



KINGDOM OF CAMBODIA

Nation, Religion, King

**Climate Change Strategic Plan for
Public Health**

**Towards Increased Climate Resilience for Better Health
and Well-being of all Cambodians**



MINISTRY OF HEALTH

2013

Preface

Recent decades of socio-economic development in the world, particular in Asia and Pacific has posed significant changes and put pressure on natural resources and environmental changes, while climate change has becoming the main challenges requiring all governments in world to take steps and seek solution by joint collaboration to ensure sustainable development. Health is one of sectors to be affected by such dilemma.

In response to the requirement of the Ministry of Environment, Kingdom of Cambodia, Ministry of Health is one among nine relevant ministries to be taking parts in formulating a strategic plan for public health in the country for the adaptation process. The integrated concept, strategic approaches, and activities are to be integrated into a single document by requested agency, then it will be adopted by the Royal Government of Cambodia.

Health Strategic Plan for Public Health is formulated based upon the National Rectangular Strategy, National Strategic Development Plan 2010-2013, Cambodia Millennium Development Goals, Health Strategic Plan 2008-2015, National Adaptation for Programs in Action, Second National Communication Strategic National Action Plan on Disaster Risk Reduction 2008-2013, Cambodia Human Development Report of UNDP 2011, Demographic and Health Survey DHS 2010, Health Strategic Plan 2008-2015, and Cambodian Health Care System.

Through the effort made by the Ministry of Environment , Ministry of Health, other line ministries supported by development partners such as UNDP, European Union, DANIDA, and SIDA for providing technical and financial assistances as well as the great work of technical working group members of respective ministry would contribute the formulation this national document relevant to the needs of Cambodian population to adapt to future climate change.

The Climate Change for Public Health road map is envisaged to ensure Cambodian people's prosperous and sustainable live-hood, taking into account the environmental health quality and people's wellbeing objectives in the context of Climate Change.

I would like to take this opportunity to highlight value and appreciate the inputs by the technical working group, inter-ministerial, and all advisors for successful development of the national climate change adaptation road map.

I would like to express my profound thanks to the development partners, the UNDP, European Union, DANIDA, and SIDA for the financial and technical support through CCCA of MOE for the development of this Climate Change Strategy for Public Health.

Finally I would like to reassert my commitment to the implement this Climate Change Strategic Plan for Public Health successfully. *MB*

Phnom Penh, 09 January 2013

Minister of Health



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Executive Summary

The Climate Change Strategic Plan for Public Health (CCSPH) is prepared as part of the Cambodia Climate Change Strategic Plan (CCCSP), funded by UNDP through the Cambodia Climate Change Alliance (CCCA). The CCCSP is intended to serve as an entry point for climate change policy development and integration, development guidance, funding mechanism, sector action plan development, campaign and awareness raising, investment, capacity building, public-private partnership (PPP) development, and green growth planning (Sitanon J., 2012). Health is one of the sectors invited to undertake sector analysis and strategic planning to be integrated in the CCCSP. The CCCSP is structured into three phases for implementation until 2023.

The CCSPH consists of six sections, of which Sections 3, 4, and 5 constitute the main analysis of health impacts of climate change and the responsive strategic plan. Section 3 provides an analysis of observed and projected health impacts of climate change, and based on this, a number of priority targets have been identified. Section 4 describes the existing health strategy and policy response, including institutional structures relevant to climate change activities. Section 5 proposes a set of objectives, actions and a matrix of possible adaptation projects/activities in response to the identified climate change related health impacts.

Following consultation with relevant departments of the Ministry of Health (MoH), a desk study of health policy documents, and a review of existing analysis and studies by the Initial National Communication (INC) team, Second National Communication (SNC) team, the World Health Organization (WHO) and Inter-governmental Panel on Climate Change (IPCC), three climate-health sensitive areas were selected as the main targets for development of an appropriate climate strategy and action for the health sector. The three targets are: vector-borne diseases; water/food borne diseases; and health impacts related to extreme weathers. Based on these three targets, a strategic plan of action has been devised with a vision, mission and goal, described below.

- A. **Vision:** *to increase climate resilience for better health and well-being of all Cambodians, especially of the poor, women and children, contributing to poverty alleviation and achieving the Cambodia Millennium Development Goals (CMDG).*
- B. **Mission:** *to provide efficient and equitable health care services and to build adaptive capacity to cope with short- and long-term climate change by mainstreaming climate change into the Health Strategic Plan and National Strategic Development Plan.*

C. Goal and Objectives

Goal: To reduce morbidity, mortality, injuries and health vulnerability to climate variability and extreme weathers.

Objective 1: To improve health care infrastructure and capacity of health personnel to cope with vector-borne and water-borne diseases in the context of climate change.

- Conduct surveillance and research on malaria and dengue fever in selected provinces to improve knowledge of the relationship between climate variability (temperature, rainfall, humidity) and epidemiologic and entomologic changes;
- Conduct surveillance and research on water-borne and food-borne diseases in selected provinces to improve the knowledge relationship between climate variability (temperature, rainfall, humidity) and infectious diseases;
- Assess health care infrastructure at all levels (especially in disaster-prone areas) in response to climate change related diseases and extreme weathers;
- Develop and update technical guidelines for diagnosis, detection, control, prevention and treatment of diseases (malaria, dengue fever, diarrhea, typhoid, cholera, etc.), injuries, and food-poisoning illnesses arising from climate change;
- Develop short- and medium-term incremental action plans for improved health infrastructure, staffing, and capacity to cope with vector-borne and water/food-borne diseases in the context of climate change, built on strategic priorities stipulated in the Health Strategic Plan.

Objective 2: To enhance emergency preparedness and response to cope with extreme weathers and climate change related disasters.

- Development and implementation of surveillance of extreme weathers and related diseases, including respiratory diseases, injuries, malnutrition, food safety/consumption in synergy or collaboration with the Cambodian Red Cross, National Committee for Disaster Management (NCDM), the Ministry of Water Resources and Meteorology (MoWRAM) and other relevant agencies;
- Setting up and strengthening emergency preparedness and response networks and plans, including food safety response, at all levels.

Objective 3: To improve knowledge and research capacity on health impacts and vulnerability to climate change as an information base for mainstreaming climate change in the health strategic planning of MoH and other sector planning.

- Development of methodologies, guidelines, models and indicators for research and health vulnerability assessment in collaboration with CCCD of the Ministry of Environment (MoE), WHO and other relevant health institutes such as Pasteur;
- Organize trainings on health impact/vulnerability assessment, modeling of climate variability and health impacts, surveillance and research, based on a training needs assessment;
- Development and implementation of short- and medium-term action plans for epidemiologic and entomologic research, surveillance and health vulnerability assessment in the context of climate change in priority areas, to build science-based knowledge for adaptation planning and decision making;
- Promoting public education and awareness campaigns on the health impacts of climate change, including disease control, prevention, treatment, epidemic preparedness and sanitation and hygiene;
- Mainstreaming and regular update of climate change and health implications, including related adaptation plans in the Health Strategic Plan.

Since modeling of climate change has many uncertainties and may not occur as projected, no-regret options can benefit society even if climate does not change. IPCC (2007) has identified rebuilding public health infrastructure as “the most important, cost-effective and urgently needed” adaptation strategy. Other no-regret adaptation options include: public health training programs; more effective surveillance and emergency response systems; and sustainable prevention and control programs. Short- and medium-term planning is more realistic and should take into account other non-climate factors, for example, migration, land-use change and deforestation, irrigation development and human population density. Systematic surveillance and observation of many causal factors can improve understanding and devise appropriate responses. In addition, it is important to note that this CCSPH also provides analysis and elaboration on cross-cutting issues such as coordination, capacity building, the Health Information System, gender, and the Health Financing Mechanism, which would support effective implementation of this strategic plan.

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Acronyms and Abbreviations

| | |
|----------------|--|
| ADB | Asian Development Bank |
| CBHI | Community-Based Health Insurance |
| CCCD | Cambodia Climate Change Department |
| CCSPH | Climate Change Strategic Plan for Public Health |
| CDC | Communicable Disease Control |
| CDHS | Cambodia Demographic and Health Survey |
| CMDG | Cambodia Millennium Development Goal |
| CNM | National Center for Parasitology, Entomology and Malaria Control |
| CRC | Cambodian Red Cross |
| CRS | Cambodia Rectangular Strategy |
| D&D | De-concentration and Decentralization |
| DDF | Department of Drugs, Food and Cosmetics |
| DPHI | Department of Planning and Health Information |
| GCM | General Circulation Model |
| GDP | Gross Domestic Product |
| GHG | Greenhouse Gas |
| GPCC | General Population Cambodian Census |
| HC | Health Center |
| HEF | Health Equity Fund |
| HIS | Health Information System |
| HIV/AIDS | Human Immunodeficiency Virus/Aquired Immune Deficiency |
| HIV/AIDS-NSPII | Syndrome |
| HP | HIV/AIDS National Strategic Plan 2006-2010 |
| HSP | Health Post |
| HSR | Health Strategic Plan |
| HWGCC | Health Sector Review |
| INC | Health Working Group for Climate Change |
| IPCC | Initial National Communication |
| MAFF | Inter-governmental Panel on Climate Change |
| MIME | Ministry of Agriculture, Forestry and Fisheries |
| MoE | Ministry of Industry, Mines and Energy |
| MEF | Ministry of Environment |
| MoEYS | Ministry of Economy and Finance |
| MoH | Ministry of Education, Youth and Sport |

| | |
|---------|--|
| MoP | Ministry of Health |
| MoWRAM | Ministry of Planning |
| MRD | Ministry of Water Resources and Meteorology |
| MPWT | Ministry of Rural Development |
| NAPA | Ministry of Public Works and Transport |
| NCD | National Adaptation Programme of Action to Climate Change |
| NCDM | Non-communicable Diseases |
| NGO | National Committee for Disaster Management |
| NMCP-SP | Non-governmental Organization |
| NNS | National Malaria Control Programme Strategic Plan |
| NSDP | National Nutrition Strategic Plan |
| PRECIS | National Strategic Development Plan |
| PHD | Providing Regional Climates for Impacts Studies |
| PMD | Provincial Health Department |
| PPP | Preventive Medicine Department |
| RGC | Public Private Partnership |
| RH | Royal Government of Cambodia |
| RS | Referral Hospital |
| SHI | Rectangular Strategy |
| SNC | Social Health Insurance |
| SNAP-DR | Second National Communication |
| V&A | Strategic National Action Plan for Disaster Risk Reduction |
| UNDP | Vulnerability and Adaptation |
| UNESCO | United Nations Development Programme |
| UNFCCC | United Nations Educational, Scientific and Cultural Organization |
| WB | United Nations Framework Convention for Climate Change |
| WHO | World Bank |
| | World Health Organization |

1. Introduction

Climate change, the consequence of global warming of our planet, is one of the challenging issues for sustainable development of the world at present and in the future. The global mean surface temperature has risen about 0.74°C for the last 100 years (IPCC, 2007) and is projected to increase between 1.8°C to 4°C by 2100, based on simulation of several General Circulation Models (GCM). Cambodia's mean surface temperature has increased by 0.8°C since 1960 (SNC, 2010). Increased green-house gas (GHG) emissions in the atmosphere are scientifically believed to be the main driver of global warming, triggering changes in climate variables and weather patterns across our planet. Consequently, severe flooding, prolonged droughts, destructive cyclones, sea-level rise and heat waves have been frequently observed and are projected to increase by the end of this century (IPCC, 2007). This extreme weather pattern varies from region to region, representing both opportunities and challenges.

Cambodia has already experienced climate change impacts caused by severe and intensive floods, drought and windstorms since 1990, which have had adverse effects on almost all Cambodian economic sectors. These impacts are undoubtedly felt in the health sector. Flooding in 2000 was the most severe ever in Cambodia, affecting millions of people, causing 347 human deaths (80% of which were children), and damaging social and physical infrastructure (US\$150 million). Vector-borne and water-borne diseases such as malaria, dengue fever and cholera also cause significant impacts on Cambodian health outcomes. Cambodia's narrow-based economy and low production capacity make it increasingly vulnerable to climate change impacts (NAPA, 2006). Cambodia's poverty rate remains high among countries in the region, although Cambodia's per capita GDP has enjoyed steady growth for the last decade. This compels the RGC to take action by developing and implementing appropriate policies, strategies and programs addressing the most urgent development needs and the emerging climate change. Notable progress has been achieved in the implementation of the Cambodia Rectangular Strategy (CRS), the National Strategic Development Plan 2010-2013 (NSDP) and other sector reforms. Cambodia's ratification of UNFCCC in 1995 and Kyoto Protocol in 2002 provide a political foundation for taking appropriate policy actions and implementation of programs that can address climate change impacts, while harnessing its opportunities. Adaptation is considered the immediate priority, while GHG mitigation activities will be gradually undertaken based on Cambodia's socio-economic conditions and cost-effective opportunities. The Asian Development Bank (ADB) has estimated that with a business-as-usual scenario, climate change could cost about 2.2% of GDP in South East Asia, but with adaptation it could save 1.9% of GDP per annum (ADB,

2009). Being one of the least-developed countries (LDC), Cambodia has a large window of opportunity to access technical and funding support from developed countries and other climate funding initiatives. The CCCSP is now being implemented, with participation of several sectors, including the health sector. It is important to note that preparation of the CCSPH faces a number of difficulties, as it is the first climate-related exercise ever conducted by MoH. Previous involvement of MoH in climate related activities, such as in the National Adaptation Programme of Action (NAPA) and INC, was limited to the provision of health data and consultation. There is a general lack of understanding of the relationship between climate change and health outcomes, thus time series health data and existing surveillance do not include climate variables as dependent determinants. Notwithstanding limited health data, this CCSPH has been prepared using existing impact analysis and studies by IPCC, INC, NAPA and SNC, among others. Preparation of this CCSPH follows a number of simple steps, such as:

- Desk study of government policies and strategies related to climate change and the health sector, including existing studies and analysis of current and projected climate change impacts on health;
- Identification and scoping of the key climate health sensitive targets for the CCSPH;
- Development of CCSPH and health adaptation options built on the Health Strategic Plan (HSP) and NSDP, through broad consultation with relevant stakeholders.

The CCSPH would serve a strategic plan providing a full range of policy responses to health impacts of climate change in Cambodia.

2. Overview of Cambodia's demography, natural features and socio-economic conditions

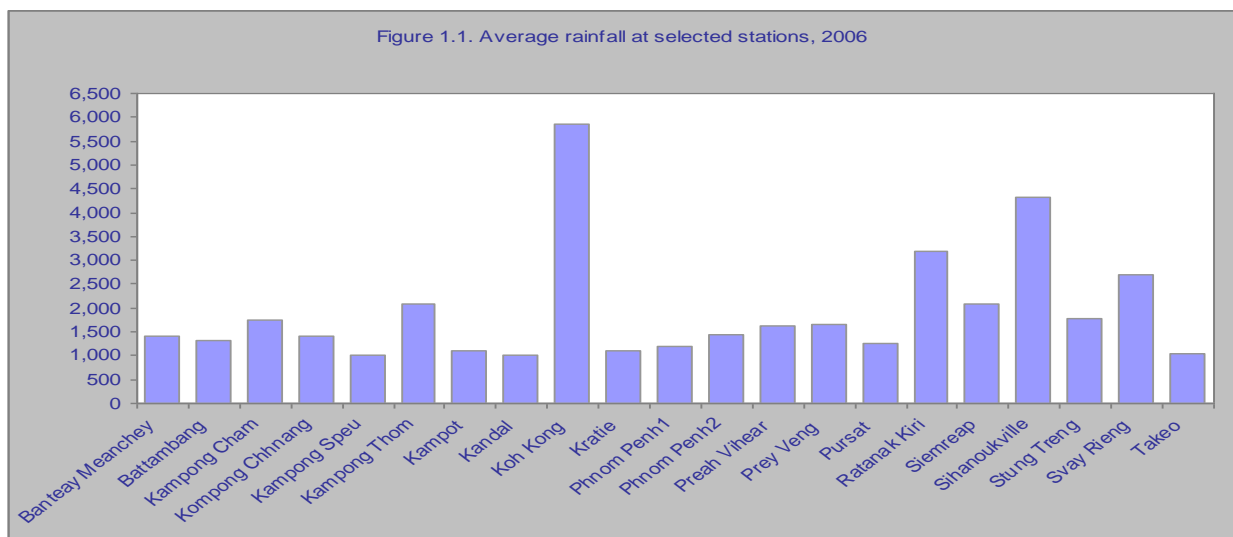
2.1 Geography, natural features and climate

Cambodia has a land area of 181,035 km² located in South-East Asia, within latitudes 10° and 15°N and longitudes 102° and 108°E. Cambodia's international borders are shared with Thailand on the west and north, the Lao People's Democratic Republic on the north, and the socialist Republic of Vietnam on the east and southeast. The country has a coastline of 440 km and extensive mangrove forests, some of which are relatively undisturbed. Cambodia's landscape is characterized by a large central plain surrounded by the Elephant Mountains and Cardamom Mountains of the southwest and western regions, the Dangrek Mountain of the north adjoining the Korat Plateau of Thailand, and the northeast highland of Rattanakiri province. The dominant features of the central low-land areas are the Tonle Sap Lake and the Mekong River with tributaries, which is considered the heart and soul of the Cambodian economy and culture. Cambodia is famous for its rich fisheries and temples. Angkor Wat and

Preah Vihear are listed as UNESCO Cultural World Heritage sites, due to their outstanding values made by humankind.

Cambodia's climate is dominated by the monsoon, with two distinct seasons – wet and dry seasons. The monsoon brings the rainy season from May to September or early October, and the northeast monsoon lasts from early November to March, marking a relatively cool month in January followed by the warmest month in April. Cambodia has a minimum average temperature of 22.5°C and a maximum average of 33.8°C. The annual rainfall varies according to the landscape, ranging from 1,000mm in the central plains to about 5,000mm in the highland region. Takeo has the lowest rainfall and Koh Kong has the highest, based on 2006 rainfall records (National Institute of Statistics, 2008).

Figure 1: Rainfall by province in 2006



Source: NIS, 2008

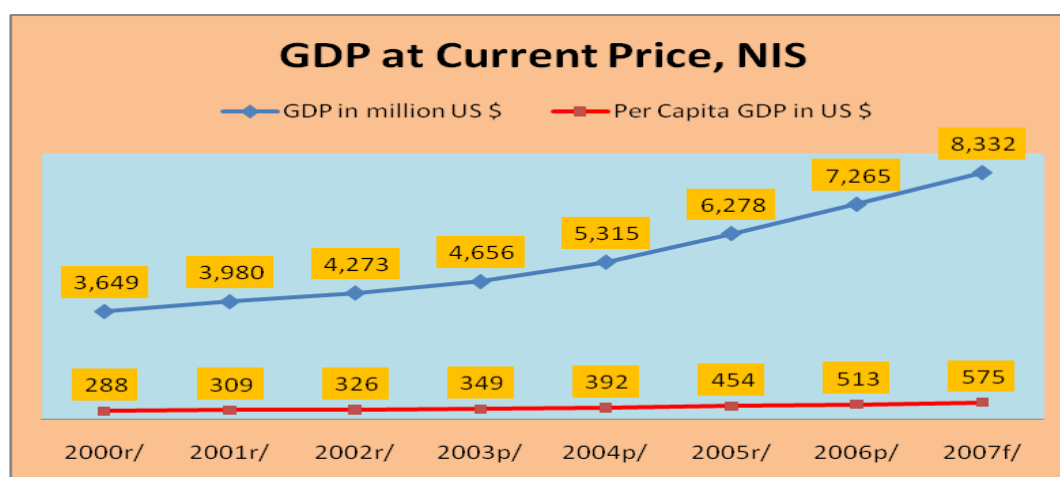
2.2 Demography

Cambodia has a total population of 13.4 million, with an annual growth rate of 1.54% as of 2008 (NIS, 2008). Around 80% of the total population lives in rural areas and 19% in urban areas. Phnom Penh has a population of 1.3 million, with an annual growth rate of around 2.82%. More than 90% of Cambodian people are Khmer, with the remaining 10% being Cham, Chinese, Vietnamese and other ethnic minorities. While Cambodian people are free to choose their religion, Buddhism is the most dominant religion. The most interesting feature of the Cambodian population is the high proportion of young people, with around 60.8% being 24 years of age or younger. The proportion of women is relatively high, with 53.7% of those who are 20 years old or more being females, according to the General Population Cambodian Census (GPCC) 1998.

2.3 Economic status

Cambodia has experienced steady economic growth, with per capita GDP rising to \$830 in 2010, three times that of 1994 (\$248) as a result of the Rectangular Strategy (RS) and National Strategic Development Plan (NSDP) which helped bring the poverty rate down to 30% in 2007. Cambodia's real GDP had a growth rate of 7.1% in 2011, and is expected to stabilize at around 6% in the coming years (MEF, 2011). The economy is narrowly based and driven by four main sectors: garment, tourism, construction and agriculture. Despite the effects of flooding, the agriculture and industry sectors experienced a growth rate of 3.3% and 14.3% respectively in 2011. With an export target of 1 million tons by 2015, rice productivity is expected to increase, attracting more investment in the rice processing industry. Agro-industrial crops such as rubber and cassava have enjoyed speedy growth, which will create more jobs in the coming years. Rubber production had a growth rate of 10.1% as of 2011 (MEF, 2011).

Figure 2: GDP Growth



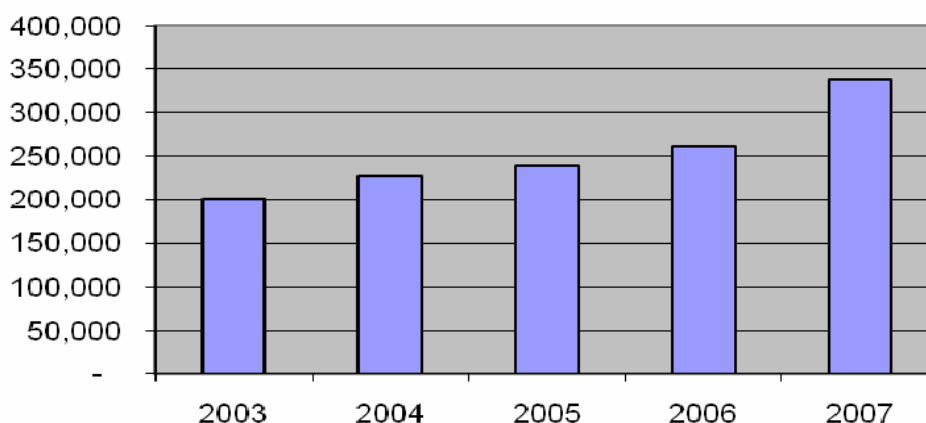
Source: NIS, 2008

2.4 Health Status

According to MoH's definition, health is complete physical, mental, social and spiritual well-being without illness, mental and physical disorders. Health is one of the priority focus and cross-cutting outcomes of many government policies and strategies, such as the CMDGs, the RS, the NSDP and the HSP. Provision of good health care services would have positive impacts on achieving the goals of other sectors, be they agriculture or fisheries. Rigorous efforts have been made for the last two decades to improve health care services and infrastructure, including setting up a financing mechanism that benefits the poor and disadvantaged across the country. As of 2007 there were 1,035 health establishments with 10,509 available medical beds. The total number of registered public health personnel was 16,541, of which 2,012 were medical doctors, an increase of 43.1% between 1997 and 2007.

Health outcomes have improved recently. The infant mortality rate has decreased from 66 per 1,000 live births in 2005 to 45 per 1,000 live births in 2010. The under-five mortality rate decreased from 83 per 1,000 live births to 54 per 1,000 live births in the same period. Life expectancy at birth is 60.5 years for males and 64.3 years for females (NIS, 2009). A total of 67,341 malaria cases (OPD) were treated in 2007, which has declined 12.3 percent from 76,829 cases treated in 2006 (HSP). Malaria fatality cases per 1,000 population in 2003 and 2007 decreased from 9.96 and 7.9 respectively (HSP). General government expenditures on health per capita increased from US\$4 in 2000 to US\$7 in 2005 and US\$11 in 2009 (Figure 3). The health status of the Cambodian people has steadily improved in a number of key areas. Nonetheless, challenges remain in many other areas, including potential health risks associated with changing climate variability and extreme weathers.

Figure 3: Health Finance



Source: HSP, 2008-2015

3. Climate change observations, projections and health implications

3.1 Climate observation and projection

The IPCC's Fourth Assessment Report (2007) observed that the global mean surface temperature has risen by 0.74°C for the last 100 years, and the warming rate is almost double for the last 50 years, and land has warmed faster than the ocean. The surface temperature is projected to increase, ranging from 1.8°C for a low scenario (B1) to 4°C for the highest scenario (A1FI) over the course of the twenty-first century, based on a large number of different global climate models and a range of plausible scenarios of greenhouse gas (GHG) emissions (Table 1). In South-East Asia, the mean temperature by 2100 is projected to increase 1.95°C under B1 and 3.77°C under A1FI, from 1990. Based on analysis and modeling

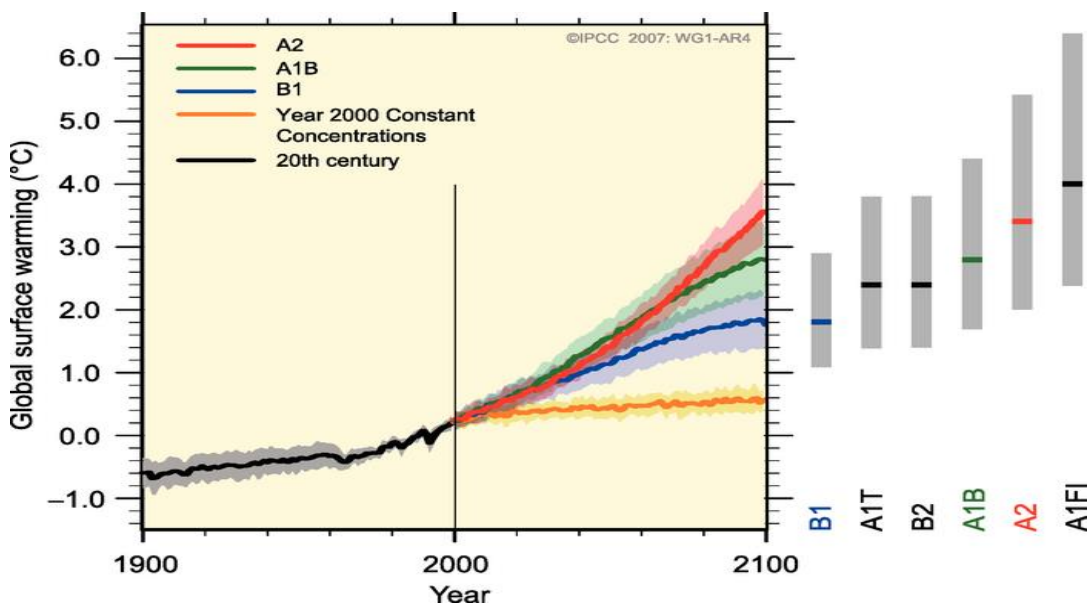
of the historical and future climate change of Cambodia using reconstructed data from Providing Regional Climates for Impacts Studies (PRECIS) and General Circulation Model (GCM) models, under Scenario B1 and A2 (SNC, 2010), the rate of mean monthly temperature increase in Cambodia ranges from 0.013 °C to 0.036°C per year, depending on the location. The rate of temperature increase is high in low altitude areas, such as in central and North Eastern Cambodia (0.036°C per year) and low in the high altitude areas such as the South West region (0.013°C per year). Since 1960, the frequency of ‘hot’ days has increased significantly (+46, with strongest increases noted from September to November), as has the frequency of ‘hot’ nights (+63, with strongest increases noted in the December to February period).

Table 1: Projection of surface temperature and sea-level rise by IPCC Fourth Assessment Report

| Scenario | Temperature Change (°C at 2090-2099 relative to 1980-1999) | | Sea-level Rise (m at 2090-2099 relative to 1980-1999) |
|-------------------------|---|--------------|--|
| | Best estimate | Likely range | |
| Constant concentrations | 0.6 | 0.3 – 0.9 | NA |
| B1 scenario | 1.8 | 1.1 – 2.9 | 0.18 – 0.38 |
| A1T scenario | 2.4 | 1.4 – 3.8 | 0.20 – 0.45 |
| B2 scenario | 2.4 | 1.4 – 3.8 | 0.20 – 0.43 |
| A1B scenario | 2.8 | 1.7 – 4.4 | 0.21 – 0.48 |
| A2 scenario | 3.4 | 2.0 – 5.4 | 0.23 – 0.51 |
| A1FI scenario | 4.0 | 2.4 – 6.4 | 0.26 – 0.59 |

Source: IPCC, 2007

Figure 4: Projection of global surface temperatures under different scenarios by 2100



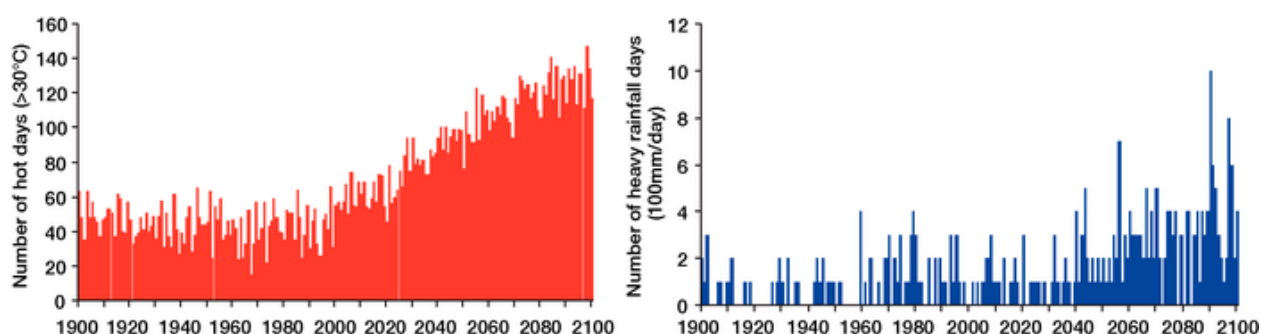
Source: IPCC, Fourth Assessment Report,

Table 2: Projection of surface temperature and precipitation in South East Asia by IPCC

| | Sea son | 2010-2039 | | | | 2040-2069 | | | | 2070-2099 | | | |
|-----------------------|------------|-------------------|------|--------------------|----|-------------------|------|--------------------|----|-------------------|------|--------------------|----|
| | | Temperature °C | | Precipitation % | | Temperature °C | | Precipitation % | | Temperature °C | | Precipitation % | |
| | | A1FI | B1 | A1FI | B1 | A1FI | B1 | A1FI | B1 | A1FI | B1 | A1FI | B1 |
| South East Asia | DJF | 0.86 | 0.72 | -1 | 1 | 2.25 | 1.32 | 2 | 4 | 3.92 | 2.02 | 6 | 4 |
| | MAM | 0.92 | 0.80 | 0 | 0 | 2.32 | 1.34 | 3 | 3 | 3.83 | 2.04 | 12 | 5 |
| | JJA | 0.83 | 0.74 | -1 | 0 | 2.13 | 1.30 | 0 | 1 | 3.61 | 1.87 | 7 | 1 |
| | SON | 0.85 | 0.75 | -2 | 0 | 1.32 | 1.32 | -1 | 1 | 3.72 | 1.90 | 7 | 2 |

Source: IPCC, 2007

Figure 5: Projection of hot days and daily heavy rainfall by IPCC



Source: IPCC Fourth Assessment Report on projected number of hot days (>30°C) and days of heavy rainfall (>100 mm/day) by the high resolution general circulation model (Hasumi and Emori, 2004).

3.2 Observation of climate change impacts in Cambodia

As a result of modeling work by the INC and SNC team, Cambodia's mean surface temperature has increased by 0.8°C compared to 1960 (SNC). This small change is very difficult for anyone to feel, or to comprehend the consequential health impacts, as humans can adapt to much higher fluctuations of temperature variables. However, what is obvious to many people in Cambodia is an observed change in climate patterns; flooding, droughts and wind storms over the last ten years are now more frequent, more severe, and last longer. According to NCDM, flooding has been recorded almost every five years but has become more frequent in the last ten years (in 1961, 1966, 1978, 1984, 1991, 1996, 2000, 2001 and 2002). Flooding in 2000 was the most severe ever in Cambodia, affecting millions of people, causing 347 human deaths (80% of which were children), and damaging social and physical infrastructure (US\$150 million). Drought was observed in 2001, 2002, and 2003, with the drought in 2002 affecting agriculture in 420 communes of 76 districts in the 10 provinces of Prey Veng, Kandal, Kampong Speu, Takeo, Svay Rieng, Kampong Thom, Kampong Cham, Kratie, Odor Meanchey and Banteay Meanchey. Table 3 provides a summary of natural disasters

between 1987 and 2007, which serves as evidence of direct and indirect health impacts that may be associated with climate change (NCDM, 2008).

Table 3: Natural Disasters in Cambodia 1987-2007 (NCDM)

| | No of Events | Death | Injury | Homeless | Population Affected | Cost of Damage ('000s) |
|----------------|--------------|-------|--------|----------|---------------------|------------------------|
| Flood | 12 | 1,125 | 53 | 275,805 | 9,514,614 | 327,100 |
| Avg. per event | | 94 | 4 | 22,984 | 792,885 | 27,258 |
| Drought | 5 | 0 | 0 | 0 | 6,550,000 | 138,000 |
| Avg. per event | | 0 | 0 | 0 | 1,310,000 | 27,600 |
| Epidemic | 8 | 788 | 0 | 0 | 413,570 | 0 |
| Avg. per event | | 99 | 0 | 0 | 51,696 | 0 |

Source: National Strategic Action Plan for Disaster Risk Reduction 2008-2013

3.3 Health vulnerability and impacts of climate change

Several initiatives were undertaken to assess health vulnerability and adaptation (V&A) in Cambodia, which served as an information base for identification of critical areas of climate-related health outcomes and devising appropriate responsive strategies to reduce climate sensitive health burdens. Significant progress on V&A for the health sector has been made by MoE as part of the preparation of the Cambodia INC (2002), SNC (2010), and NAPA (2006). Among 39 adaptation projects identified by NAPA, six were health-related adaptation projects. The INC developed the regression model to establish a mathematical correlation between malaria incidents and climate variability, as shown below.

$$Y = 24268 - 1.37 \text{ DSR} + 1.55 \text{ WSR} - 103 \text{ Tmean} - 342\text{PL}$$

Where DSR: dry season rainfall, November to April; WSR: wet season rainfall, May to October; Tmean: annual mean temperature; and PL: percentage of literate population.

The above equation indicates that the number of malaria cases is negatively correlated with dry season rainfall, means of annual temperature, and percentage of literate population, and positively correlated with wet season rainfall.

The SNC team continued to improve modeling of climate change impacts and malaria incidents by conducting two analyses (i) assessment of proneness of provinces to malaria, based on historical malaria data of 2000-2005 from MoH and (ii) assessment of malaria transmission risk under current and future climate.

Assessment of the Proneness of Cambodia Provinces to malaria was conducted based on five types of malaria indicators:

- Percentage malaria confirmed case (M). Number of confirmed malaria cases reported by every province and divided by the total confirmed malaria cases of all provinces and multiplied by 100;
- Trend of the M value over six years (TM). The trend value was estimated using a regression equation;
- Percentage number of deaths caused by malaria (N). Number of deaths caused by malaria reported by every province, divided by the total death cases of all provinces, and multiplied by 100;
- Trend of the N value over six years (TN). The trend value was estimated using a regression equation;
- Percent population at risk (PR). Number of population at risk, reported by every province and divided by the total death cases of all provinces, and multiplied by 100.

Assessment of malaria transmission risk under current and future climate follows the transmission risk formula of Reiter (2001).

$$c = \frac{ma^2 p^n}{-\ln p}$$

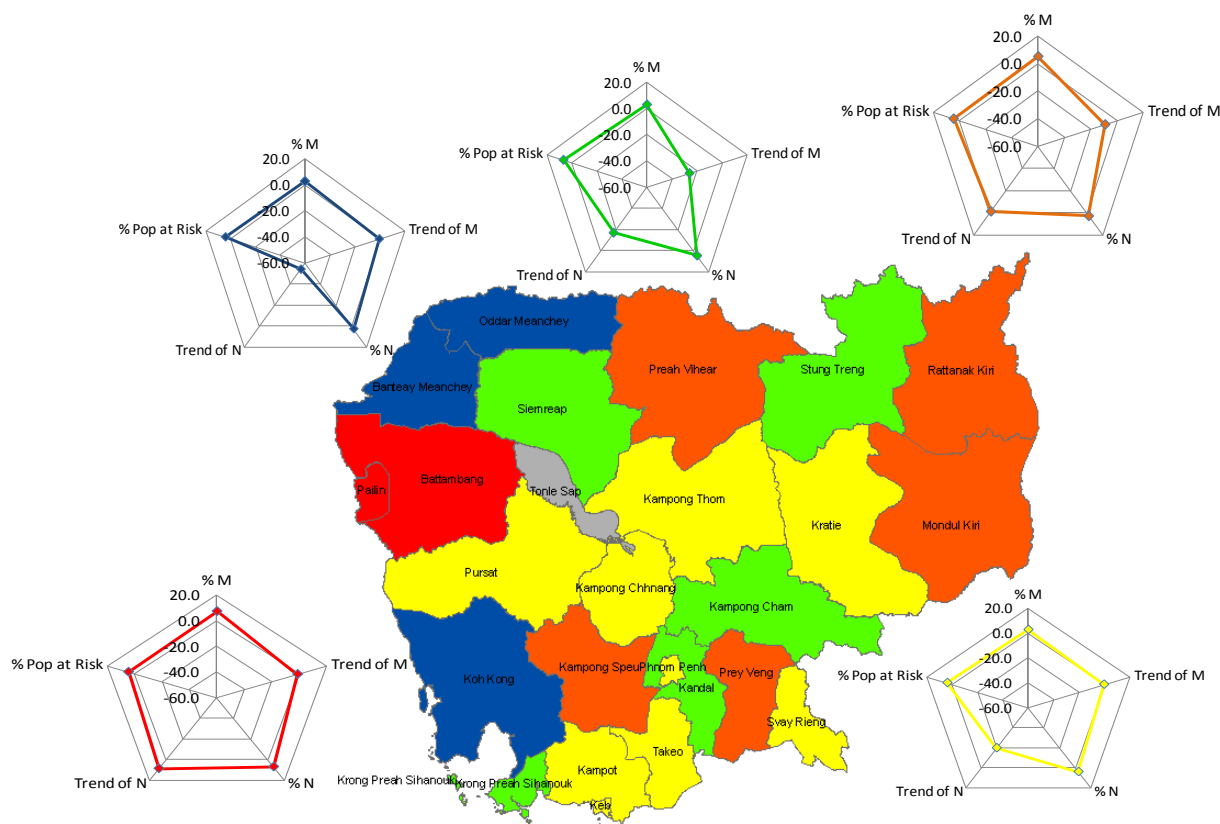
where 'm' is the mosquito density per human, 'a' is the average number of bites per day for each mosquito, 'p' is the probability of a mosquito surviving through any one day and 'n' is the extrinsic incubation period - the time taken for the pathogen to develop in the mosquito until the insect becomes infective.

Based on Malaria Proneness Index (MPI) and five clusters of proneness areas, a map was prepared as shown in Figure 6.

The MPI has indicated that Batambang¹ has the highest M (13%), followed by Pursat, Kompong Speu and Preah Vihear, while Kandal, Preah Sihanouk, Phnom Penh, Svay Rieng, Takeo, Kep, and Prey Veng have the lowest M values. It is suggested that most provinces (19 of the 24 provinces) showed a decreasing trend of the M value over six years.

¹Recent analysis conducted by MoH has revealed that Ratanakiri is the most malaria prone area, based on number of malaria incidents.

Figure 6: Map of areas prone to Malaria



Source: V&A Assessment for health sector by SNC, 2010

It is important to note that both INC and SNC focus on analysis of malaria incidents in relation to climate change variability, which may not represent the full picture of potential health impacts, therefore expansion of this modeling technique for the analysis of health risks associated with other climate related health incidents, such as dengue fever, water/food-borne diseases and extreme natural disasters, would improve understanding for devising comprehensive health adaptation planning and policy responses. In addition to the short time series data, other factors, for example humidity and human migration², are not included in the analysis. Additional studies and surveillance are needed to generate statistical data for better modeling purposes.

A health V&A assessment was conducted in 2010 by MoH, with the support of WHO, through the Department of Preventative Medicine (PMD). An assessment process was adopted as the following:

²According to the specialists from CNM, people migration is the main constraint for effective malaria control.

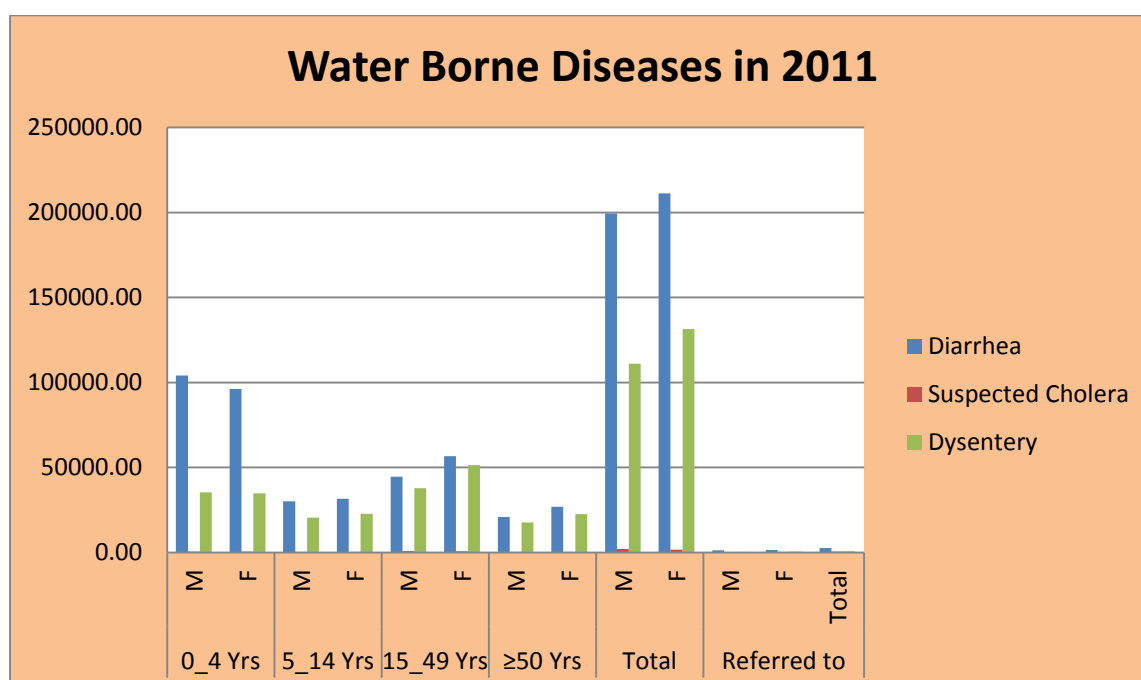
- Identification of relevant stakeholders;
- Description of current burden of climate-sensitive health outcomes, including the populations and regions that are most vulnerable;
- Description of how current burden of climate-sensitive health outcomes is likely to change over coming decades, irrespective of climate change;
- Description of the effectiveness of current programs and activities;
- Estimation of the possible additional burden of adverse health outcomes due to climate change;
- Identification and prioritization of public health and health care interventions to reduce likely future health burdens; and
- Identification of strategies to implement, monitor and evaluate the burden of climate-sensitive health outcomes and interventions to address these burdens, ensuring continued effectiveness in a changing climate.

As a result of the V&A assessment, following the steps described above, and based on the IPCC Fourth Assessment Report (2007), the main impacts of climate change on health in Cambodia have been identified in four sensitive areas:

- Vector-borne diseases (malaria, dengue fever, etc.);
- Water- and food-borne diseases (diarrhoea, typhoid, cholera, etc.);
- Food security (malnutrition);
- Health consequences of extreme weather events (death, injury, damage, vector-borne and water-borne disease).

Understanding of the health impacts related to vector-borne diseases has improved, however little is known about the relationship between health impacts, water-borne diseases and extreme weathers. The health statistics of MoH revealed an alarming number of water-borne disease cases, which accounted for about 47 cases per 1000 population, where 41% of all patients were children below the age of four years (Figure 7). It is difficult to associate these diseases with climate change, as there is no systematic collection of climate variables in parallel with water-borne disease incidents, and partly due to the complex relationships between human health and water quality, water quantity, sanitation and hygiene (IPCC, 2001). Poor access to safe drinking water is common in Cambodian rural areas and will be exacerbated by water stress caused by climate change. Respiratory diseases are normally found among elderly populations and can be caused by a combination of air pollution, extreme weathers and prolonged heat.

Figure 7: Statistics of water-borne and food-borne diseases in 2011



Source: HIS, 2011

3.4 Methodology for preparation of Climate Health Strategy and Action Plan

Several steps have been proposed for preparing this CCSPH. They include:

- Desk study of government policies and strategies related to climate change and the health sector, including existing studies and analysis of current and projected climate change impacts on health;
- Identification and scoping of the key climate health sensitive targets for the CCSPH;
- Development of CCSPH and priority health adaptation options built on HSP and NSDP, through broad consultation with relevant stakeholders.

4. Health policy and response to climate change

4.1 Government health policies and strategies

The Health Strategic Plan 2008-2015 was developed in 2008 with a broad vision “to enhance sustainable development of the health sector for better health and well-being of all Cambodians, especially of the poor, women and children, thereby contributing to poverty alleviation and socio-economic development”. The HSP comprises three goals: to reduce newborn, child and maternal morbidity and mortality with improved reproductive health; to reduce morbidity and mortality from HIV/AIDS, malaria, tuberculosis, and other communicable diseases; and to reduce the burden of non-communicable diseases and other health

problems. All three goals are relevant for health responses to climate change, particularly Goal 2. The HSP has developed a set of monitoring indicators for measuring the success of the plan.

Consistent with these goals, the health strategy has identified five strategic areas: i) health service delivery; ii) health care financing; iii) human resources for health; iv) health information system; and v) health system governance. Several elements consistent with climate change issues and response can be found among a set of policy directions identified in the HSP:

- Implement pro-poor health financing systems, including exemptions for the poor and expansion of health equity funds, in combination with other forms of social assistance mechanisms;
- Strengthen and invest in the health information system and health research for evidence-based policy-making, planning, performance monitoring and evaluation;
- Prevent and control communicable and selected chronic and non-communicable diseases, and strengthen disease surveillance systems for effective response to emerging and re-emerging diseases;
- Strengthen public health interventions to deal with cross-cutting challenges, especially gender, health of minorities, hygiene and sanitation, school health, environmental health risks, substance abuse/mental health, injury, occupational health, disasters through timely response, effective collaboration and coordination with other sectors.

4.2 Health institutional structure relevant to climate change response

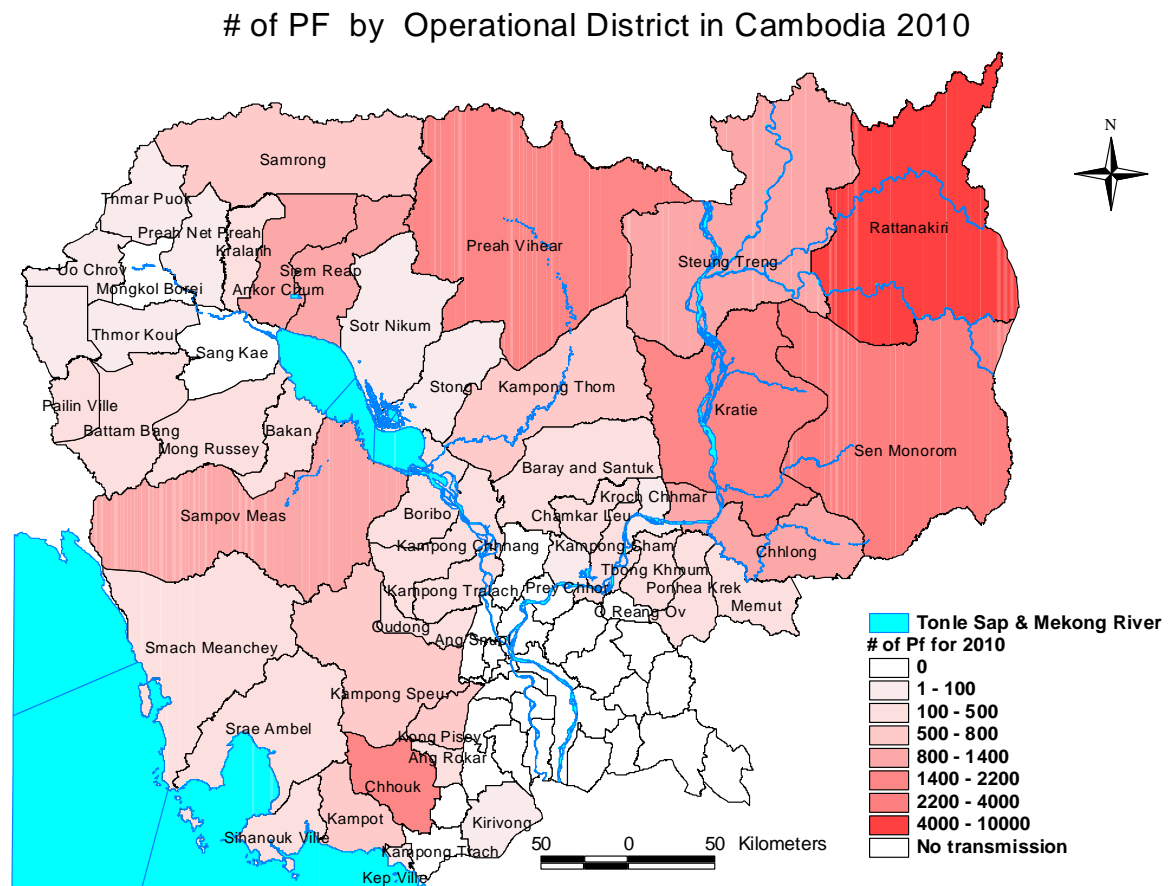
The MoH is one of the biggest public institutions, with an extensive network of health care centers and facilities across the country. Its annual budget ranks second after the Ministry of Education, Youth and Sport (MoEYS), and employs around 16,500 medical staff. Several central departments and centers established under the umbrella of MoH, being more or less relevant to climate change, include:

- Department of Preventive Medicine (disaster and environmental health management and non-communicable diseases);
- Department of Health Planning and Health Information (Health Financing and Health Information Database);
- National Center for Parasitology, Entomology and Malaria Control (CNM) [malaria, dengue, chikungunya];
- Communicable Disease Control Department (EV, new emerging diseases, zero reporting);

- National Center for Health Promotion (NCHP);
- Department of Drugs, Food and Cosmetics (food safety, drug registration and regulation);
- Hospital Services Department (role and responsibility of HC and RH);
- National Maternal and Child Health Center (NMCHC) located in the Japanese-Cambodian Friendship Hospital.

The CDC and CNM are of particular relevance as far as vector-borne disease is concerned. The CNM has an ambitious goal of full elimination of malaria incidents by 2025, stipulated by the Prime Minister Decision. It has received approximately US\$20 million from donors to combat malaria, which covers about 70% of overall malaria activity financing (CNM, 2012). The CNM has its own extensive network down to the village level (village malaria workers), which facilitates information flow between villages and the CNM, and distribution of treated nets and appropriate anti-malaria drugs. As a result, the number of malaria incidents has decreased over the last decade, as shown in Figure 8 below. Still, the CNM faces a number of constraints, notably the population movement and increase of dengue fever contracting cases.

Figure 8: Map of malaria incidents in 2010 by CNM



Source: CNM, 2010

Less attention is given to water-borne and food-borne diseases and emergency response plans by the Department of Drugs, Food and Cosmetics (DDF) and PMD. A common gap among relevant departments mentioned above is a limited knowledge and understanding of climate change impacts on health outcomes, modeling and projection techniques supporting V&A assessment, and adaptation planning. Usually, local climate variables are not included in the existing surveillance and research, for example, on epidemiology and entomology, therefore it is difficult to construct reliable modeling on the relationship between climate change and disease incidents in Cambodia.

It is worth noting that the senior leaders of MoH are committed to addressing climate change issues affecting public health. Two working groups were setup to work on climate health related projects. They are:

- Inter-ministerial Working Group, setup by *prakas* for a project “Climate Change and Vector-borne disease” supported by KOICA, and completed in 2011.
- Health Working Group for Climate Change (HWGCC) for the preparation of CCSPH, setup by MoH’s circular, and consisting of the relevant departments above.

The HWGCC may become a permanent body of MoH, which can facilitate and coordinate preparation and implementation of CCSPH, including capacity building activities. Appropriate training can be given to the HWGCC so that it can become the trainer of trainees, to pass the knowledge to other medical staff.



Frequent flooding becomes an increasing challenge for food security and public health in Cambodia.

5. Climate Change Strategic Plan for Public Health

5.1 Vision, mission and goal

Following consultation with relevant departments of MOH, a desk study of health policy documents and a review of the existing analysis and studies by INC, SNC team and WHO, three climate-health sensitive areas were selected as the main targets for development of an appropriate climate strategy and action for the health sector. The three targets include: i) vector-borne diseases; water/food-borne diseases; and extreme weather. In conformity with HSP and CMDG, the vision, mission, goal and objectives are devised to address the three targets as described below.

- A. **Vision:** *to increase climate resilience for better health and well-being of all Cambodians, especially of the poor, women and children, contributing to poverty alleviation and achieving the Cambodia Millennium Development Goals.*
- B. **Mission:** *to provide efficient and equitable health care services and to build adaptive capacity to cope with short- and long-term climate change by mainstreaming climate change into the Health Strategic Plan and National Strategic Development Plan.*
- C. **Goal and Objectives**

Goal

To reduce morbidity, mortality, injuries and health vulnerability to climate variability and extreme weathers.

Objective 1:

To improve health care infrastructure and capacity of health personnel to cope with vector-borne and water-borne diseases in the context of climate change.

- Conducting surveillance and research on malaria and dengue fever in selected provinces to improve knowledge of the relationship between climate variability (temperature, rainfall, humidity) and epidemiologic and entomologic changes;
- Conducting surveillance and research on water- and food-borne diseases in selected provinces to improve knowledge on the relationship between climate variability (temperature, rainfall, humidity) and infectious diseases;

- Assessment of health care infrastructure at all levels (especially in disaster prone areas) in response to climate change related diseases;
- Development and update of technical guidelines for diagnosis, detection, control, prevention and treatment of diseases (malaria, dengue fever, diarrhoea, typhoid, cholera, etc.), and other food-borne illness arising from climate change;
- Development of short- and medium-term incremental action plans for improved health infrastructure, staffing and capacity to cope with vector-borne and water/food-borne diseases in the context of climate change, built on strategic priorities stipulated in the Health Strategic Plan.

Objective 2:

To enhance emergency preparedness and response to cope with extreme weathers and climate change related disasters.

- Development and implementation of surveillance of extreme weathers and related diseases, including respiratory diseases, injuries, malnutrition, food safety/consumption in synergy or collaboration with the Cambodian Red Cross, NCDM, MoWRAM and other relevant agencies;
- Setting up and strengthening an emergency preparedness and response network and plan, including food safety response, at all levels.

Objective 3:

To improve knowledge and research capacity on health impacts and vulnerability to climate change as an information base for mainstreaming climate change in the health strategic planning of MoH, and other sector planning.

- Development of methodologies, guidelines, models and indicators for research and health vulnerability assessment in collaboration with CCCD of MoE, WHO and other relevant health institutes, such as Pasteur and the Institute of Public Health;
- Organizing training on the health impact/vulnerability assessment, modeling of climate variability and health impacts, surveillance and research based on needs;
- Development and implementation of short- and medium-term action plans for epidemiologic and entomologic research, surveillance and health vulnerability assessment in the context of climate change in priority areas to build science-based knowledge for adaptation planning and decision making;

- Promoting public education and awareness campaigns on health impacts of climate change and appropriate responses, including disease control, prevention, treatment, epidemic preparedness, and sanitation and hygiene;
- Mainstreaming and regular updates of climate change and health implications, including related adaptation plans in the Health Strategic Plan.

5.2 Strategic framework

A. Strategic analysis

Health outcomes are a common goal of many RGC national and sector policies and strategies. The key RGC policies and strategies that guide all sector planning, including the health sector, are the Rectangular Strategy (RS), the NSDP 2010-2013, the CMDGs and the Strategic National Action Plan For Disaster Reduction (SNAP-DR). The RS calls for improvement of health services as part of the Growth Rectangular 4, “Capacity Building and Human Resource Development”. Consistent with the RS, the NSDP has identified health priority actions and targets based on the HSP, and calls for expansion of health care facilities by construction and/or rehabilitation of facilities, for example, hospitals, health centers, etc., in rural areas. The CMDG comprises nine goals, where Goal 4, 5 and 6 are health related (Goal 4 “reduce child mortality”; Goal 5 “improve maternal health”; Goal 6 “combat HIV, malaria and other diseases”). The SNAP-DR also identifies health issues as an important part of Disaster Risk Reduction and calls for the assessment of hospitals that are located in hazard-prone areas, analysis of vulnerability of health facilities to these hazards, and development and implementation of hospital preparedness plans for all health facilities. In addition, the HSP contains several elements supporting climate health response activities. Therefore, the CCSPH and adaptation framework must be aligned with these policies and strategies, and contribute to the overall achievement of health outcomes.

Changes in the world’s climate would influence the functioning of many ecosystems and their member species. Likewise, there would be impacts on human health (WHO, 2003). Some of these health impacts would be beneficial and some may be harmful. For example, further increase in temperatures might reduce the viability of disease-transmitting mosquito populations, but may favor propagation of water-borne diseases such as typhoid, cholera and other respiratory diseases. Overall however, scientists consider that most of the health impacts of climate change would be adverse. Climate change was estimated to be responsible in 2000 for approximately 2.4% of worldwide diarrhoea and 6% of malaria in some middle-income countries (WHO, 2003). In Cambodia, the rate of malaria incidents has been declining

for the last decade due to rigorous efforts by MoH in collaboration with development partners. There is however a trend of increased dengue fever cases reported. Concerning water-borne diseases, the Health Information System (HIS) of 2011 estimated about 46 cases per 1000 population, which is higher than malaria incidents.

It is important to note that climate change is a slow process occurring over many decades, thus the health impacts³ are more pronounced over the near term (IPCC, 2001). Short- and medium-term planning is more realistic and should take into account other non-climate factors, for example, people migration, land-use change and deforestation, irrigation development and human population density. Systematic surveillance and observation of multiple causal factors can improve understanding and devise appropriate responses.

Knowledge gaps can be complemented by involvement of experts and institutions specialized in the subject of concern. Planning must be cost-effective in terms of optimal use of available knowledge and infrastructure and allocation of resources for additional activities with a minimum cost. Since modeling of climate change has many uncertainties and may not occur as projected, no-regret options can benefit society even if climate does not change. IPCC (2007) has identified rebuilding public health infrastructure as “the most important, cost-effective and urgently needed” adaptation strategy. Other no-regret adaptation options include: public health training programs; more effective surveillance and emergency response systems; and sustainable prevention and control programs. A Cambodian slogan says “Prevention is better than Cure”, because prevention is always cheaper than cure.

Diagram of Health Adaptation Strategic Framework

| Adaptation Targets | Vector-borne Disease | Water-borne Disease | Extreme Weather |
|---------------------------|---|----------------------------|------------------------|
| Adaptation Program | Improved health service delivery | | |
| | Emergency preparedness and response | | |
| | Knowledge and research capacity in V&A for planning | | |
| Strategic Approach | Capacity building | | |
| | Cross-sector coordination | | |
| | Gender | | |
| | Health information management | | |
| | Health financing mechanism | | |
| | Monitoring and evaluation | | |
| Planning Principles | Participatory, knowledge-based, and cost-effective planning | | |
| | Synergy and alignment with government policies and plans | | |
| | No-regret or win-win options | | |

³According to IPCC, human beings can better adapt to slow change in climate.

B. Health strategic response to climate change

B.1 Adaptation

WHO defines “vulnerability” as a function of Cambodia’s exposure and sensitivity to climate and climate variability, plus the adaptive capacity of the population to adjust to future challenges, while “adaptation” refers to strategies, policies and measures undertaken now and in the future to increase climate-sensitive health resilience. The V&A assessment describes the impact of climate change on health outcomes in Cambodia, and strategies for modifying these effects.

As discussed in Section 5.1, three climate-sensitive health areas are identified as the main targets for devising an adaptation strategy and corresponding health adaptation options in Cambodia. Those targets are:

- Vector-borne disease;
- Water-borne and food-borne disease;
- Health impacts arising from extreme weathers.

Three interrelated objectives are proposed with a set of actions identified for each objective as described in Section 5.1. Those objectives and actions would be relevant for many years to come, but they can be modified based on updated knowledge and projected health outcomes following several years of implementation. They can serve also as a guiding framework by which adaptation programs or interventions can be planned and implemented.

A matrix of specific adaptation options is proposed to illustrate the relevance of ongoing and newly proposed projects/activities against potential climate change impacts in the respective areas of health concern (see Table 4). This matrix has been discussed at various consultation meetings and is generally accepted. It can be used to identify most relevant adaptation projects and activities that can best address health impacts. A detailed proposal of adaptation projects and activities can be further prepared, outlining the rationale, objectives, expected outputs, inputs, cost and implementation schedule. The adaptation projects can be prioritized based on multiple criteria analysis and cost benefit analysis to ensure cost effective responses and project outcomes. In 2010, notable progress was made by MoH, in collaboration with WHO, in preparation of detailed health adaptation proposals to combat vector-borne diseases. These can be refined and considered for funding. They include:

- Malaria and climate surveillance;
- Community volunteers and village malaria workers;

- Provision of long lasting impregnation of bed nets and residual spraying;
- Dengue research;
- Strengthening the dengue surveillance system in provincial hospitals;
- Dengue prevention project.

Table 4: Matrix of health adaptation options and projects/activities

| Adaptation Strategy | Vector-borne disease | Water/food-borne disease | Extreme Weather |
|----------------------------|--|---|---|
| Prevention | <ul style="list-style-type: none"> • Use of insecticide-treated mosquito nets | <ul style="list-style-type: none"> • Sanitation and hygiene • Nutrition and Vitamin A supplement • Latrines • Safe drinking water | <ul style="list-style-type: none"> • Early warning system • Sanitation and hygiene • Nutrition and Vitamin A supplement • Latrines • Safe drinking water |
| Control | <ul style="list-style-type: none"> • Use of larvicidal and insecticidal spraying | <ul style="list-style-type: none"> • Improving infection control procedures to prevent spread of illness | |
| Treatment | <ul style="list-style-type: none"> • Use of appropriate drugs | <ul style="list-style-type: none"> • Early treatment with oral rehydration fluid • Improving access to health facilities | <ul style="list-style-type: none"> • Relevant to both vector-borne and water-borne disease and food poisoning |
| Public Education | <ul style="list-style-type: none"> • Public health awareness on climate change impacts, disease control, prevention and treatment | <ul style="list-style-type: none"> • Public health awareness on climate change impacts, sanitation and hygiene, treatment | <ul style="list-style-type: none"> • Public health awareness on climate change impacts • Improved community preparedness and sanitation |
| Capacity | <ul style="list-style-type: none"> • Improved health care facilities, staffing • Research and V&A | <ul style="list-style-type: none"> • Improved health care facilities, staffing • Research and V&A | <ul style="list-style-type: none"> • Improved health care facilities, staffing • Emergency response plan and procedures |
| Knowledge Generation | <ul style="list-style-type: none"> • Epidemiology and entomology research • V&A assessment of flood and drought | <ul style="list-style-type: none"> • Methodologies, guidelines and models • Surveillance | <ul style="list-style-type: none"> • Surveillance • Epidemic preparedness • Data management |

| | | | |
|-----------|--|---|---|
| | <ul style="list-style-type: none"> • Data management • Surveillance of Anopheles and Aedes sp. mosquitoes and examining their relationship with climate and weather • Malaria and dengue fever surveillance | <ul style="list-style-type: none"> • V&A assessment of flood and drought • Data management • Modeling of climate variability and health impacts • Data management | <ul style="list-style-type: none"> • Climate projections and early warning • V&A assessment of extreme weather |
| Financing | <ul style="list-style-type: none"> • Government budget • Health Equity Fund • Safety net • Multiple donors, bilateral • Health insurance | <ul style="list-style-type: none"> • Government budget • Health Equity Fund • Safety net • Multiple donors, bilateral • Health insurance | <ul style="list-style-type: none"> • Government budget • Health Equity Fund • Safety net • Multiple donors, bilateral • Health insurance |

B.2 Mitigation

Mitigation refers to policies, strategies and activities that can cut GHG emissions. In Cambodia, major GHG emission is attributed to some sectors, for example, land-use change and forestry (LUCF), agriculture, energy, industry and transportation, where the former contribute about 97% of GHG emissions (INC, 2002). The health sector does not belong to any of these sectors and would not require mitigation analysis and identification of GHG mitigation options. However as far as energy use is concerned, MoH can help reduce GHG emissions in the context of energy use efficiency, which can result in a reduction of energy costs and GHG emissions. An environmental audit is normally conducted to assess the energy use in the buildings and to provide recommendations for efficient energy use. It is reported that Comin Khmer Co. Ltd. can carry out such an audit, with a potential reduction of 20% of energy use. Another potential GHG mitigation option for the health sector is the use of solar power in remote areas where the national grid is not available.

C. Cross-cutting strategic approach

C.1 Cross-sectoral coordination and cooperation

Health is a cross-cutting goal of many government policies and sectors, therefore coordination is critical to ensure effective health outcomes. Several areas such as sanitation and hygiene, food security, early warning and emergency preparedness and relief, are the responsibility of the MRD, MAFF, MoWRAM, NCDM and Red Cross. MoH has experienced good cooperation with NCDM by playing a very active role in the provision of health care services during and

after disaster management and emergency relief. This mechanism can be used to address other problems related to health risks and impacts, for example, sanitation, hygiene, water supply and food safety/security, with those relevant agencies. Even public education or specific prevention programs on vector-borne and water-borne diseases cannot be achieved by MoH alone and should be promoted through involvement of many actors at different levels, for example, NGOs, commune councils and volunteer villagers. Many NGOs have a good reputation in successful implementation of activities for combating malaria with CNM and must be further encouraged. A good practice has been the formation of village malaria workers in combating malaria across the country, especially in malaria-prone areas such as in Ratanakiri. Additional mechanisms can be explored in the form of a Climate Health Network or Forum to serve as a learning platform for exchange of knowledge and experience among experts, specialists, managers and researchers.

C.2 Capacity Building

As knowledge on climate change impacts and climate related health outcomes is generally limited in the health sector, capacity building is considered one of the immediate priorities in the design of an adaptation framework. Several health departments have been identified as relevant to the three areas of health concerns in the context of climate change; they are currently the members of the HWGCC. A training plan should be developed based on a needs assessment to match specific adaptation activities. While not exhaustive, a number of potential subjects for training include:

- Basic knowledge of health implications and outcomes caused by changing climate variables (temperature, humidity, rainfall, extreme weathers);
- Modeling and projection techniques (including regression analysis, multi-criteria analysis, cost-benefit analysis) and health V&A assessment;
- Epidemiology and entomology research in the context of climate change;
- Data collection and management, incorporating climate variables in HIS;
- Surveillance of Anopheles and Aedes sp. Mosquitoes, and examining their relationship with climate variables and weather.

C.3 Gender

Good understanding on roles and responsibilities of men and women in the context of climate change would help determine a cost-effective policy response, especially in the health sector. Women constitute a significant proportion (more than 50%) of Cambodian labor forces in agriculture, industry and garment sectors, and become increasingly active in household income generation, although inequality remains a constraint among men and women in the

service and public sector (NSDP, 2010). Women play an important role in family health care and can effectively contribute to health adaptation activities, such as in sanitation and hygiene, provision of safe drinking water, and prevention and control of vector-borne and water-borne diseases. Their knowledge can be improved through public education and awareness. Disaggregate data of climate change impacts on men and women, their vulnerability, and their ability to respond to climate related diseases can be collected and integrated into the HIS, which can be used for gender analysis for health impacts.

C.4 Health Information System

MoH has developed and maintained the HIS as a good information system containing time series data related to all health care services and disease incidents for the whole country. The HIS is maintained under the Department of Health Planning which compiles reports from ODs, RHs and HCs around the country. The HIS does not have climate change variables and indicators along with health indicators, thus is not sufficient for climate-health analysis. There is an attempt to acquire mobile weather equipment for specific surveillance activities under the support of WHO, as climate variables obtained from the current meteorological stations have high variation, compared to the specific local climate of areas in question. The HIS can be improved by provision of appropriate training on collection and maintenance of climate variables, including data analysis and modeling.

It should be mentioned also that health information is part of the socio-economic survey undertaken by the NIS and other government line agencies (MRD, NCDM, MoWRAM, MAFF). Therefore, coordination and standardization of climate data and health indicators among institutions can help reduce the cost and provide accurate information for analysis, projection, monitoring and evaluation purposes. Data sharing among institutions remains a common constraint but can be resolved through better communication and dialogue.

C.5 Financing strategy and mechanism

MoH has good experience in implementing several financial schemes⁴ and fee-exemption systems supporting a wide range of health care services across the country. Two funding schemes are established, namely the Health Equity Fund⁵ (HEF) and Community-Based Health Insurance (CBHI), which offer opportunities for the poor to overcome financial

⁴Household spending is US\$25 per capita/year, or 66 percent of all health expenditures, HSP, 2008.

⁵Cost per capita is \$0.50, and cost per HEF member is \$1.40.

obstacles for qualified health care. The HEF and CBHI can be expanded to cover health care services in the context of climate change, as the poor are most vulnerable to climate change.

Table 5: Coverage of health financing schemes

| No | Coverage of health financing schemes | 2007 |
|----|--------------------------------------|-----------|
| 1 | No health facilities have HEFs | 45 |
| 2 | Operational districts | 39 |
| 3 | National hospitals | 6 |
| 4 | No of cases covered by HEFs | 246,598 |
| 5 | No of cases exempted | 1,300,025 |
| 6 | No of CBHI schemes implemented | 9 ODs |
| 7 | No of CBHI beneficiaries | 45,282 |

Source: HSP, 2008

MOH has received funding support from several development partners for specific health care activities. For example, the CNM has received approximately \$20 million annually for combating malaria. Although the rule is strict, this funding can be expanded to cover some urgent health adaptation activities identified by this CCSPH, such as prevention and control of vector-borne diseases, and conducting surveillance and capacity building of officials. Potential funding can also be tapped from the CCCA Trust Fund for supporting urgent training activities for most relevant officials, especially those members of the HWGCC. A possible special health fund for climate change can be developed with potential donors such as UNDP, USAID, WHO and AusAID.

C.6 Monitoring and Evaluation (indicators, risk assumptions, risk management, log-frame analysis)

MoH has developed a set of core indicators for monitoring and measuring the success of HSP, which can be used for monitoring and evaluation of health indicators related to climate change (see Table 6). There are missing indicators regarding water-borne and food-borne diseases, including health impacts of extreme weathers. Those missing indicators will be added to the core indicators, which will be defined based on the health statistics of the HIS. Furthermore, a set of monitoring indicators are developed at the vision, mission, goal and objectives levels to complement the core indicators (see Annex).

Table 6: Monitoring indicators adapted from HSP, NSDP and CMDG

| Selected Core Indicators | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|-------------|-------------|-------------|-------------|-------------|
| Reducing malaria case fatality rate per 100,000 pop (MoH, NSDP) | 2.1 | 1.5 | 1.2 | 1.1 | 0.99 | 0.9 |
| Reducing dengue hemorrhagic fever case fatality rate reported to public per 100,000 pop (MoH, NSDP) | 0.68 | 0.7 | 0.6 | 0.6 | 0.6 | <0.6 |
| Reducing under-five mortality rate (CMDG) | From 124 in 1998 to 65 per 1000 live births by 2015 | | | | | |
| Reducing infant mortality rate (CMDG) | From 95 in 1998 to 50 per 1000 live births by 2015 | | | | | |
| Reducing maternal mortality ratio per 100,000 live births (CMDG) | From 437 in 1997 to 140 by 2015 | | | | | |
| Reducing malaria case fatality rate (CMDG) | From 0.4% in 2000 to 0.1% in 2015 | | | | | |
| Increasing the proportion of population at high risk who slept under insecticide-treated bed nets (CMDG) | From 57% in 2002 to 98% in 2015 | | | | | |
| Decreasing the number of malaria cases treated in the public health sector per 1,000 population (CMDG) | From 11.4 in 2000 to 4.0 in 2015 | | | | | |
| Increasing the proportion of public health facilities able to confirm malaria diagnosis according to national guidelines with 95% accuracy (CMDG) | From 60% in 2002 to 95% in 2015 | | | | | |
| Decreasing the number of dengue cases treated in the public health sector per 1,000 population (CMDG) | From 1 in 2001 to 0.4 in 2015 | | | | | |
| Reducing the number of water-borne disease cases (diarrhoea, cholera, dysentery) per 1,000 population | From 43% in 2011 to 20% in 2023 | | | | | |

6. Conclusion

Climate change impacts are felt in many sectors, and across the entire Cambodian population and society. Health is considered one of the sectors that is highly vulnerable to climate change. There is strong evidence of impacts of climate variables on health outcomes in Cambodia. Most visible impacts are associated with vector-borne diseases and extreme weathers. There is however a general lack of knowledge and understanding on the causal-effect relationship of climate variables with health impacts, as health outcomes are the functions of both climate and non-climate factors. Notable progress has been made by INC and SNC teams in modeling of the malaria incidents in relation to climate variables, which is a basis for development of the CCSPH. The current HIS does not include local climate variables, therefore may not be reliable for modeling health outcomes. Nevertheless, on a basis of precautionary principles, this CCSPH has been prepared using all possible information deriving from different sources such as IPCC, WHO, UNDP, ADB and Cambodia's line agencies. Built on many government strategies and policies, the CCSPH provides a comprehensive policy framework, with a focus on adaptation in response to climate change impacts over a short- and medium-term horizon. This document can be modified after several years of implementation to update knowledge and new emerging climate issues.

7. References

1. ADB, 2009 “Economics of Climate Change in Southeast Asia”
2. Council of Ministers, 2004 “Rectangular Strategy”
3. IPCC, 2001, “Third Assessment Report”
4. IPCC, 2007, “Fourth Assessment Report”
5. MoE, 2002, “Initial National Communication”
6. MoE, 2006, “National Adaptation Program of Action to Climate Change” (NAPA)
7. MoE, 2010, “Second National Communication”, draft
8. MoH, 2008, “Health Strategic Plan 2008-2015”, a vulnerability and adaptation assessment
9. MoH, WHO, 2010, “Climate Change and Health in Cambodia”
10. MoP, 2010, “National Strategic Development Plan 2010-2013”
11. MoP, 2010, “Cambodia Millennium Development Goals”
12. NCDM, 2008, “Strategic National Action Plan on Disaster Risk Reduction (2008-2013)”
13. NIS, 2010, “Demographic and Health Survey”
14. NIS, 2008, “Statistical Year Book”
15. UNDP, 2011, “Cambodia Human Development Report”
16. WHO, WMO, UNEP, 2003, “Climate Change and Human Health – Risks and Response”

8. Annex

SWOT Analysis on health and climate change (30 July 2012)

| | Vector-borne diseases | Water/food-borne diseases | Extreme weathers |
|-----------------|---|--|---|
| Strength | <ul style="list-style-type: none"> • A National Malaria Center • National experts on malaria and dengue with good communication with international experts • Good network with provincial RH and HC • Department for Communicable Disease Control (CDC) • National Strategy and action plan to fully eliminate malaria cases by 2025 (2011-2025) • Support of NGOs and development partners • National budget and funding by development partners (70%), with good funding policy • Declining rate in malaria infection cases | <ul style="list-style-type: none"> • Rectangular Strategy • National program (policy and guidelines) • Action plan • Budget | <ul style="list-style-type: none"> • Existing structure • Strategy • Funding policy • Plan (AOP) • Human resources |
| Weakness | <ul style="list-style-type: none"> • Capacity on relationship of vector-borne diseases and climate change • Responsibility and limited coordination with relevant agencies • Use of international funding follows strict rules and cannot be changed • Government budget is limited and often slow • General knowledge on climate change • Lack of research and surveillance on climate change and vector-borne diseases • There is no budget on climate change related activities | <ul style="list-style-type: none"> • Food-borne disease policy • Limited funding and transportation • Cooperation with other agencies • Knowledge and human resources • Communication network | <ul style="list-style-type: none"> • Coordination limited, fragmented and overlapped • Scale of disaster is more than planned • Limited knowledge on disasters • Lack of mobility during flooding • Lack of safe drinking water supply in remote and rural areas • Limited knowledge on new diseases • Limited incentives for local health personnel |

| | | | |
|----------------------|--|---|--|
| | <ul style="list-style-type: none"> • Lack of understanding and participation of population • Movement of people is one of the challenges in controlling vector-borne diseases | | <ul style="list-style-type: none"> • Limited early delivery of information and messages |
| Opportunity | <ul style="list-style-type: none"> • Global Fund allocates about US\$20 million per year for malaria prevention and control (buying insecticide treated nets) • About 40 implementation partners (NGOs) | <ul style="list-style-type: none"> • Capacity building of technical officers • Develop action plan • Increase awareness and commitment of the RGC and donors | <ul style="list-style-type: none"> • Disasters are government priority • Participation of CRC, private and donors • Increase scope on disaster preparedness (human resources, funding) |
| Threat | <ul style="list-style-type: none"> • Global Fund can be stopped or reduced if the use of funding is not appropriate • Rate of dengue fever cases increases • Rate of similarly-dengue fever cases | <ul style="list-style-type: none"> • Outbreak of the diseases (cholera, etc.) • Health impacts • Loss of income and time | <ul style="list-style-type: none"> • Loss of property and crops • Damage to infrastructure, affecting work, education and development • All diseases • Loss of life • Moral trauma • Malnutrition • Poverty |
| Matrix of adaptation | <ul style="list-style-type: none"> • Agree with the table with minor suggestions | <ul style="list-style-type: none"> • Agree with the matrix with no additional ideas | <ul style="list-style-type: none"> • Agree with the matrix |
| Training | <ul style="list-style-type: none"> • Training on the use and collection of climate change variability • Impact of climate change on health | | |

Log-frame Analysis and M&E

| Name of Activity | Descriptive Statement | Indicators | Means of Verification | Risk Assumption | Risk Management |
|------------------|--|---|--|---|---|
| Vision | <i>To increase climate resilience for better health and well-being of all Cambodians, especially of the poor, women and children, contributing to poverty alleviation and achieving the Cambodia Millennium Development Goals.</i> | No. of vector-borne and water-borne diseases No. of child mortality and maternal mortality rate | MoH annual progress report HSP review report CMDG progress report NSDP M&E report CDHS reports | Limited budget and financing Limited knowledge and capacity | Developed health financing mechanism Capacity building Improved health governance NSDP and HSP include health impacts of CC |
| Mission | <i>To provide efficient and equitable health care services and to build adaptive capacity to cope with short- and long-term climate change by mainstreaming climate change in the Health Strategic Plan and National Strategic Development Plan.</i> | No. of RH and HC is improved and equipped to deal with climate related diseases No. of health adaptation activities are implemented HSP and NSDP incorporate CC impacts on health | MoH annual progress report HSP review report MDG progress report NSDP M&E report | Limited budget Inadequate staffing and capacity, especially at the provincial levels | Operational financing mechanism (government, donor, HEF, HCI, private) Capacity building Health governance NSDP and HSP include health impacts of CC |
| Goal | <i>To reduce morbidity, mortality, injuries and health vulnerability to climate variability and extreme weathers.</i> | Following the core indicators in Table 6 | MoH annual progress report HSP review report CMDG progress report | Limited budget Limited coordination Poverty Limited qualified staff at the local level | Increased government budget, contribution of donors Capacity building plan is in place |

| | | | | | |
|-----------|--|--|---|--|---|
| | | | NSDP M&E report Progress reports of programs and projects | | |
| Objective | 1. <i>Improved health care infrastructure and capacity of health personnel to cope with climate related diseases.</i> | No. of surveillance and research carried out No. of RHs and HCs upgraded and better equipped No. of personnel trained and active HSP incorporate infrastructure and capacity improvement plan | MoH progress report HSP review report NSDP M&E report NCDM reports CDHS reports Provincial reports | Limited staff incentives and motivation Budget constraints Limited knowledge and awareness among staff and rural people Inadequate cooperation of other sectors | Increased government budget, contribution of donors Capacity building plan is in place Cooperation framework in place |
| | 2. <i>Enhanced emergency preparedness and response to cope with extreme weather and climate change related disasters.</i> | EPR plan is put into practice No. of trained personnel Increased participation of health personnel dealing with extreme disasters | MoH progress report HSP review report NSDP M&E report NCDM reports CDHS reports Provincial reports | Limited inter-agency cooperation Budget constraints for the areas of concern | Increased government budget, contribution of donors Capacity building plan is in place Cooperation framework in place |
| | 3. <i>Improved knowledge and research capacity on health impacts and vulnerability to climate change as an information</i> | Research methodologies V&A and guidelines are developed and implemented | MoH progress report HSP review report NSDP M&E report Provincial reports | Budget constraints Research capacity | Increased government budget, contribution of donors, HEF |

| | | | | | |
|--|---|--|--|--|---|
| | <p><i>base for mainstreaming climate change and health into health strategic planning of the MoH and other sector planning.</i></p> | <p>Information on health impacts is included in the HIS</p> <p>No. of health V&A implemented</p> <p>HSP incorporates CC and health adaptation programs</p> | | | <p>Capacity building plan is in place</p> |
|--|---|--|--|--|---|

List of Officials Consulted

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| No | Name | Position | Organization |
|-----|-----------------------------|--|---|
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| 4. | Dr. Ly Sovann | Vice Director | CDC |
| 5. | Dr. Sok Kanha | Deputy Director | Planning and Health Information Department |
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| 9. | Dr. Ngeth Sovann | Deputy Director | PMD |
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| 1. | Dr. Tin Ponlok | Deputy Director General | |
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UNDP

| | | | |
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| 1. | Mr. Lay Khim | Assistant Country Director | Environment and Renewable Energy Section |
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