

Health Sector Capacity to Manage Climate Change in the Lao People's Democratic
Republic: Perspectives from Key Stakeholders

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Abstract

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Rationale: Climate change in the Lao People's Democratic Republic (Lao PDR) is leading to increases in temperatures and changes in rainfall patterns, a trend that is expected to accelerate in the coming decades. Weather unpredictability has become the norm resulting in an increase in frequency and intensity of extreme weather events, particularly floods and drought. Climate change and variability in Lao PDR has both direct and indirect impacts on human health and puts added strain on the health system.

Objective: This mixed methods study aims to assess the perceptions of climate change and its impacts on the health system in Lao PDR from key stakeholders in health and other relevant institutions and government ministries, as well as identify the barriers and opportunities of the health sector capacity to manage climate change in the coming decades.

Methods: Using a structured questionnaire (n=26) and semi-structured in-depth interviews (n=7), this study collected data on how key stakeholders view the health sector capacity to manage climate change in Lao PDR. Descriptive statistics from quantitative data were computed, described, and compared based on predefined themes. Interviews were recorded, transcribed and analyzed using Dedoose.

Results: 88% of participants think climate change is occurring in Lao PDR and 69.2% reported they felt health facilities were somewhat prepared for a flood event. Themes from the interviews revolved around limited human resources and budget as a major barrier to implementing climate change and health adaptation programs. Improved coordination was expressed as a significant opportunity.

Conclusion: 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 sectors capacity to manage climate change. Moving forward, coordination across sectors will be key in the development of successful climate and health adaptation programs in Lao PDR.

Keywords: Climate change adaptation, climate and health, Lao PDR

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List of Acronyms

CCA	Climate Change Adaptation
CL-SWASH	Community Led-Schistosomiosis Water, Sanitation, and Hygiene
CMPE	Centre for Malaria Parasitology and Entomology
DDMCC	Department of Disaster Management and Climate Change
DHHP	Department of Health and Hygiene Promotion
DHM	Department of Hydro-Meteorology
EOHD	Environmental and Occupational Health Division
GEF	Global Environment Facility
GoL	Government of Lao
H-NAP	Health-National Adaptation Plan
INDC	Intended Nationally Determined Contribution
LMIC	Low-and-Middle-Income Countries
MoH	Ministry of Health
MoNRE	Ministry of Natural Resources and Environment
NamSaat	National Centre for Environmental Health and Water
NAPA	National Adaptation Program of Action
NDMC	National Disaster Management Committee
NSCC	National Strategy on Climate Change
ToT	Training of Trainers
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization

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Introduction

Climate Change Impacts on Health in Lao PDR

Climate change in the Lao People's Democratic Republic (Lao PDR) is leading to increases in temperatures and changes in rainfall patterns.^{1 2} These trends are expected to accelerate in the coming decades. Weather unpredictability has become the norm. Rainfall variability is a critical issue for rural livelihoods that depend primarily on agriculture.^{1 3} Dry seasons are getting longer while rainy seasons tend to be shorter and more intense. Annual mean temperatures vary from 20-27° C and are projected to increase by approximately 1.4-4.3° C by 2100.^{2 3} Extreme weather events including cyclones and storms are also expected to occur more frequently, resulting in increased risks of flooding. There is also evidence of an increasing risk of flash floods in mountainous areas across all provinces.¹ Rural populations, which account for about two thirds of the total population, are most affected by these changing weather patterns.¹

Climate change has direct and indirect impacts on the biological, psychological and social health of individuals and communities. Health impacts of climate change include those caused by extreme weather events such as heat waves, floods, droughts and storms. Other effects relate to changes in temperature, rainfall and air quality and include an increasing risk of communicable diseases (including emerging and re-emerging diseases), food- and water-related diseases, non-communicable diseases, and effects on mental health.⁴

Vulnerability to the health impacts of climate change is dependent on a multitude of factors. These include (but are not limited to) poverty, poor standards of health, limited access to health care, low levels of education, sub-standard housing, malnutrition, poor access to water, sanitation and hygiene services, and substantial dependence on the river basin for crop production and, hence, food supply and income. In 2010-2011 a climate change and health vulnerability assessment conducted in Lao concluded that waterborne diseases, especially dysentery and typhoid, remain a significant source of morbidity, with the health burden expected to increase with climate change.⁵ Vector-borne diseases, particularly dengue, are also expected to increase. Other potential impacts include injury and possible death due to extreme weather events, such as storms and flash floods. Agricultural losses due to changing weather patterns will affect food security, putting rural populations at risk of under-nutrition.¹

Policy Context (Health Sector and Climate Change Support Programs in Lao PDR)

In recent years an increasing amount of attention has been paid to climate change and its potential affects in Lao PDR, as evidence from the development of a range of strategies and action plans at the national level. Most are not specific to health, but have close links with disease prevention and management.

The Lao People's Democratic Republic ratified the United Nations Framework for Convention on Climate Change (UNFCCC) in 1995, the Kyoto Protocol in 2003, and

signed the Paris Agreement in 2016. The Climate Change Office, Ministry of Natural Resources and Environment (MoNRE), was established in 2008 to serve as the secretariat of the National Steering Committee on Climate Change, since replaced by the National Environment Committee. It acts as the national focal point on climate change actions and initiatives, and coordinates a number of the national government's activities related to the UNFCCC. Technical working groups represent various at-risk sectors.

In 2010 the Government published the National Strategy on Climate Change of the Lao People's Democratic Republic (NSCC), describing risks and adaptation options including in the area of public health. Its focus was water and sanitation, communicable diseases, awareness raising, and streamlining and strengthening existing programs and structures.¹

Based on the 2010 Strategy on Climate Change, the Government of Lao (GoL) developed a National Adaptation Program of Action (NAPA), which focused on short-term immediate and urgent needs.^{1 6} The NAPA detailed four key initiatives including, 1.) Strengthening institutional and human resource capacities on climate change 2.) Enhancing adaptive capacity for coping with climate change 3.) Climate change mitigation through the reduction of greenhouse gas emissions 4.) Strengthening education and improving public awareness of climate change.^{1 6} Population health was identified as one of the key sectors most affected by climate change.^{1 7 8} The two key areas of public health were broadly addressed and included increased resilience of rural water supply systems to climate change and improved public health services for climate change adaptation.

In 2013, Lao PDR completed the UNFCCC Second National Communication on Climate Change as well as a Climate Change Action Plan of Lao PDR for 2013-2020.^{7 9} The purpose of the Action Plan, which was developed by MoNRE, is to identify key initiatives and outline proposed projects and activities relevant to climate change adaptation in Lao PDR. Moreover, the Action Plan is intended to guide various groups working on climate change mitigation and adaptation, including central and local government agencies, the private sector, non-government organizations, and other groups. With regard to public health, the Action Plan outlines key focus areas that include: a) increasing the resilience of rural water supply systems to climate change b) improving public health services for climate change adaptation c) improving and developing systematic drinking water management and sustainable sanitation d) promoting participation by the community in drought and flood areas.⁷

Finally, in 2015 Lao PDR completed its Intended Nationally Determined Contribution (INDC), which in line with previous strategies aims implement mitigation and adaptation activities.¹⁰ The cross-ministerial National Disaster Management Committee (NDMC) oversees the overall implementation. Public health again was highlighted as a key sector with the main objectives matching that of the Action Plan, NAPA, and NSCC.

Despite the various governmental commitments to climate change adaptation, progress within the health sector has been slow. Building a climate resilient health system and health care facilities are important measures to promote adaptation. In response, the Lao PDR Ministry of Health (MoH) along with other relevant key stakeholders, are exploring

strategies to increase resilience of the health sector to prepare for and respond to health outcomes associated with weather and climate.

Study Aims and Objectives

In support of the Lao PDR MoH and the World Health Organization (WHO) country office, this study collected data with the fundamental purpose of better understanding the climate change adaptation process in the health sector in Lao PDR, including its capacity to manage climate change in the coming decades from the perspective of key stakeholders.

Based on a review of the literature, as well as previous assessments, the specific aims of this study include:

- To assess perceptions of climate change and its impacts on the health system in Lao PDR from key stakeholders in health and other relevant institutions and government ministries.
- To identify the barriers and opportunities of the health sector capacity to manage climate change in the coming decades.

Building off of these aims, the objectives of this study will focus on climate change knowledge, as well as climate change and health adaptation strategies with the hope of providing useful feedback to the Lao PDR MoH. Specific objectives include:

- To describe and compare climate change knowledge and climate change adaptation strategies and policies using a questionnaire and in-depth, semi-structured interviews with key stakeholders in health and other relevant government institutions.
- To make recommendations on how climate change and health adaptation strategies could be improved and capacity gaps can be addressed in the health sectors' ability to adapt to climate change in Lao PDR.

Literature Review

The link between climate change and human health has been well defined, with an understanding that the effects of climate change on health will affect most populations and will put the lives of potentially billions of people at an increased risk.^{11 12 13} Climate-sensitive diseases such as vector-borne disease, diarrheal disease, heat-related illness, injury from extreme weather events, respiratory illness, highlight the predicted increased impact on morbidity and mortality globally in the coming decades.^{14 15 16} High-income countries are and will continue to feel these impacts, however low-and-middle income countries are considered to be the most at-risk and ill prepared to address the increased burden of disease due to climate change.^{17 18}

In response to the evidence of public health concerns related to climate change, there has been a growing focus on what can be done to prepare both the general public and the professionals tasked with protecting the health of a population.^{19 20 21} A significant amount of research has been done on public health adaption to climate change including practical adaptation approaches to addressing climate-related health risks, community-based adaptation, risk assessment and management, integrating climate change adaptation into public health practice, increasing adaptive capacity of health systems, and building resilience to climate change.^{22 23 24 25 26 27}

Additionally, there has been a push to incorporate public health into national adaptation planning. The WHO provides operational frameworks and guidance documents that outline steps for the successful development of Health-National Adaptation Plans (H-NAP) for low and middle-income countries, including lessons learned for integrating health into adaptation strategies.^{28 29 30}

On a global scale the barriers and constraints to successful climate and health adaptation and/or integration of climate change into public health practice have been well documented.^{13 29 31} Further, a variety of studies have explored public health adaptation to climate change (barriers and opportunities) from the perspective of key stakeholders such as public health directors and community members, in both developed and developing countries.^{32 33 34 35 36 37 38 39}

Low-and-middle-income countries face unique challenges in health adaptation to climate change. A WHO report identified case studies of the successes, barriers, and scaling up capabilities that highlight some of the concerns, as well as provide an example for LMICs moving forward. Notable conclusions include the localization of adaptation needs, the need for long-term, multifaceted, collaborative approaches, and capacity gaps in monitoring and evaluation. Limited financial and human resources, as well as lack of political will and leadership were cited as significant constraints in many countries.²⁹

In Lao PDR, various assessments and scoping reports have focused on climate change adaptation. As mentioned, Lao PDR completed a National Strategy on Climate Change and the National Adaptation Program of Action (NAPA) in 2009-10, as well as a UNFCCC Second National Communication on Climate Change in 2013 and the Intended Nationally Determined Contribution in 2015, of which public health was one of many areas of focus.^{1 7 6 9 10} Health-related policies and programs have focused on water safety improvements, particularly in rural areas.^{1 7 6} For the most part, other sectors such as agriculture, forestry, disaster management, and water have taken the lead on climate change adaptation in Lao PDR and been prioritized by stakeholders.⁴⁰ Though population health has been cited as a sector most affected by climate change, the Ministry of Health to date has played a secondary role.

Initial barriers to the implementation of proposed climate change adaptation strategies were identified during the development of the NAPA, as well as during a desk review for the Global Environment Facility (GEF) proposal development phase.^{4 6} Limited data and

information are available on who is most vulnerable and which geographical areas will be most affected. Moreover, there are capacity gaps in assessing vulnerability, as well as the capability of the health system to manage current and projected changes.^{1 5} Health service provision is especially difficult in Lao PDR, with nearly 70% of the population living in rural areas where health centres are not widely available and many lack adequate resources.⁴¹

A 2011 study evaluated the knowledge of climate change impacts and adaptation needs in Lao PDR. Key findings in the public health sector cited the monitoring of infectious disease and disaster planning as critical capacity gaps, along with ineffective communication channels to rely knowledge and expertise from the governmental to the community level. In line with other reports, the study found a shortage of data, partly due to hospitals not recording the relevant data on diseases, such as diarrhoea, water-borne diseases, dengue, and malaria.⁴²

Despite the progress being made in Lao PDR around assessing the impacts of climate change on human health, as well as identifying the capacity gaps to address such impacts, there still has been relatively little engagement with stakeholders specifically on climate change and health issues. This study, in line with the aims and objectives previously outlined, hopes to continue a dialogue with decision-makers in Lao PDR around the health sectors capacity to manage climate change. In addition, the results of this study could help inform future policy including the development the Lao H-NAP.

Conceptual Model

The web of causal pathways connecting health outcomes and climate change and variability are complex. Moreover, environmental, institutional, social, and behavioural factors contribute to and are often intensified by climate change are equally multifaceted.^{11 43 44} For that reason, the conceptual model (Figure 1) for this study was adapted from various climate and health models and simplified in order to emphasize the scope of work and the intended outcomes.^{11 44 45}

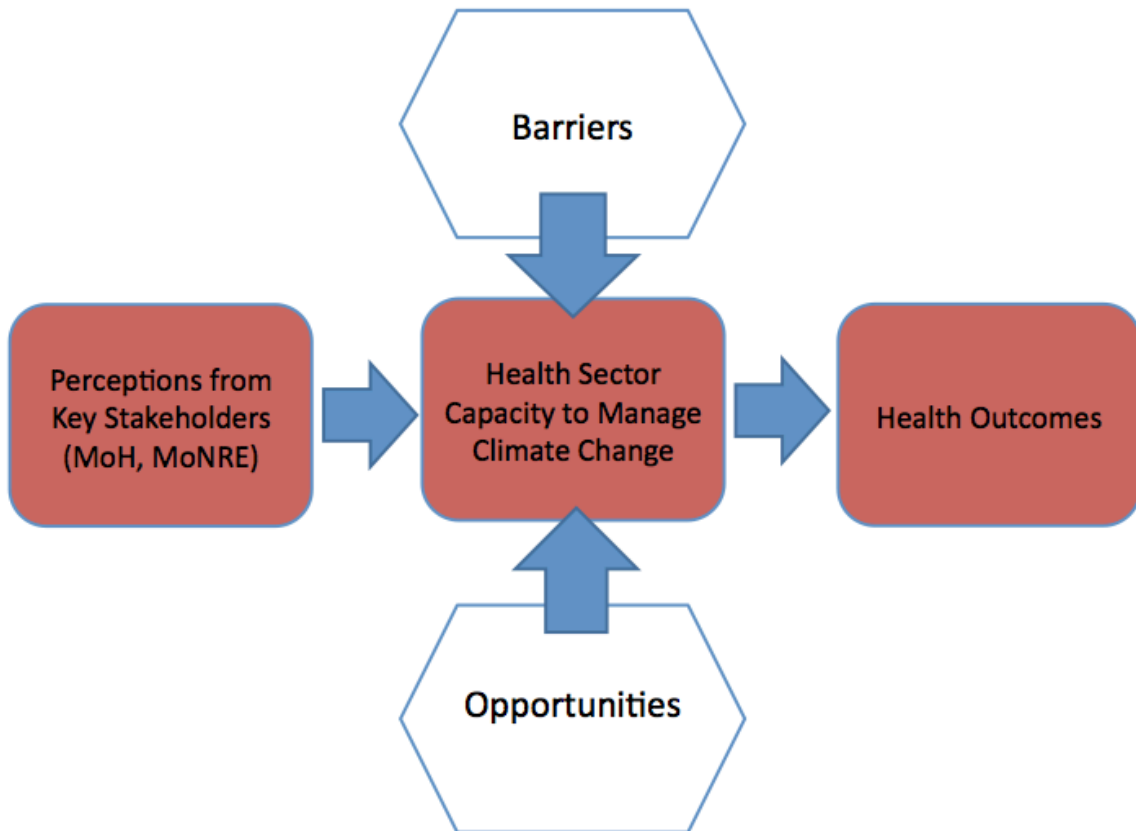


Figure 1: Conceptual Model: Health Sector Capacity to Manage Climate Change in Lao PDR

In theory, an increased understanding of the health sectors capacity to manage climate change will lead to a more efficient and successful climate change and health adaptation

plan. In turn, this will allow responsible institutions to prevent, respond, and manage the current and predicted climate-related health risks. To achieve this goal, the study will focus on the perceptions of key stakeholders in health and other relevant fields with aim of identifying barriers and opportunities of the health sector capacity to manage climate change.

Methods

Study Design

This is a cross-sectional, descriptive, mixed methods study using a structured (open and closed ended) questionnaire and semi-structured in-depth interviews to collect data on how key stakeholders view the health sector capacity to manage climate change in Lao PDR.

For clarity, the study was divided into two phases. Phase 1 involved a questionnaire and Phase 2 involved semi-structured, in-depth interviews with key informants. Both phases shared the same overall objectives and aims, but differed in the target populations and data collection methods. Each phase of the study was conducted independently and included a different study setting and population. After the data was collected and analyzed separately, the results from each phase were compared.

Phase 1 (questionnaire) of the study was intended to compliment Phase 2 (interviews) by expanding the range of perceptions of climate change and health and the health sector capacity to manage climate change in Lao PDR. The questionnaire aimed to capture information from a wider population that included central, provincial, and district level staff in various positions from departments both inside and outside the Ministry of Health. The interviews targeted participants in leadership roles that are involved in climate and health activities or work in departments that are impacted by climate change. A pilot questionnaire was conducted to aid the development of the final questionnaire and interview guide. *Figure 2* shows the study progression and the relationship between questionnaire and interview phases.

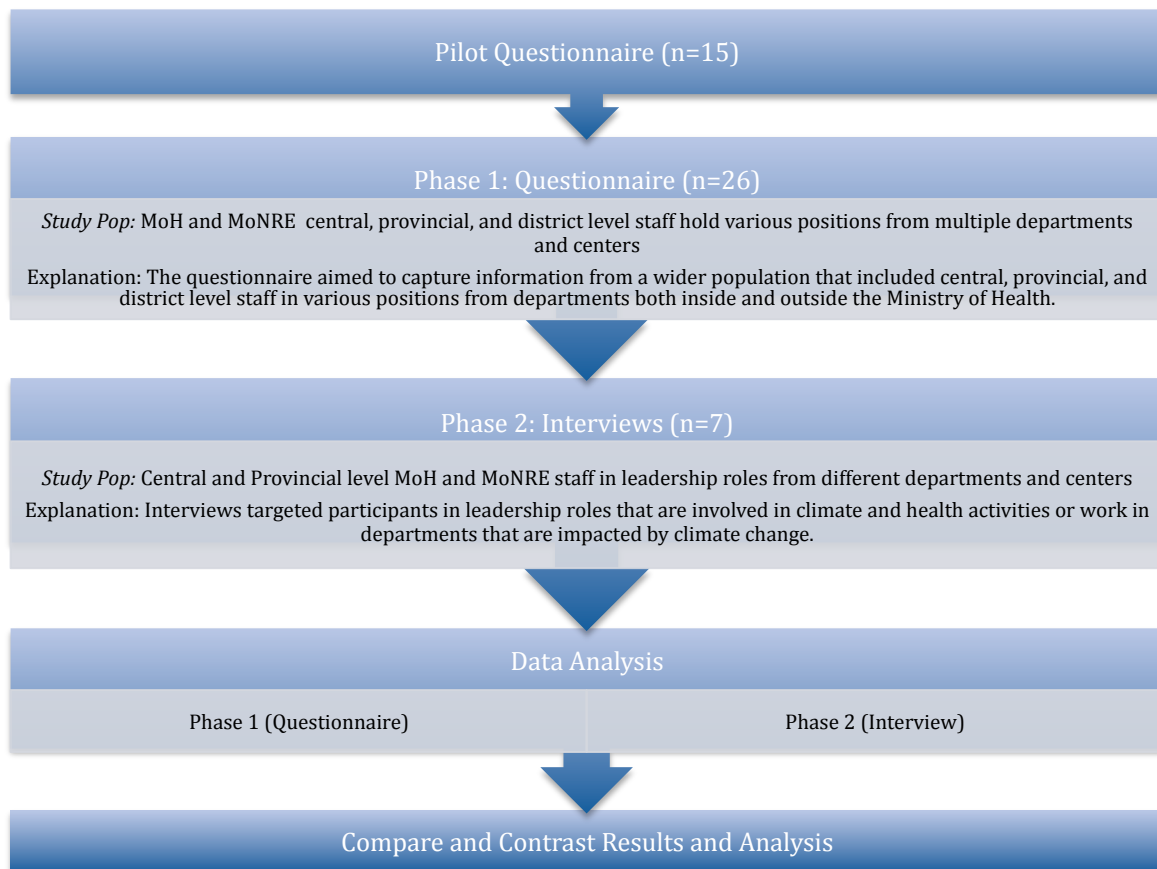


Figure 2: Study Design: Health Sector Capacity to Manage Climate Change in Lao PDR

Study Setting

Questionnaire

The questionnaire was administered during the Community-Led-Schistosomiasis Water, Sanitation, and Hygiene (CL-SWASH) training of trainers (ToT) in Khong district, Champasak province, Lao PDR. Khong district is situated in southwestern Lao and borders Cambodia. The Mekong River runs through the district and is considered a vital life source for many communities in the region.

Interviews

With the exception of one, all of the interviews were conducted in Vientiane, the capital and largest city in Lao PDR. The city of nearly one million lies on the banks of the Mekong River near the border of Thailand. Vientiane is home to all central government ministries. The one interview not conducted in Vientiane took place in Khong district.

Selection of Study Subjects

Source

The study population included key stakeholders from government health institutions, as well as other relevant ministries and departments in Vientiane Capital, Champasak

Province, Khong, and Mounlapomok districts. Overall participants for both the questionnaire and the interviews worked in the Ministry of Health (MoH) or the Ministry of Natural Resources and Environment (MoNRE). For the questionnaire, some participants were also from the Ministry of Education.

Questionnaire participants were from multiple departments and centers at the central, provincial, and district levels, including:

- Provincial Health Department (Champasak)
- District Health Office (Khong and Mounlapomok)
- District Education Office (Khong and Mounlapomok)
- Department of Communicable Disease Control (DCDC)
- Centre for Malaria Parasitology and Entomology (CMPE)
- National Center for Environmental Health and Water (NamSaat)
- Department of Nutrition
- Agriculture and Forestry Office
- Department of Animal Health and Fishery
- Education and Sport Office

Interview participants were selected from the following institutions.

Central Level

- Department of Health & Hygiene Promotion Environmental and Occupational Health Division DHHP (MoH)
- National Center for Environmental Health and Water (NamSaat) (MoH)
- Centre for Malaria Parasitology and Entomology (CMPE) (MoH)
- Department of Disaster Management and Climate Change (DDMCC) (MONRE)
- Department of Hydro-Meteorology (MONRE)

Provincial Level (Champasak)

- National Center for Environmental Health and Water (NamSaat)

Sampling/Recruitment

Subjects for the questionnaire were selected using purposive sampling methods.^{46 47} As mentioned, participants for the questionnaire came from the Community-Led-Schistosomiasis Water, Sanitation, and Hygiene (CL-SWASH) training of trainers (ToT) held in Khong district, Champasak province, Lao PDR. The workshop aimed to incorporate stakeholders from an array of technical areas, including neglected tropical disease, water, sanitation, and hygiene (WASH), as well as nutrition, education, and animal health. World Health Organization and GoL staff invited participants based on the need of the CL-SWASH program without regard for this study and/or climate-related activities. The researcher also had no involvement in the selection of ToT participants. However, though climate change was not explicitly the focus, the decision to use the CL-SWASH ToT participants was made purposefully due to the range of ministries and departments involved that are predicted to or currently face impacts due to climate

change. Additionally, the ToT included representatives from central, provincial, and district levels of government, which provided a fuller picture of climate change knowledge and the capacity to manage climate change in Lao PDR. All participants verbally agreed to participate in the study by completing the questionnaire. The number and characteristics of individuals that did not participate i.e. did not attend the CL-SWASH ToT is unknown.

In phase two of the study, subjects for the in-depth, semi-structured interviews again were selected using a purposive sampling process. After consulting with technical staff at the Lao WHO country office, specific departments and centers were identified within the MoH and MoNRE that are currently involved in climate and health programs, are impacted or are predicted to be impacted by climate change, or are key to the successful implementation of climate and health adaptation strategies. The selected institutions and justification for their selection are described below.

Department Hygiene and Health Promotion-Environmental & Occupational Health

Division (DHHP-EOHD) (MoH): This division is the current lead for climate change adaptation within the Ministry of Health.

National Centre for Environmental Health & Water (NamSaat) (MoH): This centre is responsible for rural water safety, which is predicted to be affected by climate change in Lao PDR.

Centre for Malaria Parasitology and Entomology (CMPE) (MoH): This centre is responsible for the surveillance and control of climate-sensitive vector borne diseases, including dengue, of which prevalence is predicted to increase with climate change in Lao PDR.

Department of Hydro-Meteorology (DHM) (MoNRE): This department is responsible for collecting weather data, including temperature, rainfall, and humidity, which is necessary to measure the impact of climate change on health, as well as establish early-warning systems.

Department of Disaster Management and Climate Change (DDMCC) (MoNRE): Historically, this department has been the lead for climate change activities in Lao PDR, specifically in the development of National Strategy on Climate Change (2010) and the National Adaptation Plan of Action (NAPA). Public health is one of seven strategic topics of focus.

After specific departments and centers were indentified, representatives were recruited based on there involved in climate and health activities, as well as recommendations from WHO technical staff. Each interviewee was sent background information on the proposed study as well as a formal invitation in both English and Lao. Participation in the study was voluntary.

Due to the specific nature of the study there was a need to target individuals with expert knowledge on the capabilities and functions of the MoH and the Government of Lao with regard to the impacts of climate change and variability on human health. Additionally, it was important to select institutions that are currently or will be affected by climate change and variability as it pertains to population health. For these reasons, it was felt that purposive sampling was the best option to obtain the desired information.

Pilot Questionnaire

A pilot questionnaire was conducted on October 13, 2016 with participants from the stakeholder advocacy and consultation meeting for the UNDP/WHO GEF proposal to *Build Resilience in Lao PDR Health System to Climate Change*, which took place in Vientiane Capital. The selection of participants was based on recommendations from the WHO country office based on their involvement in climate change and health related activities. The questionnaire was voluntary and was completed by 15 of 40 participants. The questions were open-ended and translated into Lao language. Responses were then translated back into English, assessed, and helped guide the development of interview guide and questionnaire by highlighting themes and concerns related to climate change and health in Lao PDR.

Inclusion/Exclusion

The inclusion and exclusion criteria for participation in the questionnaire were dependent on the individuals' involvement in the CL-SWASH ToT. Based on the goals of the workshop, the MoH selected attendees. Members from various MoH departments and centres were involved, as well as staff from the MoNRE and the Ministry of Education. Staffs from Vientiane Capital, Pakse (Champasak province) and the target districts of Khong and Mounlapomok were present. All participants were Lao nationals, above the age of 18 and currently employed by the Government of Lao PDR. Government staff from the 16 other provinces, as well as the eight other districts within Champasak was excluded. Questionnaires that were incomplete (answered less than 8 of 17 questions) were excluded.

The in-depth, semi-structured interviews targeted central and provincial level government personnel that are involved in climate and health related activities. After consulting with technical staff at the MoH and WHO, it was determined that stakeholders from the MoH and MoNRE would be included in the study. Specific departments and centers focused on vector-borne disease, water quality and quantity issues, disaster management and preparedness, and weather and climate data were included in the study based on a review of the literature. The agriculture and education sectors, though also important for climate change adaptation, were not included in this study. Climate change impacts on agriculture are a key issue in Lao, therefore this study wanted to focus more on the health sector, which has been a more neglected area. Ministries active in climate change mitigation strategies were also not included. Like the questionnaire, all interview participants were

Lao nationals, above the age of 18 and currently employed by the Government of Lao PDR.

Data Collection

Phase 1: Questionnaire

After considering the responses from the pilot, a final questionnaire was created (Appendix A). In total the questionnaire contained a mix of 17 closed and open-ended questionnaires. Closed-ended questions included ‘YES’, ‘NO’, ‘DON’T KNOW’ multiple choice; marking all that apply from a list; and opinion/Likert scale questions. The question themes included, climate change knowledge, climate change impacts on health outcomes, vector-borne disease, water-borne disease, flooding and extreme weather events, and health sector capacity to manage climate change. Demographic information was also collected including age, sex, highest level of education, ministry/department/centre affiliation, position (employment), and location of employment. Once finalized the questionnaire was translated into Lao and printed out for distribution.

On November 26, 2016 the questionnaire was distributed to participants of the CL-SWASH ToT held in Khong district, Champasak province, Lao PDR. The venue of the workshop was a large conference centre. During a break in the workshop the researcher was given the opportunity to explain the background of the study and the questionnaire

through a translator. Paper copies of the questionnaire were then handed out and participants were asked to fill in written answers to the questionnaires. Clarification of questions was given to participants when asked. Participation in the questionnaire was voluntary and participants were given the option to not complete the questionnaire. After approximately fifteen minutes the questionnaires were collected. Later the responses were translated back into English and uploaded into Microsoft Excel.

Phase 2: Interviews

Seven in-depth, semi-structured, one-on-one, face-to-face interviews were conducted with central and provincial level government staff. The same protocol was used for each interviewee and included contacting the office of each participant, sending a formal letter of invitation (by mail or electronically), which detailed the purpose of the study and the role of the interviewee, coordinating the date, time, and location of the interview, and executing the interview. The same interviewer conducted all the interviews. Four interviews were conducted in English without a translator present. Two interviews were conducted in Lao with aid of a translator and one interview was conducted in English with a translator present for minor assistance. Two different translators were used, both of which were technical officers at the WHO country office. The use of a translator was at the request of the interview participant.

All central level interviews were conducted in Vientiane capital at the office of the interviewee. The provincial level interview was conducted in Khong district, Champasak

province. All interviews were conducted in private and included only the interviewer, interviewee, and translator when needed. The length of time of each interview varied between 45 and 75 minutes. Before starting the interview, each participant was given background information on the project and the purpose of the study, as well as the intended use of the data collected, which is to aid the development of Health-National Adaptation Plan, in order to ensure confidence and trust between the investigator and participant. Written and verbal consent was also received prior to the start of every interview. The consent form can be found in the Appendix B.

The goal of the interviews was to expand the understanding of climate change adaptation in the health system as well as the health sector capacity to manage climate change in Lao PDR from the perspective of key government stakeholders. When developing the interview guide the capacity to manage climate change was evaluated by focusing on operational components adapted from WHO and UNDP frameworks, as well as information collected during the pilot and final questionnaire.

Participants were asked open-ended questions from a semi-structured interview guide on topics that included climate change knowledge, health service delivery, institutional capacity, surveillance and early-warning systems, regional cooperation, and sector coordination. The interviewees were also asked to describe the roles and responsibilities of their specific department or centre, as well as demographic information including age, sex, and highest level of education. Each interview was adapted slightly to the specific participant according to the department or centre, as well as the background of the

participant. Verbal probes were employed to allow the participants to expand and/or clarify answers. Each interview was recorded and the interviewer took written notes during the interview. Recordings and notes were kept secure upon completion of the interview and shared with no other than the principal investigator to ensure confidentiality. The interview guide can be found in the Appendix C.

Data Analysis

Phase 1: Questionnaire

Hard copies of the completed questionnaires were collected and translated into English. Responses were then uploaded into an Excel spreadsheet. Descriptive statistics from the quantitative data were computed using Dedoose software and described and compared based predefined themes (*Table 1*). Content analysis was used to analyze the open-ended responses using Excel and Dedoose software.^{46 47}

Table 1: Questionnaire Themes

Questionnaire Themes
Climate Change Knowledge
Climate Change Impacts on Health
Vector Borne Disease
Water Borne Disease
Flooding and Extreme Weather Events
Health Sector Capacity to Manage Climate Change

Phase 2: Interviews

The interviewer transcribed interview recordings. Notes taken during interviews were reviewed and expanded after listening to the recordings. An initial codebook including a priori themes and sub-themes (Appendix D) was developed based on previous literature and the experience of the researcher.^{4 5 6 29 31 42} The researcher then read through all the transcripts and revised the codebook to include any new codes that emerged. An open-coding technique was employed to capture any themes not previously identified and to allow for exploratory themes to emerge.^{46 47} Once finalized the codes were applied to each transcript and then analyzed to determine primary themes across each interview participant, and to compare similarities and differences. All coding was completed using Dedoose. There was no follow-up or clarification made with interview participants.

Ethical Considerations

This study received a determination of non-research from the University of Washington Human Subjects Division of the IRB. Additionally, this study has gained administrative approval from the Ministry of Public Works and Transport and the Department of Water Supply in Lao PDR. For both the questionnaire and the interviews measures were taken to ensure the confidentiality of the participants. All responses, transcripts, and recordings were safely secured in a password-protected folder. Names of the interviewee and questionnaire participants were not released without the consent of the individual.

Results

Phase 1: Questionnaire

Participant Characteristics

In total 38 individuals were selected by the sampling procedure, however only 27 agreed to participate and complete the questionnaire. Additionally, one questionnaire was dismissed due to lack of completion (answering less than half of questions), leaving the study with an n=26, denominator unknown. *Table 2* details the demographic information of the study population. Sixty-five percent of questionnaire participants were male. The mean age of respondents was 41.7 years, with a range of 20-58. Education levels overall were low, with only 15.4% of respondents having either a masters or doctoral level degree. Half of participants were affiliated with the Ministry of Health and 30.8% held the position of technical staff. However, for both these questions the “no answer” percentage was high compared to gender, age, and education questions. Location of respondent employment was fairly evenly distributed between Central (Vientiane), Provincial (Champasak), and District (Khong) levels; nevertheless “no answer” responses were again high with 38.5%.

Table 2: Questionnaire Participant Characteristics

Gender	
Male	17 (65.4%)
Female	8 (30.8%)
No Answer	1 (3.8 %)
Age	
20-30	6 (23.1%)
31-40	5 (19.2%)
41-50	5 (19.2%)
50+	8 (30.8%)
No Answer	2 (7.7%)
Highest Level of Education	
Secondary	10 (38.5%)
Bachelors	8 (30.8%)
Masters	2 (7.7%)
Doctor	2 (7.7%)
No Answer	4 (15.4%)
Ministry Affiliation	
MoH	13 (50%)
Other	4 (15.4%)
No Answer	9 (34.6%)
Position	
Technical Staff	8 (30.8%)
Deputy Head	5 (19.2%)
Head of Unit	5 (19.2%)
No Answer	7 (26.9%)
Other	1 (3.8%)
Location of Employment	
Vientiane (Central)	5 (19.2%)
Champasak/Pakse (Provincial)	6 (23.1%)
Khong (District)	4 (15.4%)
No Answer	10 (38.5%)

Perceptions of Climate Change Impacts on Health

The ratios of responses to each question were analyzed based on predefined themes that helped assess perceptions of climate change impacts on health and identify the opportunities and barriers to climate change adaptation in the health sector. The themes

included: Climate change knowledge (questions 1-2); Climate change impacts on health (questions 3-5); Vector borne disease (questions 6-7); Water borne disease (question 8); Flooding and extreme weather events (questions 9-13); and Health sector capacity to manage climate change (questions 14-17).

Climate Change Knowledge

Nearly all participants understood that there was a difference between climate change and variability. Similarly, the majority (88.5%) of respondents thought that climate change was occurring in Lao PDR. No significance was found when question responses were stratified by demographic characteristics.

Climate Change Impact on Health

This set of questions included closed-ended and open-ended responses. Every respondent answered, “yes” when asked if they thought changes in climate could affect health. However, when asked to explain why, responses varied. Pollution (air and water), vulnerable populations (children and elderly), changes in weather (increases in temperature), and increases in disease outbreaks were all described as reasons why climate change impacts health. Participants were also choose climate-related health risks from a list that affect their department or centre, with nearly all responses listing all the health risks and stating that all were important.

Vector and Water Borne Disease

A high percentage of respondents (92.3%) agreed that climate change would affect vector borne disease, both in intensity and geographic range. The same percentage also thought that the amount of rainfall affects the intensity or occurrence of water-borne diseases such as dysentery, typhoid, and diarrhoea. Twenty-three out of 26 participants said that climate-related variables (rainfall, temperature, humidity) were included when monitoring vector borne diseases.

Flooding and Extreme Weather Events

Most respondents agreed that floods or storm events were happening more frequently, were stronger or more intense, and increase the occurrence of disease, 84.6%, 84.6%, and 92.3% respectively. Of the three respondents that thought floods or storm events were not happening more frequently, all were above the age of 50 and male. With regard to flood and disaster preparedness of provincial level health facilities, again the majority of participants (69.2%) answered that they were felt they were somewhat prepared. The one respondent that said the provincial level health facilities were somewhat unprepared for a flood event was from Vientiane.

Health Sector Capacity to Manage Climate Change

Overall, participants responded positively when asked about climate change adaptation in the health sector. Most (84.6%) thought climate change adaptation strategies could reduce vulnerability to health risks, as well as thought they had the resources to prepare and respond to health risks resulting from climate change (80.8%). When asked if climate change was considered in health planning 23 of 26 participants answered yes, with two participants responding that they did not know. Some uncertainty did arise when asked about incorporating climate change and its health impacts into annual operational budget. Still most (69.2%) said yes, they were included, however, 21.3% were unsure and one respondent said climate change was not factored into the budget. In addition, when asked to explain why climate change was or was not included in health planning, most responses were broad and did not explain specific details. Generally, respondents cited the impact on disease, as well as the importance to prepare in order to reduce risk and ensure budget allocation. The one respondent that answered no did not answer the follow up question.

Phase 2: Interviews

Interviewee Characteristics

Key informant interviews were conducted with seven participants (n=7, denominator unknown). *Table 3* details the demographic information and interview dates for the study population.

Table 3: Interview Participant Characteristics

Reference ID	K01	K02	K03	K04	K05	K06	K07
Date	Nov. 08, 2016	Nov. 09, 2016	Nov. 16, 2016	Dec. 29, 2016	Dec. 26, 2016	Dec. 12, 2016	Nov. 26, 2016
Length (minutes)	45	60	60	60	60	70	75
Location	Vientiane	Vientiane	Vientiane	Vientiane	Vientiane	Vientiane	Khong District
Ministry	MoH	MoH	MoH	MoH	MoNRE	MoNRE	MoH
Department/Centre	DHHP-EOHD	DHHP-EOHD	NamSaat	CMPE	DDMCC	DHM	NamSaat
Position	Chief of EOHD	Technical Staff (Climate Change and Health Adaption)	Deputy Director	Deputy Chief (Lab Unit for Malaria Treatment)	Deputy Director General	Director General	Deputy Head
Sex	Male	Male	Male	Female	Male	Male	Male
Age	56	37	54	N/A	N/A	N/A	55
Education (highest level)	Doctor	Doctor	Masters	Doctor	N/A	N/A	Doctor
Translator	NO	NO	NO	YES	NO	YES	YES

Perceptions of Climate Change Impacts on Health

Table 4 highlights the main themes that emerged around the perception of climate change and health.

Table 4: Perceptions of Climate Change Impacts on Health

Emergent Themes	Details	Conclusions
General Climate Change Knowledge	<ul style="list-style-type: none"> • Understanding of health risks related to climate change, especially vector and water borne disease • Linking climate change to disasters • Confusion between natural weather patterns and climate change 	Many climate change adaptation policies have been developed, however technical knowledge regarding health risks is still lacking.
Policies, Strategies, Leadership	<ul style="list-style-type: none"> • Confident understanding of current CCA policies and strategies • Unsure about other ministries/departments • Some confusion on planning and leadership 	There is a need for clear leadership on CC&H activities moving forward. Community awareness programs should be prioritized.
Community Level and Vulnerable Populations	<ul style="list-style-type: none"> • Concerned about general public knowledge of climate change, especially ethnic and rural populations 	

General Climate Change Knowledge

Overall, the key informants shared a general awareness of climate change and its impacts on human health especially with regard to changes in temperature and rainfall and vector and water borne disease. However, specific details were sometimes absent and links between climate change and health were often simplified or lacking technical expertise.

Yes, I think you can say that Lao is one of the vulnerable countries on climate change in this region and particularly the health sector. I think it is one of sector that has limited capacity and limited infrastructure to adapt to climate change. I think for the health sector we are also limited in the systems and information, this type of thing. This is why Lao is one of the vulnerable countries, because we also rely on the natural resources. If flood or drought come it will be easy to have that impact. (K05, DDMCC, MoNRE)

It may be because we have quite limited knowledge on climate change, so we cannot really show the link between our work (malaria) and climate change. We know in the general what is climate change as far as worldwide temperature increase through the news media (newspapers, TV), but technically, deeply specific, evidence-based things we are supposed to know that we can integrate into our work is not yet found (K04, CMPE, MoH)

Disasters or extreme weather events, notably flooding, were frequently mentioned when explaining climate change to the point that the terms climate change, disaster, and flooding appeared interchangeable.

We have many diseases come from flooding. The last few years we have had a lot of flooding. When its hot its too hot, when there's rain its too much rain. (K02, DHHP-EOHD, MoH)

We have quite often floods, due to the typhoon or heavy rain. Of course we also have landslides and drought, but not as much as compared to flood. We have disease due to the temperature increase; some of the disease comes again. (K05, DDMCC, MoNRE)

Policies, Strategies, Leadership

Most interviewees were confident in their knowledge of current climate change adaptation policies, including the NAPA, as well as the development of other strategic plans across sectors.

I think for policy and everything related to policy is clear. We have NAPA from MONRE and we also focused there and developed our draft based on that. We have the priority of the MoH. I think for the document and the paper it is okay. (K02, DHHP-EOHD, MoH)

Still others were more sceptical when discussing the level of awareness of colleagues within the Ministry of Health, as well as different regions within the country.

Right now the awareness of the impact of climate change on human health in the MoH and outside the MoH is still poor. So maybe advocacy meeting should be held in the north and the southern part of Lao. For example, people in rural areas should be aware of the affect of climate change on the health of the people. They don't know anything. (K01, DHHP-EOHD, MoH)

One participant (K07) described the evolution of the word climate change in planning and how it has changed over the years.

No this year is the first year we are talking about climate change. Before we were only talking about flooding, we never mentioned any word about climate change. This year we put in our head, but not in the plan. This year I think they came to talk about climate change. Before in the activity plan and budget allocation they only talked about flooding, then the word changed to disaster, which is wider, and now this year its disaster and climate change. (K07, NamSaat Champasak, MoH)

Stakeholders also highlighted different climate change solutions, including both mitigation and adaptation strategies, however health was rarely the focus. Furthermore, there was confusion when discussing the leadership, planning, and funding of climate change and health adaptation programs.

We have a number of projects working on capacity building on the adaptation and also the mitigation, as well as pilot projects with certain provinces on the agriculture, forestry, and water sectors. I think for the health sector there are projects going on, but it is limited compared to other sectors. I would encourage the health sector to do more. (K05, DDMCC, MoNRE)

Some of the confusion regarding leadership and climate change priorities is seen in a quote from respondent K02.

Interviewer: What types of policies are in place to address health impacts from climate change?

Interviewee: Based on the MoH priorities. It is not clear. They said we have to prepare for disaster and we have the direction we have to prepare for disaster and we have one sector to prepare for disaster. As I know in many centre or department they also have one unit or team to be ready to respond to disaster (K02, DHHP-EOHD, MoH).

Community Level and Vulnerable Populations

Finally, key informants were concerned about the lack of awareness of the health risks related to climate change at the community level, as well as amongst vulnerable populations. Across respondents there was a perception that the general public knew very little about climate change or the impacts on health.

I think not much. For some people who stay in the big city or the provincial they know, but for the district or village level, which is far from the city, they still don't know. (K02, DHHP-EOHD, MoH)

The local people have limited capacity and infrastructure. We need to do more on awareness and education for the people. (K05, DDMCC, MoNRE)

The second is about community awareness, there's no awareness, they should know the situation about how climate change impacts the people, and how the community should understand. (K03, NamSaat, MoH)

Interviewer: Speaking specifically about dengue, would you say most people understand the link between dengue and temperature/rainfall/etc?

Interviewee: No I don't think so. We have to divide into 2 groups. For people like us, for the official staff or person who has knowledge, they know about the link between climate change and temperature with the cases. For local people they don't know. They just have question why? Why in this month we still have dengue fever? (K02, DHHP-EOHD, MoH)

Participant K03 described how language and geographic location could make communicating climate change more difficult.

Yes, not so easy for this because in our country we have 48 ethnic minorities. Some minorities we don't worry because we can have communication with Lao language. Some other ethnic minorities we need a translator. It is difficult mostly for women. We try now, with the Ministry of Education they can teach only Lao language, but maybe 2 year, maybe 5 year everyone in our country can speak Lao. Now it is not so easy, if go over there we will need a translator from Lao to ethnic minority language. Okay so TV and radio, not so fast information in the rural area. In a provincial centre or big district it's no problem, but in rural area it is difficult, maybe mobile is difficult to connect to them.

Radio is sub par, TV is sub par, and not everywhere can get the information clearly about climate change. (K03, NamSaat, MoH)

Barriers of Health Sector Capacity to Manage Climate Change

Table 5 highlights the main themes that emerged around the barriers of the health sectors capacity to manage climate change.

Table 5: Barriers of Health Sector Capacity to Manage Climate Change

Emergent Themes	Details	Conclusions
Budget and Human Resources	<ul style="list-style-type: none"> • Need for more budget allocation for CC&H project • Limited human resources both in numbers and technical knowledge 	Like many LMICs there is a shortage of funding and technically trained staff, CC&H in Lao is no different.
Policy and Implementation Gap	<ul style="list-style-type: none"> • Confidence in the current policies, but unsure how to implement • Connected to limited budget and human resources 	Expressed desire to put to action the policies in place, however budget and technical capacity remains a challenge.
Data and Surveillance	<ul style="list-style-type: none"> • No system in place to monitor disease or manage climate change and health data • Lacking skills and technical knowledge to understand CC&H data 	Data management and disease surveillance should be prioritized.

Budget and Human Resources

Lack of budget and limited human resources, both in number of workers and technical knowledge was voiced as a major barrier across all interviewees.

The second big challenge is the money. We have a strategy, we have a five-year plan, but how much will it cost the government and international organizations to support us to achieve the objective of our strategy? The plan is not enough (K01, DHHP-EOHD, MoH)

Currently there is no problem with communication, but the thing is budgeting. To strengthen the coordination would mean sharing budgeting. There are a lot of budgets and financial things to share. (K04, CMPE, MoH)

I mentioned that we have limited staff and capacity building. For human resources it's not enough. That is the main problem, not just for us. How can I say? One or two training is not good enough for people to work you know. Human resource development will take time. (K03, NamSaat, MoH)

If policy is clear, but there's nobody to do, that is difficult also. Now we need more training and more staff, one, two, three people are not enough. We need more stakeholders to know about the situation. Maybe easy in the future, but now it's not about the MoH to work on climate change; it should be how we can organize and work together. We need more capacity building and maybe long and short-term capacity building. (K03, NamSaat, MoH)

One key informant (K05) highlighted the need for university level curricula that covers climate change and health.

For our department we have 59 staff, but many are still young and need to learn more. They need more experience on this area. I think for other ministries at the provincial level it is still limited and even at the education level at the university there is no specific course on this area. (K05, DDMCC, MoNRE)

Policy and Implementation Gap

Closely linked to budget and human resources is the idea of a gap between policy and implementation. Many interviewees focused on this as a barrier often citing lack of capacity or funding as the major cause.

Interviewer: Any other barriers from policy to implementation?

Interviewee: Based on my personal opinion, the policy is clear, everything is clear, just the person who transfer the policy into work, maybe because of human resources or capacity. For example my background is not related to climate change. I learn by doing. I know this maybe it is not correct, but I am doing. I think most of us are learning by doing, because we don't have specialist. (K02, DHHP-EOHD, MoH)

We have the vision policy; we have the strategy and the action plan, but for the implementation this is still a challenge, the funding, the budget, the human resources, so to take it to implementation is still limited. (K05, DDMCC, MoNRE)

Participant K05 describes the need for a programmatic approach to accompany the policy level solutions.

I think we also can't only focus on the legislative and policy by revising and updating regularly; we need to do more on the ground level on the implementation of the projects. I believe we need to have a programmatic approach, not just project based on the short term when they finish a project and then not continue, so we will try on this. I think the priority is adaptation, but of course at the same time we will do the mitigation side, what we call appropriate mitigation, we need to take action. There are many things we need to do, but we need to do in the parallel on both the policy and the implementation side, not only focus on developing the policy or legislation. (K05, DDMCC, MoNRE)

K05 continues,

But we are doing well in that we have the policy and we have the framework in place already. We need to take on the implementation including the facility, the funding, and the capacity to do it. Otherwise it won't be easy. (K05, DDMCC, MoNRE)

Data and Surveillance

Access and management of climate and health data, as well as timely and accurate disease surveillance is a continuing issue in Lao PDR. However, again interviewees

linked this concern back to root barriers such as budget and human resources, as well as a lack of appropriate data systems.

The monitoring. Our system is still poor, in terms of monitoring. We have no budget and no system. So maybe if we have climate change, how do we join climate change monitoring with other monitoring? It is the kind of thing we need to improve, monitoring and evaluation. (K01, DHHP-EOHD, MoH)

Frequency of floods, impacts from floods, areas where hazards have happened. We need some type of mechanism or network so it can be functioning, not just the database established. We need people to carry out these type of exercises on a regularly basis. Sometimes we establish a database, but there is no one to use it and we try also to have this database online to be used by the public, not only for the central ministry. (K05, DDMCC, MoNRE)

Participant K06 highlights that data without knowledge is a problem.

Not only need the data only. For example with the health, we would also like to know about the diseases, how the diseases happen, and the affects of the disease. We would also like to know that. (K06, DHM, MoNRE)

Opportunities for Successful Climate Change and Health Adaptation

Table 6 highlights the main themes that emerged around the opportunities for the health sector to increase the capacity to manage climate change.

Table 6: Opportunities for Successful Climate Change and Health Adaptation

Emergent Themes	Details	Conclusions
Coordination	<ul style="list-style-type: none"> • Lack of coordination can be a barrier or an opportunity • Should be across ministries, government levels, and development partners • Potential to build off Hydro-Met relationships 	<p>Coordination across ministries and sectors is vital for successful climate change adaptation in the health sector.</p> <p>Respondents understood the importance and want to find ways to collaborate more.</p>
Training and Capacity Building	<ul style="list-style-type: none"> • Capacity building is a high priority, though not always clearly expressed • Opportunities to share experience within Lao through other sectors active in climate change adaptation. • English and project management skills highlighted 	<p>Lack of capacity is a challenge, but there is an opportunity to gain knowledge within Lao.</p> <p>Basic management skills are needed to match along with technical knowledge.</p>

Coordination

Lack of coordination is often seen as a major barrier to successful climate change and health adaptation.²⁹ However, many interviewees expressed a desire to increase coordination and collaboration across ministries and sectors to address the health risks of climate change. The Department of Hydro-Meteorology especially was interested in this idea.

Interviewer: Do you think your staff could benefit from a workshop with both the MoH and Hydro-Met to discuss the connections between rainfall, temperature, etc. and disease?

Interviewee: We would like to know that this season, what is the disease affect? For example, in rainy season how much disease? In dry season how much disease? And what kind? We have the data from the MoH. We have the lists of information. If we know we can inform. (K06, DHM, MoNRE)

Furthermore, participant K05 illustrated the need for coordination with development partners as well as within the government.

I think we need not only coordination on the government side, but we need to coordinate with development partners and other organizations. As I said this committee and this working group need to be functioning regularly and to have meetings to discuss, which I think, need to improve. Not just to establish, but to be functioning. This is still a challenge of effective coordination. (K05, DDMCC, MoNRE)

Training and Capacity Building

Training and capacity building was repeatedly mentioned as solution to improving the health sectors capacity to manage climate change. The following quotes offered specific areas that could be improved, such as modelling, English language, and project

management skills. Capacity building can also be accessed within Lao through collaboration with other ministries.

We should increase capacity building for all sectors. For example, GIS and modelling. Some departments have experience already on modelling, MONRE have experience, but for the health sector they should know about this through capacity building and training course. For example, learning how to model and predict health for the next 100 years from climate change. The health sector does not know how to do modelling. We need capacity building for different technical skills. (K01, DHHP-EOHD, MoH)

Capacity building is the main barrier at the ministry level for staff. English language skills are important as well as communication skills to communicate technical knowledge, which the government offers. (K02, DHHP-EOHD, MoH)

Any type of training workshop or information sharing would be good for them to increase climate change awareness, as well as multi-sector coordination is maybe another way to improve their work. The expert organization or sector related to climate change can maybe jump in to coordinate with our work. This is a way to improve our capacity. (K04, CMPE, MoH)

Interviewer: When you say capacity building can you explain more? What type of skills would you like your staff to have?

Interviewee: Project management. Technically we don't worry, but the management system, monitoring, should have person to work on this. Sometimes we have to meet together. We have limited human resource to work everything. If we have enough human resource development, we have responsibilities for you and for her. One person cannot work everything. There's not enough. Quality is not so good either, professionally. (K03, NamSaat, MoH)

Discussion

Perceptions varied slightly across interview participants, however; overall everyone interviewed had a basic understanding of climate change and its impacts on human health. When similar questions were expanding to provincial and district level staff from varying departments through the questionnaire, the responses reinforced that many health and health-related staff had some level of awareness of the health risks of climate change. In particular, both study populations understood a connection between climate change and extreme weather events, such as flooding. A link between weather patterns (rainfall and temperature) and increases in water and vector borne diseases, notably dengue was also well documented in both interviews and the questionnaire. Unfortunately, due to study limitations it is unclear the level of understanding or whether this knowledge can be translated into practice with regard to disease prevention.

In both the interviews and the questionnaire responses there was a high level of confidence in the health sector capacity to manage climate change. Key informants

especially voiced a strong trust in the policies in place to address climate change. The development of the National Adaptation Program of Action (NAPA) and the National Strategy on Climate Change (NSCC) were, as well as other adaptation projects were referenced repeatedly. It seems there is strong political will around climate change in Lao PDR, which is critical for successful of climate and health adaptation efforts.²⁹ The test will be if leadership can use this political will to effectively mainstream climate and health priorities into the on-going adaptation strategy.

Based on the results of this study the role the Ministry of Health in climate change adaptation in Lao PDR is still unclear. Nearly all participants expressed some understanding of climate-related health impacts and the importance of integrating climate change adaptation into health planning. However, when discussing current policies or planning other sectors, mainly agriculture, forestry, and natural resources, were identified as leaders in climate change adaptation. Moving forward it will be important to clearly define the responsibilities of the MoH and how climate change can be effectively mainstreamed into public health planning, as well as identify possibilities for the MoH to take on leadership positions in climate change adaptation programs when relevant to human health.

The barriers expressed in this study are not new. Lack of funding and limited human resources are a chronic constraint in LMICs and Lao PDR is no exception. Due to the magnitude of current and projected health risks of climate change combined with an often weak and underfunded health system, the adaptation needs for most LMICs vastly

exceeds the available funds and human resources.²⁹ Similar barriers have been identified in previous studies and assessments conducted in Lao PDR, including limited data collection and management capabilities and lack of community engagement.^{1 6 48} This study confirms many of these issues; nonetheless it is not only important to identify barriers, but to connect them to tangible solutions and actions.

Study participants identified various opportunities in which the health sector could increase its capacity to manage climate change. Of these, coordination, especially across ministries and sectors, is perhaps the most critical, as it can be linked to multiple barriers and it fundamental for successful climate change and health adaptation.^{28 29} Conversely, lack coordination can quickly become a major constraint. Literature shows that improved coordination helps address gaps between policy and implementation, a limitation expressed by interview respondents.⁴⁸ The relationship between the MoH and Department of Hydro-Meteorology is particularly key for climate change and health adaptation^{28 29} Based on this study there appears to be an opportunity to develop a stronger collaboration between the two institutions in Lao PDR either through improved lines of communication or knowledge sharing/training workshops.

Limitations

Due to budget and time constraints, this study was limited to a focused target population of participants who were available to the researcher. Therefore, bias should be placed on the participant responses due to their involvement in on-going climate-related projects. In

addition, some of the study participants had been involved in previous climate change and health trainings or workshops under various projects. For this reason, the perceptions gained from this study including the view of climate change and health understanding is likely an optimistic representation and may not reflect the knowledge level of most MoH, MoNRE, or other government staff.

Further, perceptions gained from questionnaire and interview participant were representing a single moment in time without follow up or clarification. The study also focused mostly on central level staff and included a relatively small sample, which limits the generalizability, as climate-related hazards and governmental capacity varies widely across the country. Finally, this study only focuses on government institutions and did not include perspectives from private, international organizations, or community members.

Conclusion

Climate change is currently impacting the health of people in Lao PDR and the climate-health risks are predicted to increase. In response, the Government of Lao, together with multiple sectors, has made strides in developing policies and strategies to address climate change adaptation needs. Though public health is often prioritized, for the most part other sectors (environment, agriculture, forestry, etc) have taken the lead. Conversely, the MoH has been slow to take on such a leadership role. With the possibility of increased climate change adaptation funding, and the goal of developing a H-NAP, there is a need to engage key stakeholders (both in health and other sectors) about the capacity of the health

sector to manage climate change. To many stakeholders within and outside the health sector, the risk from climate variability and change remain unfamiliar.²⁹

This study helps lay the foundation for integrating climate change into on-going public health planning by assessing the perceptions of climate change and its impacts on the health system in Lao PDR from key stakeholders in health and other relevant institutions and government ministries, as well as identifying barriers and opportunities of the health sector capacity to manage climate change in the coming decades. Moving forward it is critical to consistently gather input and insights from those who are responsible for developing and implementing climate change and health adaptation programs, as well as the populations who will face the impacts.

Recommendations

In conclusion, based on the study results and analysis, the researcher makes the following recommendations.

- To conduct a community climate change knowledge assessment in order to accurately document the level of awareness in rural and other vulnerable populations. This would also need to include an updated vulnerability and adaptation assessment.
- To provide opportunities for MoH staff to gain expertise in climate change by strengthening international university partnerships and including curricula on

climate change and health in Lao universities. This would help address some of the technical capacity needs.

- To conduct a quarterly knowledge-sharing workshop with departments and centers' across ministries active in climate change adaptation in order to strengthen relationships and crosscutting initiatives within Lao PDR.

Appendix

A. Questionnaire

Building Resilience of Health Systems in Lao PDR to Climate Change

Champasak Questionnaire

Before beginning the Training of Trainers, please spend the next 15 minutes filling in your responses to the following questions. These results will not be shared, but will be used to gain insight on stakeholder perspectives and help guide future project outcomes.

Demographic

Age:

Sex:

Highest Level of Education:

Ministry, Department, Center, Organization:

Position:

Location:

Climate Change Knowledge

1. Do climate change and climate variability differ?

- Yes
- No
- Don't Know

2. Do you think climate change is occurring in Lao PDR?

- Yes
- No
- Don't Know

Climate Change Impacts on Health Outcomes

3. Do you think changes in climate can affect human health?

- Yes
- No
- Don't Know

3. a. Please explain why or why not?

4. What climate-related health risks currently affect your ministry, department, centre, organization, or community? Mark all that apply.

- Extreme Weather Events (flood, drought, storms, heat)
- Vector-Borne Diseases (dengue, malaria,)
- Water-Borne Diseases (dysentery, typhoid)
- Food Security/Under Nutrition
- Respiratory Infection/Disease
- Maternal and Child Health
- Non-Communicable Disease
- Mental Health
- Others _____

5. Which climate-related health risk do you feel is most important?

Vector Borne Diseases (Dengue)

6. Do you think climate change will affect the geographic range and intensity of transmission of vector-borne diseases?

- Yes
- No
- Don't Know

7. Do you include climate-related variables (rainfall, temperature) when monitoring vector-borne diseases (dengue, malaria)?

- Yes
- No
- Don't Know

Water Borne and Water Related Diseases

8. Do you think the amount of rainfall affects the intensity or occurrence of water-borne diseases (dysentery, typhoid, diarrhoea)?

- Yes
- No
- Don't Know

Flooding and Extreme Weather Events

9. Do you think flood or storm events happen more frequently than they used to?

- Yes
- No
- Don't Know

10. Do you think flood or storm events are stronger or more intense than they used to be?

- Yes
- No
- Don't Know

11. Do you think floods or storm events increase the occurrence of disease?

- Yes
- No
- Don't Know

12. How prepared do you feel health facilities in Champasak are for a flood event?

Completely unprepared	Somewhat unprepared	Neither prepared nor unprepared	Somewhat prepared	Completely prepared
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13. How prepared do you feel health facilities in Champasak are for any type of disaster?

Completely unprepared	Somewhat unprepared	Neither prepared nor unprepared	Somewhat prepared	Completely prepared
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Health Sector Capacity to Manage Climate Change

14. Do you think climate change adaptation strategies can reduce vulnerability to health risks?

- Yes
- No
- Don't Know

15. Are climate change and its health impacts considered in health planning?

- Yes
- No
- Don't Know

15. a. Please explain why or why not?

16. Are climate change and its health impacts incorporated into the annual operational budgets?

- Yes
- No
- Don't Know

17. Do you feel you have the resources (staff, information, budget) to prepare and respond to health risks resulting from climate change?

- Yes
- No
- Don't Know

B. Consent Form

Consent Form

Health Sector Capacity to Manage Climate Change in Lao PDR: Perspectives from Key Health Stakeholders

Project Context: Climate change manifestations in Lao PDR include an increase in temperatures and changes in rainfall patterns – which, based on climate model projections, are likely to be accentuated in the coming decades. Climate unpredictability has become the norm. The government of Lao PDR, involving multiple ministries, is developing or has developed plans of action to address the impact of climate change with a focus on specific at-risk sectors. Public health has been identified as one of the key sectors most affected by climate change. In response, the MoH along with other relevant key stakeholders are exploring strategies to increase the resilience, as well as the health sector capacity to manage health outcomes related to climate change.

I am a MPH-Global Health student currently contracted with the WHO to provide technical support in the development of a GEF proposal to *Build Resilience in Lao PDR Health System to Climate Change*. As part of my MPH thesis I am collecting data from key stakeholders to:

- Better understand the climate change adaptation process in the health sector
- Assess the perceptions of key stakeholders to climate change adaptation in the health system
- Identify the challenges, barriers, enablers, and needs of the health sector (and relevant sectors) at all levels to address the affects of climate change
- Evaluate the health sector capacity to manage climate change in Lao PDR and make recommendations for improvement

I agree to participant in this project, whose conditions are as follows:

- The project is aimed at key stakeholder perspectives on climate change and the adaptive capacity of the health sector. For this purpose, semi-structured interviews will be conducted with key informants from the MoH and relevant departments and centers.
- Interviews will last about one hour and questions will deal with knowledge around climate change and its impact on human health; the adaptation process in the health sectors; challenges, barriers, enablers, and needs of the health sector to address the affects of climate change.
- The interview I give and the information it contains will be used solely for the purposes defined by the project.
- At any time, I can refuse to answer certain questions, discuss certain topics or even put an end to the interview without prejudice to myself.
- To facilitate the interviewer’s job, the interview will be recorded with permission from the interviewee. All recordings will be destroyed after notes are checked and confirmed.
- All interview data will be handled so as to protect their confidentiality. Therefore, no names will be mentioned and the information will be coded during the analysis and presentation phase of the project.
- When necessary, a translator will be used to help facilitate the interview questions. The translator will agree to the same confidentiality as the researcher.
- All data will be destroyed at the end of the project.
- For any information about the project, I can contact:

Chris Boyer

Email: cboyer10@uw.edu

Mobile: +1 919-623-1917

Respondents Signature: _____ Date:

Interviewer Signature: _____ Date:

Translator Signature: _____ Date:

C. Interview Guide

Health Sector Capacity to Manage Climate Change in Lao PDR: Perspectives from Key Health Stakeholders

Project Context: Climate change in Lao PDR is leading to increases in temperatures and changes in rainfall patterns. These trends are likely to accelerate in the coming decades. Weather unpredictability has become the norm. Rainfall variability is a critical issue for rural livelihoods that depend primarily on agriculture. There is also evidence of an increasing risk of flash floods in mountainous areas across all provinces. Dry seasons are getting longer while rainy seasons tend to be shorter and more intense. Annual mean temperatures are projected to increase by approximately 2.6 °C by 2050. Extreme events including floods, cyclones and storms, are also expected to occur more frequently, resulting in increased risks of flooding. Rural populations, which account for about two thirds of the total populations, are most affected by these changing weather patterns.

A climate change and health vulnerability assessment (2010-2011) concluded that waterborne diseases, especially dysentery and typhoid, remain a significant source of morbidity, with the health burden expected to increase with climate change. Vector-borne diseases, particularly dengue, are also expected to increase. Other potential impacts include injury and possible death due to extreme weather events, such as storms and flash floods. Agricultural losses due to changing weather patterns will affect food security, putting rural populations at risk of under-nutrition.

Limited data and information are available on who is most vulnerable and which geographical areas will be most affected. There is a capacity gap in assessing vulnerability, and the capacity of the health system to manage current and projected changes.

The government of Lao PDR is developing or has developed plans of action to address the impact of climate change, with a focus on specific at-risk sectors. Population health was identified as one of the key sectors most affected by climate change. Building a climate resilient health system and health care facilities are important measures to promote adaptation. In response, the MoH, along with other relevant key stakeholders, are exploring strategies to increase resilience of the health sector to prepare for and respond to health outcomes associated with weather and climate.

Providing support to the Ministry of Health and the WHO country office, the proposed study aims to collect data on the perceived knowledge of climate change among key government stakeholders and identify barriers and opportunities to increase the capacity of the health sector to manage the risks of climate change.

I am a MPH-Global Health student currently contracted with the WHO to provide technical support in the development of a GEF proposal to Build Resilience in Lao PDR Health System to Climate Change. As part of my MPH thesis I am collecting data from key stakeholders to:

Aims

- To assess perceptions of climate change and its impacts on the health system in Lao PDR from key stakeholders in health and other relevant institutions and government ministries.
- To identify the barriers and opportunities of the health sector capacity to manage climate change in the coming decades.

Objectives

- To describe and compare climate change knowledge and climate change adaptation strategies and policies using a questionnaire and in-depth, semi-structured interviews with key stakeholders in health and other relevant government institutions.

- To make recommendations on how climate change and health adaptation strategies could be improved and capacity gaps can be addressed in the health sectors' ability to adapt to climate change in Lao PDR.

The following interview is confidential and for internal use by the student and the WHO Country Office in Lao PDR to gain insight into stakeholder perspectives and help guide project outcomes. Names of participants will not be shared with any third party. Personal information will be coded during analysis and presentation phases of the project. The attached consent forms clearly details the agreement.

Interviews will be recorded with consent from the participant for reference during the analysis phase and to confirm/check notes taken during the interview. Recordings will not be transcribed. When necessary, a translator will be used to help facilitate the interview questions. The translator will agree to the same confidentiality as the researcher. Interviews should last about one hour.

Goal: Expand on the strengths, weaknesses, opportunities, threats, (SWOT) and themes surrounding the capacity of the health sector to manage climate change, as well as the awareness of the impact of climate change on the health sector from the perspective of different key central level stakeholders.

Demographic/Personal

Name:

Age:

Sex:

Highest Level of Education:

Ministry, Department, Center, Organization:

Position/Title:

Ministry Description

- Describe the roles/responsibilities of your Ministry, Department, Center, or Organization.

Basic Climate Change Knowledge

- Describe your understanding of climate change in Lao PDR
- How does climate change manifest in Lao PDR?
- Do you feel climate change is a major issue in Lao PDR?
- Does climate change impact human health in Lao PDR? If so, how?
- Describe the climate-related health impacts, if any that currently affect your ministry, department, center, or organization
- Of the climate-sensitive health risks mentioned, which do you think will be most important in the coming decades? Why?
- Are certain populations more at risk of climate-related health impacts? If so who are they and why? Do you believe climate change adaptation can reduce vulnerability? Why or why not?

Health Service Delivery

- To what extent are the health risks of climate change discussed in current planning? Why or why not?
- Are current plans likely to be sufficient to address the health risk of climate change? In 10-20 years?
- Describe any barriers that impede the development of plans to address the health risk of climate change?
- What opportunities exist to strengthen service delivery practices to ensure staff is empowered to deal with climate change. Have Standard Operating Procedures been created or updated? Has awareness training been provided?

- With regard to facilities and infrastructure, how prepared are they to respond to climate-sensitive health issues? If modifications were needed, what would they be?

Institutional Capacity

- Are you aware of any current plans for updating health system policies to address health risks due to climate change? Do these plans sufficiently address perceived/predicted needs? Why or why not?
- Describe any rules or regulations that need to be revised to increase capacity to meet health challenges posed by climate change. Do you feel they have been successful?
- Describe any financial mechanism available to address budgetary requirements for adapting to climate change.
- What additional efforts are likely to be needed? What are additional barriers or opportunities?

Surveillance and Early-Warning Systems

- Describe data availability in Lao PDR with regard to climate change and health. Is it accurate? Is it frequent? Is there an informative format provided to make good decisions? Why or why not?
- Describe data collection within your ministry, institutions, etc? Who is responsible to collect, manage, and disseminate data? How confident are you in the abilities to collect, manage, and disseminate data? Why or why not?
- Describe any early warning systems currently functioning. Is the information comprehensive? Why or why not?
- Describe any additional barriers or opportunities for collaboration with regard to data collection and/or EWS.

Regional Cooperation and Sector Coordination

- Describe the main stakeholders in Lao PDR in relation to climate change and health
- Describe any current programs or projects that are currently underway relevant to climate sensitive health risks at the regional level? At the national level?
- Do you feel there are coordination mechanisms that support multi-regional climate change and health interventions?
- Describe the coordination between sectors in Lao PDR with regard to climate change and health?
- What are some barriers to coordination? What are opportunities?
- Describe the coordination between other countries in the region? Is information shared on lessons learned? New challenges?

Additional Follow-up Questions

- What are barriers or threats to change?
- Describe any capacity gaps you feel exist.
- What is needed to meet/address challenges?
- What risks can be identified in the process of implementing or not implementing the desired change?
- What is your level of confidence that changes can be implemented to meet identified needs?
- What strategies would you propose to implement to address climate-sensitive health risks?
- How can your department, etc minimize the impacts of climate change on the health system?
- How can your department build resilience to climate change and its health impacts?

D. Codebook

Barriers/Challenges/Weaknesses

- Budget
- Human Resources
- Technical Knowledge
- Supplies
- Communication
- Implementation
- Lack of Capacity

Causes of Climate Change

- Deforestation
- Pollution

Solutions/Strategies

- Mitigation
- Adaptation
 - Increased Awareness
 - Community
 - Provincial/District Staff
 - Central Staff
 - Technical Training

Climate Change Knowledge

- Natural Disasters/Extreme Weather Events
 - Flood
 - Drought
 - Typhoon
 - Heavy Rain/Storms
- Health Risks
 - Vector Borne Disease
 - Water Borne Disease
 - Nutrition
 - Food Security
 - Injury
- Weather Patterns
 - Increases in temperature
 - Decreases in temperature
 - Increases in rainfall
 - Decreases in rainfall
 - Changes in seasons

Coordination

- International
- Sector
- National

Planning/Decision-Making Process

- Communication

- Funding
- Leadership
- Health Planning

Surveillance

- Data Availability
- Data Collection Processes
- Databases
- Early Warning Systems
- Mapping

Vulnerable Populations

Opportunities/Successes

Challenges

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