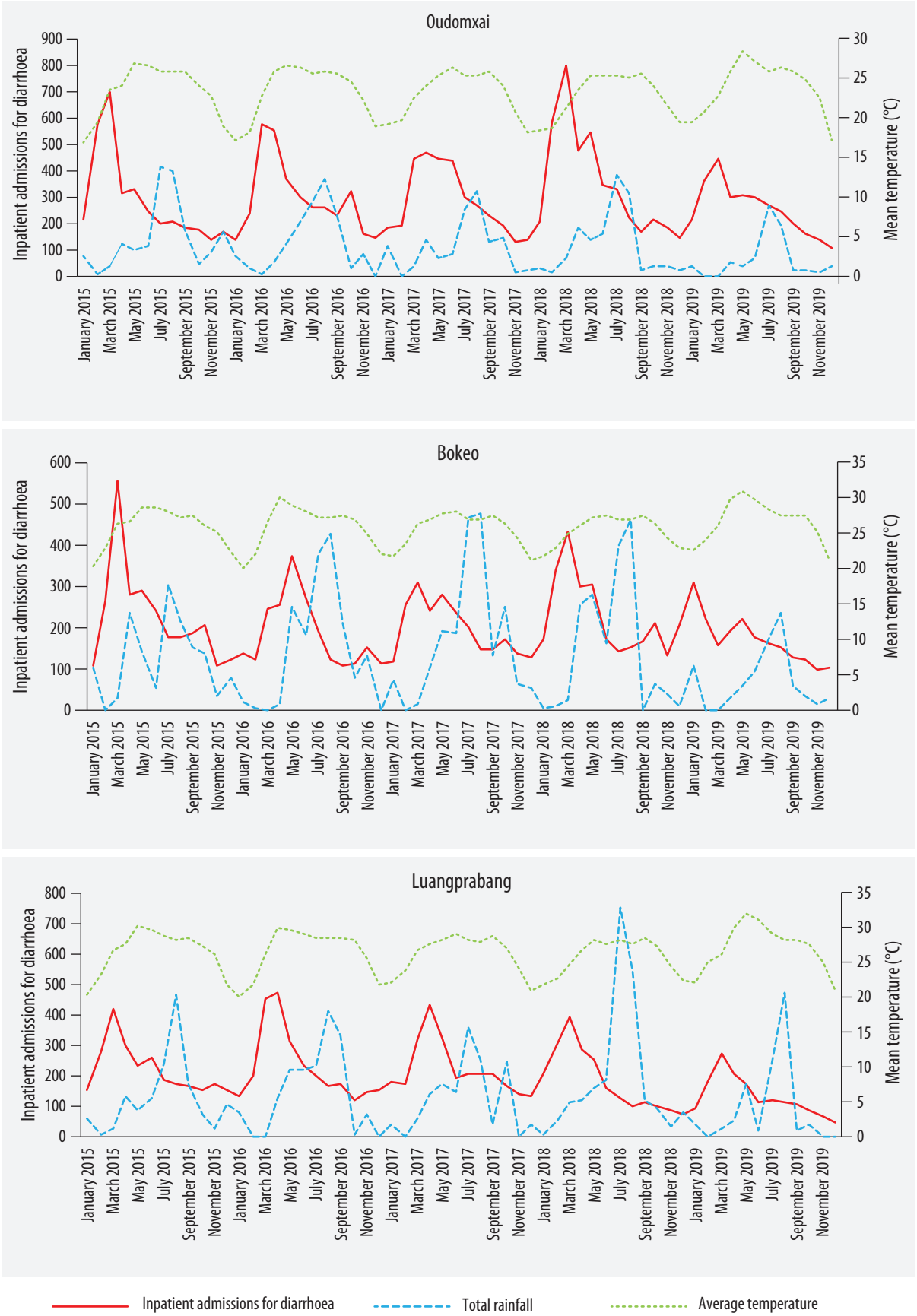
FIGURE 3. Outpatient department diarrhoeal cases (no blood, no severe dehydration) per 1000 population in 2018, by province



Source: Health Management Information System, Ministry of Health, Lao PDR

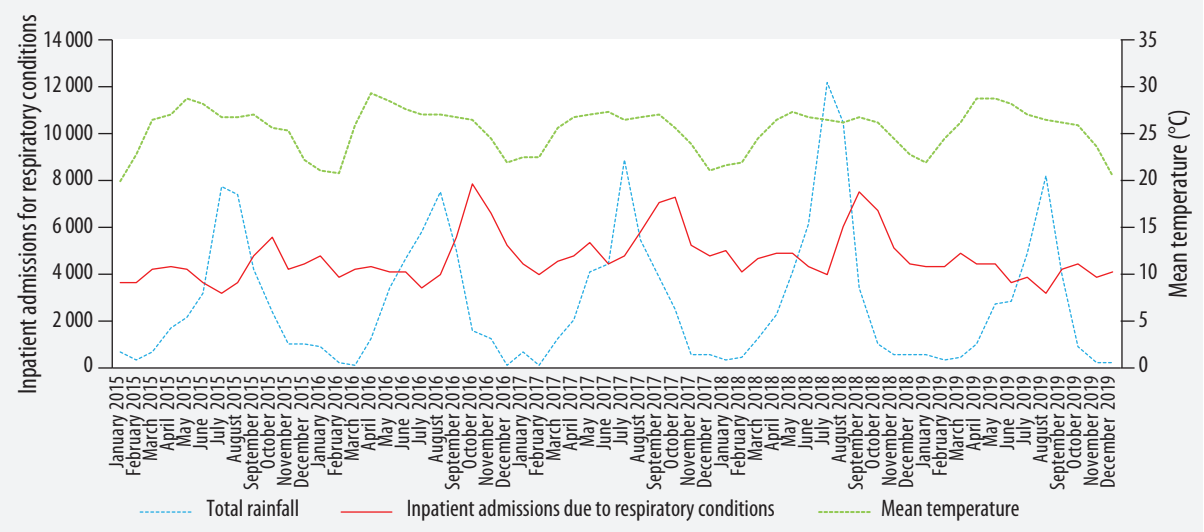
The relationship between rainfall patterns and diarrhoeal disease was assessed based on climate and weather data collected from the Department of Meteorology and Hydrology and diarrhoeal cases taken from the inpatient disease database (DHIS2) for 2016–2019. The results, as shown in Figure 4, presented a clear correlation between increased rainfall and cases of hospitalized diarrhoeal diseases.

FIGURE 4. Relationship between rainfall and diarrhoeal diseases in Lao PDR, 2016–2019



Source: Health Management Information System, Ministry of Health, Lao PDR

FIGURE 5. Relationship between rainfall and respiratory diseases in Lao PDR, 2015–2019



Source: Health Management Information System, Ministry of Health, Lao PDR

When a similar analysis was carried out between total monthly rainfall and monthly hospital admissions due to respiratory diseases between January 2015 and December 2019, there was a clearly observed pattern where admissions due to respiratory diseases usually peaked between August and October, following the peak rainy season. However, this pattern was not observed in 2019 due to COVID-19 disruptions in health seeking trends as well changes to the epidemiological patterns.

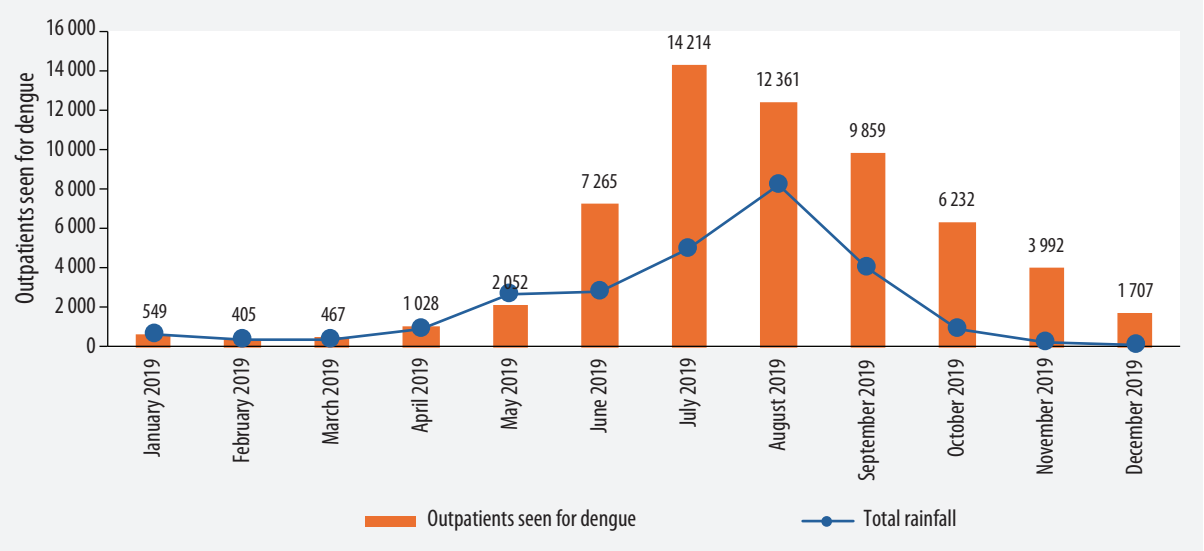
Vector-borne diseases

Dengue

Dengue is a major health problem in Lao PDR. In recent years, there have been serious epidemics of dengue. In 2006, the rate of dengue infections was 96.9 per 100 000 people [13]. Dengue tends to be found in urban areas because the mosquito vector, *Aedes aegypti*, thrives in the built environment (for example, in stored water containers). However, an increase in dengue-transmitting mosquitoes in rural areas demonstrates that the mosquito is adapting to rural environments, possibly due to changes in human behaviour. This development could lead to an increase in dengue transmission in rural areas. Climate change-related increases in temperature and precipitation in an area can substantially increase the transmission of dengue. Just a one-degree Celsius increase in the average mean temperature can lead to an increase to the number of dengue cases worldwide [14]. Temperature increases are associated with faster rates of replication of the virus within the vector as well as shorter virus incubation periods, allowing faster transmission to another host. Higher precipitation has also been associated with an increase in the population of *Aedes aegypti*, one of the main mosquito species responsible for dengue transmission [15].

The 2010 health vulnerability assessment report concluded that dengue incidence was significantly associated with mean temperature, rainfall and humidity at the national level and in the northern and central regions. Figure 6 shows that dengue is more prevalent during the wet season and peaks during June–August. The 2019 analysis that was conducted by the WHO country office in Lao PDR showed the same seasonal variations.

FIGURE 6. Seasonal variation of dengue prevalence in Lao PDR



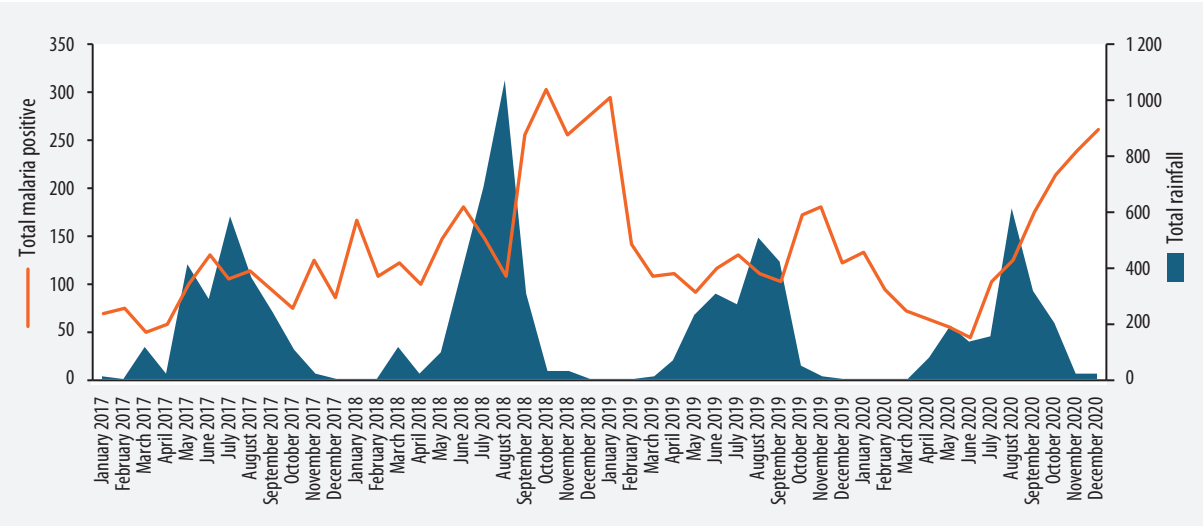
Source: Health Management Information System, Ministry of Health, Lao PDR

With numbers of dengue cases rising annually, the health sector needs to prepare for higher cases of dengue during the middle of the year when it is generally more wet.

Malaria

More cases of malaria are typically seen during the wet season and geographically are more confined to the southern provinces. As an example, Figure 7 shows malaria cases detected and rainfall in the southern province of Attapeu from January 2017 to December 2020.

FIGURE 7. Relationship between rainfall and malaria in Attapeu province, 2017–2019



Source: Health Management Information System, Ministry of Health, Lao PDR

Overall, Lao PDR has made remarkable progress in the prevention and elimination of malaria with cases declining from 46 141 in 2012 to 2305 in 2022, and the country is moving towards

elimination [16]. A climate and health country profile published by WHO also indicated that in Lao PDR the population at risk of malaria is projected to decline towards 2070 [11].

Acute malnutrition

Approximately 70% of the Lao PDR population relies on subsistence agriculture, making them acutely vulnerable to extreme weather events and other natural disasters [11]. Impacts are likely to include food insecurity, as well as loss of access to health and other services [17]. One-fifth of the country's population consumes less than the minimum dietary energy requirements, making them less able to adapt to shocks and disturbances, including climate-related shocks [18]. For example, in 2018 flooding damaged crops and limited access to roads, resulting in malnutrition and then an acute outbreak of 343 cases of beriberi in Khammuane province.

The 2010 health vulnerability assessment concluded that the country already has poor overall indicators on nutritional status, especially in rural areas where malnutrition is often chronic. Without action to mitigate the effects of climate change, including effects on food production and prices, increased rates of acute malnutrition and anaemia are likely [7]. In addition, there are associated long-term adverse health and productivity outcomes.

Injury and disability

Extreme vulnerability to climate change in Lao PDR was experienced as a result of the heavy rains and subsequent collapse of the Xepien-Xenamnoy hydropower dam construction in Attapeu province in July 2018, which led to the largest flood in the last 10 years. The flash flooding affected 17 out of 18 provinces and 90 out of 148 districts, putting nearly 268 000 people at risk. Approximately 1700 houses were damaged, displacing thousands of people and forcing them to seek shelter in local government buildings and schools [19].

Sudden increase of health service demand

Health service demand increases suddenly in response to changing climate and extreme weather events. Data on epidemic-prone diseases were extracted from DHIS2 for 2018 and 2019 and were compared.

- Cases of dengue seen as outpatients increased by 112% (from 309 to 655), cases of pneumo bronchitis by 7% (from 1742 to 1869) and cases of common colds by 34% (from 3460 to 4628) in Sanamxai district between 2018 and 2019.
- Cases of dengue seen as outpatients increased by 105% (from 354 to 727), cases of pneumo bronchitis by 68% (from 855 to 1435) and cases of common colds by 121% (from 2308 to 5103) in Xaisettha district between 2018 and 2019.

The After Action Review of the 2018 flood response in Attapeu province found that health services did not meet needs during the dam collapse disaster. Lack of access to adequate care can affect the household economy through ongoing morbidity, loss of income and productivity, and medical expenses, contributing to reduced economic mobility and long-term intergenerational effects. Increased demands for health services during the disaster were present in 13 provinces in 2018, but many services were simply not available or in limited supply [20].

Heat-related medical conditions

Periods of extreme heat also threaten health due to heat-related illness and exacerbations of chronic medical problems. Children, the elderly, outdoor workers, and people with underlying medical problems are among those most at risk during periods of extreme heat. The fact that the most vulnerable workers in developing and emerging countries (for example, the self-employed in agriculture or migrant workers in the construction sector) are the hardest hit by heat stress raises questions of social justice.

In Lao PDR, under a high emissions scenario, heat-related deaths among elderly people are expected to increase to approximately 72 per 100 000 by 2080, compared with three per 100 000 worldwide during the baseline period from 1961 to 1990 [11].

Mental health

Disasters can also affect a population's mental health and while for many people this is not long-term, some people may experience lasting post-traumatic stress disorder. Furthermore, associated severe injury and morbidity can also contribute to poor mental health outcomes.

Mental health care services in Lao PDR are extremely limited. Only two psychiatrists, one neurologist, eight general practitioners, five medical assistants and 21 nurses form the country's entire mental health workforce [21]. There is currently little to no epidemiological data on mental health issues present in Lao PDR, and the country's health system lacks the capacity to handle baseline mental health care, let alone the increase in mental health conditions that are predicted to arise as a result of climate change.

Effects on safe water and sanitation

Floods in 2018 had major effects on urban and rural WASH facilities. The post-disaster needs assessment conducted by the Government of Lao PDR estimated the total damage and losses to the water supply and sanitation sector at 69.9 billion Lao kip (equivalent to 7.5 million US dollars, 2021). Funding requirements to meet short-, medium-, and long-term recovery needs are estimated at 68.2 billion Lao kip (equivalent to 7.3 million US dollars, 2021) [19].

In the rural water supply and sanitation sub-sector, the impacted WASH facilities comprised 223 gravity-fed systems, 7700 boreholes, and 6646 dug wells. Additionally, 28 114 latrines were damaged or destroyed, and WASH facilities in 195 schools and nine health centres also were affected. The estimated damage and losses for rural water supply and sanitation amounted to 55.2 billion Lao kip (equivalent to 5.9 million US dollars, 2021) [19].

Due to the flooding, households faced the challenge of unavailable or contaminated drinking water, forcing them to purchase bottled water. The post-disaster assessment estimated that around 6 billion Lao kip was spent on bottled water. Additionally, in some regions of the country, sanitation facilities were completely destroyed by the floods. As poor sanitation and hygiene are already notable factors in the spread of diseases in Lao PDR, the potential rise in water-borne disease outbreaks due to climate change is particularly worrisome, especially for vulnerable populations.

Health risks of air pollution

One of the most direct links between climate change and ill health is air pollution. For example, burning fossil fuels for power, transport and industry drives climate change as well as emitting health-damaging air pollution. Every year more than seven million people die due as a result of exposure to indoor and outdoor air pollution [22].

A warming climate is expected to result in lower air quality [23] [24]. Similarly, current emissions trends will drive intensified ground-level ozone events especially in densely populated areas, which will lead to more respiratory illness [25] [26]. Droughts and warmer temperatures will increase the incidence of wildfires that emit particulate matter and other pollutants [27]. Drought will also lead to more dust storms.

Outdoor air pollution can have direct and sometimes severe consequences for health. Fine particles such as PM2.5 particles, can penetrate deep into the respiratory tract and bloodstream, increasing mortality from respiratory infections, lung cancer and cardiovascular disease [28]. PM2.5 concentration for Vientiane reported in the WHO ambient air pollution database was 25.766 µg/m3 in 2019 [29].

Around 95% of the Lao population use solid fuel (for example, biomass, coal, wood) for cooking, which causes localized air pollution, especially where cooking fires are indoors. Women and children are at a greater risk for disease from household air pollution, which is responsible for a significant proportion of the total number of deaths from ischemic heart disease, stroke, lung cancer and chronic obstructive pulmonary disease in women compared to men. In Lao PDR, about 63% of an estimated 2800 child deaths due to acute lower respiratory infections is attributable to household air pollution.

2.2 Summary of future climate-related health outcomes and projections of climate risks

Based on the 2021 climate risk country profile from the World Bank and Asian Development Bank, Lao PDR is amongst the most vulnerable countries to projected climate change trends [30]. Lao PDR is likely to experience more extreme weather going forward with a 2–3°C rise in temperature by 2050. Rainfall during the rainy season will increase 10–30%, especially in the southern region of the country. Floodings are also projected to increase in terms of frequency and severity, mainly in the south.

In 2015, WHO developed the climate and health country profile with projections of climate risks to health [11]. Key findings of priority health risks in Lao PDR due to climate change include:

- **Annual temperature is projected to rise:** Under a high emissions scenario, mean annual temperature is projected to rise by about 4.5°C on average from 1990 to 2100.
- **Malaria is projected to decline:** The population at risk of malaria is projected to decline towards 2070, however, it is estimated that a low emissions scenario will lead to a greater decline in population at risk than a high emissions scenario.

- **Dengue is projected to increase:** The mean relative vectorial capacity for dengue fever transmission is projected to increase under a high emissions scenario from the baseline of 0.55 to about 0.62 towards 2070.
- **Heat-related deaths are projected to increase:** Under a high emissions scenario heat-related deaths in the elderly (65+ years) are projected to increase to about 72 deaths per 100 000 by 2080 compared to the estimated baseline of about three deaths per 100 000 annually between 1961 and 1990. A rapid reduction in emissions could limit heat-related deaths in the elderly to about 15 deaths per 100 000 in 2080.

2.3 Vulnerable groups

The impacts of climate change are likely to disproportionately affect the poorer and most vulnerable groups. Inequality is widening in Lao PDR and evidence suggests that this may further amplify the impacts of climate-related disasters.

Vulnerable groups and communities include those (i) living close to rivers (flood risk); (ii) living in poverty (represented by high rates of households without toilet facilities); (iii) with limited access to clean water; (iv) who are dependent on agriculture for their livelihoods; and (v) living in low forest cover areas [5].

More than 50% of districts in Lao PDR have "high" or "very high" vulnerability to climate change [10]. Key populations at risk of being impacted by climate change include:

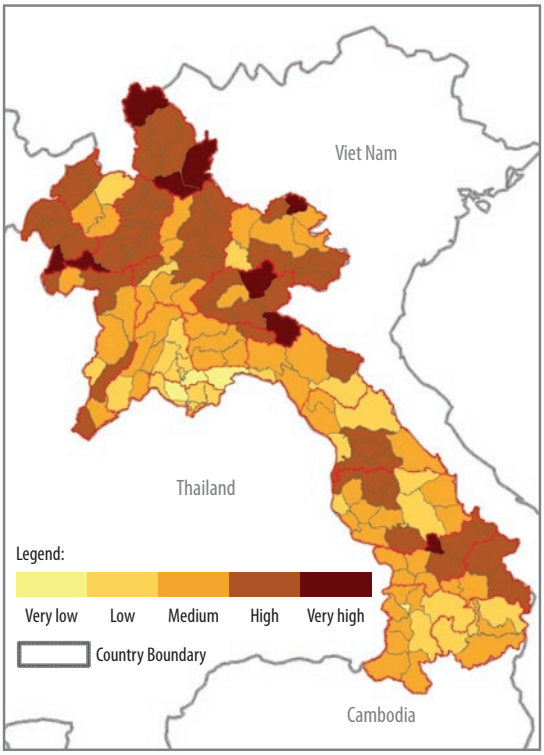
- Poor, rural populations living in hard-to-reach areas, with flood affected roads
- Women and children living in poor, rural, hard-to-reach villages
- Outdoor workers, farmers and the elderly during heatwaves

Forty-seven districts in 13 different provinces have communities that are particularly vulnerable to the effects of climate change because they lie in flood-prone zones that are considered high-risk [5]. Each of them requires immediate assistance implementing adaptation measures. Provinces where many of the districts are expected to be at very high risk of flood include Savannakhet, Luangprabang, Huaphanh, Khammuane, Luangnamtha, Saravan, Sekong and Vientiane.

The assessment results of the 2020–2021 vulnerability assessment undertaken by the Ministry of Natural Resources and Environment indicated that most northern provinces, including Phongsaly, Huaphanh and Xiengkhouang, as well as certain districts in Khammuane, Saravan and Champasak had a high degree of sensitivity. In terms of adaptive capacity, it was found that most major cities and provincial capital districts had a very high level of adaptive capacity. It was noted that districts in the central provinces had more adaptive capacity than districts in the southern provinces.

The results of the assessment are reflected in the Decision No. 1030/MONRE, dated 10 March 2020, and the ongoing efforts to revise the National Adaptation Plan. The vulnerability assessment results were also considered for the development of the H-NAP by giving priority to the 47 most vulnerable districts.

FIGURE 8. Vulnerability map of Lao PDR



Source: Ministry of Natural Resources and Environment; 2020 [10]

The main results are shown by the maps in Figure 9–12. These maps illustrate district vulnerability. The majority of districts in the north, particularly in Phongsaly, Houaphanh, and Xiengkhouang provinces, are rated as very high (level 5). This assessment uses various types of datasets. Statistical data is crucial, particularly at the district and village levels.

FIGURE 9. Climate change exposure map at district level

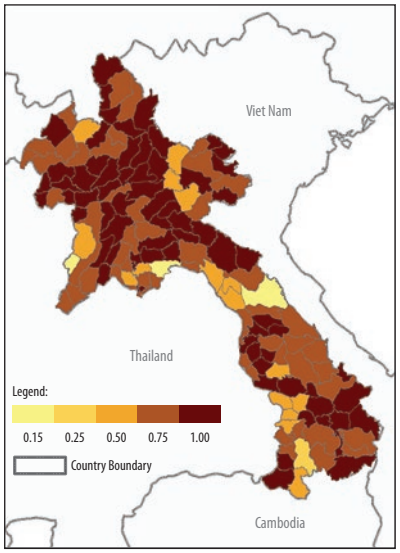


FIGURE 10. Level of sensitivity

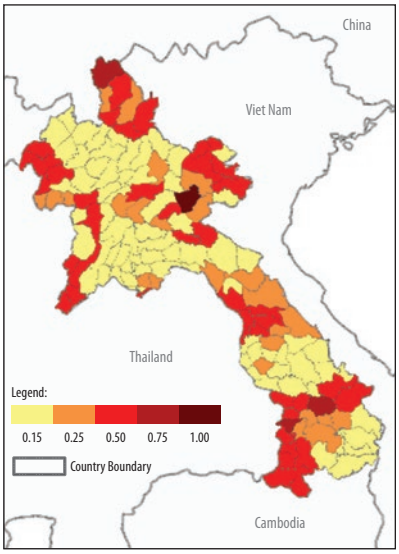
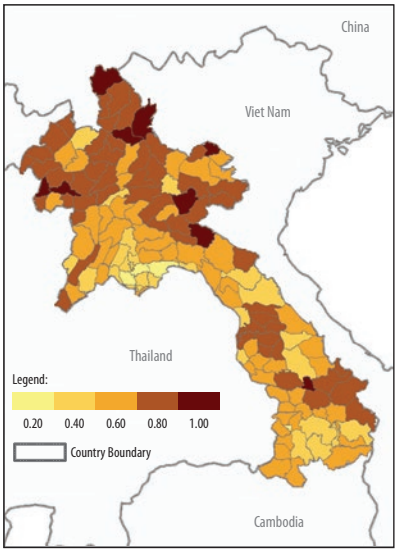


FIGURE 11. Vulnerability map at district level



Source: Ministry of Natural Resources and Environment; 2020 [10]

PART 3. Climate change and health-related institutional and policy framework of the country

3.1 National development strategies, priorities and plans

3.1.1 Key strategies directly concerning climate change and health

The following strategies, plans and regulations strongly support climate change and health as a priority of the country.

The National Adaptation Programme of Action to Climate Change was endorsed by the Lao Prime Minister on 12 March 2010 [5]. The National Adaptation Programme of Action identifies urgent needs for climate change adaptation in the country within four main sectors, one of which is public health. One of the priority areas for health is to develop a timely and accurate reporting system for epidemic diseases and to improve the capacity of the epidemic disease surveillance system.

In 2010, the Strategy on Climate Change of the Lao PDR was approved and provided a vision on how to address climate change in the country [31]. The Strategy outlines key strategic priorities for climate change mitigation and adaptation within key sectors including highlighting some priorities for health in Lao PDR.

Public health is one of seven priority sectors of the national Strategy on Climate Change (2010). The Strategy outlines four priority areas for the public health sector:

- **Incorporating current climate change concerns into ongoing programmes and measures,** including regular evaluations to determine ability to cope with projected climate risks.
- **Providing access to safe water and improved sanitation** to reduce diarrhoeal diseases, and implementing surveillance programmes to identify and respond to outbreaks of malaria and other infectious diseases.
- **Raising public awareness** effectively using local resources, appropriate governance arrangements and community participation.
- **Strengthening existing capacity and applying new approaches** to examining the risks associated with a changing climate and increased climate variability.

The Climate Change Action Plan of Lao PDR for 2013–2020 was developed by the Ministry of Natural Resources and Environment. The Action Plan is based on the national Strategy on Climate Change (2010) and the Second National Communication to the UNFCCC (2013) [32]. The Action Plan outlines the following key focus areas for public health:

- Increase the resilience of rural water supply systems to climate change;
- Improve public health services for climate change adaptation;
- Improve disease monitoring and reporting;
- Improve the treatment of water- and vector-borne disease and other climate-related health impacts;
- Strengthen nutrition and prepare to respond to nutrition emergencies through improved food security, emergency food aid, and nutritional surveillance;
- Strengthen disaster preparedness and recovery, including maintenance of public health services; and
- Strengthen health education and communication and promote individual action to reduce vulnerability to climate change.

The Action Plan states that the Ministry of Natural Resources and Environment will be a focal point for the coordination of climate change mitigation and adaptation programmes in Lao PDR. Importantly, it outlines the need for the Ministry of Natural Resources and Environment to collaborate and coordinate with other government ministries.

The Ministry of Health developed the Climate Change and Health Adaptation Strategy in 2017 based on findings of the 2010 health vulnerability assessment and national strategic directions with the objective of promoting the capacity of the public health and community sectors to prevent climate change and protect the health of the people from its effects [8] [7]. The Strategy consists of the following six strategic directions to guide climate resilient health system building:

3. Leadership and governance
4. Organizational and staff capacities strengthening
5. Information systems
6. Resilience to climate change conditions and sustainability of technology and infrastructure
7. Service provision
8. Public health finance and climate change

3.1.2 Additional key strategies

The following national development strategies, priorities and plans highlight public health as a priority sector in Lao PDR and should be considered in implementing actions related to climate and health.

Lao PDR's 2015 revised constitution specifically mentions improvements to public health services, with a focus on women, children, and those living in poverty and in remote areas [33]. Supporting the constitution is the national long-term Vision 2030 that sees continued economic growth in Lao PDR dovetailed with balanced economic and social development, including social safety nets. Vision 2030 is implemented through five-year national socioeconomic development plans, as well as provincial, district, and sectoral five-year plans.

The 9th National Socioeconomic Development Plan focuses on the following priority areas:

1. Continuous, quality, stable and sustainable economic growth;
2. Improved quality of human resources;
3. Enhanced well-being of the people;
4. Enhanced environmental protection and reduced disaster risks;
5. Engagement in regional and international cooperation and integration; and
6. Improved public governance and administration, and an equal and fair society protected by the rule of law.

The Five-Year Plan targets continued poverty reduction, graduation from least developed country status, effective management and use of natural resources, and strong regional and international integration.

The Health Sector Reform Framework 2013–2025 aims to achieve universal health coverage by 2025 as part of its recognition of the need to improve access to and the quality of services. Health system strengthening is central to the reform framework's priority areas that include health financing, health governance, human resources for health, health service delivery, and health information systems. Health Sector Reform Framework implementation is supported through the 9th HSDP (2021–2025), which prioritizes climate change as well as improving access to sufficient clean water. Among the Ministry of Health's 133 priority projects under the 9th HSDP, the following projects are included, to be supervised by the Department of Hygiene and Health Promotion and implemented by the Division of Environmental Health, Water and Sanitation: clean–safe water management; environmental health and sanitation; management of health workforce; climate change; and health impact assessment.

3.2 Nationally Determined Contribution of Lao PDR

Over the last 50 years, human activities have released massive quantities of carbon dioxide and other greenhouse gases with negative impact on global climate. Globally, the health care sector is confronted with challenges from climate change and environmental threats [34].

In 2015, the intended Nationally Determined Contribution (NDC) plan was developed through an inclusive stakeholder consultation process, including line ministries, research institutions, civil organizations, provincial governments, the private sector, and international development partners [35].

The NDC was submitted in 2021 and is implemented in a coordinated manner with the National Strategy on Climate Change, climate change action plans, and sectoral plans [36]. It included a Strategy on Climate Change and Health Adaptation 2018–2025 and Action Plan 2018–2020, which define the strategic directions for the country to build resilience in the sector.

Long-term adaptation objectives indicated for the public health sector are a) increasing the resilience of public health infrastructure and the water supply system to climate change and b) improving public health services for climate change adaptation and coping with climate change-induced impacts.

The NDC highlights that the health sector is the only sector for which a results-based framework is available for adaptation, allowing for effective design, implementation and monitoring of NDC long-term adaptation objectives [36]. Other priority adaptation sectors such as agriculture and water have not been approached in such a systematic way.

In the NDC, WASH is very well represented, with the implementation of the Scaling-Up Water Supply, Sanitation and Hygiene Project in flood- and drought-prone areas and Climate Resilient Water Safety Plan Project outlined, with clear links to health made.

Mitigation action of the health sector

In Lao PDR, the government has committed to reducing 60% of greenhouse gas emissions, including within the health sector, and between 2000 and 2020 the country saw a 34% reduction in emissions [36].

Global modelled estimates indicate that the health care sector is responsible for approximately 5% of global greenhouse gas emissions [37]. In 2022, as part of the 26th UN Climate Change Conference of the Parties Health Programme, the Ministry of Health committed to building a climate resilient and low-carbon sustainable health system. Supply chain, emergency and non-emergency transportation, heating and ventilation, and medical waste management are key contributors to the carbon footprint of the health care sector and a systematic approach is required to design environmentally sustainable and climate-sensitive alternatives to current operating models.

WHO's global policy recommendations support Member States' efforts aimed at achieving Sustainable Development Goals (SDGs) and Paris Agreement targets. The 2020 *WHO guidance for climate resilient and environmentally sustainable health care facilities* recommended that Member States base the regulation, development, construction and retrofitting of HCFs on low carbon approaches to ensure climate resilience and environmental sustainability [38].

To support implementation of national WASH standards and regulations at the HCF level, Lao PDR adopted the WHO Water and Sanitation for Health Facility Improvement Tool (WASH FIT) in 2017 and adapted it to the local context. When first piloted in Champhone district hospital (Savannakhet province), improvements to water, sanitation, and medical waste management followed [39].

The Ministry of Health initiated the Safe Clean Green and Climate Resilient Healthcare Facilities Initiative in 2020, expanding WASH FIT and further supporting the implementation of national WASH standards by focusing on interventions to assess, improve and monitor WASH services in HCFs. Recently, health-care waste management regulations were devised for the use of non-combustion technology in central, provincial and district hospitals as part of the Initiative. HCFs most impacted by COVID-19 and climate change were chosen to be part of the Initiative, with 70 facilities having joined thus far [40].

PART 4. Adaptation capacity of the health sector

4.1 Guiding principles followed during adaptation planning in Lao PDR

- **Use the best available science and technology**: Focus on mitigation of greenhouse gas emissions from HCFs by introducing best available science; for example, replacing incineration technology for infectious and sharp waste management with steam treatment technology and using mercury free medical devices in health practices.
- **Employ gender-sensitive approaches**: Women and children are often considered more vulnerable to climate change impacts. Consider gender-sensitive approaches during all stages, from planning to implementation and evaluation, of H-NAP actions.
- **Integrate adaptation measures into health sector policy and planning**: The H-NAP is intended to incorporate climate change adaptation measures further into the Disaster Management Plan for the health sector and traditional WASH actions.

4.2 The overall purpose of the H-NAP

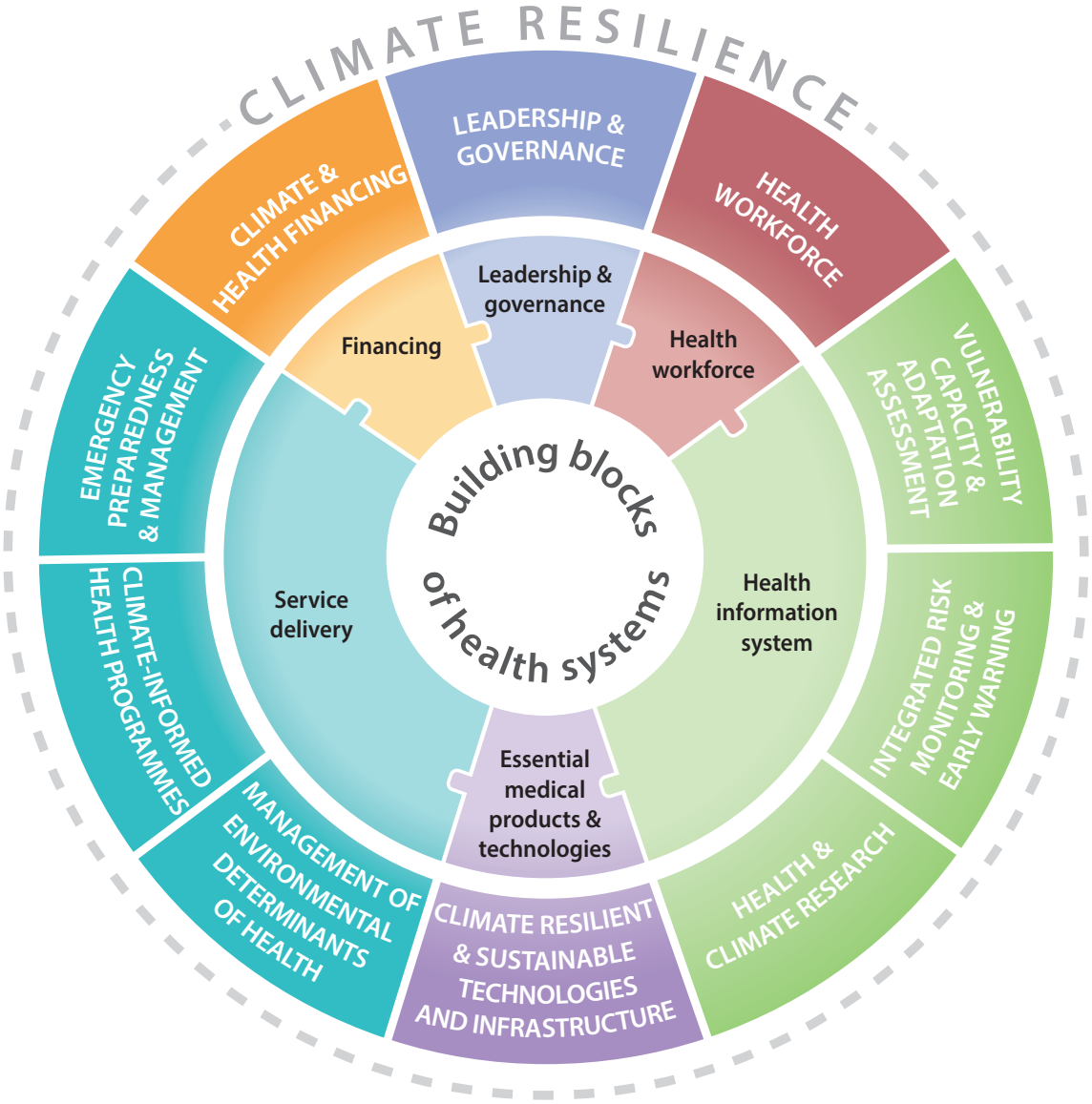
The overall purpose of the H-NAP is to support the development of a climate resilient health system, as well as to mainstream climate risks into health planning, policies, and annual or mid-term operational plans and programmes.

To achieve these, adaptation options of the H-NAP can be used for mainstreaming and incorporating climate risks into medium- and long-term planning, policies and monitoring for sustainable long-term capacity building. In addition, the H-NAP adaptation options can be used for the development of proposals for additional resource mobilization.

4.3 The 10 components of the Lao PDR adaptation plan for building climate resilient health systems in the country

The WHO *Operational framework for building climate resilient health systems* was launched in 2015 to guide Member States, particularly their health sectors, to systematically and effectively address the increasing challenges posed by climate variability and change. The framework covers the six building blocks of health systems (leadership and governance, health workforce, health information systems, essential medical products and technologies, service delivery, and financing) through 10 components (see Figure 12) [41].

FIGURE 12. The 10 components of the WHO *Operational framework for building climate resilient health systems*, and their links to the building blocks of health systems



Source: Reproduced from WHO; 2015 [41]

The objective of the operational framework is to provide guidance for health systems and public health programming to increase their capacity for protecting health in an unstable and changing climate. By implementing the 10 key components of the six building blocks laid out in this framework, the Lao Ministry of Health, its six departments, all national health centres – including, Nam Saat, National Center for Laboratory and Epidemiology, Center of Malariology, Parasitology, and Entomology, and National Center for Mother and Child Health – provincial health and district health departments, and all HCFs will be better able to anticipate, prevent, prepare for and manage climate-related health risks.

Table 1 outlines the integration of climate risks and considerations into different health programmes; the table classifies adaptation options by priority climate risks and health outcomes and the six building blocks of health systems.

TABLE 1. Adaptation options by the six building blocks of health systems

Priority climate risks and health outcomes in the country	Building blocks of WHO operational framework					
	Leadership and governance	Health workforce	Health information systems	Essential medical products and technologies	Service delivery	Financing
Current health impacts:						
Effects on WASH	Incorporate climate risks and considerations into overarching WASH policy, Rural and Urban WASH Strategy and action plans	Train central, provincial and district Nam Saat staff and provide guidance support on the use of the Climate Resilient Water Safety Plan for piped and non-piped small community water supply systems	Incorporate climate variables and considerations into HCF survey and DHIS2 platform Develop map of districts, villages and HCFs vulnerable to droughts and floods/storms SDG monitoring	Adopt the use of climate resilient WASH technology Develop climate smart HCF standards	Implement interventions in the climate resilient WASH in HCFs tool (based on existing WASH FIT) Develop accreditation indicators/ score card for performance-based incentive system for health centres	Seek additional funding support from climate finance
Water-related diseases	Incorporate climate risks and considerations into public health emergency response plan	Incorporate climate risks into training programme for field epidemiology Training on use of climate informed early warning system	Strengthen water-related diseases surveillance system Develop climate-informed Early Warning and Response System for diarrhoeal diseases	Establish vaccination plan in high-risk areas/disaster affected villages	Develop clinical guidance on case management and reporting of climate-sensitive diseases	Allocate regular budget for essential health service package
Health impacts from extreme weather events and injury and disability	Incorporate climate risks and considerations into Disaster Management Plan for health sector Strengthen the Public Health Emergency Operations Centre as a platform for decision making as well as fast-track fund release during emergencies	Conduct trainings for emergency response team	Incorporate climate risks and considerations into DHIS2 and conduct analysis of the relationship between climate variables and health outcomes	Early warning system to be established by the Ministry of Labour and Social Welfare that will help community actions and be beneficial to health service providers	Implement interventions in the disaster response and preparedness plan at disaster prone HCFs Health sector will get support from national contingency plan and coordination at national level	Allocate regular budget for HCF management

Table 1. Adaptation options by the six building blocks of health systems (cont'd)

Priority climate risks and health outcomes in the country	Building blocks of WHO operational framework					
	Leadership and governance	Health workforce	Health information systems	Essential medical products and technologies	Service delivery	Financing
Sudden increase of health service demand		Train subnational level staff to be deployed	Incorporate climate risks and considerations into DHIS2 and conduct analysis of the relationship between climate variables and health outcomes		Implement interventions in the climate resilient WASH in HCFs tool	Disaster management fund
Acute malnutrition	Incorporate climate risks and considerations into nutrition strategy	Include climate risks in the nutrition and food security training programme and practical training for staff at the National Center for Mother and Child Health and the National Center of Nutrition at three levels	Incorporate climate risks and considerations into DHIS2 and nutritional survey and conduct analysis of the relationship between climate variables and health outcomes SDG monitoring	Implement nutrition-specific interventions to vulnerable children and vulnerable areas	Enhance monitoring of nutritional status of young children, mother's education and counselling services in vulnerable areas	Seek additional funding support from climate, food security and nutrition-related fund
Predicted future health impacts:						
Vector-borne diseases	Incorporate climate risks and considerations into national programmes on dengue Research and apply a climate-informed early warning system for dengue	Incorporate climate risks in the regular training programmes for Center of Malariology, Parasitology, and Entomology staff	Incorporate climate risks and considerations into DHIS2 and conduct analysis of the relationship between climate variables and health outcomes Develop climate-informed early warning and response tool for dengue outbreaks	Modelling to predict future disease outbreak and high-risk geographical areas	Develop clinical management guideline for dengue outbreak	Allocate regular budget for vector-borne disease control and seek additional funding support from climate fund

Table 1. Adaptation options by the six building blocks of health systems (cont'd)

Priority climate risks and health outcomes in the country	Building blocks of WHO operational framework					
	Leadership and governance	Health workforce	Health information systems	Essential medical products and technologies	Service delivery	Financing
Heat-related medical conditions	Incorporate climate risks and considerations into: • Noncommunicable diseases and essential service packages (2015 International Labour Organization guidelines [42]) • Worker's health and safety standards	Conduct training on clinical management of heat-related conditions for intensive care unit physicians at outpatient clinics and on emergency call	Incorporate climate risks and considerations into DHIS2 and conduct analysis of the relationship between climate variables and health outcomes	Modelling/ forecast to predict extreme hot events	Develop clinical management guideline for heat-related medical conditions	Allocate regular budget for intensive care units
Health risks of air pollution	Incorporate climate risks and considerations into clean air policy	Conduct training for Nam Saat and Natural Resources and Environment Research Institute staff	Establish data-sharing practice between health, environment, and meteorological sectors and use for assessing relationship between climate risks and current and future health outcomes	Develop clean air policy based on climate mitigation and clean energy principles	Strengthen air quality monitoring and short-lived climate pollutants in Vientiane Capital	Seek additional funding support from climate fund and air pollution projects

COMPONENT 1: Leadership and governance

This component aims to maintain the existing coordination committee and to update or define specific responsibility and accountability mechanisms for climate change and health within the Ministry of Health, including the incorporation of climate change and variability considerations into health policies and programmes. Strengthened coordination across sectors, such as water, public works, transport, agriculture, environment, and energy, as well as collaboration among departments and programmes within the Ministry of Health, are key to maximizing synergies and ensuring that sectors actively protect and promote health.

Current status

A Strengths, Weaknesses, Opportunities, and Threats Analysis showed that there is a shortage of funding and technically trained staff to implement policies and strategic plans. There is an expressed desire to translate the policies into action, however budget and technical capacity remain a challenge. The Analysis found that most study participants had some understanding of climate change and its impact on health in Lao PDR, resulting in a high level of confidence in the health sector's capacity to manage climate change. Moving forward, coordination across sectors will be key in the development of successful climate and health adaptation programmes.

The Ministry of Health's Climate Change and Health Adaptation Strategy (2017) prioritized the following objectives:

- to establish an organization responsible for the adaptation of the health sector to climate change; and
- to identify roles and responsibilities, as well as the coordination mechanism within the Ministry of Health.

The Strategy includes activities for improving multisectoral collaboration and coordination mechanisms. Adaptation options for this component were developed to effectively implement the Climate Change and Health Adaptation Strategy.

Priority adaptation options to support the implementation of the policy, governance and multisectoral coordination mechanisms and sustainability are provided. Adaptation options for the leadership and governance component are presented with the main goal being to mainstream priority climate risks into medium- and long-term health planning, policies, and monitoring for sustainable long-term capacity building.

TABLE 2. Adaptation options for the leadership and governance component

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated annual budget, US$
Policy					
Priority climate risks and hazards: • Increased temperature • Longer dry season and shorter rainy season with increased intensity of rain • Increased number, frequency and intensity of extreme weather events, floods, landslides, and droughts	All priority health outcomes and climate-sensitive diseases of the H-NAP	**Barriers:** There is a climate change and health policy and implementation gap largely due to limited budget and human resources for assessing and managing climate risks to health **Specific objectives:** Select priority adaptation actions and implement them in the most vulnerable areas	• Ensure policy and implementation capacity building define current and future climate effects on health and prioritize climate change and health outcomes in the country • Assess current and future climate hazards on a regular basis • Implement priority adaptation actions in the H-NAP • Engage stakeholders in the design and development of operational work plans • Ensure implementation with regular funding support (refer to the financing component) • Update the H-NAP when needed • Conduct monitoring of the H-NAP • Partnering: Engage partners for effective implementation and monitoring	Ministry of Health • Department of Hygiene and Health Promotion • Nam Saat • Cabinet	20k/ annual budget
Governance					
Priority climate risks and hazards: • Increased temperature • Longer dry season and shorter rainy season with increased intensity of rain	All priority health outcomes and climate-sensitive diseases of the H-NAP	**Barriers:** Limited management skills in managing programmes, addressing climate risks and monitoring health outcomes at central and subnational levels **Specific objectives:** • Maintain regular function of the technical unit • Strengthen capacity by providing training (using WHO climate change and health training modules) and enabling attendance of the inter-country meeting and workshop to share experiences and learning opportunities	• Enable policy- and decision-makers to participate in regional and intercountry workshops and conferences on climate change and health adaptation and to gain management and technical skills and experiences in coordinating climate change adaptation programmes • Conduct a quarterly knowledge-sharing workshop with departments and centres across ministries active in climate change adaptation to strengthen relationships and crosscutting initiatives • Support the implementation and enforcement of the Hygiene and Health Promotion Law	Establish a team with adequate staff and office equipment in the Department of Hygiene and Health Promotion (Ministry of Health) according to the Climate Change and Health Adaptation Strategy	50k

Table 2. Adaptation options for the leadership and governance component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated annual budget, US$
Cross-sectoral coordination and collaboration					
Priority climate risks and hazards: • Increased temperature • Longer dry season and shorter rainy season • Longer dry season and shorter rainy season with increased intensity of rain	All priority health outcomes and climate-sensitive diseases of the H-NAP	**Barriers:** Limited inter-sectoral data sharing practice **Specific objectives:** Maintain function of the coordination mechanism established by the Climate Change and Health Adaptation Strategy	• Maintain regular function of the coordination committee across ministries and sectors, which is established by the Climate Change and Health Adaptation Strategy by providing secretarial support from the technical unit of the Department of Hygiene and Health Promotion (Ministry of Health) • The technical unit provides secretariat support to the committee and facilitates regular communication and meeting arrangements • Ensure the Climate Change and Health Adaptation Strategy and H-NAP are linked/coordinated with the national Strategy on Climate Change, National Adaptation Plan, and national communication to the UNFCCC • Ensure health adaptation measures are reflected in the country programmes for Green Climate Fund/Global Environment Facility and other international climate finance mechanisms • Ensure effective coordination with construction and infrastructure development sectors for reconstruction of HCFs • Use "build back better" principles for the reconstruction of HCFs (post-disaster needs assessment recommendation), if any HCF is damaged or destroyed [43]	Technical unit and a focal person from the Department of Hygiene and Health Promotion (Ministry of Health) are responsible for the coordination and representation of the health sector through the coordination committee, including in formal communications and face-to-face meetings Technical unit at Department of Hygiene and Health Promotion (Ministry of Health) and rural WASH division of the central Nam Saat are responsible for coordination between urban and rural WASH sectors	50k

Table 2. Adaptation options for the leadership and governance component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated annual budget, US$
All climate hazards and risks	Health co-benefit of climate change mitigation	**Barriers:** Health impact is not considered in developing mitigation plan of other sectors such as energy, waste management and transport **Specific objectives:** Conduct assessment of health co-benefits from mitigation strategies and actions of other sectors	Conduct health co-benefit assessment for waste management, disseminate and share the results with other sectors for mitigation planning; and use the results for advocacy and awareness raising for effective implementation of the NDCs and H-NAP	Ministry of Health Ministry of Natural Resources and Environment Line ministries and relevant sectors Research and academia institutes Consultancy firms Development partners	n/a

COMPONENT 2: Health workforce

This component is intended to:

- Strengthen the technical and professional capacity of health personnel, and the organizational capacity of health systems and their institutional capacity to work with other programmes and support cross-programme work.
- Develop capacity specifically for climate change and health, including health policy and management, research and analysis, health care and public health service delivery.

Current situation

The Climate Change and Health Adaptation Strategy defined barriers to implementing climate change and health adaptation measures. One is limited capacity, knowledge, and experience relevant to climate change adaptation at government, health sector, and community levels in Lao PDR. A compounding factor is heavy reliance on overseas development assistance in the country, which makes it difficult to create and maintain sustainable programmes that can be implemented by the Lao people. An estimated 70% of public investment is financed by outside resources [44].

In 2016, 20 484 persons were employed by the Ministry of Health leading to a ratio of 3.11 public health sector employees per 1000 inhabitants. This number includes 17 666 staff working at HCFs, which is equivalent to 2.68 per 1000 inhabitants. Of these, 12 904 were formally trained workers including village health workers, nurses, midwives, medical assistants, medical doctors, and specialists, equivalent to 1.96 per 1000 inhabitants.

Primary health care policy will help to mobilize village volunteers and improve human resource capacity in primary care units such as health centres, small hospitals, and health volunteer units.

Human resource distribution and capacity building for HCFs located in climate/extreme weather event prone areas has not yet been reflected in priority areas of health sector policy.

Adaptation options

Adaptation options are focused on the three main objectives, which were defined in the Climate Change and Health Adaptation Strategy:

a. to establish a sustainable academic training programme;
b. to develop a short-term course on climate change and health; and
c. to develop a communication strategic plan for raising awareness.

TABLE 3. Adaptation options for the health workforce component

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated annual budget, US$
Climate change and health adaptation and mitigation					
Priority climate risks and hazards: • Increased temperature • Longer dry season and shorter rainy season • Longer dry season and shorter rainy season with increased intensity of rain	All priority health outcomes and climate-sensitive diseases of the H-NAP	**Barriers:** Climate change and health adaptation capacity gap with limited knowledge and experience relevant to climate change adaptation at central and subnational health institutions and among health care workers in provincial and district hospitals and health centres and at community levels in Lao PDR **Specific objectives:** Establish sustainable short- and long-term training programmes for current and future health care workers and public health specialists	• Develop academic training curriculum on climate change and health topics including adaptation options for medical, nursing, and public health students • Develop optional training courses for Master of Public Health students to give skills in managing public health programmes including climate change and health adaptation programmes/ climate and health linkages • Customize a three-day training module on climate change and health based on the WHO training modules; train health care personnel managers in environmental health and other public health programmes at central and subnational institutions with support from the Department of Hygiene and Health Promotion (Ministry of Health) and Nam Saat trainers • Upload the WHO training materials adopted in the country onto the website of the National University of Health Sciences and the Ministry of Health for optional use for health care personnel	Ministry of Health National University of Health Sciences	50K
Organizational capacity development					
Priority climate risks and hazards: • Increased temperature • Longer dry season and shorter rainy season	All priority health outcomes and climate-sensitive diseases of the H-NAP	**Specific objectives:** Increase awareness of health care workers on climate change and health effects and core adaptation options	• Set up guidance (standard operating procedures [SOPs]) for education and deployment mechanism for health care workers at all levels	Ministry of Health • Department of Health Personnel • Department of Healthcare and Rehabilitation	n/a

Table 3. Adaptation options for the health workforce component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated annual budget, US$
• Longer dry season and shorter rainy season with increased intensity of rain			• On-the-job training programme for emergency response and recovery team/ health care workers at three levels using the WHO training programme and presentation materials • On-the-job training and mentoring support to prepare researcher team (National University of Health Sciences, Public Health Institute, and Health Information System/Ministry of Health) with capacity in undertaking vulnerability and adaptation capacity assessments, and monitoring climate-related health outcomes and effectiveness of adaptation measures such as early warning and response systems	Development partners, including WHO National University of Health Sciences • Public Health Institute	
Communications and awareness raising					
Priority climate risks and hazards: • Increased temperature • Longer dry season and shorter rainy season • Longer dry season and shorter rainy season with increased intensity of rain	All priority health outcomes and climate-sensitive diseases of the H-NAP	**Barriers**: Limited communication strategy and materials for community awareness raising **Specific objectives:** Increase community awareness raising materials and availability of the developed communication strategy related to climate change and health	• Assess community knowledge, attitudes, and practices (with a Knowledge, Attitudes, and Practices survey) on protecting from and preventing health impacts related to climate change (high risk community to flood/drought/storm) • Pilot and evaluate the public awareness raising materials for selected communities for community actions to prevent and control climate-related health outcomes • Develop a communication strategy related to climate change and health • Promote behavioural change and communication activities such as distributing health educational materials and tools and using mass media (TV, radio) for community outreach • Evaluate effectiveness of the interventions and share the results with partners and stakeholders	Ministry of Health	n/a

COMPONENT 3: Vulnerability, capacity and adaptation assessment

This component includes the range of assessments that can be used to generate policy-relevant evidence on the scale and nature of health risks, and the most vulnerable populations, considering the local circumstances. For example, a vulnerability assessment is used for understanding the main health risks posed by climate change and identifying vulnerable population groups in the country. A capacity and gaps assessment is used for understanding the health system challenges posed by climate change. Adaptation options include information on the main adaptation options available, including their comparative advantages, potential costs and efficiency, and availability for selection by health system decision-makers.

Current situation

Vulnerability and adaptation capacity assessments were conducted in the country with funding and technical support from development partners. There were several barriers identified in the vulnerability assessment reports from the Ministry of Health and WHO (2010), and National University of Health Sciences and Asian Development Bank (2019) [7] [9].

Adaptation options

The Climate Change and Health Adaptation Strategy of the country emphasized objectives and activities related to vulnerability and capacity assessment and developing climate change adaptation plans. The following adaptation options are prioritized based on the strategic plan and current needs.

TABLE 4. Adaptation options for the vulnerability, capacity and adaptation assessment component

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated annual budget, US$
Vulnerability and capacity assessment and capacity development					
Priority climate risks and hazards: • Increased temperature • Longer dry season and shorter rainy season • Longer dry season and shorter rainy season with increased intensity of rain	All priority health outcomes and climate-sensitive diseases of the H-NAP	**Barriers:** • Current health data collection systems are weak, limiting opportunities for assessing vulnerability and adaptation capacity, and monitoring climate-sensitive diseases and appropriate responses • Total mortality data is not available • Limited data on injury/accident due to extreme events • Climate data is not shared with health sector	• Establish mechanism to share climate and health data between health and environment sectors • Incorporate climate variables in the ongoing health data management system (using DHIS2) for regular update/ assessment of vulnerability and health adaptation options • Set up guidance/SOP in using vulnerability assessments to identify which populations and communities are most at risk; as a result, disaster preparedness plan will focus on regions and communities most at risk	Ministry of Health Ministry of Natural Resources and Environment	40K

Table 4. Adaptation options for vulnerability, capacity and adaptation assessment component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated annual budget, US$
		• Air quality monitoring data is updated on the website of the Ministry of Natural Resources, not used for health impact assessment and public health and community actions/emergency response **Specific objectives:** Establish a regular mechanism to assess and update vulnerability and health adaptation options and use the results for policy-making and planning	• Establish regular mechanism and practice in using the results of the vulnerability and adaptation assessment for taking appropriate action/responses; for example, H-NAP revision • Develop guidance for assessing current relationships between climate variables and health outcomes • SOP development for using rapid assessment results of air quality and health risks for sharing risk communications and public warning messages in case of public health emergency		
		Barriers: Limited human resources in assessing vulnerability and adaptation and use of the results for planning **Specific objectives:** Build vulnerability assessment capacity such as trained staff and availability and access to climate and health data	• Identify current priorities and highlight knowledge/ capacity gaps of the vulnerability and capacity assessment • Develop recommendations for addressing gaps and building health system capacity • Develop a short training module for selected central government and academic staff and provide training for preparing the national team in undertaking health vulnerability and adaptation assessment and using the findings for developing and revising the H-NAP • Develop capacity for country-specific climate modelling through trained staff by attending an international training course and in-country training • Advice/mentoring support to facilitate vulnerability and adaptation assessments and apply results to prioritize adaptation options, allocate of resources and develop effective interventions in health and related sectors for high risk and vulnerable populations	Ministry of Health National University of Health Sciences	n/a

COMPONENT 4: Integrated risk monitoring and early warning

The objective of integrated risk monitoring is to generate a holistic perspective of health risks with real-time information about climatic and environmental conditions, health conditions, and response capacity. The information is used to design an early warning and response system. This risk monitoring system gives an opportunity to enhance surveillance of environmental determinants of health (for example, water and air quality, variability in ambient temperature and humidity, or incidence of extreme weather events) and resulting health outcomes.

Current situation

Health adaptation planning is limited by a lack of reliable data on climate change and associated health effects in the country, as stated in the Climate Change and Health Adaptation Strategy. The Strategy identified barriers, including limited knowledge and experience of climate risks and health linkage, and limited monitoring, surveillance, control, early warning, prevention, diagnosis and management of climate-sensitive diseases and associated risk factors.

There is a need to enhance data sharing practices linked with the climate database of the Ministry of Natural Resources and Environment and health data in the DHIS2.

Adaptation options

The overall objective of this component is to strengthen the current health information system for detecting diseases and quick climatic conditions risks and use it for early warning messages that can be disseminated through mass media to communities to improve their response. Specific objectives to overcome barriers are provided in the following adaptation options.

TABLE 5. Adaptation options for the integrated risk monitoring and early warning component

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated annual budget, US$
Integrated risk monitoring data					
Priority climate risks and hazards: • Increased temperature • Longer dry season and shorter rainy season • Longer dry season and shorter rainy season with increased intensity of rain	All priority health outcomes and climate-sensitive diseases of the H-NAP	**Barriers:** • A data-sharing mechanism for climate/weather data between the Ministry of Health and the Ministry of Natural Resources and Environment is not in place • Population-based data on mortality is not available in Lao PDR due to limitations of civil registration, with the only available mortality data being that obtained from hospital records [21] • There is a lack of data on drought and underground water sources [17] **Specific objctives:** • Strengthen data access and availability • Link climate/weather and health/diseases surveillance data	• Establish enabling environment (Memorandum of Understanding/SOP) to share climate/weather and health outcome data and environmental data (air quality, water quality, etc.) • Integrate climate/weather and environment data with DHIS2 system for climate-sensitive diseases surveillance and prediction • Translate climate-related health outcomes and climate-sensitive disease surveillance data into actions/adaptation measures by sharing timely information with respective managers	Ministry of Health • Center for Health Statistics and Information • Department of Planning and Finance • Department of Hygiene and Health Promotion Ministry of Natural Resources and Environment	50K
		Barriers: • Climate and health data are not linked • Limited data and capacity for regular monitoring of climate change impacts, vulnerability, response capacity and emergency preparedness capacity reported over time **Specific objectives:** Set up practice to use climate and health data for monitoring of climate-related health outcomes, vulnerability, and response capacity	Medium-term: • Enhance capacity and practice to use online real-time monitoring data (WHO, World Meteorological Organization, other reliable sources) for local early warning and response, until the country has its own real-time monitoring system for health specific actions and response long-term • Feasibility study for establishing integrated real-time risk monitoring system for climate change impacts, vulnerable/high-risk areas, and response capacity • Build capacity to establish an integrated monitoring system and maintain operation	Ministry of Health Ministry of Natural Resources and Environment • Department of Meteorology and Hydrology Development partners, including WHO and World Meteorological Organization	n/a

Table 5. Adaptation options for the integrated risk monitoring and early warning component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated annual budget, US$
Communication					
Priority climate risks hazards: • Increased temperature • Longer dry season and shorter rainy season • Longer dry season and shorter rainy season with increased intensity of rain	All priority health outcomes and climate-sensitive diseases of the H-NAP	**Barriers:** No integrated health and climate and environment data **Specific objectives:** Climate informed early warning systems for climate-sensitive diseases established and used	• Use monitoring data to design early warning system • Develop SOP for early warning messages for mass media and community response • Develop a plan for practical application • Disseminate messages to community through mass media for community response • Based on modelling in Lao PDR, be able to predict climate-sensitive disease outbreaks ahead of time in order to prevent them or mitigate their impacts • Pilot use of the early warning messages and mode of dissemination (TV, radio, cell phone and loudspeaker in a village level) • Evaluate the effectiveness of the interventions (define the fastest mode and best messages)	Ministry of Health • Center for Health Statistics and Information • Department of Hygiene and Health Promotion • Nam Saat • Center of Malariology, Parasitology, and Entomology • National Center for Laboratory and Epidemiology • Provincial health departments • District health offices • Communication and health education unit Journalists and media agencies Community/ village heads	40k
		Specific objectives: • Timely warnings communicated to health decision-makers, the media, and the public for effective action to prevent negative health outcomes • There is experience using climate, health and environmental real-time monitoring data for community early warning and response	• Develop response protocol and implementation support including strengthening capacity on dengue and other vector-borne diseases in all provinces and districts • Develop response protocols and strengthen implementation capacity on diarrhoeal diseases in all provinces and districts	Ministry of Health • Department of Hygiene and Health Promotion • Nam Saat • Center of Malariology, Parasitology, and Entomology • National Center for Laboratory and Epidemiology Development partners	50k annual

COMPONENT 5: Health and climate research

This component is intended to support a multidisciplinary, national research agenda and the dissemination of findings for planning and policy-making, and to strengthen research capacity on climate change and health.

Current situation

Health adaptation planning is limited by a lack of reliable data on climate change and associated health effects in the country. There are no current mathematical models predicting shifts in distributions of parasitic, vector-borne, and tick-borne diseases, nor is there sufficient data on the effect of a changing climate and environment on hosts and vectors, socioeconomic factors, or how populations are adapting to change [17].

Models to predict or capture disease trends are essential for assessing a country's risk and identifying potential areas for improvement.

Adaptation options

The Climate Change and Health Adaptation Strategy emphasized the objectives and activities to study climate-related health outcomes, effects on WASH, food insecurity, nutrition, noncommunicable diseases and social-mental illnesses caused by climate change and to develop a proposal for raising funds for health and climate research in the country. This adaptation option in this component focuses on developing proposals for conducting research on one of the mentioned priority topics and enhancing research capacity building in the sector.

TABLE 6. Adaptation options for the health and climate research component

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
Priority climate risks and hazards: • Increased temperature and extreme heatwaves • Increased extreme weather events such as tropical storms/floods/ flash foods/ landslides • Drought/ extended dry season/food insecurity	• Increased climate-sensitive diseases (such water, vector- and food-borne diseases) • Heat-related medical conditions • Health impacts related to air pollution • Occupational exposure • Injury/accidents • Mental health effects • Malnutrition and other related health outcomes	**Barriers:** • Health adaptation planning is limited by a lack of reliable data on climate change and associated health effects in the country • There are no current mathematical models predicting shifts in distributions of parasitic, vector-borne and tick-borne diseases • There is insufficient data on the effects of a changing climate and environment on hosts and vectors, socioeconomic factors, and how populations are adapting to change	• Develop a research proposal for assessment of priority climate-sensitive diseases such as water-borne diseases (diarrhoea, typhoid) and effects on WASH and other health impacts from extreme weather events • Study climate-related health outcomes, effects on WASH, food insecurity, nutrition, noncommunicable diseases and social-mental illnesses caused by climate change • Study under-nutrition, food insecurity, and sudden increase of health service demand • Establish collaboration with research and academic institute for further capacity building	Ministry of Health • Nam Saat • Center of Malariology, Parasitology, and Entomology • National Center for Mother and Child Health National University of Health Sciences • Public Health Institute • Faculty of Public Health • Faculty of Medical Technology	150k

Table 6. Adaptation options for the health and climate research component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
		Specific objectives: • Develop detailed proposals for building staff and institutional capacity to conduct research • Assess current health impacts and predict disease trends using models, including identification of risks and potential mitigation measures	• Support joint research between Lao researchers/ graduate students and academia and research institutes in other Asian/ Mekong countries • Provide research grant to public health researchers/ young researchers • Technical assistance for research and academia facility staff and institutional development • Mentorship/coaching support and summer course opportunities for young researchers/graduates and postgraduate students • Technical and funding support for conducting research, or supporting joint research in collaboration with research institutes in the Asia-Pacific, Association of Southeast Asian Nations, or Mekong regions • Develop health and environment sector partnership • Strengthen public–private partnerships and government, non-government and international organizations in developing research capacity, and conducting joint research and publications • Support for translating the results into policy, proposal development and practical actions		

COMPONENT 6: Essential medical products and technologies

This component supports the adaptation of medical and health technology, construction of HCFs, WASH and energy provisions and promotion of new technologies to enhance climate resilience and contribute to long-term sustainability.

Strengthening universal access to health care, education, and safe water, and generally improving the standard of living for the population, are also basic tools for climate change adaptation.

Current situation

As in most countries, residents of rural areas in Lao PDR are at the greatest risk of being affected by climate change-related health issues. The lack of access to health services and limited availability of resources underpins the increased risk in rural areas [45]. In the northern mountainous provinces of Lao PDR, 70% of the population is comprised of poor households. These communities are primarily small, remote, and have limited access to roads, food, safe water supply, and sanitation; they also have a high reliance on natural resources for survival [46].

WASH services infrastructure is vulnerable to climate change effects. The National WASH Survey 2021 surveyed almost all HCFs in the country and found that 11% had been affected by extreme weather events (extreme heat, floods, droughts, etc.). Of these, some had experienced damage to non-structural elements (computers, diagnostic equipment and testing reagents), however a majority (56%) experienced severe damage, defined as damage to robust structural elements of the HCF (such as windows, doors and roofs) [40].

Improved WASH services are an important component of the government's strategic directions for the health sector. The National Plan of Action 2018–2030 sets the aim of basic services in 85% of HCFs by 2025 and relevant WASH-related policies, strategies, standards and regulations, and tools for implementation have been prioritized accordingly. For example, the Safe Clean Green and Climate Resilient Healthcare Facilities Initiative will help to improve the resiliency of hospitals to extreme weather events, supporting a win-win approach to save costs and reduce greenhouse gas emissions, and to achieve adaptation, risk reduction, and development benefits.

Adaptation options

The Climate Change and Health Adaptation Strategy defined objectives for this component to adjust the current infrastructure and technology, and to promote new technologies and operations. The adaptation options are focused on the activities of developing safe and green hospitals for existing HCFs and introducing climate-smart HCF standards for designing and constructing new HCFs.

TABLE 7. Adaptation options for the essential medical products and technologies component

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
Integrated interventional packages for making hospitals safe, clean, green and climate resilient					
Safe WASH in HCFs					
Extreme weather events such as extreme heat, floods, droughts, wildfires and storm surges	• Effects on WASH services • Effects on HCFs	**Specific objectives:** • Develop a road map for achieving SDG for climate change, WASH and health • Continue expanding the Safe Clean Green and Climate Resilient Healthcare Facilities Initiative	• Develop long-term plans/road map for providing basic level of WASH and health care waste management services for all HCFs • Support implementation and monitoring of the above-mentioned plans to achieve SDG for climate change, WASH, and health for 2023–2030 • Develop checklists for assessing progress of the implementation of the Safe Clean Green and Climate Resilient Healthcare Facilities Initiative and define gaps/ needs • Scale-up the Safe Clean Green and Climate Resilient Healthcare Facilities Initiative by developing criteria for model hospitals and giving awards/recognition to the best model hospitals each year • Define targets and select the HCFs to implement the Safe Clean Green and Climate Resilient Healthcare Facilities Initiative every year • Adopt the WHO guidance for climate resilient and environmentally sustainable HCFs [38] by integrating with existing training modules for promoting the Safe Clean Green and Climate Resilient Healthcare Facilities Initiative and continue to expand this initiative	Ministry of Health • Department of Hygiene and Health Promotion • Nam Saat • Nam Papa • Division of Health Information and Research • Provincial health departments • District health offices • All HCFs Development partners	7.1 million

Table 7. Adaptation options for the essential medical products and technologies component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
			• Capacity building and technical support for effective implementation and evaluation of the Safe Clean Green and Climate Resilient Healthcare Facilities Initiative • Train subnational and facility level teams in central and northern provinces • Set up a regular monitoring mechanism at facilities with monitoring sheet • Evaluate effectiveness of the integrated intervention packages • Organize experience-sharing workshop for other hospitals for expansion and share a case study		
Promote low carbon and environmentally sustainable health service					
Extreme weather events such as extreme heat, floods, droughts, wildfires and storm surges	Effects on health service, such as disrupting day-to-day operations and hindering the ability of HCFs to treat patients	**Barriers:** No standard for hospital infrastructure is available **Specific objectives:** • Develop a Safe Clean Green and Climate Resilient Healthcare Facilities Initiative standard • Consider the Initiative in the design and construction of new hospitals	• Develop hospital infrastructure standards as part of the Safe Clean Green and Climate Resilient Healthcare Facilities Initiative and link with accreditation indicators/score card for performance-based incentive system for health centres • Meetings and trainings for managers, planners and project developers to encourage them to use the climate-smart standards from design stage of hospital buildings	Ministry of Health Ministry of Public Works and Transport Relevant sectors Development partners	n/a

Table 7. Adaptation options for the essential medical products and technologies component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
Extreme weather events such as extreme heat, floods, droughts, wildfires and storm surges	Health co-benefit of climate change mitigation	**Specific objectives:** Promote low carbon and environmentally sustainable health service	• Awareness raising activities for managers, planners, procurement officers and staff on the use of environmentally friendly, energy efficient technology • Support and encourage smart procurement for supply, drugs, vaccines and equipment to reduce general waste (plastics) and other kinds of wastes (including hazardous chemical waste) • Climate-smart HCF standard should improve HCF design, energy efficient cooling, and ventilation • Continue to support the non-combustion technology use in hazardous waste management • Progressively introduce green mitigation measures in health programmes and project management	Ministry of Health Relevant sectors Development partners	n/a

COMPONENT 7: Management of environmental determinants of health

Climate change threatens health through many environmental determinants such as water, air and food quality, waste streams and chemical safety. The health sector does not usually have direct control over environmental determinants; however, it has an essential role to play at both the policy and programme levels in providing evidence and raising awareness, promoting joint monitoring of environmental exposures and outcomes, defining regulatory standards, and managing health risks. This requires active coordination and intersectoral planning.

Current situation

Health risks associated with environmental determinants of health are strongly influenced by socioeconomic determinants of health. High rates of poverty, low levels of education, high reliance on natural resources for livelihoods, and limited access to health care and clean water and sanitation greatly limit the capacity of individuals, households and communities to respond to climate change. Approximately 64% of the rural Lao population lack improved sanitation, and 40% do not have access to safe water [47].

Adaptation options

The Climate Change and Health Adaptation Strategy includes objectives to enhance multisectoral policy and actions to protect human health and management of environmental health risks by using legislation, standards, and health risk management. The Strategy promotes multisectoral coordination, joint planning, and sharing of information to manage environmental risk factors to health.

Key adaptation options for this component:

- Building climate resilient WASH systems, which requires multisectoral actions and long-term capacity building. As noted, a variety of health conditions are associated with poor WASH facilities.
- Strengthening capacity to tackle health impacts as a result of air pollution, whilst working on mitigation. A warming climate will worsen air quality [24]. If current emissions continue, ground-level ozone events are expected to intensify, especially in densely populated areas, leading to more respiratory illness [23]. In certain areas, the frequency and extent of wildfires and, with them, particulate matter emissions and other pollutants are projected to increase.

TABLE 8. Adaptation options for the environmental health determinants and management component

Climate hazards/ risks	Priority health risks	Specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
Safe WASH in urban and rural water supply systems					
Extreme weather events such as drought and water stress during dry season	• Water-borne diseases (diarrhoeal diseases) are high in dry season • WASH as a critical determinant of health	• Incorporate climate risk maps and seasonal trends in WASH and disease control programme in long term • Identify vulnerable population/areas for water shortage and implement WASH adaptation actions in those areas	• Update overarching WASH policy • Map districts, villages and HCFs vulnerable to water stress and flood • Update climate resilient WASH in HCF tool (based on existing WASH FIT) • Improve community knowledge of WASH practices, including education on household level water treatment and safe storage during high-risk season	Ministry of Health • Department of Hygiene and Health Promotion • Nam Saat • Nam Papa Ministry of Public Works and Transport Ministry of Natural Resources and Environment Development partners	n/a
Extreme weather events such as floods	• Water-borne diseases (diarrhoeal diseases) are high in dry season • WASH as a critical determinant of health	• Support the implementation of the Rural and Urban WASH Strategy and Action Plans • Explore additional funding support from climate finance	• Implement and develop a risk-based approach for improving WASH, medical waste, and HCF management to ensure regular functionality and resilient basic infrastructure in high-risk HCFs • Adopt the use of climate resilient WASH technology according to climate smart hospital standards • Train central, provincial and district Nam Saat staff on use of Climate Resilient Water Safety Plan for piped (Nam Papa) system • Train provincial and district Nam Saat staff in implementing water safety plan for small community water supply system	Ministry of Health • Department of Hygiene and Health Promotion • Nam Saat • Nam Papa • Division of Health Information and Research Ministry of Public Works and Transport	n/a

Table 8. Adaptation options for the environmental health determinants and management component (cont'd)

Climate hazards/ risks	Priority health risks	Specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
Water-related diseases surveillance					
Water stress	Water shortage and lack of functionality of WASH facilities in dry season	• Strengthen prevention and control measures of water-borne diseases in high-risk areas during the dry season • Climate-informed early warning system used to predict water-borne disease outbreaks	• Strengthen water quality surveillance and monitoring in high-risk provinces for both flood and storm in the wet seasons and drought and water shortage in the dry season • Strengthen water related diseases surveillance during the dry season • Improve community knowledge of WASH practices, including education at the household level on water treatment and safe storage during the dry season • Strengthen existing, successful WASH programmes, and strengthen partnerships between all WASH stakeholders	Ministry of Health • Nam Saat Village head Village WASH committee/team Community	n/a
Addressing health risks of air pollution					
Increased frequency of forest fire, longer hot dry season and increased number of mobile and stationary sources	Air quality pollution is increasing in dry season and leading to noncommunicable diseases	To tackle increased noncommunicable diseases: • Strengthen health sector adaptation capacity For mitigation: • Create enabling environment for cycling, walking, and land and waste management (bins) • Mitigate or reduce use of plastics • Increase awareness of harmful effects of air pollution and burning • Develop and implement a Clean Air Policy which includes policy to support clean energy, clean technology, and sustainable public transport	• Baseline assessment of health risks and air quality based on existing available data • Inventory study of climate/air pollutants • Expansion of air quality monitoring to high-risk provinces where hot spot (forest fire, slush burning, waste burning practices are common) detected (based on high risk map by Natural Resources and Environmental Research Institute, Ministry of Natural Resources and Environment) • Develop and implement Clean City (Healthy City) Action Plan that supports infrastructure for cycling, safe driving, walking and parking areas and provision of waste collection bins on streets of big towns	Ministry of Natural Resources and Environment • Natural Resources and Environment Research Institute Ministry of Health Multisectoral engagement and city governor office	n/a

COMPONENT 8: Climate-informed programmes

Many climate-sensitive health risks and health impacts, such as vector- and water-borne diseases and those related to extreme weather events and nutritional crises, are a Ministry of Health responsibility.

Current situation

The Climate Change and Health Adaptation Strategy and associated vulnerability assessment results indicated that water-borne diseases, WASH effects, noncommunicable diseases caused by heatwaves, air pollution and the subsequent increased demand of health services are current priority areas. The Ministry of Health operates surveillance systems for 17 communicable diseases and emergency response.

Adaptation options

The Climate Change and Health Adaptation Strategy includes the objective to develop plans for the creation and implementation of adaptation measures that target climate-sensitive diseases (such as dengue, water-related diseases, noncommunicable diseases caused by heat waves, malnutrition, neglected tropical diseases, and mental health) and increased demand of health service delivery with a focus on maternal and child health services, disease surveillance, and climate and environmental monitoring data.

Adaptation options give priority to noncommunicable diseases caused by heatwaves, as they are a current top priority.

TABLE 9. Adaptation options for the climate-informed programme component

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
Number of extreme hot, extreme dry, and hot days increasing	Heat-related medical conditions	Adaptation options give priority to noncommunicable diseases caused by heatwaves **Barriers:** Heat-related medical conditions are either underreported or misreported as noncommunicable diseases **Specific objectives:** Establish recording, reporting and early warning system for heat-related medical conditions (noncommunicable diseases)	For adaptation proposal development: • Assessment of linkage between climate/weather events and noncommunicable diseases, and heat warning and response system • Develop heat–health action plans, including early warnings, public communications, and responsive preventive measures for high-risk populations (elderly or with chronic conditions) • Develop public education programme/communication materials to promote positive behaviour changes with focus on protection of agricultural/ construction and outdoor workers	Ministry of Health • Department of Healthcare and Rehabilitation • Department of Hygiene and Health Promotion • Department of Health Personnel • Center for Health Statistics and Information Community and volunteers	n/a

Table 9. Adaptation options for the climate-informed programme component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
			• Develop guideline and tool for treatment of heat-related medical conditions • Develop and implement public education programming to promote positive behaviour changes (e.g. physical activity) • Develop evidence-based national guidelines on the management of noncommunicable diseases, and train health sector staff on their implementation		
Extreme heat	Health effects for outdoor workers including heat-related medical conditions	**Specific objectives:** • Protect outdoor workers • Protect agricultural workers	Establish occupational health exposure standards and monitor their implementation • Set up occupational diseases surveillance system (registration, reporting and compensation system) • Develop capacity on occupational hazards and risks assessment and control measures for agricultural and outdoor workers	Ministry of Health • Department of Hygiene and Health Promotion • Nam Saat Ministry of Labour and Social Welfare Lao Federation of Trade Unions Ministry of Natural Resources and Environment Ministry of Agriculture and Forestry Development partners including International Labour Organization and WHO	50K

Table 9. Adaptation options for the climate-informed programme component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
Drought	Malnutrition and undernutrition are high	**Specific objectives:** Food security and nutrition	For adaptation proposal development: • Strengthen nutritional surveillance to build knowledge of and data on malnutrition in the populations vulnerable to climate change • Perform seasonal nutritional screening in high-risk communities • Educate health professionals about food security and safety, nutrition, and food-borne diseases • Promote public education on food security, nutrition, and food hygiene • Scale up integrated food security, nutrition, WASH and health programmes in high-risk areas	Ministry of Health • Department of Hygiene and Health Promotion • National Center for Mother and Child Health • National Center of Nutrition • Nam Saat • Department of Health Personnel • Center for Health Statistics and Information	n/a
Dry/air pollution	Communicable diseases including neglected tropical diseases	**Specific objectives:** Strengthen the health sector's capacity to deal with circumstances expected during poor air quality	• Increase capacity to manage health service delivery with a focus on maternal and child health services • Strengthen disease surveillance and climate and environmental monitoring data • Develop and implement public education to increase awareness on harmful effects of air pollution and burning	Ministry of Health	n/a

Table 9. Adaptation options for the climate-informed programme component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
Extreme weather events	All priority health outcomes and climate-sensitive diseases of the H-NAP	**Barriers:** Limited awareness of community-based actions **Specific objectives:** Strengthening community-based actions in high-risk villages	• Assess community needs in randomly selected high-risk villages to flood/storm and heat wave • Develop publicly available, community-level education materials with adaptation scenarios for floods, storms, and heatwaves • Educate community members on disaster preparedness and response, particularly those living in high-risk areas • Disseminate public education messages through mass media • Promote awareness raising campaigns during national events (e.g. Boat Racing Festival, National Games) • Train village health volunteers on the use of public education materials	Ministry of Health Development partners Non-government organizations/ civil society organizations	n/a
Extreme weather events	Sudden increase of health service demand due to extreme weather events	**Specific objectives:** Improve staff and institutional capacity to assess and manage health services	• Collect information on climate-sensitive diseases and study what supply and equipment are needed • Develop list for essential back-up supplies and resources and resiliency capacity for health centre or district hospital	Ministry of Health • Food and Drug Department • Department of Hygiene and Health Promotion	n/a
Extreme weather events	Undernutrition and food insecurity	**Specific objectives:** Increase public awareness and knowledge on climate change impacts on food insecurity and associated health impacts	• Develop public education materials about climate change effects on food security and safety, nutrition, and food-borne diseases • Develop curriculum for primary, secondary, and high schools • Short-term on-the-job training and add in maternal and child health programme	Ministry of Education Ministry of Information, Culture and Tourism Lao Federation of Trade Unions Lao Women's Union Youth groups	n/a

COMPONENT 9: Emergency preparedness and management

Outbreaks and health emergencies triggered by climate variability are of primary concern. Climate-informed preparedness plans, emergency systems, and community-based disaster and emergency management are essential for building climate resilience.

Health operations, including for HCFs, and public health infrastructure related to water supplies, drainage, waste disposal and sanitation, telecommunications, energy supplies, and medical transport should be safe and functional during these types of extreme weather events. This includes the need for safe storage and transport of pharmaceuticals, vaccines, and medical equipment in extreme heat conditions. In addition to health-system specific safety protocols, a prepared, active, and well-organized community can reduce risks, save lives, and minimize the impact of emergencies.

Current situation

In 2018, Lao PDR experienced three major disasters. First, Tropical Storm Son-Tinh struck on July 18–19, followed by flash flooding from a hydropower dam that was under construction. Subsequently in the following month, the country was hit by Tropical Storm Bebinca. These events caused extensive damage, impacting 17 provinces and Vientiane Capital, affecting 616 145 individuals. Fifty-six people were confirmed dead, and over 1600 homes were damaged [19].

There was severe damage to health system infrastructure, undermining the ability to respond to increased health service demands. After Action Review recommended the development of a plan for national, provincial and district emergency response capacity building, including training and annual simulation exercises [20].

Adaptation options

The Climate Change and Health Adaptation Strategy supports the objective of ensuring that public health and community systems can deal with health risks through emergency preparedness and readiness. This objective is achieved through the development of short- and long-term plans for public health infrastructure to combat water-related diseases. Adaptation options for this component give priority to long-term plans for building stronger public health infrastructure for WASH and health care service delivery in high-risk HCFs prone to floods and tropical storms.

TABLE 10. Adaptation options for the emergency preparedness and management component

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
Extreme weather events such as flood/landslide/ tropical storm	All priority health outcomes and climate-sensitive diseases of the H-NAP, particularly increased injuries and deaths, effects on HCF infrastructure to continue provision of health services, WASH as determinants of health	**Specific objectives:** • Develop emergency response plan for HCFs • Strengthen mental health/psychosocial support for people affected by emergencies	• Emergency response plans for individual HCFs that can be defined and implemented in high-risk areas, in case of need • Develop a plan for national, provincial and district emergency response capacity building, including training and annual simulation exercises • Establish plans and standards for mental health/ psychosocial support assessment and response in emergencies, including mhGAP training in each province	Ministry of Health • Cabinet to collaborate with relevant departments	n/a
	All priority health outcomes and climate-sensitive diseases of the H-NAP, particularly WASH as determinants of health and increased cases of water-borne diseases	**Barriers:** Limited capacity in WASH response during emergency **Specific objectives:** Improve readiness capacity to make health care and water services available and safe to use during emergency response	• Improve coordination of WASH response and management at national, subnational, and local levels under supervision of the Cabinet, Ministry of Health • Improve hospital and health centre disaster preparedness, for example, by securing and stockpiling essential equipment and supplies • Prepositioned supply and equipment for WASH response at central Nam Saat and high-risk provinces that can include chlorine tabs, safe storage containers for drinking water, water quality tests for residual chlorine and E. coli, and basic supply for medical waste management	Ministry of Health	n/a

Table 10. Adaptation options for the emergency preparedness and management component (cont'd)

Climate hazards/ risks	Priority health risks	Barriers and specific objectives	Adaptation options	Implementing units	Estimated budget, US$, annual
			• Public education materials including instructions for proper use of chlorine tab, advice on water filtering or boiling methods and safe storage for clean water • Training of technical staff who can undertake health rapid assessment to know urgent needs • Training in WASH rapid assessment to inspect HCF and community WASH facilities • Trained managerial staff who can manage, coordinate and monitor all WASH responses on the site to be ready to respond to emergencies • Vaccines (typhoid and dysentery) for water-borne diseases should be prepositioned in areas at high risk to water-borne diseases outbreak		

COMPONENT 10: Climate and health financing

Health planning and management teams should consider funds a) to maintain core health care and public health services such as water, sanitation, environmental hygiene, disaster and health emergency preparedness and b) to access climate change specific funding mechanisms for effectively building the resilience of the system.

Current situation

In Lao PDR, general government health care spending is less than 1% of gross domestic product [48]. With a rise in the gross domestic product, educational services have expanded over the past decade, however, there has been a less pronounced expansion in the health care sector [49]. There are four government health insurance schemes that cover only 13.7% of the total population. The remaining 86.3% of the population are uninsured [21].

A compounding factor is Lao PDR's heavy reliance on overseas development assistance, which makes it difficult to create and maintain sustainable programmes that can be implemented by the Lao people. An estimated 70% of public investment is financed by outside resources [44].

Opportunities are now becoming available to mobilize additional resources specifically to address the additional risks presented by climate change, including for health. At the international level, the main multilateral mechanisms are mandated under the UNFCCC and the Kyoto Protocol, promoting financial assistance from more developed parties to those countries deemed more vulnerable and with fewer resources available to adapt to climate change. Parties to the UNFCCC have mandated that the Global Environment Facility is to manage the Special Climate Change Fund and the Least Developed Countries Fund, established by the Adaptation Fund under the Kyoto Protocol and recently supported by the Green Climate Fund [50].

In addition to the main international climate change specific funding mechanisms, funding is also available through bilateral and regional channels.

Adaptation options

The Climate Change and Health Adaptation Strategy has goals to raise the funds for resolving the health risks from climate change by investing in relevant sectors and facilitating funding support from international organizations to implement climate change and health care operations.

Adaptation options for this component give priority to proposal development for health sector adaptation projects to access the climate change funding mechanisms with support from international organizations.

TABLE 11. Adaptation options for the climate and health financing component

Barriers	Specific objectives	For climate adaptation/resource mobilization	Budget (Yes), if added in annual workplan for (Year)
Health sector has limited funds to implement the adaptation options stated in the H-NAP	Maintain core health care and public health services	• Build on core investments in the health sector with support from national resources or external donors • These investments provide support to ensure that adequate numbers of health personnel are trained, and basic health infrastructure and services are available, which also helps to address climate change risks	
	Explore opportunities for leveraging additional climate change adaptation funding	• H-NAP will be linked and coordinated with the National Adaptation Plan (Ministry of Natural Resources and Environment, 2019) for long-term capacity building and implementation • This H-NAP will be used in incorporating health priority projects and adaptation options into the country's cooperation strategic plan for the Green Climate Fund developed by the Ministry of Natural Resources and Environment • Explore and harness opportunities for climate change mitigation and adaptation financing, which includes a feasibility assessment, proposal development, stakeholder consultation, and technical support Note: Annex 4 provides additional information about the international climate funding mechanism (Green Climate Fund, Global Environment Facility, Adaptation Fund)	

PART 5. H-NAP implementation strategy

5.1 Coordination mechanisms

The health adaptation planning process should be aligned with the national process for the National Adaptation Plan.

Coordination is important for success and developing the H-NAP is a process that needs to be embedded within the existing national health plan development processes, rather than as an independent process. Climate variability and change will mainly alter the burden of diseases and other public health conditions that already affect the country. The 9th HSDP has been guided by local SDGs and health sector reform with a focus on universal health coverage.

Enhancing cross-programme coordination and addressing health determinants by multisectoral actions is one of the key objectives of the 9th HSDP. Thus, the H-NAP has been developed to be incorporated into the 9th HSDP and complement specific public health programmes such as the Rural and Urban WASH Strategy and Action Plans, the noncommunicable and communicable diseases control and prevention programmes, and the nutrition programmes. These strategies and action plans need to build resilience through integration with existing programmes at the respective operational levels.

5.2 Operational planning

National advocacy and planning:

H-NAP is designed to be used for annual operational planning. In August 2023, the Department of Hygiene and Health Promotion (Ministry of Health) conducted a workshop with over 70 participants from various departments, divisions and technical units of the health sector and environment, water and other key sectors (details are available in Annex 2). Participants identified priority objectives, adaptation strategies and actions for the Ministry of Health and the national health centre's implementation. The selected priority adaptation plans for 2023–2025 can be used for Ministry of Health and development and government partners' workplans.

Provincial advocacy and planning:

The Department of Health and Hygiene Promotion jointly with WHO Lao office conducted two workshops for advocacy and developing operational plans for all provincial divisions of hygiene and health promotion and Nam Saat. A northern provincial workshop was held in Luangprabang with participants from all northern provincial health departments and Nam Saat staff. Southern provincial health department representatives had a meeting in Savannakhet on 17–23 September 2023.

In general, each provincial health department discussed climate change and health effects and local challenges to adapt to and identified priority components from 10 operational frameworks and strategic objectives. They developed implementation plans for the effective implementation of the adaptation actions that they selected from the H-NAP. The implementation plan includes what to adapt, and who, when, and where to implement the adaptation actions for inclusion in the provincial health department's workplan for 2023–2025.

Table 12 summarizes priority adaptation measures selected by stakeholders for inclusion in the national/Ministry of Health workplan and implementation in 2023–2025.

TABLE 12. Summary table of the H-NAP 2023–2025 implementation plan

Priority health outcome	Selected H-NAP adaptation strategies and actions	H-NAP component	Key implementer	Timeframe		How to implement (adding in existing programme)	Possible funding and technical support/ development partner support
				2023	2024–2025		
All priority health outcomes and climate-sensitive diseases of the H-NAP	H-NAP operationalization, implementation, and monitoring: - Finalize Lao version and editing - Approval by end September - Committee: Ministry of Health (Department of Hygiene and Health Promotion; Department of Planning and Finance; Department of Health Personnel; Department of Healthcare and Rehabilitation; Center for Health Statistics and Information), Ministry of Education, Ministry of Home Affairs, Ministry of Natural Resources and Environment, Ministry of Public Works and Transport, Ministry of Labour and Social Welfare, Lao Federation of Trade Union - Dissemination meeting for regions from Sep to Dec 2023	1 - Leadership and governance	Ministry of Health • Department of Hygiene and Health Promotion	Endorsed by end of year 2023 Dissemination in provinces from Sep to Dec 2023	Implementation starts	By establishing coordination committee	WHO

Table 12. Summary table of the H-NAP 2023–2025 implementation plan (cont'd)

Priority health outcome	Selected H-NAP adaptation strategies and actions	H-NAP component	Key implementer	Timeframe		How to implement (adding in existing programme)	Possible funding and technical support/ development partner support
				2023	2024–2025		
Damages to WASH in HCFs	Safe Clean Green and Climate Resilient Healthcare Facilities Initiative - Supply and equipment of cleaning and disinfection materials (Chlorine) to be developed - Training on WASH FIT	9 - Emergency preparedness and management	Ministry of Health • Department of Hygiene and Health Promotion • Nam Saat • Division of Health Information and Research	Continue the implementation of the Initiative	Continue the implementation of the Initiative	Budget plan Annual plan	WHO Development partners
Sudden increase of health service demand for extreme weather events	- Collect information on climate-sensitive diseases and what supply and equipment is needed - Develop list for essential back-up supplies and resources and resiliency capacity for health centre or district hospital	9 - Emergency preparedness and management	Ministry of Health • Food and Drug Department • Department of Hygiene and Health Promotion	Draft to be ready by Dec	June 2024, approval given in Q1 Implementation starts from Q2 2024	Budget plan Annual plan	WHO Development partners
Undernutrition and food insecurity from extreme events	- Develop public education materials about climate change effects on food security and safety, nutrition, and food-borne disease (target is community using participatory approach) - Develop curriculum for primary, secondary, and high schools - Short-term on-the-job training and add in maternal and child health programme	8 - Climate informed health programmes	Ministry of Education Ministry of Information Culture and Tourism Lao Federation of Trade Unions Lao women's union youth group	Adding in annual work plan for 2023	2024 annual work plan	Add into annual workplan of Ministry of Health and Ministry of Education Add into primary, secondary and high school curriculum	Require technical assistance and funding support from development partners

Table 12. Summary table of the H-NAP 2023–2025 implementation plan (cont'd)

Priority health outcome	Selected H-NAP adaptation strategies and actions	H-NAP component	Key implementer	Timeframe		How to implement (adding in existing programme)	Possible funding and technical support/ development partner support
				2023	2024–2025		
Heatwaves	- Strategy development - Guideline and tool for treatment of health-related medical conditions - Develop public education programme/ communication materials to promote positive behaviour changes with focus on protection of agricultural/construction and outdoor workers	8 - Climate informed health programmes	Ministry of Health • Department of Hygiene and Health Promotion • Department of Healthcare and Rehabilitation • Center for Health Statistics and Information • Division of Health Information and Research • National centres Ministry of Labour and Social Welfare National University of Health Sciences	Technical working group, Oct 2023	Implementation starts in 2024	Budget plan Annual plan	Require technical assistance and funding support from development partners
Vector-borne disease (dengue)	- Continue establishing early warning system for dengue - Develop response protocol/SOPs for timely response for climate-sensitive diseases including dengue	4 - Integrated risk monitoring and early warning	Ministry of Health • Center for Health Statistics and Information • Department of Communicable Diseases and Control • National Center for Laboratory and Epidemiology • Center for Malariology, Parasitology and Medical Entomology	Piloting the automated weather data transfer into DHIS2	Piloting the automated weather data transfer into DHIS2	Budget plan Annual plan	WHO

5.3 H-NAP financing strategy

5.3.1 Cost estimates for H-NAP actions

An implementation strategy for operationalizing the H-NAP and integrating climate change adaptation into health-related planning processes at all levels should be developed, including enhancing the capacity for conducting future H-NAP.

The H-NAP offers the opportunity to ensure that the health risks of climate change are considered in health planning from a national to local scale.

5.3.2 Financing in Lao PDR

Internal funding sources

The H-NAP is linked with the National Adaptation Plan, from the Ministry of Natural Resources and Environment (revision in draft), in Lao PDR for long-term capacity building and as guided by the National Climate Change Strategy. The National Climate Change Adaptation Plan has been included in the 9th Socio-economic Development Plan, which is guided by the goal of graduating from low-middle-income status by 2024.

The H-NAP has been developed as part of the 9th HSDP aim to support adding climate change into existing public health programmes, plans, and strategies, which should improve access to central and local government funds.

External funding sources

The H-NAP includes an activity to develop a resource mobilization plan. This plan provides the opportunity to identify key external funding sources to target as well as the best way to access funds. Health, climate change, rural water and sanitation, food security, nutrition, and climate-related intersectoral funding streams should be included in the resource mobilization plan.

5.3.3 Potential funding sources

Development partners, including bilateral donors, multilateral and United Nations organizations, and non-government organizations contribute a large proportion of climate finance and may be approached for initial funding to begin implementation of the H-NAP.

The **UNFCCC** has some financing mechanisms that are a significant international source of adaptation funding. The two funds (Adaptation Fund and Green Climate Fund) have different rules and access mechanisms.

The **Green Climate Fund** is a new global fund within the UNFCCC mechanisms, created for climate change adaptation and mitigation.

The **Adaptation Fund** was established by the parties to the Kyoto Protocol of the UNFCCC to finance concrete adaptation projects and programmes in 45 developing countries that are parties to the Kyoto Protocol.

The **Global Environment Facility** is an international partnership of 183 countries, international institutions, civil society organizations, and the private sector that aims to address global environmental issues. Funds are available to developing countries, and countries with economies in transition, to meet the objectives of the international environmental conventions and agreements. Two funds under the Global Environment Facility are the Least Developed Country Fund and the Special Climate Change Fund.

Finally, the **World Bank** and **other development banks** have climate funding streams which can be accessed for H-NAP implementation and adaptation actions. The Health and Nutrition Services and Access Project Phase II (HANSA II) (Ministry of Health, World Bank, Global Fund, Department of Foreign Affairs and Trade, Gavi) will support the implementation of the H-NAP by mainstreaming climate change and health adaptation measures into primary health care service delivery, management of infectious wastes, and strengthening health information systems to provide disaggregated health-related data of vulnerable populations living in natural disaster-prone areas.

Other international funding agencies are listed in Annex 4.

5.3.4 Coordination

Coordination and synergy with the National Adaptation Plan process should be promoted, particularly with sectors that can affect health and with multilateral environmental agreements.

This effort includes coordinating adaptation plans of health-determining sectors within the overall National Adaptation Plan process and linking the H-NAP with regional and national health planning processes and multilateral environmental agreements.

Coordination with health-determining sectors is critical to identify potential synergies and promote health co-benefits. An option to ensure this coordination is the inclusion of health indicators within the monitoring programmes of those sectors. Further details on indicators are available under the WHO *Operational framework for building climate resilient health systems* [41]. Ensuring that implementation is coordinated across sectors will help to avoid overlapping and maximize efficiency in health gains from adaptation and mitigation. Proper planning and budgeting of these activities will be needed.

PART 6. H-NAP monitoring and evaluation

6.1 H-NAP review process

The main goal of the H-NAP review is to assess progress, effectiveness and gaps.

Managing the health risks of climate change will require regular revision of the H-NAP to take into account experience gained with implementing adaptation options, new knowledge, understanding of climate variability and change and its health risks, and changes in, for example, institutional structures, available technologies, and demographics.

The Lao PDR H-NAP process could be revised every five years. The H-NAP is a flexible document. Major changes and updates can be done every year during operational planning as part of an annual review. Suggested changes and necessary revisions could be done based on conclusions and approaches to adaptation measures, the development of breakthrough technology in disease control, new climate change projections, or changes in vulnerability.

6.2 H-NAP reporting

Reporting on progress and effectiveness should be agreed to by stakeholders. The report should include the time frame, progress made on implementation, main milestones, target indicators, lessons learnt, challenges, solutions, and action plans for the following years. The report can attach detailed information such as generated data, assessment findings, synthesis report, developed communication materials, and decisions made.

Finally, reporting the relevant health processes and programmes is key to ensuring the successful mainstreaming of health adaptation to climate change. Reporting to WHO will facilitate global monitoring, reporting and outreach based on the indicators selected at the national level.

6.3 Monitoring and evaluation plan (2018–2030)

Climate-relevant health indicators should be integrated within the national health information system (DHIS2).

Baseline and target indicators are shown in Table 13 below.

TABLE 13. Baseline and target indicators

Sector/components	Baseline indicators	Target indicators	Information sources
Health sector leadership			
H-NAP developed and operational	0	1	Document review, Climate Change and Health Adaptation Strategy
Vulnerability, capacity and adaptation assessment			
Climate and health data linked and integrated with DHIS2	0	1	DHIS2 report
H-NAP linked and coordinated with National Adaptation Plan	0	1	National Adaptation Plan and H-NAP documents
Integrated risk monitoring and early warning			
Climate and health data linked and integrated with DHIS2	0	1	Ministry of Natural Resources and Environment: Department of Climate Change report
Intersectoral mechanism for sharing climate, weather and health, and environmental monitoring data	0	1	SOPs
Number of partnership programmes and joint research			
Number of joint research proposals and studies developed or conducted to assess climate and health impacts	0	1	National University of Health Sciences report
Health workforce development			
Academic training programme on climate change and health developed	0	1	National University of Health Sciences report
Short-term on-the-job training to enhance capacity on climate change and health adaptation	0	1	Ministry of Health: Department of Hygiene and Health Promotion and Nam Saat reports
Climate informed programmes			
Climate risks added in the current water-borne disease surveillance and community-level early warning messages	0	1	Ministry of Health: Department of Communicable Disease Control, Center of Malariology, Parasitology, and Entomology, and Nam Saat reports
Management of environmental determinants of health			
Number of HCFs joining the Safe Clean Green and Climate Resilient Healthcare Facilities Initiative	70	20 HCFs every year	Ministry of Health: Department of Hygiene and Health Promotion reports
Essential medical products and technologies: Urban and rural water supply systems			
Number of climate resilient water safety plans developed and operational	34	10 annually	Reports from Department of Water Supply, Ministry of Public Works, and Transport and Nam Saat, Ministry of Health
Emergency preparation and management			
Number of HCFs developed emergency response plan/ annual	1	20 HCFs every year	Country case study: Lao PDR National WASH Survey 2021
Climate and health financing			
Number of project proposals submitted to international climate fund	3	2 concept notes/ annual	Ministry of Health: Department of Planning and Finance and Department of Hygiene and Health Promotion reports

Annexes

Annex 1. Proposed climate change and health stakeholders

Stakeholders name
Central government: Ministry of Health Ministry of Natural Resources and Environment Ministry of Public Works and Transport
National institutes: National Centre for Environmental Health and Water Supply (Nam Saat) Center for Nutrition Center for Malariology, Parasitology and Medical Entomology National Center for Laboratory and Epidemiology National University of Health Sciences
Subnational institutions: Provincial and district health offices HCFs at central, provincial, and district levels Health centres, outreach service providers, and health volunteers
Community-based organizations: Non-government organizations, women's union, youth union, and community
Entities from private sector that can support the following: • Clean-green technology • Climate resilient technology and engineering solutions in health and WASH systems • Carbon credit financing system
International organizations: Development partners Climate finance/funding agency

Annex 2. Stakeholder engagement

- **Inception meeting and road map**: On 14 August 2019, a one-day workshop was held in Vientiane Capital with stakeholders. During the meeting, H-NAP guidance and key components of the National Adaptation Plan were discussed with stakeholders. The workshop was hosted by the Department of Hygiene and Health Promotion (Ministry of Health) with technical support provided by the WHO Lao country office and the regional coordinator of the health and environment programme, WHO Western Pacific Regional Office. Global Environment Facility provided funding support for the meeting.
- **Stocktaking exercise and prioritization:** Priority areas for health adaptation planning were defined by the Department of Hygiene and Health Promotion based on the results of the vulnerability assessment conducted in 2017–2019. Priority areas were presented by respective technical units during the workshop. Some gaps and barriers such as multisectoral coordination, data sharing, lack of linkage between climate and health data, vulnerability assessment and adaptation assessment capacity, and further adaptation options were discussed. Timeline for finalization of the draft H-NAP document was agreed to.
- **Local consultation:** A second stakeholder consultation meeting was held in Savannakhet province, including representatives from Sekong Provincial Health Department, to get input from local stakeholders on the draft H-NAP and discuss adaptation options and its application in local and cultural context.
- **Experts' consultation and development of H-NAP:** International and local experts were engaged in the development, consultation and review process. All adaptation options were picked up from WHO guidance documents, case studies, document review and government and development partners' technical reports and recommendations. Priority plans and priority adaptation options were selected based on documented best-practice examples. A WASH experts' technical consultation meeting was held in Vientiane Capital in mid-August 2021 to share experiences and lessons on climate resilient water and sanitation technology. A list of climate resilient water and sanitation technology was developed based on the experts' guidance and Water Safety Plan. The list can be found in Annex 3.
- **Central government stakeholders' consultation meeting:** Undertaken by the Department of Hygiene and Health Promotion and WHO in September and November 2022. Discussion focused on building awareness for both health care workers and the community.
- **Multisectoral stakeholders' training workshop:** A two-day training workshop was conducted for managers of public health programmes and policy-makers of climate change, environment, water, meteorology and health sectors on 17–19 July 2023, with technical support. A total of 66 people participated. They identified priority adaptation measures and developed detailed implementation plans for 2023–2024. World Bank and WHO technical staff and consultants facilitated the group work.
- **Advocacy and high-level consultation:** A half-day consultation meeting with attendance of high-level officials was conducted on 4 August 2023, under the leadership support of Dr Snong Thongsna, Vice Minister of Health, Dr Phonepaseuth Ounaphom, Director General of Hygiene and Health Promotion and Dr Ying-Ru Jacqueline Lo, WHO Representative to Lao PDR. Over 60 people attended; mostly deputy directors of technical divisions and departments

of health, air pollution monitoring, water and meteorology, climate change sectors and directors of health institutes for water, sanitation, environmental health, communicable and noncommunicable disease surveillance, health care service, rehabilitation, nutrition, mother and child health, and emergency preparedness and health education of the Ministry of Health. The World Bank, Asian Development Bank, Save the Children and WHO technical officers and consultants participated and worked as facilitators of the group work. The H-NAP was presented and the implementation plan was finalized for 2023–2024 to manage various climate-related health impacts and agreed by all participants.

- **Finalization, review, translation and editing:** The H-NAP draft was finalized by WHO technical staff in consultation with the Department of Hygiene and Health Promotion and Nam Saat technical staff. Translation and editing in both English and Lao versions were done by the Ministry of Health and WHO technical staff.
- **Provincial advocacy and planning:** The Department of Hygiene and Health Promotion with WHO Lao country office conducted two workshops, in Luangprabang for North and Savannakhet for South. These resulted in undertaking advocacy and developing operational plans for all provincial hygiene and health promotion divisions and Nam Saat. All provincial health department representatives developed their operational plans for inclusion in the provincial health department's workplan and development partners' workplan for 2023–2024.
- **Communication:** A summary of the H-NAP is posted on the website of the WHO Lao country office. Communication and awareness raising material have been developed and posted on social media.

Annex 3. List of climate resilient water and sanitation technologies

TABLE A.1. Climate resilient water and sanitation technologies

Category	Water technology [51]	Sanitation technology [52]
Category 1: Potentially resilient to all expected climate changes	• Utility piped water supply Note: Plumbing should not have any cross connections; after an adverse event where water quality is compromised, treatment should be used and water system flushed. • Tubewells	
Category 2: Potentially resilient to most expected climate changes	• Protected spring • Small piped water supply system	*Medium resilient* • Modified sewerage (small bore and shallow sewers) Note: Some adaptive capacity; vulnerable to flooding though less vulnerable to reduced water availability than conventional sewerage.
Category 3: Potentially resilient to only a restricted number of climate changes	• Dug well • Rain water harvesting system	*Low to medium resilient* • Septic tank Note: Some adaptive capacity; vulnerable to flooding and drying environment. • Conventional sewerage (combined sewers, gravity sewers) • Fecal sludget treatment Note: Some adaptive capacity; vulnerable to increases/decreases in water availability; reduced carrying capacity may increase sludge treatment requirements.
Technologies categorized by JMP[1] as unimproved drinking water sources [53]	• Unprotected dug well • Unporetcted spring • Carts with small tank or drum • Surface water • Bottled water	
Household water treatment and safe storage including raised water storage tanks	• Boiling • Filters (ultra or nano membrane filter) • Solar chlorine (for non-turbid water) • Coagulation/flocculation • Higher performing technologies (see WHO table that includes two- or three-stars technologies including membrane filters, UV and coagulants/flocculants[2]) are recommended for vulnerable groups Note: Technologies should meet one of WHO's performance categories [54].	• Bathroom showers and sprayers should have backflow protectors to prevent blackwater or fecal matter entering system
Back-up water and power supplies	• Back-up water supplies in event of drought, flooding, power outages • Use of renewable power (e.g. solar)	

[1] JMP = WHO/UNICEF Joint Monitoring Programme.

[2] Water sanitation and health: Products evaluated. World Health Organization. https://www.who.int/tools/international-scheme-to-evaluate-household-water-treatment-technologies/products-evaluated

Annex 4. International climate funding

1. The **Green Climate Fund** is a new global fund within the UNFCCC mechanisms, created to support the efforts of developing countries to respond to the challenge of climate change with both mitigation and adaptation actions.
2. The **Adaptation Fund** was established by the parties to the Kyoto Protocol of the UNFCCC to finance concrete adaptation projects and programmes in 45 developing countries that are parties to the Kyoto Protocol.
3. The **Global Environment Facility** is an international partnership of 183 countries, international institutions, civil society organizations, and the private sector that aim to address global environmental issues.
4. Two funds under the Global Environment Facility are the Least Developed Country Fund and the Special Climate Change Fund.
    a. The **Least Developed Country Fund** was established to assist least developed countries to take quick actions including implementing projects identified under the National Adaptation Programme of Action to Climate Change [5].
    b. The **Special Climate Change Fund** supports adaptation and technology transfer in all developing countries party to the UNFCCC. The Fund supports both long- and short-term adaptation activities in water resources management, land management, agriculture, health, infrastructure development, fragile ecosystems (including mountainous ecosystems), and integrated coastal zone management.

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