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Ministry of Health & Family Welfare
Government of India

NATIONAL ACTION PLAN FOR CLIMATE CHANGE & HUMAN HEALTH

NATIONAL PROGRAMME ON CLIMATE CHANGE AND HUMAN HEALTH (NPCCHH)



National Centre for
Disease Control
Government of India



National Programme
on Climate Change
and Human Health

PREFACE

Climate sensitive illnesses are on increase due to climate change and extremes of weather either through direct or indirect impact. The United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol in 1997 refers to the legal framework for Climate change process internationally. The Conference of the Parties (COP) to the Convention meets annually to negotiate and discuss the international climate change agenda and related commitments from countries. The sustainable development Goal 13 (SDG 13) also emphasises to “take urgent action to combat climate change and its impacts.”

India's first National Action Plan on Climate Change (NAPCC) was released by the then Prime Minister Manmohan Singh on June 30, 2008. It outlines existing and future policies and programs addressing climate mitigation and adaptation. The plan identifies eight core “national missions”. After the 21st Conference of Parties (COP 21) under the United Nations Framework Convention on Climate Change (UNFCCC) concluded in Paris, Hon'ble Prime Minister Mr Narendra Modi broadened India's response to climate change, by introducing four new missions including one for “Health” in 2014. The proposed ‘Mission on Health’ will address the health- related aspects of climate change through multi-pronged approach.

A National Expert Group on Climate Change & Health was constituted in July 2015 under the chairmanship of Dr Vishwa Mohan Katoch, Former Secretary (Health Research), Government of India and DG (ICMR) to prepare action plan, recommend strategies for adaptation, capacity building etc. The National Centre for Disease Control (NCDC) is the nodal agency for drafting of Action Plan under the Health Mission. The expert group (NEGCCH) had members' representation from Dte.GHS, MoHFW, MoEFCC, ICMR, DST, NDMA, CGWB, Min of Agriculture, CPCB, MoES, TERI, NEERI, which had drafted the National Action Plan on Climate Change and Human Health after detailed deliberation.

India is a diverse country in terms of geography, climatic conditions, resources and health care infrastructure etc. Owing to this diversity, each state and UT may have morbidity and mortality due to diseases which may occur as per the geographic-climatic conditions. Hence it was realised that country requires state/region specific action plan for climate change and human health (SAPCCHH). Four regional consultations for all the states and UTs were conducted by Centre for Environmental & Occupational Health, National Centre for Disease Control recently. The states and Union Territories were sensitized on effect of climate variability and change on ‘occurrence and virulence of vectors’ and recent change in pattern of different climate sensitive illnesses in their geographic area.

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EXECUTIVE SUMMARY

Climate change is occurring due to natural internal processes or external force and is defined as: “a *change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.*” It affects social and environmental determinants of health like –clean air, safe drinking water, sufficient food and secure shelter.

Climate change may negatively affect human health through a number of ways, but the commonly experienced are increased frequency and intensity of heat waves, rise in heat related illnesses and deaths, increased precipitation, floods and droughts, costing lives directly. High temperature is known to increase the level of ‘ground level ozone’ and other ‘climate altering pollutants’ other than carbon dioxide, which further exacerbate cardio-respiratory and allergic diseases and certain cancers. Beside these, there is increase in transmission and spread of infectious diseases, changes in the distribution of water- borne, food borne and vector-borne diseases and effects on the risk of disasters and malnutrition.

The *United Nations Framework Convention on Climate Change (UNFCCC)* came into force on 21st March 1994. Since then many steps were initiated to reduce the effect of climate change at meetings like “Rio Convention 1992”, *Kyoto protocol 1997*”, “Convention of Parties”, “*Cancun Agreement 2010*”, “*Durban Platform 2011*”, “Nationally Determined Contributions” (NDCs) at Conference of Parties 21”,

Initiatives undertaken by India are: a) Identification of Ministry of Environment, Forest & Climate Change (MOEF&CC) as nodal ministry; b) Formulation of National Environmental Policy 2006; c) Formulation of Prime Minister’s Council on Climate Change for matters related to Climate Change. MoEFCC has developed National Action Plan on Climate Change with eight missions. Later on four new missions (including Health Mission) were identified. As a follow-up action, MoHFW constituted a National Expert Group on Climate Change & Health (NEGCH) under the chairmanship of *Dr Vishwa Mohan Katoch, Former Secretary (Health Research), Government of India and DG (ICMR)* to prepare action plan, recommend strategies for indicators, mitigation, capacity building etc.

The Health Mission aims to reduce climate sensitive illnesses through integration with other missions under NAPCC as well as through programmes run by various ministries, The vision of NAPCCHH is: To strengthen health of citizens of India against climate sensitive illness, especially among the vulnerable like children, women and marginalized population. With a goal to reduce morbidity, mortality, injuries and health vulnerability to climate variability and extreme weathers. The NAPCCHH objectives with some initially identified key actions are:

1. To create awareness among general population (vulnerable community), health-care providers and Policy makers regarding impacts of climate change on human health.
 - a. Sensitization meeting
 - b. IEC
 - c. Environment Days
2. To strengthen capacity of healthcare system to reduce illnesses/ diseases due to variability in climate
 - a. Trainings
 - b. Workshops
 - c. Teaching Curricula
3. To strengthen health preparedness and response by performing situational analysis at national/ state/ district/ below district levels.
 - a. Vulnerability needs assessments
 - b. Health Adaptation Plan
 - c. Surveillance
 - d. Green and Climate Resilient Healthcare Facilities
4. To develop partnerships and create synchrony/ synergy with other missions and ensure that health is adequately represented in the climate change agenda in the country

5. To strengthen research capacity to fill the evidence gap on climate change impact on human health

Initial Inputs desired (first 2 years)

1. Establish 'Environmental Health Cell' in State Health Department,
2. Identification of State Nodal Officer- Climate Change at State Health Department
3. Notification of Task Force with representation of other health programmes (vector-borne disease, infectious diseases, nutrition etc) multi-sectors/ departments such as Disaster Management Authority, Health Information System, district unit of departments of Meteorology, Pollution Control Board, Water and Sanitation, Public Works Departments and civil societies etc.
4. Vulnerability Assessment for baseline rate for Climate Sensitive Illnesses in terms of
 - Geography (Plain/ Mountain/ Desert/ Coastal), identify worst affected areas (districts)
 - Risk mapping with extreme events (heat/ cold/ drought/ flood/ cyclone/other),
 - Affected Population (Total, density, Vulnerable, Occupation)
 - Contributing/ exaggerating factors for these Climate sensitive illnesses
 - Healthcare Infrastructure/ facilities like PHC, CHC, District hospital, Tertiary care hospitals- Government as well as Private.
 - Identify areas for capacity building –human resource, technical and healthcare service delivery.
5. State health adaptation plan must be prepared with at least chapters on heat related illness and Air Pollution related health issues
6. State health department should identify and strengthen local organizations for support to manage climate related health issues
7. Coordinate with Centre of Excellence for subject specific health adaptation plans.
8. IEC plan for climate change and health

Process: 2 to 5 years

1. Formulate specific implementation framework for climate sensitive diseases.
2. Contingency plans for climate sensitive illnesses - appropriate and efficient health personnel, logistics & resource allocation.
3. Capacity building and training of health care personnel on guidelines for climate sensitive illnesses at district level in each state.
4. Development of early detection tools for CSDs (diagnostics, surveillance) or prediction models for preparedness of population and health care system.
5. Periodic reviews of vulnerability, response capacity and preparedness
6. Adapt new technologies, building design, energy, water and sanitation provisions for new constructions of healthcare facilities and modify existing ones.
7. Link data on climate sensitive diseases, environmental factors, meteorological information, and outcomes.
8. Risk mapping for seasonal trend of CSDs.
9. Research for climate sensitive illnesses.

Expected Output:

1. Awareness & Behavior modification of general population for impact, illnesses, prevention and adaptive measures for climate sensitive illnesses.
2. Increase in trained healthcare personnel and equipped institutes/ organization towards achievement of climate resilient healthcare services and infrastructure at district level in each state.
3. Integrated monitoring system for collection and analysis of health related data with meteorological parameters, environmental, socio-economic and occupational factors
4. Evidence-based support to policy makers, programme planners and related stakeholders

The Monitoring & Evaluation of the implementation of NAPCCHH has been stipulated with a mix of internal and external approaches. MoHFW, State DoHFW, District Health Officers and the individual health facilities will be involved in regular internal monitoring. External Monitoring will be done by an independent agency.

To address the diversity and to target the specific health issues, four regional consultations with states and

Union Territories were conducted in 2017-18 by *Centre for Environmental and Occupational Health*, National Centre for Disease Control, Delhi. The aim was to sensitize states/UTs' health personnel to reassess diseases' morbidity and mortality with respect to climate variability and extremes. The states and UTs were communicated to identify the '*Nodal Person for Climate Change from State Health Department*', Constitution of "*State Environment Health Cell*" at State Health Ministry level and Constitution of a team of experts with representation from Ministry for Environment, Forest & Climate Change, Ministry of Drinking Water and Sanitation, Ministry of Agriculture, Ministry of Earth Sciences, ICMR branch (if in state), Disaster Management Authority, State Pollution Control Board or other stakeholders identified by state.

These regional consultations had participations from health and non-health department of states and UTs, as well as from WHO as well as research institutions. The representatives were aware of the urgency and had serious concern for the agenda of these consultations. State health teams were expected to list and prioritize climate sensitive illnesses in their state and UTs, compilation of data on morbidity and mortality, statistics related to vulnerable population, geographical factors, health care infrastructure/ facilities, or any mitigation and adaptation measures adopted by state against impact of climate change on human health. The available data of states and UT need to be linked to climate/ weather data for which the assurance was given by the representative from Regional Centre Meteorological Departments. Many states have initiated actions by identifying State Nodal Officer (Climate Change), notified experts from non-health sectors for Task Force and few states have prepared their action plan for climate change as well as adaptation plan for heat related illnesses.

Now, India is signatory to "*Male' Declaration*" wherein health sector has to be strengthened so as to make it climate resilient. According to Male' Declaration, it is desired that health-care facilities should be prepared & climate-resilient, particularly in promoting to encourage that these are able to withstand any climatic event, and that essential services such as water, sanitation, waste management and electricity are functional during such events. Further, for climate resilient, the health department has to undertake measures to initiate the greening of the health sector by adopting environment-friendly technologies, and using energy-efficient services.

I. INTRODUCTION

Climate change refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties (usually by models or statistical tests), and that persists for an extended period, typically decades or longer^{1-2,6}. Climate change may be due to natural internal processes or external force such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use. The Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods³”. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes^{4,5}.

Climate change is perceived to be among the greatest health risks of the 21st Century^{4,5}. It affects social and environmental determinants of health like –clean air, safe drinking water, sufficient food and secure shelter. Climate change, together with other natural and human- made health stressors, influences human health and disease in numerous ways(Fig:1).

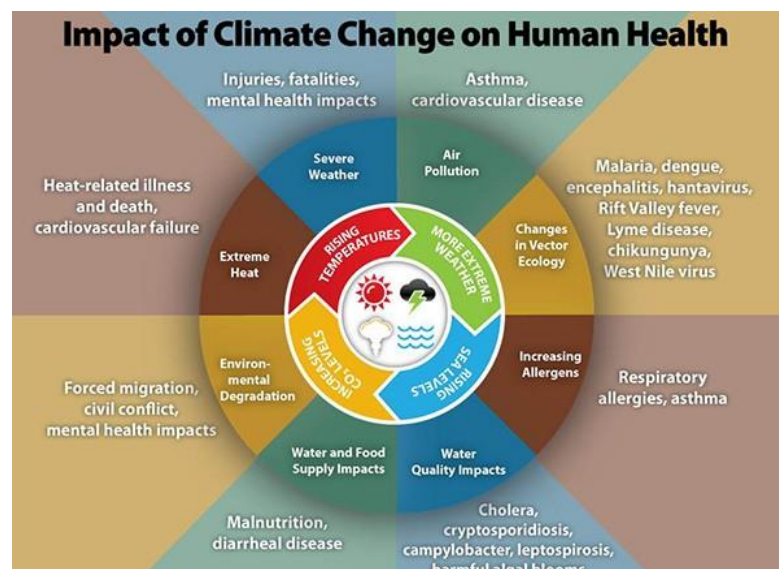


Fig:1. Likely Impacts of Climate Change on Human Health
Source: <https://www.cdc.gov/climateandhealth/effects/default.htm>

Climate change may have various impacts, but most commonly observed negative effects on human health are seen as rise in illnesses and deaths. The climatic variables costing lives directly are identified as increase in frequency and intensity of heat waves, increased precipitation, floods and droughts^{17-18,26}. High temperature is known to increase the level of ‘ground level ozone’ and other ‘climate altering pollutants’ other than carbon dioxide, which further exacerbate cardio-respiratory and allergic diseases and certain cancers.

Beside these, there is increase in transmission and spread of infectious diseases, changes in the distribution of water-borne, food borne and vector-borne diseases and occurrence of disasters and increased probability of malnutrition. The marginalized populations among all are found to be more adversely affected due to variability and change in climatic conditions.

The World Health Organization (WHO) estimates that between 2030 and 2050, climate change is expected to cause approximately 2,50,000 additional deaths per year, resulting from malnutrition, malaria, diarrhea and heat stress. These deaths will further have financial implications which are estimated to be between US\$ 2-4 billion/year by 2030^{13,14,16}. Diseases such as malaria, yellow fever, dengue and cholera are all sensitive to climate change due to effect on the viability and the geographical distribution of the mosquitoes and micro-organisms, which prefer a wetter, warmer world.

India is a highly populous country, undergoing industrialization, with large scale rural to urban migration, chaotic, unplanned urbanization, depletion of forest cover and requirement of high energy demand makes it more vulnerable to adverse impacts of climate change. As evident from various literature worldwide, the health effects may occur either due to direct or indirect causes of climate change or extremes of weather 21.

A) Direct Impacts of Change in Climate and Weather on Health:

Changes in temperature and precipitation and occurrence of heat waves, floods, droughts and fires directly impact health of people.

1. Heat-Stress and Related Impacts

The IPCC Special Report on Extreme Events (SREX)⁶ has a mention that there has been an overall decrease in the number of cold days and nights, and an overall increase in the number of warm days and nights, at the global scale. If there has been an increase in daily maximum temperatures, resulting in increase in number of heat-related illnesses. As per the basic processes of human thermoregulation, the health effects are seen when body temperature rises above 38°C i.e. physical functions are impaired with experience of weakness (heat exhaustion), when body temperature rises further to 40.6°C, the risk of physical and cognitive functions get impaired (heat syncope), risks of organ damage, loss of consciousness, and death increase sharply at further rise in body temperature usually above 40.6°C (heat stroke). Various factors interplay in occurrence of these morbidity and mortality majorly affecting mainly the vulnerable population especially in the vulnerable regions²¹⁻²³.

The *vulnerable population* implies the demography (extremes of age, sex, population density, pregnant women and certain occupations), Health Status (like proportion of malnourishment, suffering with infectious and/ or chronic diseases, mental or physical disability), socio-economic status (poor/ marginalized- more vulnerable), type of occupation or socio-cultural practices. The *vulnerable regions* implies unplanned urban housing, proportion of slums, drought risk zones, water-stressed zones, food-insecure zones and remote rural areas

Numerous studies have reported increase in temperature-related morbidity (hospital admissions or emergency presentations), events due to cardiovascular, respiratory, and kidney diseases. These impacts have been related to the duration and intensity of heat. Health risks during heat extremes are greater in people who are physically active.

Eighteen heat-waves were reported in India between 1980 and 1998, with a heat-wave in 1988 affecting ten states and causing 1,300 deaths. Heat-waves in Odisha, India during 1998 to 2000 caused an estimated more than two thousand deaths and heat-waves in 2003 in Andhra Pradesh, India, caused more than 3000 deaths. The significant correlation between mortality and high temperature and high heat index has also been documented.

2. Drought, Storms and Floods

Climate change can result in more hot days, resulting in more periods of 'drought', 'dust storms', or 'heavy rains (precipitation)', and even 'flooding'. The health gets directly affected due to injuries, hypothermia, hyperthermia, drowning and indirectly through population dislocation, crowding, poor living conditions, faeco-oral transmission of gastro-intestinal pathogens causing water and food borne illnesses, respiratory illness and other infectious diseases (e.g., leptospirosis, vector-borne disease, cholera and also mental illnesses)⁴⁸⁻⁵⁰. The reason primarily is due to contamination of water and sewage disposal.

3. Ozone

Ozone is a secondary pollutant, formed via sunlight-driven photochemical reactions involving precursor hydrocarbons and oxides of nitrogen. Ozone pollution is projected to increase because warmer temperatures enhance these reactions. Ozone is a powerful oxidant that has been persistently associated with damage to structure of airway or lung tissue. It contributes to more severe symptom of asthma, increase in other respiratory illnesses and deaths. High concentration of ground-level ozone accompanied with Heat waves result in higher frequency and severity of cardio-pulmonary attacks³⁴⁻³⁶. Similarly,

combination of high level of Ozone and dust storms or alteration of allergens or all, will result in outbreaks of asthma and allergic rhinitis.

4. Air pollution

Air pollution is a major environmental risk to health. The formation, transport and dispersion of many air pollutants is determined partly by climate and weather factors such as temperature, humidity, wind, storms, droughts, precipitation and partly by human activities known to produce various air pollutants. It is thus logical to assume that climate change will influence the dynamics of air pollution. By reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma^{29,30}.

Ambient (outdoor air pollution) in both cities and rural areas was estimated to cause 3.7 million premature deaths worldwide in 2012. Air pollution also affect health by causing acid rain; eutrophication due to nitrogen oxides emission in air from power plants, cars, trucks, and other sources; Haze; toxic effects on wildlife; Ozone depletion; Crop and forest damage etc. Over 4 million people die prematurely from illness attributable to the household air pollution from cooking with solid fuels. 3.8 million premature deaths annually from non- communicable diseases including stroke, ischemic heart disease, chronic obstructive pulmonary disease (COPD) and lung cancer are attributed to exposure to household air pollution⁴¹⁻⁴³.

5. Ultraviolet Radiation

The IPCC AR5 mention few studies which states that ultraviolet radiation (UVR) are linked to higher incidence of few skin carcinoma for every 1°C increment in average temperatures³⁶. However, exposure to the sun also has beneficial effects on synthesis of vitamin D, with important consequences for health. Accordingly, the balance of gains and losses due to increased UV exposures vary with location, intensity of exposure, and other factors (such as diet) that influence vitamin D levels.

The excess of exposure to solar *ultraviolet radiation (UVR)* even within the ambient environmental range may results in sunburn, photo-ageing, cataracts, immune suppression and skin melanomas³⁷. UVR induced immune-suppression may influence occurrence of various infectious diseases as well as affect vaccine efficacy. There is evidence to support a relationship between sunburn during childhood and adolescence and skin cancer in adulthood. The World Health Organization (WHO) has argued that school sun protection

programmes should be emphasized, because a sizeable portion of lifetime sun exposure occurs during childhood and adolescence. Similarly, personal exposure studies among outdoor workers found that individuals engaged in road construction, horticulture, roofing and other outdoor occupations received ~20 - 26% of the total daily ambient solar UV radiation levels.

B) Indirect Impacts of Climate and Weather on Health:

Indirect impacts are due to ecological disruptions, rising sea level, changing temperatures and precipitation patterns which leads to crop failures, shifting patterns of disease' vectors, water-borne disease, vector-borne disease. Climate dependent diseases particularly affecting the vulnerable populations include the following:

1. **Air-Borne and Cardio-Respiratory Illnesses:** Climate change influences various illnesses including respiratory tract infections like asthma, rhino-sinusitis, chronic obstructive pulmonary diseases (COPD), respiratory viral diseases (Avian Influenza) & circulatory collapse posing danger to cardiac patients. The cited reasons are poor air quality, high ozone, dust storms, extreme heat, desertification, alteration of allergens, change in timing and duration of survival and transmission cycle of respiratory virus, alteration in bird migration. Further the other contributory factors are demographic factors (age, sex, immunity status, pregnant women, prevailing endemic illnesses etc) low socio-economic status, overcrowding, poor hygienic conditions, accessibilities to health care facilities, population with tuberculosis, immune-compromised level, or mentally or physically challenged people³⁷⁻³⁹.
2. **Vector-borne diseases (VBD):** Climate change and other weather parameters have significant impact on vector borne diseases such as Malaria, Dengue, Chikungunya, Japanese Encephalitis, kala-azar, and filariasis. The known parameters are temperature, humidity, wind, rainfall, flood and drought, affecting 'distribution of vector' and 'effectiveness of transmission of pathogen' through vectors. The temperature affects: vectors' survival, population growth, feeding behaviour, susceptibility to pathogen, incubation period, seasonality of vector activity as well as pathogen transmission. The roles of rainfall on vectors are: increase in breeding sites due to increase in surface water, increase vegetation and expansion of vertebrate hosts, flooding bring vertebrate host close to human population⁴¹⁻⁴³.

Other factors affecting VBDs are population growth, population displacement, socio-economic status, changes in residential pattern, changes in land use, water projects,

agricultural practices, housing projects, international travel, resistance of diseases vectors and pathogens, accessibility to health care and diagnostic facilities.

3. **Waterborne & Foodborne diseases** such as typhoid, hepatitis, dysentery, and others caused from micro-organisms such as *Vibrio vulnificus* and *Vibrio cholera*, *E.Coli*, *Campylobacter*, *Salmonella*, *Cryptosporidium*, *Giardia*, *Yersinia*, *Legionella* are some climate-dependent infectious diseases. The increase in temperature is seen to be associated with increased survival and abundance of micro-organisms^{44,46}. The decreased precipitation and drought result in decrease availability of safe-water, reuse of wastewater, contamination of water sources, transmission from vertebrate to human or human to human etc. Flooding cause contamination of water source as well as disruption of sewage disposal system, further contributors are population displacement, overcrowding, poor sanitation and hygiene, subsequent faeco-oral contamination and spread of pathogens etc.
4. **Malnutrition** and consequent disorders, like retarded child growth and development have been identified as one of the health threat by the Working Group-II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Climate change result in food insecurity, namely, food availability, food accessibility, food utilization, and food system stability. Drought occurrence diminishes crop yield, dietary diversity, supply chain disrupted, increase in market prices, also reduction in animal and aquatic products are being experienced. These factors reduce overall food consumption, and may therefore lead to macro as well as micronutrient deficiencies.

For India, a proactive approach is critical as nearly half of children (48%) aged less than five are chronically malnourished, more than half of women (55%) and almost one-quarter of men (24%) are anaemic (NFHS-3). The health of the vulnerable population is further threatened by the changing climate. For instance, in Gujarat, during a drought in the year 2000, diets were found to be deficient in energy and several vitamins. In this population, serious effects of drought on anthropometric indices may have been prevented by public- health measures^{48,49}.

There are certain **positive effects of climate change** too, like modest reductions in cold-related morbidity and mortality, geographical shifts in food production, and reduced capacity of disease-carrying vectors due to exceeding of thermal thresholds. These positive effects will however be increasingly outweighed, worldwide, by the magnitude and severity of the negative effects of climate change.

II. STEPS TO REDUCE IMPACTS OF CLIMATE CHANGE

The United Nations Framework Convention on Climate Change (UNFCCC) came into force on 21st March 1994. The “Rio Convention”, was adopted out of three conventions identified at “Rio Earth Summit” in 1992. Today, this convention known as “Convention of Parties” has 197 countries. Industrialized nations agree under the Convention to support climate change activities in developing countries by providing financial support for action on climate change. This was followed by first Conference of Parties (COP1) that took place in Berlin in 1995.

Another milestone was *Kyoto protocol*, which was adopted in Kyoto, Japan, on 11th December 1997. The Parties agreed-for were made bound for ‘targets’ for reducing emission. The Kyoto Protocol places a heavier burden on developed nations under the principle of “*common but differentiated responsibilities*”, owing to high level of GHG emissions by developed nations by their industrial activity for approximately 150 years. The detailed rules for the implementation of the Protocol were adopted at COP-7 in Marrakesh, Morocco, in 2001, and are referred to as the “Marrakesh Accords.” Its first commitment period started in 2008 and ended in 2012.

The *Cancun Agreement* came up in 2010 at COP-16 in Cancun, where Governments decided to establish a “*Green Climate Fund*”. The fund will support projects, programmes, policies and other activities in developing country using thematic funding windows. The objective was to enhance action on adaptation, international cooperation and coherent consideration of matters relating to adaptation under the Convention.

At COP17, *Durban Platform*, Enhanced Action drafted, where governments clearly recognized the need to draw up the blueprint for a fresh universal, legal agreement to deal with climate change beyond 2020, where all will play their part to the best of their ability and all will be able to reap the benefits of success together. The Durban outcome recognized, in its spirit and intention that smart government policy, smart business investment, and the demands of an informed citizenry, all motivated by an understanding of mutual self-interest, must go hand in hand in pursuit of the common goal.

At COP 21 in Paris, Parties to the UNFCCC reached a historic agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. The Paris Agreement requires all Parties to put forward their best efforts

through “Nationally Determined Contributions” (NDCs) and to strengthen these efforts in the years ahead.

India has undertaken many initiatives in pursuance to the obligation implied by UNFCCC like: a) Identification of Ministry of Environment, Forest & Climate Change (MOEF&CC) as nodal ministry for matters related to Climate Change; b) Formulation of National Environmental Policy 2006; c) Formulation of Prime Minister’s Council on Climate Change to advice proactive measures, facilitate inter-ministerial coordination and guide policy in relevant areas.

The Hon’ble Prime Minister of India office had released a National Action Plan on Climate Change in June 2008. NAPCC addresses the urgent and critical concerns of the country through enhancement of the current and planned programmes presented in the Technology Document. It identifies measures that promote our development objectives along with yielding co-benefits for addressing climate change effectively. It outlines a number of steps to simultaneously advance India’s development and climate change related objectives of adaptation and mitigation. The NAPCC identified eight national missions initially:

1. National Mission on Sustainable habitat
2. National Mission for Sustaining the Himalayan Ecosystem
3. National Mission for Sustainable Agriculture
4. National Solar Mission
5. National Mission for Enhanced Energy Efficiency
6. National Water Mission
7. National Mission on Strategic Knowledge for Climate Change
8. National Mission for “Green India”

The reconstituted Prime Minister Council on Climate Change (PMCCC) reviewed the progress of eight national missions on 19th January 2015 and suggested formulation of four new missions on Climate Change viz.

1. Health Mission
2. National Mission on “Waste to Energy Generation”
3. National Mission on India’s Coastal areas
4. National Wind Mission

In this background, the proposed 'Health Mission' was undertaken by Ministry of Health & Family Welfare, Government of India under the umbrella of 'National Action Plan on Climate Change' by MoEFCC. As a follow-up action, MoHFW constituted a National Expert Group on Climate Change & Health (NEGCH) under the chairmanship of *Dr Vishwa Mohan Katoch, Former Secretary (Health Research), Government of India and DG (ICMR)* to prepare action plan, recommend strategies for adaptation and response plan for diseases occurring due to climate variability and change.

National Centre for Diseases Control (NCDC) was identified as the nodal agency for 'Health Mission' by Ministry of Health & Family Welfare, Government of India. An expert group was constituted with members' representation from Dte.GHS, MoHFW, MoEFCC, ICMR, DST, NDMA, CGWB, Min of Agriculture, CPCB, Ministry of Earth Sciences, TERI, NEERI etc.

III. INDIA'S STRATEGIC FRAMEWORK FOR ADAPTATION OF HUMAN HEALTH AGAINST CLIMATE CHANGE

India's Health and Family Welfare System derives strength from several institutes and infrastructures of the GOI, multi-lateral institutes, and NGOs including the National Institute of Malaria Research; Indian Institute of Tropical Meteorology, India Meteorological Department, Director General of Health Services, Indian Council of Medical Research, National Centre for Disease Control and many others.

Measures that would help address the imminent challenges would include *development of an integrated early health warning system, state specific emergency response plan*, along with increased capacity to provide health care to the most vulnerable and the marginalized populations.

Therefore, a fundamental area of intervention would include strengthening of local monitoring of appropriate climate and disease variables. This would be directed at building temporally and spatially *disease specific database*. A strong surveillance would help develop effective prevention strategies, aid epidemiological understanding and predictive computations. Improvements in information infrastructure that are innovative and that promote interdisciplinary collaborations have been identified as areas that require strengthening in India (Bush et al. 2011).

The linkage of health with environmental and climate change determinants is well recognized. Consequently, coordination and synergies with other Ministries becomes crucial to yield health benefits. To facilitate joint action and Inter-Ministerial cooperation, it is imperative to develop feedback mechanisms of health trends to related Ministries and agencies to enable health statistics to leapfrog.

Health sector in preparedness for climate change needs urgent, serious, and multifaceted action, which should include:

1. Strengthen/ develop coordination for health related early warning and surveillance systems in specific areas (e.g. heat waves, floods, air pollution, ultraviolet radiation, vector borne, water-borne and infectious diseases) through an integrated disease surveillance system.

2. Feedback mechanisms to other ministries responsible for several ecological determinants of health particularly- air, water, food, fuel and human resource.
3. Development of risk maps for climate sensitive diseases for each geographical area.
4. Strengthening/ developing response action based on innovative or new strategies or technological approaches to increase access, early health care advice/ referral and health tracking system incorporating *Aadhaar* card number to assist surveillance and generate trends.
5. Undertake case studies and research and pilot test new approaches aimed at building health resilience in climatically sensitive locations.

The proposed 'Health Mission' will take a multi-pronged approach to address the health-related aspects of climate change through the strategies listed in the National Action Plan for Climate Change and Human Health (NAPCCHH). The Health Missions seeks coordination with other missions identified under the umbrella of National Action Plan for Climate change (NAPCC) listed earlier in this document. The targets achieved by other national missions launched under the NAPCC will also scale down the morbidity and mortality of various types of illnesses.

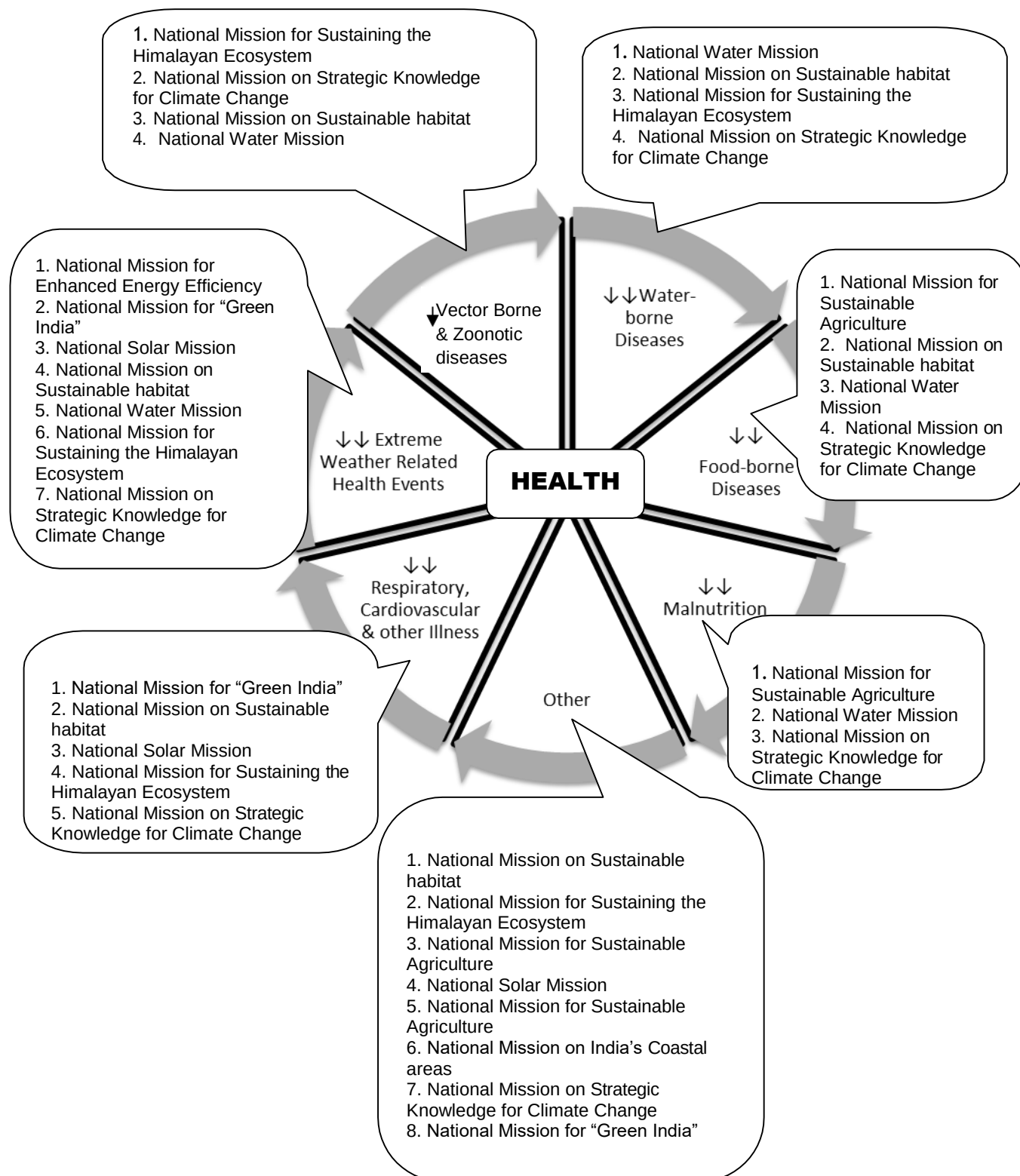
IV: INTEGRATION OF HEALTH MISSION WITH OTHER MINISTRIES AND MISSIONS ON CLIMATE CHANGE

The frequency and magnitude of occurrence of “morbidity and mortality”, “acute and chronic” “communicable” or “Non-Communicable” illnesses depends on socioeconomic status, residence, occupation, level of nourishment, underlying illness, availability of safe drinking water, sanitation facilities, overcrowding, pollution, extreme weather, chemical exposures, agricultural practices, governance (local, state and national level), access to health facilities, trained/ skilled health manpower, laboratory support, and religious practices etc.

The strengthening of the National Programmes under various ministries will raise the level of health of people through direct or indirect impacts by reducing risk factors. To name the beneficial national programmes/ schemes are: Namami Gange Programme, Mid Day Meal Programme, Integrated Child Development Schemes, Indira Gandhi Matritva Sahyog Yojna, Deen Dayal Upadhyaya Gram Jyoti Yojna, Atal Mission for Rejuvenation and Urban Transformation, Gramin Bhandaran Yojna, Jawaharlal Nehru National Urban Renewal Mission, Livestock Insurance Scheme, National Urban Livelihood Mission, Smart Cities Mission, National Vector Borne Disease Control Programme, *National Programme for Prevention and Control of Diabetes, Cardiovascular diseases, Cancer and Stroke, National Mental Health Programme, National Iodine Deficiency Disorder Control Programme, Revised National TB Control Programme (RNTCP), National Programme for Control and Treatment of Occupational Disease, National Programme for the Health Care for the Elderly, National Programme for Prevention and Control of Deafness and Universal Immunization Programme.*

The MoHFW seeks to coordinate & collaborate with other Ministries, departments & NGOs/CBOs. These Ministries & Departments are: *Ministry of Environment, forest & Climate Change, Ministry of Information & Broadcasting, Ministry of Human Resource Development, Indian Council of Medical Research, Ministry of Agriculture, Medical Council of India, Ministry of Drinking Water and Sanitation, Min. of New & Renewable Energy, National Disaster Management Authority, Ministry of Women and Child Development, Indian Institute of Tropical Meteorology, Indian Institute of Tropical Meteorology, Department of Space, Department of Science & Technology, Council of Scientific & Industrial Research, Ministry of Home Affairs, Defence Research & Development Organization, Indian Council of Agricultural research, National Institute of Malaria Research, Food Safety and Standards Authority of India, Department of Health Research, National Environmental Engineering Research Institute, Community Based Organizations, Public Health Foundation of India etc.*

The possible health impacts of other missions under NAPCC are foreseen as follows:



V: NAPCCHH: VISION, GOAL & OBJECTIVES

Vision: Strengthening of healthcare services for all the citizens of India esp vulnerable like children, women and marginalized population against climate sensitive illnesses.

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

Objective: To strengthen health care services against adverse impact of climate change on health.

Specific Objectives

Objective 1:

To create awareness among general population (vulnerable community), health-care providers and Policy makers regarding impacts of climate change on human health.

- Sensitization meetings
- IEC
- Environment day

Objective 2:

To strengthen capacity of healthcare system to reduce illnesses/ diseases due to variability in climate.

- Trainings
- Workshops
- Teaching Curricula

Objective 3:

To strengthen health preparedness and response by performing situational analysis at national/ state/ district/ below district levels.

- Vulnerability needs assessments
- Health Adaptation Plan
- Surveillance
- Green and Climate Resilient Healthcare Facilities

Objective 4:

To develop partnerships and create synchrony/ synergy with other missions and ensure that health is adequately represented in the climate change agenda in the country

Objective 5: To strengthen research capacity to fill the evidence gap on climate change impact on human health

Objective wise progress so far:

A. To create awareness among general population, health care providers and policy makers regarding impacts of climate change on human health

- Issuing seasonal advisory on Climate Sensitive Diseases (CSDs) including Acute Respiratory Illnesses (ARI) in context of air pollution and Heat Related Illnesses (HRI).
- Developed IEC content on CSDs including ARI and HRI
- Running social media campaign
- Organizing sensitization workshop on climate change and health
- Observing international days related to environment and health such as World Environment Day annually, International Day of clean air for blue sky in 2020.
- Task force meeting on CSDs

B. To strengthen capacity of healthcare system to reduce illnesses/diseases due to variability in climate

- 36 states have appointed a State Nodal Officer for Health & Climate Change
- 24 states have established state level Environment Health Cells
- 24 states have set up multi-sectoral Task Force under Principal Secretary (Health)
- 17 states have set up Governing Bodies under Hon'ble Health Ministers of States
- Training of all nodal officers on Climate Change
- Training of hospital nodal officers on strengthening of air pollution related surveillance
- Developed community level training modules on air pollution issues for women and children
- Conducted three workshop on health related impacts of air pollution
 - Building the bridge between air quality, weather and health in India
 - Technical consultation on Tools for assessing health impacts of air pollution
 - National Consultation on Burden of Diseases from Air Pollution and role of health sector in combating health impacts of air pollution
- Initiated effort with all six councils i.e. Medical Council of India, Dental Council of India, Nursing Council of India, Central Council of Homeopathy, Central Council of Indian Medicine and National Board of Examination for inclusion of climate change in the teaching curricula. The content on the matter are under consideration in respective councils.

C. To strengthen health preparedness and response by performing situational analysis at National/State/ District/below district level

- Provided template for drafting State- specific Action Plan for Climate Change & Human Health – First draft submitted by 12 States.
- Vulnerability Need Assessment (VNA) initiated in 3 States
- Acute Respiratory Illness (ARI) surveillance in context of air pollution
 - Going on in Delhi
 - 49 Surveillance Cities initiated reporting in the country
 - 60 Surveillance Hospitals initiated reporting ARI data in the country
- HRI surveillance in 23 heat vulnerable States March to July
- Developing Technical Expert Group and Task Force for all CSDs
- National Review workshop of all States in 2019, and Online reviews in 2021
- Principles of 'Climate Resilient' and "Green" submitted for inclusion in Indian Public Health Standards (IPHS) under NHM

D. To develop partnerships and create synchrony/ synergy with other mission and ensure that health is adequately represented in climate change agenda in country

- Initiated integration NPCCHH with NCD, NVBDCP, IMD, NDMA, MoEFCC, DST activities
- Identified 16 Centre of Excellences

E. To strengthen research capacity to fill the evidence gap on climate change impact on human health

- Supported MoEFCC in National Clean Air Programme (NCAP) preparation, Indoor air pollution guidelines, 20 cities study
- Supported ICMR in disease burden studies
- Requested ICMR to constitute research committee to guide in CSDs and air pollution research
- Contributed by sharing research questions to ICMR
- Over 30 institutions contributed to Compendium on Indian research on air pollution and health impacts
- Held regional and national Consultations in last two years

Regarding status of budget for the NPCCHH programme for the FY 2020-21, a state wise presentation on the budget allotted under the NCD Flexi pool of the NHM, MoHFW is placed in the table (below) which is shown regarding the following three categories as-

- NCD Flexi pool budget allocation under NHM for the FY 2020-21: **Rs 702.89 (Crores)**
- Total NPCCHH budget under NCD Flexi pool under NHM as per Record of Proceedings (ROP) for the NPCCHH programme for FY 2020-21: **Rs 28.981(Crores)**
- Expenditure done on the programme related activities in the States/UTs FY 2020-21 (reported till 5th Feb. 2021) – Rs. **0.46 Crores**. The reasons for very low budget expenditure observed from the allotted budget under the programme is being communicated by the programme officers as due to the exceptional and unusual COVID-19 pandemic situations. However, during the national review meeting conducted recently in Jan-Feb 2021, the programme officers reported that as the pandemic situations are started observing stabilizing the allocated budgets are gradually initiated utilizing the budget for the programme related activities for the FY 2020-21.

Table: Status of the NPCCHH programme Budget for the States/UTs under the NHM FY 2020-21

Sl.No	State/UTs	NCD Flexi pool budget allocation under NHM FY 2020-21	Approved ROP for respective States/UTs for NPCCHH programme under NHM FY 2020-21	States expenditure FY 2020-21 (reported till 5 th Feb. 2021)
1	Andaman & Nicobar Island	0.64	0	
2	Andhra Pradesh	24.62	4.223	
3	Arunachal Pradesh	7.12	0.520	
4	Assam	40.50	0.318	0.02
5	Bihar	51.32	0.403	
6	Chandigarh	0.59	0.030	
7	Chhattisgarh	21.12	12.625	
8	DD, DD&NH	0.98	0.04	
9	Delhi	5.75	0	
10	Goa	0.65	0.023	
11	Gujarat	30.01	0.373	
12	Haryana	10.74	0.575	0.07
13	Himachal Pradesh	9.22	0	
14	Jammu & Kashmir	17.30	0.155	
15	Jharkhand	21.50	0.644	
16	Karnataka	30.06	0.102	0.0011
17	Kerala	13.09	0.375	0.14
18	Lakshadweep	0.11	0.005	
19	Madhya Pradesh	50.36	0.845	0.23
20	Maharashtra	53.11	0.593	0.003
21	Manipur	4.56	0.0	
22	Meghalaya	4.84	0.0	
23	Mizoram	2.60	0.087	
24	Nagaland	3.33	0	
25	Odisha	27.80	0.257	
26	Puducherry	0.99	0.14	
27	Punjab	11.80	0.367	
28	Rajasthan	50.78	0.34	
29	Sikkim	1.16	0.675	
30	Tamil Nadu	30.31	0	
31	Tripura	4.85	0.055	
32	Uttar Pradesh	102.15	1.95	
33	Uttarakhand	12.66	0.483	
34	West Bengal	35.21	0.639	
35	Telangana	17.60	2.74	
36	Ladakh	3.45	0.0025	
	Total	702.89	28.981	0.46

S.no	Key Actions	Short term (2021-23)	Medium Term (till 2026)	Indicators
1	Development & dissemination of IEC material on health impacts of Climate variability & change	-Undertake communication needs assessment Develop Communication Strategy & Tools Develop IEC materials in Hindi, English and other vernacular languages: Indicator: IEC developed on illnesses due to air pollution and heat in 10 regional languages and in 60% States Dissemination of IEC: mass media and inter-personal communication: Indicator: IEC disseminated in 50% of each States Sensitization of Health Care Providers, population grps, policy makers Indicator: 50% districts sensitized	IEC development and Dissemination: Indicator: IEC developed in on all climate sensitive diseases in 100% States and IECs revised in 60% States IEC disseminated in 100% of States -Explore inter-sectoral / inter- ministerial / civil society / NGOs for collaboration Sensitization of Health Care Providers, population grps, policy makers Indicator: 100% districts sensitized and 100% re-sensitized -Integrate health impacts of climate change into school and College curricula Periodic Impact assessment of communication activities and monitor dissemination and utilization of IEC material	Number of states and UTs developed & translated IEC on Health impacts of Extreme weather event like 'Heat' in local language Number of states and UTs developed & translated IEC on Health impacts of Air Pollution in local language Number of states and UTs developed & translated IEC on Health impacts of climate change on vector borne illnesses in local language Number of states and UTs developed & translated IEC on Health impacts of climate change on water borne illnesses in local language Number of states and UTs developed & translated IEC on Health impacts of climate change on food borne illnesses in local language Number of states and UTs developed & translated IEC on Health impacts of climate change on One Health / zoonotic diseases in local language Number of states and UTs developed & translated IEC on Health impacts of climate change on nutrition issues in local language

			Number of states and UTs developed & translated IEC on Health impacts of climate change on mental health in local language Number of states and UTs developed & translated IEC on Health impacts of climate change on occupational health in local language

S. No.	Key Actions			
		Short term (2021-23)	Medium Term (till 2026)	Indicators
2.				
	Strengthening of health care system in context of climate change	-Establishment of 'Environment Health Cell' at Health deptt.in all States and 150 districts -Appointment of State Nodal Officer (CC) in Health deptt of all States -Appointment of District Nodal Officer (CC) in Health deptt of 150 districts - Consultant Climate Change recruited in 15 States - Notify Task Force with multiple stakeholders in all states - Task force meetings: at least one meeting in all States and at least two Meeting in 18 States - Notify high level governing body in all states - State Action Plan finalized by 20 States/UTs. State to prepare action plan and upload the same on its website for ready reference. - District Action Plan published by 5 Districts	- Environment Health Cell established in all districts - Nodal officers in all blocks - Consultant Climate Change in all States/UTs -State Action Plan finalized by all States/UTs. Revised by 15 States. - District Action Plan published by 300 Districts -Coordinate with other agencies (municipalities, PRIs) for efficient and effective implementation of proposed activities at state and below level.	- Number of States/ UT with 'Environment Health Cell' at Health deptt - Number of States/ UT deputed State Nodal Officer (CC) at Health Department - Number of Districts deputed District Nodal Officer (CC) at Health Department - Number of States/ UT which have notified Task Force -Number of Task Force meetings conducted
	Capacity building in context of climate change	- Develop training modules and guidelines -Organize training of medical officers and healthcare personnel - Conduct workshops to strengthen knowledge on CC&HH for health care professionals	- Sensitize and orient private health care providers - Integrate health impacts of climate change into Medical undergraduate and postgraduate curriculum	- Number of States/ UTs that have enlisted organizations in their state for development of guidelines related to climate sensitive illnesses. - Number of States/ UTs conducted Training Need assessment in view of climate sensitive illnesses. -Number of States/ UTs conducted Training of medical officers and healthcare personnel on climate sensitive illnesses.

S. No.	Key Actions	Short term (2021-23)	Medium Term (till 2026)	Indicators
3.	To strengthen health preparedness and response by performing situational analysis at national/ state/ district/ below district levels.			
	Vulnerability Assessment of CSDs	- Vulnerability Need Assessment to be done in 20 States/UTs	- Vulnerability Need Assessment done in all States/UTs	- Number of states/ UTs conducted vulnerability assessment in the state.
	Develop/ strengthen the monitoring and surveillance systems for climate sensitive diseases	- Develop / strengthen surveillance for Heat Related Illnesses and Acute Respiratory Illnesses (ARI) in context of air pollution: • First surveillance training at State level in all States/UTs and at district/below district level in 550 districts • Heat related illnesses surveillance: 80% districts sending real time data • Air Pollution related surveillance started in one major hospital in 100 cities -Standardize information: Prepare Guidelines, reporting forms for Air pollution and heat related conditions.	- Develop / strengthen surveillance for Heat Related Illnesses and Acute Respiratory Illnesses (ARI) in context of air pollution: • Second training at State level in all States/UTs and at district/below district level in all districts • Heat related illnesses surveillance: 100% districts sending real time data • Air Pollution related surveillance started in 3 major hospital in 300 cities and 1 major hospital in 250 more cities - Develop / strengthen surveillance for other CSDs - Build an interdisciplinary platform i.e. link health databases with real-time monitoring of weather, climate, geospatial, and exposure data so as to accurately forecast health illness/event. Integrate relevant non-health data in the health surveillance system - Develop/ modify mechanism and indicators to monitor trend of CSDs. - Conduct Joint Review Missions / Central Internal Evaluations and feedback mechanisms.	- Number of states and UT conducted training for concerned personnel on surveillance system. -Number of states/ UT initiated surveillance for Climate sensitive illnesses (Illnesses due to Air Pollution, Heat Exposure, Vector borne and Water borne illnesses) -Number of states and UT integrated relevant meteorological data in the surveillance system of Climate sensitive illnesses.

Develop mechanisms for EWS/alerts and responses at state, district and below district level	Constitute multi-stakeholder working group for development of early warning system for each CSD - Design and integrate public health response plan	-Review monitoring and surveillance system of CSDs -Develop thresholds/prediction models for health events or CSDs. -Develop communication plan and dissemination systems to warn people and communities	- Number of States and UTs constituted working group for development of mechanism for EWS/alerts -Number of states and UTs developed mechanism to integrate public health response plan with related stakeholders Number of states and UTs developed communication plan and dissemination systems to warn people and communities
Develop subject specific health adaptation plans for CSDs	-Identify Centres of Excellences that will develop the health adaptation plans -All CoEs submit first draft of HAPs -CoEs provide handholding to States in specific subjects	-CoEs submit final draft of HAPs -CoEs develop guidelines and training modules for concerned subject -CoEs undertake trainings	- Number of CoEs that submitted HAPs
Green and climate resilient healthcare sector	- Identify measures needed in health sector building design to make it green and climate resilient. Incorporate them in Indian Public Health Standards and other standards • Use of energy-efficient equipment and services • Solar energy to replace traditional energy • Rain water harvesting - 20 district hospitals, 10 CHCs, 20 PHCs ensured use of energy efficient equipment and technologies - 5 district hospitals, 2 CHCS, and 2 PHCS develop rain water harvest and solar energy use provisions - 15 PHCs & 2 CHCs developed Climate Resilient healthcare facilities	- Expand measures to make healthcare sector green and climate resilient - Replicate the successful 'model of building design' for new healthcare facilities - 100 district hospitals, 60 CHCs, 140 PHCs ensured use of energy efficient equipment and technologies - 100 district hospitals, 60 CHCS, and 140 PHCS develop rain water harvest and solar energy use provisions - 140 PHCs, 40 CHCs and 17 district hospitals developed Climate Resilient healthcare facilities	- Number of states and UTs initiated 'Greening Effort' in their healthcare sector -Number of states and UTs which have successfully built the 'prototype of healthcare building' which has incorporated measures to make it withstand climate disasters

S. No.	Key Actions	Short term (2021-23)	Medium Term (till 2026)	Indicators
4.	To develop partnerships and create synchrony/ synergy with other missions and ensure that health is adequately represented in the climate change agenda in the country			
	Develop joint action plan with other deptt./ organizations In view of their capabilities and complementarities	-Enlist, map and analyze services by all possible stakeholders in the state as per their role in Climate Resilient Health Services -Identify health and non-health programmes, missions, projects and align health mission objectives in those programmes, missions, projects etc	-Broaden Stakeholders' network and partnership -Establish Corporate Social Responsibility / Accountability in terms of finances for implementing measures for prevention/ reduction/ treatment of CSDs -Develop affordable and acceptable tools for risk reduction and Environmental Health Impact Assessment	-Number of states and UTs conducted stakeholders' mapping -Number of states and UTs which have developed partnerships with other programmes, projects, missions in management of CSDs. -Number of states and UTs developed tool for Environmental Health Impact Assessment for commonly occurring CSDs.
		-	-	

S. No.	Key Actions	Short term (2021-23)	Medium Term (till 2026)	Indicators
5.	To strengthen research capacity to fill the evidence gap on climate change impact on human health.			
	Strengthening of healthcare services based on researches on climate variables and impact on human health	- Develop a research committee with ICMR that would develop research strategy for climate change and environment related health issues - Create database of professionals, researchers and institutions engaged in studies of impact of weather and climate on health – air pollution and health - Create a platform for 'data-repository' of various researches on climate and health effects – air pollution and health	- Initiate research projects that can guide climate service - Development of models mathematical or other types for early warning alerts for CSDs. - Inform Policy-makers about 'scenario' of health-related statistics with focus on CSDs. - Conduct workshops, conferences on new knowledge. - Vector mapping started in all States/UTs	- Number of states and UTs with database of professionals, researchers and institutions engaged in studies of impact of weather and climate on health - Number of states and UTs which have created a platform for 'data-repository' of various researches on climate and health effects - Number of states and UTs which have listed 'Best Practices' of measures to combat effect of climate change





Year-wise Output Outcome indicators for National Programme on Climate Change and Human Health (NPCCHH) for year 2021-25 submitted to NHM

S.No	Output	Indicators	Target					Outcome	Indicators	Target				
			2021-22	2022-23	2023-24	2024-25	2025-26			2021-22	2022-23	2023-24	2024-25	2025-26
1	Development of IEC material and advocacy on health impacts of Climate variability & change	1. Development of IEC prototype and translation in regional language 2. Revision of IEC	1. IEC developed for Acute respiratory illnesses due to Air pollution and Heat Related Illnesses in 5 regional languages	1. IEC developed for Acute respiratory illnesses due to Air pollution and Heat Related Illnesses in 10 regional languages	1. IEC developed for Acute respiratory illnesses due to Air pollution and Heat Related Illnesses in 15 regional languages 2. IEC developed on 6 Climate sensitive diseases in 5 regional languages	1. IEC developed for all climate sensitive diseases 2. IEC revised for 3 climate sensitive diseases	1. IEC revised for all climate sensitive diseases	To create awareness among general population (vulnerable community), health-care providers and policy makers regarding impacts of climate change on human health.	1. % of States developed the IEC	1. IEC developed in 30% States	1. IEC developed in 60% States	1. IEC developed in 100% States	1. IEC revised in 30% States	1. IEC revised in 60% States
		2. Dissemination of IEC.	1. IEC disseminated in 70% districts 2. IEC disseminated in 50% blocks	1. IEC disseminated in 95% districts 2. IEC disseminated in 70% blocks	1. IEC disseminated in 100% districts 2. IEC disseminated in 90% blocks	1. IEC disseminated in 100% districts 2. IEC disseminated in 90% blocks	1. IEC disseminated in 100% districts		Percentage of population covered through IEC	1. IEC disseminated in 1/3 rd of each States	1. IEC disseminated in 1/2 of each States	1. IEC disseminated in 3/4 th of each States	1. IEC disseminated in 100% of States	1. IEC disseminated in 100% of States
		3. Meeting workshops and Health education campaign for health effect of climate change	1. First meeting at State level in 20 States/UTs 2. Two meeting at District/below level in 200 districts	1. First meeting at State level in 36 States/UTs 2. Four meeting at district/below level in 550 districts	1. Second meeting at State level in 25 States/UTs 2. Five meeting at district/below level in 739 districts	1. Four meeting at district/below level in 400 districts	1. Second meeting at district/below level in 739 districts		% of districts sensitized	1. 20% of districts sensitized	1. 50% districts sensitized	1. 95% districts sensitized	1. 100% districts sensitized 2. 50% districts re-sensitized	1. 100% districts re-sensitized

S.No	Output	Indicators	Target					Outcome	Indicators	Target				
			2021-22	2022-23	2023-24	2024-25	2025-26			2021-22	2022-23	2023-24	2024-25	2025-26
2	Strengthening health care system and Capacity building for vulnerability assessment in context of climate change	Establishment of Environment Health Cell (EHC) at State, District/block level	1. EHC in all States 2. EHC in 150 districts 3. Consultant climate change recruited in 5 States	1. EHC in 400 districts 2. Nodal officer in 10% blocks 3. Consultant climate change recruited in 15 States	1. EHC in 600 districts 2. Nodal officers in 30% blocks 3. Consultant climate change in 25 States	1. EHC in all districts 2. Nodal officers in 50% blocks 3. Consultant climate change in all States/UTs	1. Nodal officers in all blocks	To strengthen capacity of healthcare system to reduce illnesses/disease due to variability in climate	Percentage of the State healthcare system made climate resilient	30% States	50% States	75% States	95% States	100% States/UTs
		Development of State Action Plan on Climate Change and Human Health (SAPCCHH)	10 States/UTs	20 States/UTs	30 States/UTs	All States/UTs	Revised by 15 States		% States developed SAPCCHH	25% States	50% States	75% States	100% States	
		Development of District Action Plan on Climate Change and Human Health (DAPCCHH)	2 Districts	5 Districts	20 Districts	100 Districts	300 Districts		Districts developed DAPCCHH	2 Districts	5 Districts	20 Districts	100 Districts	300 Districts
		Situational analysis and Health Vulnerability Assessment for common climate sensitive illnesses in the State	10 States/UTs	20 States/UTs	30 States/UTs	All States/UTs			% States developed VNA for State specific CSDs	25% States	50% States	75% States	100% States	
		Task force meetings	First meeting 10 States/UTs, 1 st in 5 Districts	First meeting in 20 States/UTs, 1 st in 10 Districts	First meeting in 30 States/UTs, second meeting in 10 States/UTs,	First meeting in all States/UTs, 2 nd meeting in 20 States/UTs 1 st in 200 Districts	Second meeting in 30 States/UTs, 1st in 500 Districts		% of State conducted task force meeting	25% States	50% States	75% States	100% States	

					1 st in 50 Districts									

S.No	Output	Indicators	Target					Outcome	Indicators	Target				
			2021-22	2022-23	2023-24	2024-25	2025-26			2021-22	2022-23	2023-24	2024-25	2025-26
3	Develop/ strengthen the monitoring and surveillance systems for climate sensitive diseases and develop mechanisms for EWS/ alerts and responses at state, district and below district level	- Develop / strengthen surveillance for Heat Related Illnesses and Acute Respiratory Illnesses (ARI) in context of air pollution	1. First training at State level in 20 States/UTs 2. First training at District/below level in 200 districts	1. First training at State level in 36 States/UTs 2. First training at district/below level in 550 districts	1. Second training at State level in 25 States/UTs 2. First training at district/below level in 739 districts	1. Second training at State level in 36 States/UTs 2. Second training at district/below level in 400 districts	1. Second training at district/below level in 739 districts	To strengthen health preparedness and response at national/ state/district/ below district levels	Surveillance of priority CSDs in the State	Surveillance system strengthened in 30% States	Surveillance system strengthened in 50% States	Surveillance system strengthened in 80% States	Surveillance system strengthened in 100% States	
		- Initiate Sentinel & real-time surveillance for illnesses due to Air Pollution, Heat etc	1. Heat related illnesses: 50% districts sending real time data 2. ARI surveillance started in one major hospital in 50 cities	1. Heat related illnesses: 80% districts sending real time data 2. ARI surveillance started in one major hospital in 100 cities	1. Heat related illnesses: 100% districts sending real time data 2. ARI surveillance started in one major hospital in 200 cities	1. ARI surveillance : 50% hospitals sending real time data 2. ARI surveillance started in two major hospital in 100 cities and one major hospital in 250 cities	1. ARI surveillance: 50% hospitals sending real time data 2. ARI surveillance started in 3 major hospital in cities 300 cities and one major hospital in 250 cities		% of State sending real time data	30% State sending real time data	50% State sending real time data	80% State sending real time data	90% State sending real time data	100% State sending real time data
4	Integrate, adopt and implement environment friendly and climate resilient methods	Green efforts in healthcare sector (solar power, rain water harvesting, LED lighting)	10 district hospitals ensured use of energy efficient equipment and technologies	20 district hospitals, 10 CHCs, 20 PHCs ensured use of energy efficient equipment and technologies	40 district hospitals, 20 CHCs, 40 PHCs ensured use of energy efficient equipment and technologies	80 district hospitals, 40 CHCs, 80 PHCs ensured use of energy efficient equipment and technologies	100 district hospitals, 60 CHCs, 140 PHCs ensured use of energy efficient equipment and technologies	To strengthen the green efforts and climate resilient methods	% of districts developed Green healthcare facilities	0.5% districts	1% districts	2% districts	5% districts	10% districts

						technologies								
		Building prototype of healthcare building to withstand climate disasters (retrofitting the existing)	5 PHCs developed Climate Resilient healthcare facilities	15 PHCs & 2 CHCs developed Climate Resilient healthcare facilities	35 PHCs, 10 CHCs & 2 district hospitals developed Climate Resilient healthcare facilities	70 PHCs, 20 CHCs and 7 district hospitals developed Climate Resilient healthcare facilities	140 PHCs, 40 CHCs and 17 district hospitals developed Climate Resilient healthcare facilities		% of districts developed Climate Resilient healthcare facilities	0.5% districts	1% districts	2% districts	5% districts	10% districts

S.No	Output	Indicators	Target					Outcome	Indicators	Target				
			2021-22	2022-23	2023-24	2024-25	2025-26			2021-22	2022-23	2023-24	2024-25	2025-26
5.	Strengthening of healthcare services based on researches on climate variables and impact on human health	Vector Borne Disease: vector mapping	Vector mapping started in 5 States	Vector Mapping Started in 9 more States	Vector mapping started in 15 more State	Vector mapping completed in 5 States	Vector mapping completed in 14 States	To strengthen research capacity to fill the evidence gap on climate change impact on human health	% of States started vector mapping	10% States started vector mapping	40% States started vector mapping	100% States started vector mapping	10% States completed vector mapping	40% States completed vector mapping

VI. CLIMATE CHANGE vs HEALTH RESILIENCE

As per the available evidences, it is known that change or variation in climate at any geographic location may affect the pattern of morbidity and mortality among the dwelling population. The commonly identified illnesses may be grouped as i) Extreme events (heat related illness), ii) Air Pollution and health related issues, iii) Vector borne diseases and iv) Water borne illnesses v) Malnutrition and vi) Various NCDs.

To protect health of people, it is necessary that health department of all states must consider the climate change as an emerging threat in causation of most of the illnesses and hence must undertake measures to adequately address this issue.

Initial Inputs/ activities desired (first 2 years)

1. Establish 'Environmental Health Cell' in State Health Department,
2. Identification of State Nodal Officer- Climate Change at State Health Department
3. Notification of Task Force with representation of other health programmes (vector-borne disease, infectious diseases, nutrition etc) multi-sectors/ departments such as Disaster Management Authority, Health Information System, district unit of departments of Meteorology, Pollution Control Board, Water and Sanitation, Public Works Departments and civil societies etc.
4. Vulnerability Assessment for baseline rate for Climate Sensitive Illnesses in terms of
 - a. Geography (Plain/ Mountain/ Desert/ Coastal), identify worst affected areas(districts)
 - b. Risk mapping with extreme events (heat/ cold/ drought/ flood/cyclone/other),
 - c. Affected *Population* (Total, density, Vulnerable, Occupation)
 - d. Contributing/ exaggerating factors for these *Climate sensitive illnesses*
 - e. Healthcare Infrastructure/ facilities like PHC, CHC, District hospital, Tertiary care hospitals- Government as well as Private.
 - f. Identify areas for capacity building –human resource, technical and healthcare service delivery.
5. State health adaptation plan must be prepared with at least chapters on heat related illness and Air Pollution related health issues
6. State health department should identify and strengthen local organizations for support to manage climate related health issues
7. Coordinate with Centre of Excellence for subject specific health adaptation plans.
8. IEC plan for climate change and health

Process: 2 to 5 years

1. Formulate specific implementation framework for climate sensitive diseases.
2. Contingency plans for climate sensitive illnesses - appropriate and efficient health personnel, logistics & resource allocation.
3. Capacity building and training of health care personnel on guidelines for climate sensitive illnesses at district level in each state.
4. Development of early detection tools for CSDs (diagnostics, surveillance) or prediction models for preparedness of population and health care system.
5. Periodic reviews of vulnerability, response capacity and preparedness
6. Adapt new technologies, building design, energy, water and sanitation provisions for new constructions of healthcare facilities and modify existing ones.
7. Link data on climate sensitive diseases, environmental factors, meteorological information, and outcomes.
8. Risk mapping for seasonal trend of CSDs.
9. Research for climate sensitive illnesses.

Expected Output:

1. Awareness & Behavior modification of general population for impact, illnesses, prevention and adaptive measures for climate sensitive illnesses.
2. Increase in trained healthcare personnel and equipped institutes/ organization towards achievement of climate resilient healthcare services and infrastructure at district level in each state.
3. Integrated monitoring system for collection and analysis of health related data with meteorological parameters, environmental, socio-economic and occupational factors
4. Evidence-based support to policy makers, programme planners and related stakeholders

India is signatory to “Male’ Declaration” wherein health sector has to be strengthened so as to make it climate resilient. According to Male’ Declaration, it is desired that health-care facilities should be prepared & climate-resilient, particularly in promoting to encourage that these are able to withstand any climatic event, and that essential services such as water, sanitation, waste management and electricity are functional during such events. Further, for climate resilient, the health department has to undertake measures to initiate the greening of the health sector by adopting environment-friendly technologies, and using energy-efficient services(Annexure-).

The existing efforts in public health preparedness, disaster risk reduction, and programs for communicable and non-communicable diseases may be inadequate, ineffective or unsustainable, if they are not climate resilient. It requires vulnerability re-assessment and should take into account both current climate variability and projected future impact of climate change on disease burden and hence management. The overview of roles and activities for health as well as non-health departments are listed below as guide for group of Climate Sensitive Diseases. States and UTs have to make micro-plan as per their vulnerabilities and geo-climatic conditions.

A. Human Health vs Extreme weather events

States and UTs may have recorded raised morbidity and mortality due to effect of extreme weather conditions viz frequent and severe episodes of heat waves, floods, droughts and fires as a direct impact of climate variability and affecting population at large.

Vulnerability factors: Demography especially people at extremes of age (>65yrs, children), Health status, Socioeconomic status, Occupation, working place and working conditions, unplanned urban housing, overcrowding, remote area, Drought/ flood prone area, water scarcity zone

Role of Health Sector(State Nodal Officer and Task Force)

1. Develop/ adapt health micro-plans for extreme weather events based on meteorology warnings and change in trend of illnesses in recent years.
2. Map vulnerable population based on demography, land cover, water bodies, potential exposure, available resources health insurance coverage, and burden of chronic illnesses in the community.

3. Develop or translate IEC in local language, and make a communication plan for dissemination of health related alerts/ education materials for target or general population.
4. Build capacity of health care personnel to detect and treat illnesses associated with extreme weather events
5. Issue health advisory to healthcare personnel based on IMD seasonal prediction or warning
6. Ensure health related Real-time Surveillance and Monitoring System in case of extreme event
7. Explore collaborative mechanisms (e.g. memoranda of understanding) with other departments, stakeholders, such as meteorological, pollution control board etc for sharing data and for coordinating efforts to manage health risks.
8. Ensure Inter-sectoral convergence and coordination for improving architecture, design, energy efficient cooling and heating system at health facility, increase in plantation i.e. Climate Resilient Green Building Design.
9. Reassess 'Occupational Health standards' for various types of Occupation.
10. Ensure strict implementation of legislative/ regulatory actions as per Occupational Health Standards.

Coordination with other sectors in reducing illnesses due to Extreme Weather Events

SNO-CC and the Task Force should explore collaborative mechanism (e.g. memoranda of understanding) for regular sharing data and for coordinating efforts to manage health risks. The suggested sectors are listed below, however the list may be expanded or modified as per the need of the state /UT.

Meteorological Department

- Accurate and timely forecast for extreme weather
- Communication of 'alert' to state health departments, vulnerable groups/agencies

Water Board

- Management and supply of safe and adequate water to all in the state.
- support & promote water conservation methods like rain water harvesting.

Municipalities

- Develop and promote building design and other infrastructure codes supporting 'Green building' and use of energy efficient and natural ways of lighting and cooling
- Undertake actions like: planting trees, ensure non-burning of garbage, supply of safe water and maintaining sanitation.
- build cool shades at public places, cool corridors for pedestrians

Ministry of Environment, Forest Climate Change

- Develop/ encourage projects to decrease the 'Urban Heat Island effect'.

- Ensure green coverage in the cities through checking deforestation, urban planning and increasing plantation.

Ministry of Education

- Sensitize students towards health impact of extreme events and disseminate health ministry approved prevention and first-aid measures.
- Train teachers on first aid measures for all possible extreme events (as per state's vulnerability)
- During extreme events: keep a check on outdoor activities and close teaching institutes in case of issue of alert from Government.

Ministry of Transport

- Provision of safe and improved Public transport like air conditioned buses, local trains and other transport at affordable rates.

Media & NGOs

- Disseminate success stories, methods and measures to promote community awareness on preventive measures and first aid to reduce health impacts of extreme weather.

B. Water borne & Food borne diseases

Illnesses due to contaminated water and food are usually seen following flood, drought, religious or other mass gatherings. SNO-CC and the related stakeholders must undertake suitable measures to keep a check on morbidity and mortality due to water and food borne illnesses.

Vulnerability: Availability of safe water supply to all, sanitation facilities in general and in urban slums and remote rural areas, personal hygiene, political willingness, Socio-economic status, cultural beliefs, natural disasters, demographic changes, accessibility to health care.

Role of Health Sector(State Nodal Officer and Task Force)

1. Develop/ adapt health micro-plan for water and food borne illnesses (case management, resources required like logistics, drugs, vaccines, laboratories' role)
2. Map vulnerabilities: population at risk, geo-climatic conditions, recent trend of climate variability (flood, drought), change in population demography (migration), available resources, healthcare infrastructure, laboratories, burden of chronic illnesses in the community etc
3. Build capacity of health care personnel to detect and treat water and food borne illnesses
4. Strengthen/ Develop real-time surveillance, evaluation and monitoring system for water and food borne illnesses, enhance this surveillance during high risk period
5. Issue advisory to healthcare personnel, laboratories and related stakeholders
6. Develop or translate IEC in local language, and make a communication plan for dissemination of health related alerts/ education materials.

7. Ensure adequate supplies (vaccines and medications) for cases management with other required logistic as identified to the affected region
8. Improve access to health care facilities by vulnerable population, especially those in remote areas.
9. Coordinate with related stakeholders like Municipalities to keep a check and strengthen surveillance of food handling units, local vendors, water supply etc.
10. Explore collaborative mechanisms (e.g. memoranda of understanding) with other departments, stakeholders for sharing of data and for coordinating efforts to manage health risks.

Coordination with other sectors in reducing water and Food borne illnesses

Department of Water & Sanitation

- Ensure minimum household safe water supply
- Reuse treated waste-water for non-household use
- Encourage water saving technologies like low-flow toilets & Showers, rain water harvesting etc

Municipalities and other Local regulating bodies

- Ensure safe water supply and good sanitation to check transmission of infective agents
- Regulate street vendors, food handling units for quality food

Ministry of Agriculture

- Develop/ encourage programs for efficient use of irrigation water.
- Promotion of climate resilient crops among farmers

FSSAI and other food regulatory body

- Check food items for various types of contamination or adulteration
- Disseminate appropriate information for reducing food borne illnesses

C. Air Borne, Cardio-pulmonary & Respiratory Allergic Diseases

Climate variability and frequent change in weather and extreme events affects have been linked to increase in illnesses of lungs and cardio-vascular system.

Vulnerability: Change in timing, survival, transmission & duration of certain microbes (like Influenza virus), Interaction of air pollution, pollen and weather, Proportion of population-malnourished, extremes of age, underlying illnesses, pregnant females, Commonest type of occupation, urban slums and remote rural areas, Socio-economic status, accessibility to health care

Role of Health Sector(State Nodal Officer and Task Force)

1. Develop/ adapt health micro-plan for 'Air borne, Cardio-pulmonary and Respiratory diseases (case management, resources required like logistics, drugs, vaccines, and laboratories' role).

2. Map vulnerabilities: population at risk, geo-climatic conditions, seasonal variation, exposure to pollens or allergens by change in types of crops or flower plants, change in population demography, migration (in & out), available resources, healthcare infrastructure, laboratories, burden of chronic illnesses in the community
3. Strengthen/ Initiate Sentinel surveillance, real-time surveillance, evaluation and monitoring system for respiratory and cardio-vascular illnesses, hospital admission as well as Outpatient attendance in relation to weather and air quality parameters.
4. Enhance vaccination programs and 'Vaccination Campaign' for vaccine-preventable air borne and respiratory diseases
5. Develop or translate IEC in local language, and make a communication plan for dissemination of health related alerts/ education materials.
6. Capacity building and increasing awareness for individuals, communities, health care workers through involvement of various media as well as campaigns and training workshops.
7. Develop Standard treatment guidelines for allergen management based on exposure forecasts – air quality, allergens, dust, etc.
8. Ensure adequate logistic support, including equipments and other treatment modalities and supplies for case management at all levels of health care and also under 'Emergency response Plan' in case of any disaster where air borne illnesses may occur as an out break
9. Inter-sectoral and stakeholders' coordination to monitor health outcomes with early warning system related to extreme weather events/ Air Quality Index/ ground level Ozone etc.

Coordination with other sectors for reducing respiratory and cardio-vascular illnesses

(Adapted from MoHFW's Steering Committee Report on Air Pollution & Health Related issues 2015)

Ministry of Environment, Forests and Climate Change

- Ensure that Central and State Pollution Control bodies set standards for industry-specific emission and effluent, monitor levels of pollutants and enforce penalties.
- Enforce strict air quality standards for pollution
- Strict implementation of Environment Impact Assessments (EIA) to minimize the adverse impact of industrial activities on the environment
- Effective implementation of 'National Green Tribunal' directives on trash burning/ waste disposal from different sources
- Take strict measures for unregulated sectors (such as brick kilns, trash burning, stone crushing) which contributes to ambient air pollution

Ministry of Human Resource Development

- Regular screening of school children for early detection of diseases, this can be attributed to the existing air pollution

- Inclusion of harmful health effects of environmental pollution (AAP and HAP) in the school curriculum, including current policies and mitigation practices that are designed to reduce air pollution
- Improve indoor air quality of educational institutions nationwide
- Improve walkability and access to educational institutions by non-motorised transport, thus minimizing the air pollution in the school surroundings
- Sensitize students and teachers on using the Air Quality Index in planning outdoor school activities

Ministry of Agriculture

- Policy in place to promote multiple uses of crop residues and prevent their on-farm burning.

Ministry of Rural Development

- Include health promotion (like clean air) guidelines as part of “Nirmal Gram Puraskar”/ Model Villages evaluation criteria/ create alternate awards with specific criteria based on air pollution.
- Under integrated rural development, develop and implement micro level planning policies/schemes with Panchayati Raj Institutions to address the social determinants of health for reducing the hazards of air pollution (lack of education, unemployment, poverty, poor housing conditions ,etc.)

Ministry of Urban Development

- Formulate/revise urban transport policy which reduces vehicular pollution (Include Health Promoting city guidelines in the “100 Smart Cities”)
- Develop and implement policies to reduce indoor air pollution (like disincentivizing diesel gensets and promoting clean cooking fuels thus ‘making available clean and making clean available’)
- Enforcement of ban on burning garbage or biomass (especially during winter months)
- Help cities develop air pollution alerts and emergency plans based on the Air Quality Index or CPCB continuous air monitoring data

Ministry of New & Renewable Energy

- Develop policies for truly clean cook stoves and support research and development.
- Research and development of other non-conventional/renewable sources of energy and programmes relating thereto, including locally generated power to supply cooking appliances;
- Support and strengthen Integrated Rural Energy Programme (IREP) with emphasis on indoor air pollution
- Develop National Policy on clean Biofuels (biogas, ethanol, etc) and set up National Biofuels Development Board for strengthening the existing institutional mechanism and overall coordination.
- Create a national consensus action plan for replacing biomass fuels with alternative clean fuels

Ministry of Petroleum & Natural Gas

- Expand new initiatives to increase the availability of LPG and other cleaner fuels to the rural & tribal areas
- Expand the piped natural gas network to reach out to a larger population
- Better target LPG subsidies to poorer households

Ministry of Power

- Promote the development of more efficient cooking devices
- Evaluate the potential for electric cooking appliances to substitute for biomass and LPG

Ministry of Road Transport and Highways

- Ensure effective implementation of New Motor Vehicles Act, once approved
- Ensure proper engine checks for vehicles to assess pollution levels

Ministry of Information and Broadcasting

- Develop hard hitting, high impact and cost effective media plans, strategies and conduct activities for awareness generation on harmful effects of air pollution and options for their mitigation.
- Ensure enforcement of relevant provisions in the Cable Television Networks Act to regulate advertisements of tobacco etc.
- Involvement of Songs & Drama division; Department of Field Publicity to promote health promotion activity for air pollution and its impact on respiratory and NCD risk factors
- Develop policies to ensure that media houses allocate free airtime for health promotion messages as a corporate social responsibility activity

Ministry of Communications & Information Technology

- Use of mobile phones to encourage healthy choices and warn people about air pollution (both AAP and HAP, using Air Quality Index)
- Establish Telemedicine linkages between different levels of health care

Ministry of Labour and Employment

- Regular health check- ups for early screening of pollution related diseases.
- Frame guidelines and conduct workshops for health promoting workplaces, (guidelines on indoor air quality),
- Strengthen the capacity of ESI Hospitals to cater to the growing burden of respiratory diseases and NCDs
- Showcase and support companies which employ workplace policies that can reduce vehicular travel such as telecommuting, or placing the workplace in sites that are accessible through public transportation (eg. Metro) or non-motorised transport.

Ministry of Women and Child Development

- Advocate through Self Help Groups and Mahila Mandals for protection of women and children from significant exposure to smoke from biomass while inside the house.

- Awareness raising can be done to improve household ventilation to reduce smoke inhalation from lighting (ex. kerosene) or cooking fuel

Ministry of Finance

- Analysis of the economic and financial implications of the health and other impacts of air pollution

Ministry of Law and Justice

Support enforcement on bans of burning trash for heating or as a way of disposal

D. Vector-borne and Zoonotic diseases

Effect of variation in climate has been well established for illnesses which are spread through vectors or which are transmitted from animals to humans..

Vulnerability: Weather variables: temperature, rainfall, humidity, floods, drought, wind, daylight duration etc., Change in Vector / animal population due to change in growth, survival, feeding habits, seasonality, breeding sites, resistance etc, Change in interaction of vector/ animal & pathogen due to change in susceptibility, Incubation period, or transmission, Change in demography, migration, land-usage practices, water projects, agricultural practices and Public health infrastructure and access to it.

Role of Health Sector(State Nodal Officer and Task Force)

1. Programme Officer for National Programs for control of vector borne diseases (NVBDCP) & various zoonotic diseases must consider climate variability as an important factor for assessment of morbidity and mortality statistics and develop/ adapt health micro-plan based on recent VBD & Zoonotic diseases trend
2. Map vulnerabilities: population at risk, geo-climatic conditions, seasonal variation, change in population demography, migration (in & out), available resources, healthcare infrastructure, laboratories ,etc.
3. Strengthen/ Develop active and passive surveillance and establish sentinel sites for vector borne & Zoonotic diseases.
4. Capacity building and increasing awareness for individuals, communities, health care workers through involvement of various media as well as campaigns and training workshops.
5. Develop or translate IEC on effects of climate change on VBDs & zoonotic diseases in local language, and make a communication plan for dissemination of health related alerts/ education materials.
6. Ensure adequate logistic support, including equipments and other treatment modalities and supplies for case management at all levels of health care and also under 'Emergency response Plan' in case of any disaster or an out break
7. Vaccination of animals and animal handlers for vaccine preventable diseases.

8. 'Environmental Health Impact Assessment' of new development projects
9. Early warning system for vector borne and zoonotic diseases.
10. Enforce legislation and regulations of vector borne and zoonotic diseases

Coordination with other sectors for reducing VBDs & Zoonotic diseases

(As per the suggested sectors in the NVBDCP)

- Inter-sectoral collaboration for vector control
- Providing equipments and other related logistics for control of vectors
- Elimination and reduction of vector breeding sites.
- Encourage research on new safe and effective control measures

Intervention by veterinary task force

- Prevention and control of animal diseases and zoonoses
- Vaccination of animals & control on population of stray animals
- Safe destruction of carcasses and other material of animal origin
- The care of 'food animals', including collection, feeding, sheltering, slaughtering etc

Intervention by Community & Individual

- Eliminate/ control small & manmade vector breeding sites
- Make barriers for human dwellings to keep stray animals away from human dwellings by fencing the residential areas especially if in approximation to forests etc.
- House protection by using screening windows, doors and fencing the garden etc.
- Use self protection measures like protective clothing etc,

E. Nutrition related diseases

Climate variability and extremes of weather events affect food quantity and quality through reducing production, poor storage, pathogen infestation, disrupted supply chain, hike in market price.

Vulnerability: Changes in food like availability, accessibility, utilization, system stability, crop failure/ yield decline. Indirect effects are due to reduction in animal/ aquatic population, agricultural yield

Role of Health Sector (State Nodal Officer and Task Force)

1. Develop/ adapt health micro-plan for reducing nutritional deficiency disorders
2. Map vulnerabilities based on seasonal nutritional screening (Vit A, Anaemia) in children, pregnant & lactating females high risk communities
3. Capacity building and increasing awareness for individuals, communities, health care workers through involvement of various media as well as campaigns and training workshops.
4. Strengthen/ Develop active and passive surveillance for nutritional deficiency diseases

5. Strengthening surveillance & control programs for diseases like malaria, schistosomiasis, parasitic infections
6. Scale up integrated food security, nutrition and health programmes in vulnerable zones for at risk populations
7. Strengthen maternal & child health services and promote implementation of IMNCI programme.
8. Expand & promote fortified food consumption in the vulnerable population
9. Develop or translate IEC, communication plan and mass media strategy for behaviour change of vulnerable population.
10. Capacity building and increasing awareness of the population through regular training workshops on health and nutrition education
11. Support and strengthen preventive programme on health nutrition (fortification and supplementation) and projects within public health divisions, with emphasis on community involvement projects.

Coordination with other sectors for reducing Nutrition related diseases

Ministry of Human Resource Development & Ministry of Women & Child Development

- Regular screening of school children for early detection of nutritional diseases.
- Inclusion of dietary guide in the school curriculum, with reference to Indian food habits.
- Sensitize students and teachers on nutritional deficiency, worm infestation and other Gastro-intestinal infections leading to malnutrition.

Ministry of Agriculture

- Promote agriculture practice addressing specific nutrition demand of general population and availability of same

F. Non-communicable Diseases (NCD) & Mental illnesses

Non-communicable diseases and mental disorders have been found to be closely associated with variation in climate, exposure to various types of pollutants and type of occupation

Vulnerability: Demography, Health status, Socio-economic status, type of occupation, accessibility to health care and diagnostic facilities, weather variables, exposure to pollution and Nutritional status

Role of Health Sector and related non-health sectors (State Nodal Officer and Task Force)

1. Establish & Integrate multisectoral mechanisms to plan, guide, monitor and evaluate and enactment of NCD through implementation of plans, policies and legislation

2. Adapt and implement WHO surveillance framework that monitors exposure (risk factors), outcome (morbidity and mortality), and health system response
3. Implement effectively the national health programmes aimed at reducing/ controlling NCD and mental illnesses.
4. Strengthen surveillance and monitoring for the high risk population and identify/ assess need in routine as well as in emergency situation (Emergency preparedness plans).
5. Ensure access to appropriate diagnostic facilities, related logistics and case management to the high risk population.
6. Define price regulatory mechanism for NCD drugs and basic diagnostic equipments and laboratory tests to increase affordability by the poor section of the society.
7. Risk communication, counselling and case management skills, should be available at all the levels including primary health-care level
8. Capacity building through training of human resource for addressing NCD related risk factors due to climate change.
9. Raise public and political awareness and understanding about NCDs including mental health, oral health, injuries and indoor air pollution through social marketing, mass-media and responsible media-reporting during extreme weather.
10. Assess the health impact of policies in non-health sectors e.g., agriculture, education, trade, environment, energy, labor, sports, transport, urban planning.
11. Strengthen supportive policies and legislations to promote healthy diet, reducing food with high trans fat content, artificial colours and junk food
12. Strengthen capacity of the enforcement agencies (Police, Food Trade Inspectors and Road Safety Inspectors).
13. Provide adequate and sustained resources for NCDs by increasing domestic budgetary allocations, innovative financing mechanisms, and through other external donors

IX. NAPCCHH: ORGANISATIONAL FRAMEWORK FOR IMPLEMENTATION

Operational framework for implementation of National Action Plan for Climate Change and Human Health at National, States/UTs, District and Health-facility level is as follows:

National Level

A) National Level- Advisory Committee

This committee shall function under the Chairmanship of Secretary Health & Family Welfare. The proposed members of this committee are:

Secretary Health & Family Welfare	Chairman
Additional Secretary, Health, MoHFW, GOI	Member
Secretary Health Research cum Director General-ICMR, GOI.	Member
Director General Health Services, GOI	Vice-Chairman
Director, NCDC, Dte. GHS, MoHFW, GOI	Member Secretary
Director, NVBDCP, Dte. GHS, MoHFW, GOI	Member

Representation from other Ministries/ departments

Director General, National Disaster Management Authority	Member
Secretary, Ministry of Environment, Forest & Climate Change	Member
Secretary, Ministry of Earth Sciences	Member
Secretary, Ministry of Agriculture	Member
Secretary, Central Ground Water Board, Ministry of Water Resources, Rural Development and Ganga Rejuvenation	Member
Chairman, Central Pollution Control Board	Member
Representation from Department of Science & Technology	Member

Roles and Responsibilities of the National Level Advisory/ Steering Committee

- ☐ Nodal body to take decision regarding the policy making and implementation of the National Action Plan for Climate Change and Human Health (NAPCCHH) in the country.
- ☐ Nodal body to roll out the NAPCCHH in the country.

B) National Level- Centre for Environmental & Occupational Health Climate Change & Health (CEOHCCH) at National Centre for Diseases Control.

This centre is nodal agency for Climate Change & Human Health and will provide technical inputs and support to Environmental Health Cell at state and UTs regarding the capacity building, implementation, monitoring, supervision & evaluation of the NAPCCH program. Director, NCDC is the Nodal Person and Member-Secretary of Climate Change and human Health. The proposed manpower structure at this centre is as follows:

Additional Director & Head (Public Health)	1
Joint Director(Public Health)	3
Deputy Director(Public Health)	3
Assistant Director(Public Health)	6
Senior Consultant-Capacity building/Training	2
Senior Consultant-Environmental Health Specialist	2
Senior Consultant –Monitoring &Evaluation	1
Senior Consultant- Public Health Informatics Specialist	1
Consultant- Finance& Admin	1
Consultant-Communication/Advocacy	1
Technical Officer –Data Management	3
Secretarial Assistants cum Data Entry Operators	3

Roles and Responsibilities of the CEOHCCH Division, NCDC are:

- ☐ Technical inputs to be provided to all states and UTs for activities related to climate change and human health.
- ☐ Plan, Coordinate, Monitor and evaluate NAPCCHH related activities at National, State and below level
- ☐ Support states and UTs for development of health adaptation plan and operational guidelines for Climate Sensitive Diseases’.
- ☐ Review meetings, field observations regarding implementation of NAPCCHH.
- ☐ Strengthening of Surveillance of Climate Sensitive Diseases
- ☐ Strengthening of health care system by involving premiere institutes and organization for disease management

- Development of prototype of IEC and advocacy material, training modules for healthcare personnel, revision of students' curriculum.
- Guiding state health department for providing list of required manpower, logistics, drugs and equipments for managing climate sensitive illnesses.
- Conduction of operational research and evaluation studies for the NAPCCHH

For coordination with other stakeholders, government departments at National and states/ UTs level in the country, the Environmental Health Cell at the Directorate General Health Services will support CEOHCCH division at NCDC. It will help assess the achievement of targets planned under the NAPCCHH programme.

State Level:

A) State Level - Governing Body

The state level governing body shall be working under Chairmanship of Honorable State Health Minister. The other members may be as follows:

<i>Honorable State Health Minister</i>	<i>Chairman</i>
Principal Secretary (Health)	<i>Vice Chairman</i>
Director Health Services/Head of Health System	Member Secretary
Mission Director-National Health Mission	Member
Director Medical Education	Member
Regional Director -Health &Family Welfare	Member

B) State Level Task Force

This task force shall be working under the guidance of Principal Secretary (Health) of the state. It shall be directly overseeing the implementation of the State Action Plan for Climate Change and Human Health (SAPCCHH) in their state/UT. It shall be working through Directorate of Health Services (DHS) of the state, which will be the implementing agency for SAPCCHH.

DHS will create an **Environmental Health Cell** within State Health Department, and will identify a **Nodal Officer** from Health department which preferably should be Public Health Expert of the rank of Joint/ Deputy Director. The State level task force shall have inter-ministerial members which are suggested as:

- *Public Health Expert* from State Health Department **Nodal Officer**
- Director, ICMR Institute/Centre (If any branch in the State/UT)Member

• Director, Meteorological department of State/UT	Member
• Chairman, State Pollution Control Board	Member
• Chairman, State Disaster Management Authority	Member
• State Surveillance Officers	Member
• Environmental Engineer/ Scientist from MOEFCC	Member
• Secretary, State Agriculture Ministry	Member
• Secretary, State Ground Water Board	Member

The Task force of the State/ UT's Environmental Health Cell will coordinate with the Centre for execution of state/ UTs SAPCCHH. The proposed State Level Structure of Environmental Health Cell is as follows:

Structure at State/ UT Environment Health Cell:

Nodal Officer (State Health Department)	1
Consultant-Capacity building/ Training/HR Management	1
Consultant-Environmental Health	1
Data Manager & Analyst	1
Secretarial Assistants cum Data entry Operator	1

Roles and Responsibilities of the State/ UT Environmental Health Cell

- ☐ Preparation and Implementation of State Action Plan for Climate Change and Human Health
- ☐ Conduct Vulnerability assessment and risk mapping for commonly occurring climate sensitive illnesses in the state/UT.
- ☐ Assessment of needs for health care professionals (like training, capacity building) and organize training, workshop and meetings.
- ☐ Maintain State and District level data on physical, financial, epidemiological profile for climate sensitive illnesses.
- ☐ Ensure Convergence with NHM activities and other related programs in the State /District
- ☐ Monitor programme, Review meetings, Field observations.
- ☐ Timely issue of warning/ alerts to health professionals and related stakeholders as well as general public through campaign or using mass media (Electronic or printed),

- ☐ Social mobilization against preventive measures through involvement of women's self-help groups, community leaders, NGOs etc.
- ☐ Advocacy and public awareness through media (Street Plays, folk methods, wall paintings, hoardings etc.)
- ☐ Conduction of operational research and evaluation studies for the Climate change and its impact on human health.

District Level:

At District level, a District Environmental Health Cell shall be constituted; which shall be comprised of the following:

The proposed District Level Structure is as under:

• District Magistrate/District Commissioner	Chairman
• Chief Medical Officer/CDHO	Member Secretary
• Deputy CMO(Admin)	Member
• Senior Deputy CMO	Member
• DMO/DVBDOPO	Member
• District Health Education Information Officer	Member
• District Coordinator	Member

Structure at District Environment Health Cell:

District Coordinator	1
Data entry operator	1

Roles and Responsibilities of the District Environmental Health Cell

- ☐ Preparation and Implementation of District Action Plan for Climate Change and Human Health.
- ☐ Conduct Vulnerability assessment and risk mapping for commonly occurring climate sensitive illnesses in the district.
- ☐ Maintain and update district database of illnesses identified in the district.
- ☐ Assess needs for health care professionals and conduct sub-district/ CHC level training/ workshop and meetings for capacity building.
- ☐ Ensure appointment of contractual staff and engage them in the assigned task of data management under the NAPCCHH.
- ☐ Maintain District level data on physical, financial, epidemiological profile for these illnesses.

Community Health Centre Level

The proposed CHC Level Structure is as under:

- Medical Superintendent(CHC Hospital) :Chairman
- Health Education Officer :Member Secretary
- Block Development Officer :Member
- Health Supervisor :Member

Health Facility Level:

At the health facility, the responsibility for implementation will lie with the Medical Officer (In-charge) of the facility. The existing machinery of NHM will be utilized for the related activities. The Rogi Kalyan Samiti (RKS) would be reviewing and monitoring implementation at the health facility level. The ANM, ASHA and Anganwadi worker will assist in activities related to implementation of action plan at local level.

X. NAPCCHH: CAPACITY BUILDING AND SYSTEM AWARENESS

Capacity building will be based on the baseline and follow-up situation which should be assessed periodically. Communication and training are crucial in adaptation to variability or changes in the climate. Communication programmes based on a thorough needs assessment must aim to enable and empower people, in particular, the illiterate, poor and other vulnerable people such as women, children, the elderly, people suffering from debilitating medical problems and those living in coastal areas, highlands and urban slums. Such programmes should have adequate and appropriately designed communication tools that are locally suitable, popular and comprehensible.

- ☐ Effective communication and public awareness activities/advocacy: sensitize, orient and take support of leaders/ opinion makers / stakeholders/ celebrities/ civil societies.
- ☐ Communication intervention for target audience: Appropriate, efficient and cost-effective measures include clear and timely information covering who is involved; what happened; when it happened; where it happened; and why or how it happened or what may happen – how, why, where, among whom and how to face it.
- ☐ National and Regional level capacity building institutions needs to be identified for capacity building of health staff: include training and imparting technical skills for case management, risk assessment skills, entomology, epidemiology, climate models, disaster management, meteorology, monitoring and evaluation, and research.
- ☐ Conducive institutional and management arrangements to ensure involvement of private sector by forming public private partnerships.
- ☐ Hospital and all other health-care systems must be strengthened. Involve community in the process of strengthening and in managing and maintaining the system.
- ☐ Inventory management: standardized list of adequate and appropriate logistics medicines, kits, equipment and machines along with efficient storage systems.
- ☐ Specific strategies and standard operating procedures for managing climate sensitive diseases need to be developed in light of the future impacts of climate change with prevention in mind.
- ☐ Communication interventions in schools are effective approaches for which teachers would need materials and training to educate the children.

XI. NAPCCHH: REPORTING, MONITORING AND EVALUATION

The Monitoring & Evaluation of the implementation of NAPCCHH has been stipulated with a mix of internal and external approaches. MoHFW, State DoHFW, District Health Officers and the individual health facilities will be involved in regular internal monitoring. External Monitoring will be done by an independent agency.

- a) **Internal:** Monthly / quarterly progress monitoring for climate sensitive illnesses has to be done at all levels, i.e. District to State to MoHFW. These Monthly / Quarterly Progress Reports should include a collation / aggregation of the data / information compiled in each health care facility. The District Cell will have the responsibility of collation / aggregations of the data / information compiled in each health care facility and submit to the State Cell which will validate and forward the data to the National Cell. A set of indicators for NAPCCHH implementation should be merged with the overall HMIS that has been established under the NHM.
- b) **External:** Each state should commission an independent evaluation every 2 years. At the minimum, the audit should cover one well performing district and one slack performing district. The agency to conduct the NAPCCHH Implementation Audit should be chosen based on the background, experience in the State's health sector, environmental auditing and reputation of reliability. The recommendations of the audit should be developed into an action plan to strengthen the existing system.

XII. FRAMEWORK FOR STATE SPECIFIC ACTION PLAN FOR CLIMATE CHNAGE AND HUMAN HEALTH

India is a diverse country in terms of geography, climatic conditions, resources and health related infrastructure. Also, it is a highly populous country, undergoing rapid industrialization, unplanned urbanization, increasing malnutrition and having triple burden of diseases comprising of communicable, non-communicable, emerging and re-emerging diseases. All these factors have cumulative effect resulting in risk of ill- health of citizens of India.

States have developed Action Plan on Climate Change (available at MoEFCC's website), but, 'health related component' is missing in it. Hence all states and Union Territories are being encouraged to develop their State-specific Action Plan on Climate Change and Human Health (SAPCCH). The broad suggested framework for the same is as follows:

1. Background

(Following Data has to be compiled district wise)

Geo-physical & Climate variables: Type of area (Plain/ Mountain/ Desert/ Coastal), type of Climatic or extreme events (heat/ cold/ drought/ flood/ cyclone/other) usually occurring in the state/ UT with potential to affect health status of the population. Approximate green cover and recent change in green cover/ forest, if any.

Statistics of state/ UT: Population (Total, Population density), Vulnerable Population (Under five Children, Adolescents, Elderly, migrants and Occupation (Primarily for major population and others).

Health care Infrastructure: Enlist the number of Health care Infrastructure/ facilities like PHC, CHC, District hospital, Tertiary care hospitals- Government as well as Private in State/UTs (preferably District wise).

Enlist and identify roles and responsibilities of operational district level bodies relevant to climate change and their constitution, such as Distt. Disaster Management Authority, Disease Surveillance Programmes, Distt. Health Information System, district unit of Departments of Meteorology, Pollution Control Board, Water and Sanitation, Public Works Departments and civil societies etc.

2. Operational Framework at StateLevel

Governing Body

The state level governing body for policy level decision may be constituted under Chairmanship of Honorable State Health Minister or any other Senior Officer. The suggested body is as below:

• Honorable State Health Minister	Chairman
• Principal Secretary(Health)	Vice Chairman
• Director Health Services/Head of Health System	Member Secretary
• Director Medical Education	Member
• Mission Director-National Health Mission	Member
• Regional Director -Health &Family Welfare	Member

(However, State may take its own decision).

Task Force: The task force under the guidance of Principal Secretary (Health) with Directorate of Health Services (DHS) of the state, and will ensure implementation of the State Action Plan for Climate Change and Human Health (SAPCCHH) in their state/UT.

Environmental Health Cell within State Health Department, DHS may identify a Nodal Officer from Health department, preferably should be Senior Public Health Expert. The State level task force shall have inter-ministerial members which are suggested as:

• Public Health Expert from State Health Department	Nodal Officer
• Director, ICMR or other Research Institute	Member
• Director, Meteorological department of State/UT	Member
• Chairman, State Pollution Control Board	Member
• Chairman, State Disaster Management Authority	Member
• Environmental Engineer/ Scientist from MOEFCC	Member
• Secretary, State Agriculture Ministry	Member
• Secretary, State Ground Water Board	Member
• State Surveillance Officers	Member

The details of Nodal Officer and experts in Task Force like name, designation, contact details (Phone number, postal address and email) should be listed in the SAPCCHH.

3. Current status of Climate Sensitive Illnesses

- Identify, assess, and document potential risks of climate sensitive diseases (as applicable to the state)like
 - Extreme weather events affecting health
 - Vector Borne diseases
 - Water & Food Borne disease
 - Cardio-respiratory illnesses
 - Zoonotic diseases
 - Others like renal diseases, nutritional deficiency disease etc

- Document Morbidity, Mortality and related statistics of these Climate Sensitive diseases with reference to change in recent years.
- Risk Mapping to identify the 'Hot spots' for vulnerable population with respect to health infrastructure and other resources.

4. Adaptation strategy and action plan for each of the illnesses/ diseases sensitive to Climate variability (as listed in point 3above)

- List the stakeholders with defined roles and responsibilities (Govt. & non-Govt)
- Identify and list the resources available
- Identify actions for risk reduction that are agreed upon by stakeholders and the public
- Operational Coordination (Stakeholders' role and involvement): Building partnerships by involving citizens, organizations, and businesses.
- Make a detailed action plan with checklist for each identified climate sensitive illness:
 - Logistics required at health care facilities
 - Preparedness of health system and personnel
 - List activities for prevention of illnesses (IEC, pamphlets, advisories, training, workshop etc).
 - Operational communication channel
 - Mechanism to ensure data maintenance, surveillance, timely sharing with concerned departments and stakeholders.

5. List Actions undertaken and further proposed to reduce the burden of Climate sensitive illnesses at State/UT

- Activities conducted and planned for awareness generation on the health impacts of climate change
- Activities conducted and proposed to integrate climate-sensitive health concerns in respective health programmes or policy.
- Activities undertaken if any and further proposed to train health workforce on climate change.
- Actions undertaken if any and further proposed to ensure unaffected water supply, sanitation, waste management and electricity.
- Activities undertaken and further proposed related to greening of health sector i.e. health facilities use energy-efficient services and technologies.
- Activities undertaken and further proposed related to integration with State Disaster Management Authority for emergency risk reduction and early response.

- Activities undertaken and further proposed related to data collection and analysis, strengthening of surveillance related to climate variable and climate change sensitive illnesses.

6. Miscellaneous

- Diseases Specific Action plan/ Advisory/ IEC prepared if any, please enumerate and may kindly share with NCDC at email:ncdc.env@gmail.com.
- Other factors (if any) contributing to increase/ decrease of climate sensitive illnesses in your state
- How effective are current health and other sector policies and programmes to manage the climate sensitive illnesses in your state/UT.
- Success Stories if any, of the State/ UT health sector for adaptation or mitigation of climate sensitive illnesses.
- Research studies, reports, innovative actions etc related to climate change and human health if taken in the state must be shared with CEOHCCH division at NCDC for sharing it further with our states and UTs.

(Note: The indicators related to input process, output and outcome shall be added in the State Action Plan during subsequent meetings at time of firming up the State Action Plan for Climate Change and Human Health).

Regional Consultations

The *Centre for Environmental and Occupational Health Climate Change & Health*, National Centre for Disease Control, Delhi, conducted four regional consultations in 2017-18 involving all the states and Union Territories' of the country. Officials from Health department and related stakeholders were invited in these consultations.

Regional consultations aimed at sensitizing states and Union Territories on reassessment of diseases' morbidity and mortality with respect to climate variability and extremes have been conducted. Prior to these regional consultations, the states and UTs were requested for:

1. Identification of *Nodal Person for Climate Change* from *State Health Department*.
2. Constitution of "*State Environment Health Cell*" at State Health Ministry level.
3. Notification of a Task Force with experts from other departments/ organization or other stakeholders identified by state.

These regional consultations had participations from ministries and department of states and UTs including Senior Regional Directors, Regional Directors from Regional Office of Health & Family Welfare, State Nodal Officers, State Surveillance Officers, National Vector Borne Diseases Control Programme, Officers from Integrated Diseases Surveillance Programme, representatives from identified Centre of Excellence, representatives from Regional Centre of Meteorological Departments, Ministry of Environment Forest and Climate Change and Central Ground Water Board. The states and UTs' representatives were aware of the urgency and serious concern for the agenda of the consultation.

State health teams were expected to list and prioritize climate sensitive illnesses in their state and UTs, compilation of data on morbidity and mortality, statistics related to vulnerable population, geographical factors, health care infrastructure/ facilities, or any mitigation and adaptation measures adopted by state against impact of climate change on human health. The salient points of recommendations of regional consultations are as follows:

- Representative from Regional Centre, Indian Meteorological Department suggested to use the term '*Climate Variability*' to study the health consequence as Climate Change is more vast and generic term.
- The geographical distribution, mapping and epidemiology of the diseases like vector borne, water borne etc should be done at the earliest in each state/UT.
- "*Personal Cooling Garment*" or equivalent devices developed by other agencies may be advocated for use if it is (these are) found appropriate.
- Existing surveillance system like IDSP should be used for disease related data capture, through expanding of reporting units and regularly conducting review meetings may be weekly.
- As population is indirectly related and resulting to climate change, population policy may be revised.
- Vector survival and breeding are known to be affected by the climate variability hence programme on vector borne diseases control should be revised to check diseases occurrence in new areas.
- For dealing with the extreme heat events, reconsider the following for issue of health related advisories:
 - OPD timings in healthcare settings
 - Drugs and vaccine storage
 - Norms for Working hours at workplace
 - School timings etc

- Detailed plan for each climate sensitive illnesses should be laid down by each state/ UT considering planning for present illnesses and also with scope to include new/ emerging or re-emerging climate sensitive illnesses.
- The state while drafting their state health action plan for climate change should also refer the Joint Monitoring Meeting report of IDSP.
- Rapid Response Teams may be trained at state level using infrastructure of CSU, IDSP and medical colleges.
- Participants proposed rules and regulations formulation should be in place for the factors which are directly or indirectly affecting weather and climate and hence the human health.
- Actionable points/ good initiatives/ practices should be shared so as the same can be adopted by other states/UTs.
- Chairman proposed a 'Climate Change Health Forum' to include all experts as informal members. This forum will help in sharing of experience, meeting outputs and further it will bring all together to contribute in terms of feedback, suggestions,

XIII. NAPCCHH: BUDGET

The proposed activities under NAPCCHH focus primarily on awareness generation, sensitization for effect of climate on occurrence of CSD, making of health system climate resilient, capacity building of states and UTs for preparing their specific action plan for climate change, promotion of partnership with multiple stakeholders and strengthening of monitoring, surveillance of CSDs in a geographic area and encouraging research for identifying linkages between weather parameters and diseases in a geographic area and supporting evidence based building capacity of health personnel.

To undertake proposed activities, it requires establishment of an 'Environment Health cell', hiring of experts and other human resources on the subject, arrangement of logistics/ equipments, carrying out capacity building activities like training and meetings, development of IEC material and advisories (*Dissemination cost of IEC material cost is not included in the first year of proposed budget*), development of Health Adaptation Plan and prediction model for developing early warning system for climate sensitive diseases.

The tentative budget proposal of NAPCCHH has been proposed under the NHM through EPC. The proposed sub-heads are as a) Human Resource (Contractual), b) Logistics/ Equipments, c) Trainings/ Meetings/ Workshops, d) Centre of Excellence (initially six in first year), e) Development of pilot models like Integration, Green hospitals etc, f) Development of prototype of IEC/ Advisory for impact of Climate Change on Human health (do not include dissemination cost) and g) Air pollution and Human health (do not include dissemination cost).

The budget for the NPCCHH programme for the FY 2021-22 of Rs.7.5 Crore is approved under the NCDC budget but it is yet to released. (Annexure C1).

The budget for States and UTs for the programme under the NHM for 2021-26:

The states every year proposed their budget through PIP after necessary deliberation during Pre NPCC, NPCC, Post NPCC meetings. In the F.Y.2020-21 about 29 Crore where sanctioned through PIP for state level activity. Due to COVID-19 not too much should be received in the F.Y.The PIP process for F.Y.2021-22 is in process. The proposed budget for next five years (2021-26) for the National Programme on Climate Change and Human Health (NPCCHH) has been submitted under the NHM and it has a total amount of **Rs 1,98,65,43,000/- (One Ninety eight Crore Sixty Five Lakhs Forty Three Thousands Rupees)** The tentative budget is attached at the Annexure-C.2

SFC Draft Proposal
**(The National Programme on Climate Change and Human Health
for activities at the central level)**

The draft SFC proposal is presently put up for considerations and it is detailed below with a proposal of a total amount of the budget is approximately about Rs.97.246 Crore (INR) (Ninety seven Crore twenty four lakh and sixty thousand rupee only) and it is attached at Annexure C.3

Part A

1. Name of the Umbrella scheme under which scheme is to be continued: **Not Applicable (Standalone Scheme)**
2. Total outlay of the umbrella scheme: **Not Applicable**
3. In case of centrally sponsored umbrella scheme, specify central component: **Not part of centrally sponsored umbrella scheme yet.**

Part B

1. Name of the scheme:

National Programme on Climate Change and Human Health

2.Objective of the scheme: The vision of NPCCHH is: To strengthen health of citizens of India against climate sensitive illness, especially among the vulnerable like children, women and marginalized population. With a goal to reduce morbidity, mortality, injuries and health vulnerability to climate variability and extreme weathers. The NAPCCHH objectives with some initially identified key actions are:

- i. To create awareness among general population (vulnerable community), health-care providers and Policy makers regarding impacts of climate change on human health.
- ii. To strengthen capacity of healthcare system to reduce illnesses/ diseases due to variability in climate
- iii. To strengthen health preparedness and response by performing situational analysis at national/ state/ district/ below district levels.
- iv. To develop partnerships and create synchrony/ synergy with other missions and ensure that health is adequately represented in the climate change agenda in the country
- v. To strengthen research capacity to fill the evidence gap on climate change impact on human health

3. Background of the scheme:

Climate sensitive illnesses are on an increase due to climate change and extreme weather events. India is signatory to “Male’ Declaration” wherein health sector has to be strengthened so as to make it climate resilient. According to Male’ Declaration, it is desired that health-care facilities should be prepared & climate-resilient, particularly in promoting to encourage that these are able to withstand any climatic event, and that essential services such as water, sanitation, waste management and electricity are functional during such events. Further, for climate resilient, the health department has to undertake measures to initiate the greening of the health sector by adopting environment-friendly technologies, and using energy-efficient services

At the 21st Conference of Parties (COP 21) under the United Nations Framework Convention on Climate Change (UNFCCC) concluded in Paris, Hon’ble Prime Minister Mr Narendra Modi broadened India’s response to climate change, by introducing four new missions including one for “Health” in 2014. The proposed ‘Mission on Health’ will address the health-related aspects of climate change and the Ministry of Health and Family Welfare (MoHFW) is the nodal ministry. Thus, The National Programme on Climate Change and Human Health (NPCCHH) was approved by National Health Mission Empowered Programme Committee (EPC) in Nov 2018 and NHM Mission Steering Group (MSG) in Feb 2019 to support the States in implementation of NPCCHH at States. However NHM will not support central component of NPCCHH. Hence this proposal seeks funds to support central component of NPCCHH.

4. Whether Central Sector (CS) scheme/Centrally sponsored scheme:

Central component of NPCCHH is proposed to be implemented as Central Sector Scheme (CS) while state/district level components are included under NHM-PIP and is proposed to be continue in same manner.

5. Total Proposed outlay (component-wise and year-wise)

New proposal: Attached at Annexure C.3.A

6. Actual Expenditure of the ongoing scheme in last 3 years

State level expenditure of FY 2020-21 is at Annexure C.3.B

7. Approved output/outcome of ongoing scheme year wise and achievements (in tabular form)

Achievements of programme in FY 2020-21 is at Annexure C.3.C

8. Existing and proposed funding pattern (in a tabular form) along with rationale

New proposal: Attached at Annexure C.3.A

9. Major findings of evaluation/outcome review and comments of the Ministry/Department on each observation of the scheme (Attach evaluation report)

No evaluation done

10. Major changes/departure proposed from earlier scheme along with justification

New proposal

11. Major changes in costing norms, if any

New proposal

12. Convergence architecture with other central government schemes

NA

13. Rationale for continuation

New proposal

14. Proposed output/outcomes year-wise (per year)

- NPCCHH/NCDC activities
 - National Action Plan on Climate Change and Human Health (updating/revision)
 - Development of guidelines and SOPs on various climate sensitive health issues with 10 expert group meetings per year
 - Review of all CoEs activities, 3 times/year
 - National Review meeting of all State, 2 times a year
 - Capacity building of State Nodal Officer and Consultant Climate Change, 5 day training, twice a year
 - One day workshop, 5 workshop a year
 - Development of IEC prototype (print, audio visual, Gif, social media)
- CoE activities
 - Development of Health Action Plan on Climate sensitive subject allocated to CoE
 - Develop guidelines and SoPs on subject area
 - To support States for development of chapter in their State Action Plan on Climate Change and Human Health(SAPCCHH) related to climate change subject looked after by CoE
 - Development of training modules

- Develop surveillance or integrate in existing surveillance of climate sensitive conditions looked after by CoEs.
- Develop Monitoring and evaluation system for climate change subject looked after by existing CoE
- Documentation of Reports, best practices
- Training of trainers
- IEC development on subject specific climate sensitive health issues

15. Sunset date

Ongoing Programme

16. Details of posts created for the Scheme (Regular/Contractual separately) and the number of persons engaged against them with annual financial implications

Two Senior Consultant: Rs 3600000

Two Technical Officers: 1800000

Total: 54,00,000

17. Any additional posts proposed to be created with annual financial implication

At NPCCHH/NCDC

One senior programme Manager : Rs 2100000

Two Senior Consultant: Rs 3600000

One Consultant Communication: Rs 1200000

One Administrative Manager: 900000

One Financial Consultant: 900000

One secretariat Assistant: 960000

Graphic Designer: 900000

Total: 1,05,60,000

For CoEs

One consultant, one Scientist and two Technical Officer-Data management

Total: Rs 3540000

18. Comments of other stakeholders including Ministries/Departments/NITI Aayog and response thereon (in a tabular form)

Nil

Table: Status of the NPCCHH programme Budget for the States/UTs under the NHM FY 2020-21

Sl.No	State/UTs	NCD Flexi pool budget allocation under NHM FY 2020-21	Approved ROP for respective States/UTs for NPCCHH programme under NHM FY 2020-21	States expenditure FY 2020-21 (reported till 5 th Feb. 2021)
1	Andaman & Nicobar Island	0.64	0	0
2	Andhra Pradesh	24.62	4.223	0
3	Arunachal Pradesh	7.12	0.520	0
4	Assam	40.50	0.318	0.02
5	Bihar	51.32	0.403	0
6	Chandigarh	0.59	0.030	0
7	Chhattisgarh	21.12	12.625	0
8	DD, DD&NH	0.98	0.04	0
9	Delhi	5.75	0	0
10	Goa	0.65	0.023	0
11	Gujarat	30.01	0.373	0
12	Haryana	10.74	0.575	0.07
13	Himachal Pradesh	9.22	0	0
14	Jammu & Kashmir	17.30	0.155	0
15	Jharkhand	21.50	0.644	0
16	Karnataka	30.06	0.102	0.0011
17	Kerala	13.09	0.375	0.14
18	Lakshadweep	0.11	0.005	0
19	Madhya Pradesh	50.36	0.845	0.23
20	Maharashtra	53.11	0.593	0.003
21	Manipur	4.56	0.0	0
22	Meghalaya	4.84	0.0	0
23	Mizoram	2.60	0.087	0
24	Nagaland	3.33	0	0
25	Odisha	27.80	0.257	0
26	Puducherry	0.99	0.14	0
27	Punjab	11.80	0.367	0
28	Rajasthan	50.78	0.34	0
29	Sikkim	1.16	0.675	0
30	Tamil Nadu	30.31	0	0
31	Tripura	4.85	0.055	0
32	Uttar Pradesh	102.15	1.95	0
33	Uttarakhand	12.66	0.483	0
34	West Bengal	35.21	0.639	0
35	Telangana	17.60	2.74	0
36	Ladakh	3.45	0.0025	0
	Total	702.89	28.981	0.46

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S. No	Objective	Activities done in FY 2020-21
1.	To create awareness among general population (vulnerable community), health care providers and Policy makers regarding impacts of climate change on human health,	1. Issued seasonal advisory to all States on Acute Respiratory Illnesses (ARI) in context of air pollution and 2. Issued seasonal advisory to 23 heat vulnerable States on Heat Related Illnesses (HRI). 3. Observed World Environment Day every year (also in 2020) and had observed first International Day of clean air for blue sky in year 2020. 3. Developed IEC on ARI and HRI and shared with all States. 4. Running social media campaign on MoHFW and NCDC twitter. 5. Access to Air Quality Index of all cities on NCDC website 6. Daily heat wave alerts sent to state health departments for predicted heat waves for next 5 days (March-July)
2.	To strengthen capacity of healthcare system to reduce illnesses/ diseases due to variability in climate	1. Trained 230 hospital nodal officers of sentinel hospitals from 24 States and 4 UTs on 5th Oct 2020 on Acute Respiratory Illness (ARI) Sentinel Surveillance in relation to air pollution. 2. Conducted training of State and District Nodal Officer Climate Change (SNO-CC and DNOCC), Madhya Pradesh and the training of SNO-CC and DNO-CC of Kerala, Mizoram, Rajasthan and Haryana is undergoing on Climate change and health (20-28th Oct 2020) 3. Developed community level training modules for women and children. ToT done on 03 Sept 2020. Awareness campaign on air pollution and health done in villages by States and districts from 07-12 Sept 2020. 4. As per Male' Declaration 2017, NPCCHH is undertaking measures for developing Climate Resilient and Green Healthcare facilities. 5. The principles of "Climate Resilient" and "Green" in healthcare facilities approved for inclusion in IPHS standards under National Health Mission
3	To strengthen health preparedness and response by performing situational analysis at National/ state/ district/ below district levels	1. Acute Respiratory Illnesses (ARI) surveillance in context of air pollution in 6 Central Hospitals in Delhi 2. Acute Respiratory Illnesses (ARI) surveillance in context of air pollution in 317 Hospital of 23 States initiated 3. Heat related illnesses (HRI) surveillance in 23 heat vulnerable States 4. Vulnerability Need Assessment (VNA) started in 3 states (Madhya Pradesh, Puducherry and Haryana) 5. Online Nation Review Meeting of all State Nodal Officers Climate Change: 21st Jan to 09th Feb 2021
4.	To develop partnerships and create synchrony/ synergy with other missions and ensure that health is adequately represented in the climate change agenda in the country	1. Focusing on Climate and Health specific inputs through collaboration with other National Programmes i.e., Non-Communicable Diseases and Vector Borne Disease 2. High level Inter-Ministerial committee chaired by Secretary (Health) and Secretary (Environment) for issues of Climate Change, Environment and Health: held on 4th Dec 2020 3.
5	To strengthen research capacity to fill the evidence gap on climate change impact on human health	1. Supporting ICMR and other institution in Air Pollution studies 2. Over 30 Institutions contributed to Compendium on Indian research on air pollution and health impacts, uploaded on website.

Progress of NPCCHH in States/UTs

- Notification of State Nodal Officers – Climate Change – 36 States
- Environment Health Cell – 24 States
- Notification of Task Force with representation from various department and relevant stakeholders - 24 States
- Governing Body – 17 States
- Provided template for drafting State- specific Action Plan for Climate Change & Human Health – First draft submitted by 25 States
- Held regional and national Consultations in last two years

All six councils i.e. Medical Council of India, Dental Council of India, Nursing Council of India, Central Council of Homeopathy, Central Council of Indian Medicine and National Board of Examination have accepted the proposal for inclusion in the teaching curricula. The content on the matter are under consideration in respective councils

The programme has identified sixteen Centre of Excellences (CoE) for various CSDs, for developing subject specific Health Adaptation Plan, guidelines and standard operating procedures in subject area, for developing training modules and organize training of trainers, to develop IECs, support states with State Action Plan on Climate Change and Human Health (SAPCCHH) document best practices and document impact of actions.

Following 18 institutes were identified as Centre of Excellence for 17 Climate Sensitive Health Issues :

S. No.	Centre of Excellence	Health Issue
1	A. National Institute of Medical Research, Delhi (NIMR) B. Centre for Medical Entomology and Vector Management , NCDC	Vector Borne Diseases
2	National Institute of Cholera and Enteric Diseases, Kolkata (NICED)	Water Borne Diseases
3	Post-graduate Institute of Medical Education & Research, Chandigarh (PGIMER)	Air Pollution related Illness
4	Vallabhbhai Patel Chest Institute, New Delhi (VPCI)	Allergic Diseases
5	All India Institute of Medical Sciences, New Delhi (AIIMS)	Cardio-pulmonary Diseases
6	National Institute of Nutrition (NIN)	Nutrition related diseases
7	National Institute of Occupational Health, Ahmedabad (NIOH)	Occupational Health
8	National Institute of Mental Health & Neurosciences, Bangalore (NIMHANS)	Mental Health
9	National Institute of Disaster Management. New Delhi (NIDM)	Climate Change and Disaster related diseases

10	Indian Institute of Public Health, Gandhinagar (IIPH)	Heat related Illness
11	Public Health Foundation of India, Gurugram (PHFI)	Green and Climate resilient Infrastructures
12	Nutrition Foundation of India, Delhi (NFI)	Foodborne Illnesses
13	International Institute of Health Management Research, Delhi (IIHMR)	Vulnerability Assessment
14	The Energy and Resources Institute, Delhi (TERI)	Health Information System
15	Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry (JIPMER)	Coastal Climate Sensitive Diseases
16	North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences, Shillong (NEIGRIHMS)	Hilly region Climate Sensitive Diseases
17	Division of Zoonotic Disease Programmes, NCDC	Zoonotic Disease and One Health

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LIST OF ABBREVIATIONS

WHO	World Health Organization
IPCC	Intergovernmental Panel on Climate Change
IPCC SREX	Intergovernmental Panel on Climate Change -Special Report on Extreme Events
UV	Ultraviolet
GOI	Government of India
NGO	Non-Governmental Organization
NIMR	National Institute of Malaria Research
IITM	Indian Institute of Tropical Meteorology
IMD	India Meteorological Department
DGHS	Director General of Health Services
ICMR	Indian Council of Medical Research
MOHFW	Ministry of Health & Family Welfare
MOEF&CC	Ministry of Environment, Forest and Climate Change
NCDC	National Centre for Diseases Control
NDMA	National Disaster Management Authority
MHRD	Ministry of Human Resource Development
NEERI	National Environmental Engineering Research Institute
TERI	The Energy and Resources Institute
PHFI	Public Health Foundation of India
UNICEF	United Nations International Children's Emergency Fund
IEC (ICT)	Information Education Communication (Information and communications technology)
EWS	Early Warning System
PHC,	Primary Health Care
CHC	Community Health Centres
V&A	Vulnerability and Adaptation Assessments for Climate Change assessments
FSSAI	Food Safety and Standards Authority of India
MHA	Ministry of Home Affairs
DHR	Department of Health Research
DST	Department of Science & Technology
DOS	Department of Space
GIS	Geospatial Information System
ENSO	El Niño-Southern Oscillation

PRECIS	Providing Regional Climates for Intervention Studies
HADCM3	Hadley Centre Coupled Model, version 3
Ministry of I&B	Ministry of Information & Broadcasting
MCI	Medical Council of India
Dy.DG	Deputy Director General
DoHF&W	Department of Health & Family Welfare
NAPCCH	National Action Plan on Climate Change & Health
RKS	Rogi Kalyan Samiti
NHM	National Health Mission
PIP	Programme Implementation Plan

Constitution of NEGCCCH: Office Order



T-25013 03/2013-NCD
Government of India
Ministry of Health and Family Welfare

Nirman Bhawan, New Delhi
Dated 2nd July, 2013

साधारण ड
ORDINARY PC

OFFICE ORDER

Subject: Constitution of National Expert Group on Climate Change and Health

Pursuant to the decision to establish a Health Mission on Climate Change, the Government hereby constitutes an Expert Group comprising representatives from different Ministries, Institutions, State Governments and Special Invitees as under:

Composition of the Expert Group

Sl.No	Name and Designation	
1	Dr Vishwa Mohan Katoch, Former Secretary (Health Research), Government of India & Former DG ICMR	Chairperson
2	Joint Secretary (PH), Ministry of Health & Family Welfare, GOI Joint Secretary (NCDs), Ministry of Health & Family Welfare, GOI Joint Secretary (VBDs), Ministry of Health & Family Welfare, GOI	
3	Director (NVBDCP), Dte.GHS, MOH&FW, GOI Dy. Director General (PH), Dte.GHS, MOH&FW, GOI Dy. Director General (NCD), Dte.GHS, MOH&FW, GOI	Members
4	Representative of National Disaster Management Authority*	
5	Representative of Ministry of Environment Forest & Climate Change*	
6	Representative of Ministry of Earth Sciences*	
7	Representative of Central Ground Water Board, Ministry of Water Resources, River Development & Ganga Rejuvenation*	
8	Representative of Ministry of Agriculture*	
9	Representative of ICMR, New Delhi*	
10	Chairman, Central Pollution Control Board, New Delhi or his representative*	
11	Director / Director General Health Services from the State Governments**	Member Secretary
14	Director, National Centre for Disease Control, Delhi	

*Joint Secretary level representative from Ministries / Departments / Institutions.

** Representative from the State Governments of Maharashtra, Uttarakhand and Odhisa at present.

Special Invitees:

Sl.No	Name and Designation
1	WHO India Country Representative, New Delhi
2	Dr K Srinath Reddy, President, Public Health Foundation of India, New Delhi
3	Director, Calcutta School of Tropical Medicine, Kolkata
4	Director, Centre for Environment and Occupational Health, MAMC, New Delhi
5	Director, National Environmental Engineering Research Institute (NEERI), Nagpur
6	Director, The Energy and Resources Institute (TERI)
7	Dr (Ms) H Achyuthan, Dept. of Geology, Anna University, Chennai
8	Dr R Nigam, Scientist F, Dy. Director, Geological Oceanography Division, National Inst. Of Oceanography, Goa

The MoH&FW, Govt. of India, may add members / experts to the said expert group as per requirement.

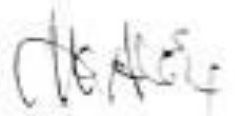
Terms of Reference

- (1) Prepare an Action Plan for climate change, environment and human health
- (2) Recommend strategies for mitigating adverse effects of climate change on human health
- (3) Review epidemiological data on environment health and climate change
- (4) Recommend strategies including indicators for monitoring and evaluation of health impact of climate change
- (5) Recommend coordination mechanism with various stakeholders
- (6) Recommend means of financial assistance to States and other Agencies working in the field of health and environment / climate change
- (7) Suggest ways for building capacity in different areas of health including human resources, infrastructure and research for addressing the issues emanating from climate change
- (8) Recommend National Environment Health Policy and Strategy
- (9) Any other matter as requested by MoH&FW, Govt. of India

Meetings and Report

The "Expert Group" will meet as required with the objective to submit an interim report by the end of 3 months and a final report by the end of 6 months from the date of this office order.

All financial expenditure towards organizing meetings of the "Expert Group", including TA/DA, etc. will be borne under the NCDC Budget as per Govt. of India norms. TA/DA of government officials will be borne by their respective organizations as per Govt. of India norms. TA/DA of non-official members (including Special Invitees) will be provided by NCDC as per eligibility and as per Govt. of India norms. The outstation non-official members shall be entitled to economy class to & fro airfare as per applicable rules.



(A.K. Arora)
Deputy Secretary to the Government of India.
Tele: 23061975

Distribution:

Chairperson and all Members / Special Invitees of the "Expert Group" on Climate Change and Health

Copy with request to nominate appropriate level officer as indicated in the OM for "Inter Ministerial Expert Group" to:-

1. Secretary, MOEF&CC / Secretary, Ministry of Earth Sciences / Chairman, NDMA
Secretary, Ministry of Water Resources, RD &GR / Secretary, Ministry of Agriculture / DG,
ICMR / Director, TERI / Health Secretaries of the State Govt. of Uttarakhand, Odhisa &
Maharashtra

Copy for information to:

1. Secretary (H&W)
2. DGHS
3. AS & MD, NHM, MOH&FW / AS (Health), MOH&FW / AS (SK), MoEF&CC
4. JS (PH)
5. Director (IFD)

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National Expert Group for Climate Change & Health (NEGCCH)

S.No. Name & Designation

1	Dr Vishwa Mohan Katoch , Former Secretary (Health Research), Government of India and Former DG,ICMR	Chairman
2.	Shri Anshu Prakash , Joint Secretary (PH & NCD), Ministry of Health and Family Welfare, Nirman Bhawan, New Delhi –110011	Member
3.	Shri Ravi S. Prasad , Joint Secretary, Ministry of Environment, Forests and Climate Change, Indira Paryavaran Bhawan, JorBagh, Aliganj, New Delhi –03.	Member
4.	Dr N. S. Dharmshaktu , Additional Director General, Directorate General of Health Services, Nirman Bhawan, New Delhi –110011	Member
5.	Dr A.C. Dhariwal , Director, National Vector Borne Disease Control Programme, Block Number -III, Ground Floor, Delhi IT Park Shastri Park, Delhi-110053	Member
6.	Dr Inder Parkash , DDG(PH), Dte General of Health Services, Nirman Bhawan, New Delhi–110011	Member
7	Dr Mohammed Shaukat , DDG(NCD), Directorate General of Health Services, Nirman Bhawan, New Delhi –11	Member
8	Dr A.K. Sinha , Senior Research Officer, National Disaster Management Authority, No. 1, Safdarjung Enclave, NDMA Bhawan, New Delhi-110029	Member
9	Dr Ajay Raghav , Scientist F, Climate Change Division, Ministry of Environment, Forests and Climate Change, Indira Paryavaran Bhawan, Jor Bagh, Aliganj, New Delhi –03	Member
10.	Dr S. K. Peshin , Scientist F, India Meteorological Department, Prithvi Bhawan, Opposite India Habitat Centre, Lodhi Road, New Delhi-110003	Member
11	Dr B. C. Joshi , Scientist D, Central Ground Water Board, Bhujal Bhawan, NH-IV, Faridabad – 121001	Member
12.	Dr Dushyent Gehlot , Soil Conservation Officer (Climate Change), Climate Change Cell (Room No. 22), Department of Agriculture and Cooperation, Ministry of Agriculture, Krishi Bhawan, New Delhi	Member
13.	Dr D. K. Shukla , Scientist G, Indian Council of Medical Research (ICMR), ICMR HQ, New Delhi	14. Dr R. M. Bhardwaj , Scientist

t E, In-charge, Pollution Assessment Monitoring Survey, Central Pollution
Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi –110096

Member

15.

Dr S. Venkatesh, Director, National Centre for Diseases Control,22-Shamnath
Marg,Delhi-110054

Member

Member
Secretary

Special Invitees

S.No. Name & Designation

- 1 **Dr Sadhna Bhagwat**, National Professional Officer (NCD), WHO Country Office For India, First Floor, RK Khanna Stadium, Safdarjung Enclave, Africa Avenue, New Delhi-110029.
- 2 **Dr V. Rao Aiyagari**, Senior Advisor, Research and Scientific Operations, Public Health Foundation of India (PHFI), Plot No. 47, Sector 44, Gurgaon-122002.
- 3 **Prof Nandita Basu**, Director, School of Tropical Medicine, 108, C. R. Avenue, Kolkata-700073
- 4 **Dr T. K. Joshi**, Director, Centre for Occupational and Environment Health, Maulana Azad Medical College, New Delhi-110002.
- 5 **Dr Pravin Naoghare**, Scientist, Environmental Health Division, National Environment Engineering Research Institute (NEERI), CSIR Lab, Nehru Marg, Nagpur-440020.
- 6 **Dr Suruchi Bhadwal**, Associate Director, Earth Science and Climate Change Division, The Energy and Resources Institute (TERI), Darbari Seth Block, India Habitat Centre, Lodhi Road, New Delhi-110003.
- 7 **Dr Hema Achyuthan**, Department of Geology, Anna University, Chennai

Invitees

S.No. Name & Designation

- 1 **Dr Jyoti Misri**, Principal Scientist (AH), Indian Council of Agriculture Research (ICAR), Room No. 410-A, Krishi Bhawan, New Delhi-110001
- 2 **Dr Tanvir Kaur**, Scientist E, Indian Council of Medical Research (ICMR), ICMR HQ, New Delhi
- 3 **Dr Anjali Srivastava**, Chief Scientist and Head, NEERI Zonal Centre, Lohamandi Marg, Naraina Industrial Area Phase I, Naraina, New Delhi, Delhi-110028.
- 4 **Ms Meena Sehgal**, Fellow, The Energy and Resources Institute (TERI), Darbari Seth Block, India Habitat Centre, Lodhi Road, New Delhi-110003.
- 5 **Dr D.R. Sikka**, Former Director, Indian Institute of Tropical Meteorology (IITM), Dr. Homi Bhabha Road, Pashan, Panchawati, Pune, Maharashtra-411008.
- 6 **Dr Akhilesh Gupta**, Head, Climate Change Programme & Strategic Programme, Large Initiatives and coordinated Action Enabler (SPLICE), Department of Science & Technology, Technology Bhawan, New Mehrauli Road, New Delhi-110016.
- 7 **Dr Nisha Mendiretta**, Scientist F and Director, Climate Change Programme, Department of Science & Technology (DST), Ministry of Science & Technology, Government of India

- 8 **Dr D. Behera**, Professor and Head, Pulmonary Medicine, PGIMER, Kairon Block, Sector-12, Chandigarh –160012.
- 9 **Prof. Manju Mohan**, Professor, Centre for Atmospheric Sciences, Indian Institute of Technology, Delhi –16
- 10 **Dr Sagnik Dey**, Assistant Professor, Centre for Atmospheric Sciences, Indian Institute of Technology, New Delhi –110016.
- 11 **Dr Vidhya Venugopal**, Professor, Department of Environmental Health Engineering, Sri Ramachandra University, Porur, Chennai –600116.
- 12 **Dr P.K. Sen**, Additional Director, National Vector Borne Disease Control Programme, Block Number -III, Ground Floor, Delhi IT Park, Shastri Park, Delhi-110053.
- 13 **Dr. Sher Singh**, Assistant Director (PH), National Vector Borne Disease Control Programme, Block Number -III, Ground Floor, Delhi IT Park, Shastri Park, Delhi-110053.

OFFICERS FROM NCDC (Nodal Agency for Climate Change & Human Health)

S.No. Name & Designation

- 1 **Dr CS Aggarwal**, Additional Director, Centre for Environment, Occupational Health, and Climate Change, National Centre for Disease Control (NCDC), Delhi-110054
- 2 **Dr Shikha Vardhan**, Deputy Director, Centre for Environment and Occupational Health, National Centre for Disease Control (NCDC), Delhi-110054
- 3 **Dr Pranil M Kamble**, Assistant Director, Centre for Environment and Occupational Health, National Centre for Disease Control (NCDC), Delhi-110054

NAPCCHH: Proposed Annual Budget

Annexure:C.1

Proposed budget for Centre for Environmental & Occupational Health Climate Change& Health (includes CCHH related activities to be conducted by Division of Entomology) Financial year 2021-22									
Activities 2021-22									
S. No	Title	2021-22				Units	Unit Cost	Estimated budget in Rs	
		Q 1	Q 2	Q 3	Q 4				
1.	Human Resources								
	Senior Consultant-Capacity building/ Training/ Monitoring & Evaluation					1	150000	18,00,000	
	Senior Consultant-Environmental Health Specialist/ Public Health Informatics Specialist					1	150000	18,00,000	
	Technical Officer-Data Management					2	75000	18,00,000	
	Subtotal							54,00,000	
2.	Logistics								
	Annual Consumables for computer and related equipments/ instruments including stationeries etc*					@5000/- per unit for 12 months		3,60,000	
	*Logistics required for new consultants and Technical Officers								
	Sub Total								3,60,000
3.	Travel related expenses of Contractual Consultants and Staffs								
	Travel expense and avg three days stay at hotel of Consultants as per eligibility. (Two consultants; one visit per month by each consultant)	Travel to and fro @ 35000/-;				24	44,750	10,74,000	
	Travel expense and avg three days stay at hotel of Technical Officer/ staff as per eligibility. (Two Technical Officers; one visit per month by each)	3 Days Hotel stay @ 2250/- per day; 3 days food @1000/- per day				24	44,750	10,74,000	
	Sub Total								21,48,000
4	Training and capacity building								
	Four days Training of Trainers (TOT)/workshop					14	1118750	1,56,62,500	
	Two days training/ Workshop / meeting					12	860250	1,03,23,000	
	One day Training/ Meeting/ Expert Group consultation					22	541250	1,19,07,500	
	Sub Total								3,78,93,000
5	Proposed budget for identified Centres of Excellence (COE) for services related to CCHH								
	Health Adaptation Plan, Training Modules, SOPs, Expert inputs for CSDs, Guidance to states for CSD					16	10,00,000	1,60,00,000	
6	Proposed budget for development of prototype of IEC/ Advisories for Impact of Climate Change & Human Health								
	Prototype of IEC Creative (Print, Audio Visual and Social media) on Climate Sensitive diseases							60,00,000	
7	Printing of documents developed under the NPCCHH								
	Printing and related cost including binding etc of documents developed under the NPCCHH like Adaptation plans for CSDs, manuals, compendium, posters etc							12,00,000	
8	Misc cost								
	Cost pertaining to hiring consultancies for developing training modules, hiring consultancies for developing softwares and other information technology based platforms, purchasing maps or data etc							60,00,000	
	Total								7,50,01,000

	Rupees Seven Crore Fifty Lakh One Thousands only

Resource requirement (year wise) for five years for National Programme on Climate Change and Human Health (NPCCHH) - Rs 198,6543 000/- (One Ninety eight Crore Sixty Five Lakhs Forty Three Thousands Rupees)

S.No	Heads	FMR Code	Year wise expenditure expected (in Rs '000)					Amount for 5 years
			2021-22	2022-23	2023-24	2024-25	2025-26	
A	Non-recurring expenditure							
1	Vulnerability assessment	10.2.14	48,00	96,00	1,9200	10000	2500	3,91,00
2	Printing State Action Plan Climate Change & Human Health, Climate Change and Health Training Module, Climate Change and Health Module for women+ children+ municipality+ traffic police	12.17.3	1000	2000	3000	4000	10000	2,00,00
3	Greening of health sector (Solar panel with battery installation, rain water harvesting, energy efficient LEDs)	5.1.1.2.13	1,44,00	2,16,00	2,16,00	2,88,00	5,76,00	14,40,00
4	Climate resilient Healthcare facility (retrofitting)	5.1.1.2.13	25,00	43,00	2,42,00	2,50,00	5,00,00	10,60,00
5	Research on climate variables	10.2.14	5000	80,00	80,00	4000	4000	2,90,00
B	Recurring expenditure							
1	IEC on Climate Sensitive Diseases at Block , District and State level – Acute Respiratory Illnesses in context of Air pollution; Heat and other relevant Climate Sensitive diseases	11.24.4.4	7,14,90	14,29,80	18,00,00	20,00,00	20,00,00	79,44,70
2	Training of Panchayati Raj Institution/block level under NPCCHH	3.3.3.3	40,00	80,00	1,60,00	2,00,00	3,00,00	7,80,00
3	Training at State level: Training of Trainers of District Nodal Officer Climate Change (DNO-CC)	9.5.29.8	3,00,00	1,00,00	1,00,00	4,00,00	1,00,00	10,00,00
4	Training at District level (One training in a year for each nodal officer for 5 days)	9.5.29.8	4,85,00	6,06,25	5,80,00	9,70,00	8,22,00	34,63,25
5	Sensitization workshops/meeting at State level (Two day workshop) (All district officers)	16.1.2.1.24	21,00	12,18	25,00	10,00	15,00	83,18

6	Sensitization workshops/meeting at District level	16.1.2.1.24	1,22,00	3,05,00	2,00,00	1,00,00	3,00,00	10,27,00
7	Task force meeting @Rs 1000/meeting	16.1.2.1.23	500	250	250	500	250	17,50
8	Consultant Climate Change @ Rs 95,000/month	16.4.1.5.2	90,00	2,90,00	4,51,00	6,00,00	6,00,00	20,31,00
9	Maintenance cost for greening health sector (Solar panel with battery installation, rain water harvesting, energy efficient LEDs)	5.1.1.2.13	2,88	4,32	4,32	5,76	11,52	28,80
	Total		20,57,78	32,85,05	40,82,82	50,08,76	54,31,02	1,98,65,43

The proposed budget for next five years (2021-26) for National Programme on Climate Change and Human Health (NPCCHH) is **Rs 1,98,65,43,000/- (One Ninety eight Crore Sixty Five Lakhs Forty Three Thousands Rupees).**

SFC FY 2021-26 Proposal for NPCCHH under NCDC

C.3.A.1. NPCCHH/NCDC activities and CoE activities budget proposal for FY 2021-26

(in Crore)

NPCCHH/NCDC activities and CoE activities	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	Total
1.1 Budget for NPCCHH/NCDC activities	4.678	4.487	4.487	4.487	4.487	22.626
1.2 Budget for CoEs activities	14.924	14.924	14.924	14.924	14.924	74.62
Total	19.602	19.411	19.411	19.411	19.411	97.246

C.3.A.1.1. Budget proposal for NPCCHH activities under each head for FY 2021-26

(in Crore)

Heads/Component	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	Total
Activities: NAPCCHH update/revision/print, Development of guidelines/SOPs, Review meeting with (CoE, States), Capacity building(ToTs/Workshop), IEC development (print/audio/visual)(details at C.3.A.1.1.A)	2.448	2.448	2.448	2.448	2.448	12.24
Human resource, logistic, travel of HR for conducting activities, miscellaneous (details at C.3.A.1.1.B)	2.23	2.039	2.039	2.039	2.039	10.386
Total	4.678	4.487	4.487	4.487	4.487	22.626

NAPCCHH: National Action Plan on Climate Change and Human Health, SOP: Standard Operating Procedures, CoE: Centre of Excellence

C.3.A.1.2. Budget proposal for CoE activities under each head for FY 2021-26

(in Crore)

Heads/Component	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	Total
Activities: Development of National Action Plan on CSDs/guidelines/SOPs/Training Modules/Surveillance, To support states for development of SAPCCHH, Training of Trainers, IEC development, Documentation of Reports/best practices, Develop Monitoring and Evaluation system(details at C.3.A. 1.2.A)	5.4	5.4	5.4	5.4	5.4	27
Human resource, Travel for HR for conducting activities , Contingencies/Overheads. (details at C.3.A. 1.2.B)	9.524	9.524	9.524	9.524	9.524	47.62
Total	14.924	14.924	14.924	14.924	14.924	74.62

CSDs: Climate Sensitive Diseases, SAPCCHH -State Action Plan on Climate Change and Human Health

C.3.A.1.1.A. Details of budget proposal for NPCCHH/NCDC activities

(in Lakh)

[illegible]

C.3.A.1.1.B. Human resource, logistic, travel of HR for conducting activities, miscellaneous
(in Lakh)

Human resources	Unit	Unit Cost	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	Total
Senior Programme Manager-Climate Change	1	1.75	21.0	21.0	21.0	21.0	21.0	105.0
Senior consultant-climate change*	4	1.50	72.0	72.0	72.0	72.0	72.0	360.0
Consultant-Communication Officer	1	1.00	12.0	12.0	12.0	12.0	12.0	60.00
Technical Officer- Data Management	2	0.75	18.0	18.0	18.0	18.0	18.0	90.00
Administrative Manager	1	0.75	9.0	9.0	9.0	9.0	9.0	45.00
Finance Manager-Consultant	1	0.75	9.0	9.0	9.0	9.0	9.0	45.00
Graphic Designer	1	0.75	9.0	9.0	9.0	9.0	9.0	45.00
Secretariat Assistant	2	0.40	9.6	9.6	9.6	9.6	9.6	48.00
Sub Total	13		159.6	159.6	159.6	159.6	159.6	798.0
Logistic Equipments	Unit	Unit Cost						
Computer with Printer	13	0.60	7.80					
Table with Chair	13	0.10	1.30					
Photocopy Machine	1	1.50	1.50					
Photocopy Machine(Colour)	1	3.00	3.00					
Video conferencing Device and Projector	1	1.00	1.00					
Almirah	13	0.10	1.30					
Scanner (High Resolution)	1	2.00	2.00					
Laptop	1	0.80	0.80					
Hard Disks/Pen- Drives	4	0.10	0.40					
Sub Total			19.1					19.1
Travel for HR for conducting the activities	Unit	Unit Cost						
Travel expense and average 3 days stay at hotel(One visit per month by each**)	96	0.3475	33.36	33.36	33.36	33.36	33.36	166.8
Travel expense and average 3 days stay at hotel(one visit per 2 month by each***)	18	0.3475	6.255	6.255	6.255	6.255	6.255	31.27
Sub Total			39.61	39.61	39.61	39.61	39.61	198.05
Miscellaneous (Additional meetings/Training/printing cost)			5.00	5.00	5.00	5.00	5.00	25.00
Total			223	203.9	203.9	203.9	203.9	1038.6

*Senior consultant-climate change-Senior Consultant-Capacity Building/Training, Senior Consultant-Environment Health Specialist, Senior Consultant-Monitoring & Evaluation, Senior Consultant-Public Health Informatics Specialist .

**1 Senior Programme Manager,4 Consultants,1 Communication officer,2 Technical officer

***1 Graphic Designer, 1 Administrative manager,1 Finance Manager

C.3.A.1.2.A. Details of Budget Proposal for CoEs Activities

(in Lakh)

Heads	*Unit Cost	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	Total
Development of Health Action Plan on Climate sensitive subject allocated to CoE Develop guidelines and SoPs on subject area To support States for development of chapter in their State Action Plan on Climate Change and Human Health(SAPCCHH) related to climate change subject looked after by CoE Development of training modules Develop surveillance or integrate in existing surveillance of climate sensitive conditions looked after by CoEs. Develop Monitoring and evaluation system for climate change subject looked after by existing CoE Documentation of Reports, best practices	10	180	180	180	180	180	900
Trainings: Training of Trainers (ToTs) (9 CoE will conduct training in one year) (detail at C.3.A.1.2.A.1)	20	180	180	180	180	180	900
IEC development on the subject specific climate sensitive diseases (print, audio visual, Gif, social media)	10	180	180	180	180	180	900
Total		540	540	540	540	540	2700

*unit-18 CoEs

C.3.A.1.2.B. Human resource, Travel for HR for conducting activities, Contingencies/Overheads**(in Lakh)**

Human resources	Unit	Unit Cost	CoE/ year	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	Total
Consultant	1	1.20	14.4	259.2	259.2	259.2	259.2	259.2	1296
Scientist	1	0.75	9	162	162	162	162	162	810
Technical Officer-Data Management	2	0.50	12	216	216	216	216	216	1080
Sub Total	4		35.4	637.2	637.2	637.2	637.2	637.2	3186
Travel for HR for conducting the activities	Unit	Unit cost							
Travel expense and avg three days stay at hotel;one visit per month by each#).	36	0.3475	12.51	225.18	225.18	225.18	225.18	225.18	1125.9
Sub Total			12.51	225.18	225.18	225.18	225.18	225.18	1125.9
Contingencies/o ver heads			5.0	90.0	90.0	90.0	90.0	90.0	450.0
Total				952.4	952.4	952.4	952.4	952.4	4762

#1consultant, 1 scientist,1 data entry operator

C.3.A.1.1.A.1. Detail cost of Expert Group Meeting**(in Lakh)**

Budget Head	Unit	Unit Cost	Total
Travel cost for outstation <i>Guest Expert</i> at Regional/ state / National Level	4	Travel to and fro @ 25000/- round trip	1.0
Accommodation to outstation <i>Guest Expert</i> at Regional/ state / National Level	4	@4500/- per night	0.18
Refreshments (incl tea , snacks and lunch)	35	Rs 700/- per person per day	0.245
Incidental expenditure, photocopying, job aids etc	10	Rs 250/- per day per expert	0.025
Total			1.45

C.3.A.1.1.A.2 National level review meetings (9 Meetings/YEAR) for the programme for 18 Centres of Excellence

Budget for 1 meeting: Detail cost of one batch of Centres of Excellence (6 CoE) At the National Level review meeting per 1 day for 2 consultants of the CoE

(in lakh)

	Budget Head	Unit	Unit cost	Total
CoE consultants	Travel cost	12	Travel to and fro @10,000 per consultant	1.2
	Accommodation	12	@ 4500/-per consultant per night	0.54
	Refreshments (including tea, snacks and lunch	27	@700/- per person per day	0.189
	Incidental expenditure, photocopying, job aids etc.	12	@250/- per day per participants	0.03
	Total			1.959

C.3.A.1.1.A.3. National level review meetings (6/YEAR) for the programme for 36 States/UTs

Budget for 1 meeting: Detail cost of one batch of State Nodal Officer – Climate Change (12 States) at the National Level review meeting per 1 day for 2 consultants of the States

(in lakh)

	Budget Head	Unit	Unit cost	Total
Guest Faculty	Travel cost for outstation	15	Travel to and fro@25,000/-	3.75
	Accommodation	15	@4500/- per night	0.675
SNO-CC consultants	Travel cost	24	Travel to and fro@10,000 per consultant	2.4
	Accommodation	24	@ 4500/-per consultant per night	1.08
	Refreshments (including tea,snacks and lunch	54	@700/- per person per day	0.378
	Incidental expenditure,photocopying, job aids etc.	24	@250/- per day per participants	0.06
	Venue Hiring		(2500 x 54)+ 30% GST	1.755
	Total			10.098

C.3.A.1.1.A.4 Capacity Building of State Nodal Officer and Consultant-Climate Change

(5days Training at National Level; Twice a year)

	Budget Head	Unit	Unit cost	(in Lakh) Total
Guest Faculty	Travel cost for outstation Guest faculty	15	Travel to and fro @ Rs.25,000/-	3.75
	Accommodation	15	2 days Hotel stay @4500/-per day	1.35
	Honorarium	15	2 days @1500/-per day	0.45
In-House Faculty	Honorarium	8	5 days @1000/- per day	0.40
Trainee	Travel cost	72	Travel to and fro@10000/-	7.2
	Accommodation	72	5 days Hotel stay @4500/-per day	16.2
	DA	72	5 days @1000/- per day	3.60
	Refreshments (including tea,snacks and lunch	102	5 days @700/- per day	3.57
	Incidental expenditure, photocopying, job aids etc	72	5 days @250/-per day	0.90
	Venue Hiring		(2500 x 102) + 30% GST	3.315
	Total			40.735

C.3.A.1.1.A.5 Workshop (1 day) (5 workshop/year)

(in Lakh)			
Budget Head	Unit	Unit cost	Total
Travel cost for Guest faculty	10	Travel to and fro @ Rs.25,000/-	2.5
Accommodation	10	1 day hotel stay @ 4500/-	0.45
Refreshments (including tea,snacks and lunch	25	@700/- per day	0.175
Incidental Expenditure, photocopying,job aids etc	20	@250/-per day	0.05
Venue Hiring		(2500 x 25) + 30% GST	0.8125
Total			3.9875

C.3.A.1.2.A.1 Training of Trainers by Centres of Excellence

(3 days Training at National Level; 9 CoE will conduct training in a year)

(in Lakh)				
	Budget Head	Unit	Unit cost	Total
Guest Faculty	Honorarium	4	3 days @1000/-per day	0.12
Trainee	Travel cost	72	Travel to and fro@10000/-	7.2
	Accommodation	72	3 days Hotel stay @4500/-per day	9.72
	DA	72	3 days @1000/- per day	2.16
	Refreshments (including tea,snacks and lunch	82	3 days @400/- per day	0.98
	Incidental expenditure, photocopying, job aids etc	72	3 days @100/-per day	0.22
	Total			20.4

REGIONAL METEOROLOGICAL OFFICES: Address

Regional Meteorological office	Address
India Meteorological Department, Regional Meteorological Centre, Chennai	New 6, Old 50, College Road, Chennai, Tamil Nadu- 600006
India Meteorological Department, Regional Meteorological Centre, Guwahati	LGBI Airport, Guwahati, Assam- 781015
India Meteorological Department, Regional Meteorological Centre, Kolkata	4, Duel Avenue, Alipore, Kolkata, West Bengal – 700027
India Meteorological Department, Regional Meteorological Centre, Mumbai	Regional Meteorological Centre, Mumbai, Colaba, Mumbai, Maharashtra- 400089
India Meteorological Department, Regional Meteorological Centre, Nagpur	Regional Meteorological Centre, IMD DBAI Airport, Sonegaon, Nagpur, Maharashtra- 440005
India Meteorological Department, Regional Meteorological Centre, New Delhi	RMC Building, Lodi Road, New Delhi- 110003

STATE POLLUTION CONTROL BOARD: Address

State Pollution Control Board	Address
Andhra Pradesh Pollution Control Board	Paryarana Bhawan, A-3, Industrial Area , Sanath nagar, Hyderabad-500 018, Andhra Pradesh
Arunachal State Pollution Control Board	Government of Arunachal Pradesh Office of the Principal Chief and Secretary (E&F) Conservator of Forests, Itanagar 791111, Arunachal Pradesh
Assam Pollution Control Board	Control Board Bamunimaidam, Guwahati - 781021 Assam
A & N Islands Pollution Control Committee	Van Sadan, Port Blair-744 102
Bihar State Pollution Control Board	IInd Floor, Beltron Bhavan, Jawaharlal Nehru Marg, Shastri Nagar, Patna 800023, Bihar.
Chattisgarh State Environment Conservation Board	Nanak Nivas, Civil Lines Raipur - 492001 Chattisgarh
Chandigarh Pollution Control Committee	Chandigarh Administration, Additional Town Hall Building, IInd Floor, Sector 17-C, Chandigarh 160 017.
Delhi Pollution Control Committee	4th Floor, I.S.B.T. Building, Kashmere Gate, Delhi-110006
Daman Diu & Nagar Haveli Pollution Control Committee	Office of the Dy. Conservator of Forests, Moti Daman-396220, Daman
Goa State Pollution Control Board	Dempo Tower, Ist Floor Patto Plaza Goa 403110
Gujarat State Pollution Control Board	Sector 10-A, Gandhi Nagar 382043 Gujarat
Haryana State Pollution Control Board	S.C.O.No.11 A-12, Sector 7-C Madhya Marg, Chandigarh – 160019
H.P. State Environment Protection & Pollution Control Board	Paryavaran Bhawan, Phase III New Shimla -171 009 Himachal Pradesh
Jammu & Kashmir State Pollution Control Board	SheikhulAlam Campus, Behind Govt. Silk Factory, Rajbagh , Srinagar (April - Oct.) Parivesh Bhawan Forest Complex, Gandhi Transport Nagar (Nawal), Jammu (Nov. - March)
Jharkhand State Pollution Control Board	T.A. Building, HEC P.O. Dhurwa Ranchi - 834004 Jharkhand
Karnataka State Pollution Control Board	6th-9th floors Public Utility Building NSB Building, Mahatama Gandhi Marg Bangalore 560001 Karnataka

Kerala State Pollution Control Board	Plamoodu Junction Pattom Palace Trivandrum 695004 Kerala
Meghalaya Pollution Control Board	"ARDEN", Lumpyngngad, Shillong – 793 014, Meghalaya.
Madhya Pradesh Pollution Control Board	E-5, AreraClony, ParyavaranParisar, Bhopal - 463016 Madhya Pradesh.
Maharashtra Pollution Control Board	Kalpataru Points, 3rd & 4thfloor, Opp. Cine Planet, Sion Circle, Sion (E) Mumbai-400 022.
Mizoram State Pollution Control Board	M.G. Road, Khatna, Aizwal-796 012, Mizoram
Manipur Pollution Control Board	Langol Housing Complex, Imphal-795 004, Manipur.
Nagaland Pollution Control Board	Office of the Chairman, Forests Colony, Dimapur, Nagaland
Orissa State Pollution Control Board	A-118, Nilakantha Nagar, Unit-VIII, Bhubaneswar 751012. Orissa
Punjab Pollution Control Board	Vatavaran Bhawan, Nabha Road, Patiala-147 001 Punjab.
Pondichery Pollution Control Committee	Department of Science, Technology & Env. Housing Board Complex, Illrd Floor Pondicherry-600 005
Rajasthan Pollution Control Board	A-4, Institutional Area, JalanaDungri, Jaipur-302 004, Rajasthan.
Sikkim Pollution Control Board	State Land Use and Environment Cell Govt. of Sikkim, Deorali,- 737101
Tamil Nadu Pollution Control Board	No. 76, Mount Salai, Guindy, Chennai- 600 032, Tamil Nadu.
Tripura State Pollution Control Board	Vigyan Bhawan, Pandit Nehru Complex, Gorkhabasti,PO-Kunjaban, Agartala (W)-799 006 (Tripura) .
Uttar Pradesh Pollution Control Board	Illrd floor PICUP Bhavan, Vibhuti Khand, Gomti Nagar, Lucknow - 226020, UP.
West Bengal Pollution Control Board	Paribesh Bhavan, 10-A, Block LA, Sector III, Salt Lake City, Kolkata-700 091.

Subject Specific Health Action Plans on Climate Sensitive Diseases

National Programme on Climate Change and Human Health

Subject Specific Health Action Plan (HAP) on Climate Sensitive Health related issues identified under the NPCCHH

Sl. No.	Subject Specific HAPs on Climate Sensitive Health related issues	Agencies / Centres of Excellence which develop the HAP
1	Comprehensive health adaptation plan on air pollution related illnesses	NCDC with three CoEs - All India Institute of Medical Sciences , Postgraduate Institute of Medical Education and Research, Chandigarh and Vallabhbhai Patel Chest Institute
2	Health adaptation plan for heat related illnesses	NCDC with Technical Expert Group
3	Health adaptation plan for cardio-pulmonary diseases	All India Institute of Medical Sciences, Delhi
4	Health adaptation plan for allergic diseases	Vallabhbhai Patel Chest Institute , Delhi
5	Health adaptation plan for vector borne diseases	National Institute of Malaria Research , Delhi
6	Health adaptation plan for water borne diseases	National Institute of Cholera and Enteric Diseases , Kolkata
7	“One Health Action” plan for climate sensitive zoonotic diseases	Divison of Zoonotic Disease Programmes, NCDC
8	Health adaptation plan for nutrition related illnesses	National Institute of Nutrition, Hyderabad
9	Health adaptation plan for mental health illnesses	National Institute of Mental Health and Neuro-Sciences , Bangalore
10	Health vulnerability assessment in context of climate change	International Institute of Health Management Research , Delhi
11	Health adaptation plan on climate change related disasters	National Institute of Disaster Management, Delhi
12	Health adaptation on green and climate resilient healthcare facilities	Public Health Foundation of India, Gurugram
13	Health adaptation plan for hilly and mountainous areas	North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences , Shillong
14	COVID-19 experiences and climate change	Centre for Environmental and Occupational Health and Climate Change Health Division, NCDC

Comprehensive Health Adaptation Plan on Air Pollution Related Illnesses

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Table 4: The major components of the comprehensive health action plan on Air Pollution and Health

Abbreviations

AB-HWC	- Ayushman Bharat- Health & Wellness Centre
ACE-2	- Angiotensin Converting Enzyme - 2
AIIMS	- All India Institute of Medical Sciences
AQI	- Air Quality Index
ARI	- Acute Respiratory Infection
ASHA	- Accredited Social Health Activist
AWC	- Anganwadi Centre
AWW	- Anganwadi Worker
BMO	- Block Medical Officer
CDPO	- Child Development Project Officer
CEOH & CCH	- Centre for Environmental & Occupational Health, Climate Change & Health
CHC	- Community Health Centre
CHO	- Community Health Officer
CMO	- Chief Medical Officer
COPD	- Chronic Obstructive Pulmonary Disease
CPCB	- Central Pollution Control Board
CPD	- Cardio-Pulmonary Disease
DAPCCHH	- District Action Plan on Climate Change and Human Health
DGHS	- Director General of Health Services
DNO-CC	- District Nodal Officer –Climate Change
ED	- Emergency Department
ICMR	- Indian Council of Medical Research
IEC	- Information Education Communication
IHD	- Ischemic Heart Disease
IIHMR	- Indian Institute of Health Management Research
IMD	- Indian Meteorological Department
IV	- Invasive Ventilation
MAS	- Mahila Arogya Samiti
MoEFCC	- Ministry of Environment, Forest and Climate Change

MoHFW	- Ministry of Health and Family Welfare
MO	- Medical Officer
MWCD	- Ministry of Women and Child Development
NCAP	- National Clean Air Programme
NCDC	- National Centre for Disease Control
NCD	- Non-Communicable Disease
NFHS	- The National Family Health Survey
NGO	- Non-Governmental Organization
NHM	- National Health Mission
NIV	- Non-Invasive Ventilation
NPCCHH	- National Programme on Climate Change and Human Health
NPCDCS	- National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke
OIC	- Officer in Charge
PGIMER	- Postgraduate Institute of Medical Education and Research
PHC	- Primary Health Centre
PM 2.5	- Particulate Matter 2.5
PM 10	- Particulate Matter 10
PMCCC	- Prime Minister Council on Climate Change
PMO	- Prime Minister's Office
RBSK	- Rashtriya Bal Swasthya Karyakram
RKSK	- Rashtriya Kishore Swasthya Karyakram
SAFAR	- System of Air Quality and Weather Forecasting And Research
SAPCCHH	- State Action Plan on Climate Change and Human Health
SARS	- Severe Acute Respiratory Syndrome
SARS-CoV	- Severe Acute Respiratory Syndrome –related Corona virus of the genus Beta-coronavirus
SBCC	- Social and Behaviour Change Communication
SHC	- Sub-Health Centre
SNO –CC	- State Nodal Officer –Climate Change
SOP	- Standard Operating Procedure
SPCB	- State Pollution Control Board

TERI	- The Energy and Resource Institute
UNEP	- United Nations Environment Programme
VHSNC	- Village Health, Sanitation and Nutrition Committees
WHO	- World Health Organization

I.Climate Change and Air Pollution

Climate change impacts social and environmental determinants of health like clean air, safe drinking water, sufficient food and secure shelter. Among all, air pollution is a major environmental risk to health. The formation, transport and dispersion of many air pollutants is determined partly by climate and weather factors such as temperature, humidity, wind, storms, droughts, precipitation and by human activities like industrialisation, construction and demolition activities, vehicular pollution, episodic crop residue burning etc. known to produce various air pollutants. Air pollution is also associated with acid rain, eutrophication due to nitrogen oxides emission in air from power plants, cars, trucks, and other sources; haze; toxic effects on wildlife; ozone depletion in the atmosphere; crop and forest damage etc.

The health risks due to air pollution are associated with exposure to high levels of particulate matter (PM), ozone (O₃), nitrogen dioxide (NO₂) and sulphur dioxide (SO₂) etc. and the air quality levels in an area are collectively communicated to the public as Air Quality Index (AQI). The particulate matters of less than 10 and 2.5 microns in diameter (PM₁₀ and PM_{2.5}) are capable of penetrating deep into the airway passages, entering the bloodstream, causing illnesses from acute and chronic respiratory systems, increase in malfunction of the other organs affecting health of cardio-cerebrovascular-renal diseases, and among pregnant females due to trans-placental crossing of pollutants affect foetus resulting in low birth congenital problems and associated complications.

Among the air pollutants, Ozone, a secondary pollutant is formed via sunlight driven photochemical reactions involving precursor hydrocarbons and oxides of nitrogen. Ozone pollution is projected to increase because warmer temperatures enhance these reactions. Ozone is a powerful oxidant that has been persistently associated with damage to airways or lung tissue structures. It contributes to the more severe symptom of asthma, an increase in other respiratory illnesses and deaths. High levels of *ground-level Ozone with heat-waves* may result in higher frequency and severity of cardio-pulmonary attacks. Similarly, the combination of *high levels of Ozone and dust storms or*

alteration of allergens or all will result in outbreaks of asthma, allergic rhinitis and other allergic manifestation of varying degrees depending on exposure dosage and duration and vulnerability of exposed persons.

Ambient (outdoor) air pollution in both cities and rural areas was estimated to cause approximately 7 million deaths worldwide, and 90% of these deaths have occurred in low and middle-income countries. In India, nearly 12.5% of deaths have been attributed to air pollution. Thus, it is logical to assume that reduction in air pollution levels can help reduce the burden of diseases like acute and chronic respiratory diseases, heart diseases, strokes and other allergic problems.

The quality of air is expressed as Air Quality Index (AQI) which is broadly categorized into six levels as Good, Satisfactory, Moderately Polluted, Poor, Very Poor, and Severe to communicate and help understand and the associated health problems with the public and officials.

II. Linkage of Climate Change, Air pollution and infectious diseases including COVID-19 infection

Climate change threatens public health systems across the world. Apart from damage to infrastructure it also affects various illnesses, including but not limited to respiratory tract problems like asthma, rhino-sinusitis, chronic obstructive pulmonary diseases (COPD), bacterial and viral infections affecting respiratory passage (Coronavirus, SARS, Influenza) and also, circulatory collapse. The cited reasons may vary from poor air quality, high ground-level ozone, dust storms, changing of temperature, alteration of allergens, extreme heat, desertification, change in timing and duration of survival due to more particle surface to stick and transported over affecting transmission cycle of respiratory virus, alteration in bird migration. Further, the other contributory factors are demographic factors (age, sex, immunity status, pregnancy, prevailing endemic illnesses, etc.); low socio-economic status, , poor hygienic conditions, accessibilities to

health care facilities etc, Population experiencing more episodes of coughing and sneezing with the increase in the susceptibility of respiratory infection like Tuberculosis, SARS and Coronavirus, immuno-compromised level, or mentally or physically challenged people are also at high risk due to exposure to air pollutants.

Studies (2020) across the world on air pollution and COVID-19 infections show a positive relationship between them. Air pollution is observed to be associated with increasing severity and mortality of the COVID-19 cases. Some of the empirical findings from the studies on air pollution and Covid-19 are presented in the Annexure1.

Studies so far have provided preliminary evidence of association of COVID 19 positivity and severity with higher PM 2.5 concentration, exposure to NO₂ and other pollutants. However, the following associations between Air Pollution and COVID -19 need to be explored scientifically with the more evidences in futures

- PM 2.5 concentration and rapid spread of COVID -19
- Effects on lung function due to Air pollution and COVID-19
- Exposure to air pollutants and COVID-1 and their effect on multiple systems in the human body in long term
- Universal proper mask use as a preventive measure at an individual and population level

III. Health Impacts of Air Pollution

- Air Pollution is recognised as the greatest environmental risk to human health and is a main avoidable and preventable risk factor. It can affect every part of the body particularly skin and eyes, respiratory tracts, cardiovascular and cerebrovascular functions etc. and may be associated with health problems like asthma, chronic respiratory problems like COPD, cardiovascular problems like ischaemic coronary heart diseases, cerebrovascular like strokes, cancers, diabetes, hypertension, etc. According to the report of Steering Committee on Air Pollution from the MoHFW (2015) and WHO reports on Air Pollution and Health, certain short term and long-term health effects due to air pollution are shown as in the Table 2:
-

Table 2. Health Effects attributed to short-term and long-term exposures to Air Pollution	
Health Effects attributed to short-term exposure to air pollution	Health Effects attributed to long-term exposure to air pollution
1. Respiratory & cardiovascular emergency department visits 2. Respiratory & cardiovascular primary care visits 3. Use of respiratory & cardiovascular medications 4. Respiratory & cardiovascular hospital admissions 5. Days of restricted activity 6. Work absenteeism 7. School absenteeism 8. Daily mortality/deaths	1. Acute symptoms (Wheezing, coughing, phlegm production, respiratory infections) 2. Chronic respiratory diseases incidence & prevalence (asthma, COPD, chronic pathological changes) 3. Physiological changes (e.g. lung function) 4. Chronic changes in physiologic functions 5. Chronic cardiovascular diseases 6. Intrauterine growth restrictions (low birth weight at term, intrauterine growth retardation, small for gestational age) 7. Mortality due to cardiovascular & respiratory diseases 8. Lung cancers

As air pollution is recognized to impact health of a large population living in both urban and rural areas in India, there is an urgent need to develop state specific health adaptation plan related to air pollution. So, this will help develop state specific objectives and targets to prioritize resources to address health related issues in context of air pollution.

IV. Structural and Functional Flow of activities on ‘Air Pollution and Health’ under the NPCCHH programme.

The various structural and functional elements to implement action plan on Air Pollution and Health under the NPCCHH programme is shown below in the Figure 1. It shows structures and the flow of functions initiating from Ministry of Health and Family Welfare percolating down to the States/UTs and District level, including collaboration with other Ministries and Departments, international and national premier institutes and NGOs working with the aim

Fig.1 Structural and Functional Flow of Activities on Air Pollution and Health under NPCCHH (MoHFW)



V. Vision, Goal and Objectives of ‘Air Pollution and Health’ under the NPCCHH programme

The Vision, Goal and Objectives of the Health Adaptation Plan on Air Pollution and Health under the NPCCHH programme are briefly outlined in the Table 3.

Table 3: Vision, Goal and Objectives of the Health Adaptation Plan on Air Pollution and Health under the NPCCHH programme

Vision: A resilient health system that promotes health and protects against health impacts due to air pollution for all citizens of India, especially the vulnerables which include children, women, elderly and marginalized populations etc.

Goal: To reduce morbidity, mortality, health vulnerability due to air pollution

Objective: To develop comprehensive response of the health system for prevention and control of health impacts due to air pollution

Specific Objectives:

1. To create awareness on health impacts due to air pollution among general population, vulnerable communities, health-care providers and policy makers.
2. To strengthen the capacity of the health system (infrastructure, training, guidelines, SOP) to respond to health problems related to air pollution.
3. To strengthen health preparedness and response at national / state/ district/ sub-district levels to cope with adverse health impacts due to air pollution.
4. To conduct situational analysis of the health problems in the context of air pollution in the state
5. To develop partnerships with other related stakeholders in the government and non-government sectors including civil society, and create synergy to ensure that health related issues are adequately represented in policies in the country.
6. To strengthen supervision and monitoring mechanisms of the programme related activities
7. To develop research capacity at State level to understand linkages of air pollution and health outcomes and develop mechanisms to fill gap in the evidence-based health policy

VI. Comprehensive Health Action Plan on 'Air Pollution and Health' under the programme

A comprehensive health action plan on 'Air Pollution and Health' under the National Program on Climate change and Human Health (NPCCHH) is being developed to protect, prevent control *health problems and* reduce morbidity and mortality due to illnesses related to air pollution.

The major components of the comprehensive health action plan on air pollution and health are shown in the Table 4.

Table 4: The major components of the comprehensive health action plan for air pollution and health.

- A. *Situational Analysis* of illnesses in context of Air Pollution
- B. Awareness generation through targeted IEC for vulnerable populations in locally acceptable language
- C. Surveillance establishment on illnesses due to air pollution to help understand the health problems in the area.
- D. Need-based Capacity Building: training, workshops, meetings to be conducted to sensitise and to update on activities related to air pollution and its health impacts.
- E. Public health Management of the illnesses: based on the reported pattern of illnesses, types and severity of illnesses reported at the health facilities, management of the available resources (human resources, materials and finances) to address the health problems
- F. Timely issue of alerts/warnings on health risk factors related to the air quality level (AQI) and weather conditions like temperature, humidity etc. obtained from IMD/Pollution Control Boards to the health professionals and the people.
To coordinate with other sectors to promptly alert/ early warning for health risk factors related to air pollution like AQI levels, weather and other relevant data.
- G. Operational Coordination with other stakeholders (Health & Non-health)

The major components considered under the comprehensive health action plan on air pollution and health are described in detail in the following sections:

A. *Situational Analysis* for illnesses in context of Air Pollution

1. ***Vulnerable area*** - Geo-physical & climatic variables (geography, meteorological variables, extreme weather conditions, green cover, industries, type of occupations and practices).
 2. ***Selection of air pollution hotspots***: States may refer to the MoEFCC website for enlisting their non-attainment cities as listed under the National Clean Air Programme. But, as the AQI levels are dependent on various natural and human-induced activities, the hot-spots for poorer air quality may vary from day to day at any place. Some suggestive lists of hotspot areas are those which are likely to have higher air pollution (hazard), risk of exposure and health impacts to those exposed, for example, area with routine traffic congestion, industrial area, schools, bus/ truck bay etc. Detailed surveys to identify such hotspots needs to be conducted by the State and should update data regularly in terms of the AQI level displayed at CPCB/ SPCB websites. States may preferably maintain a digital and live database for:
 - I. Districts covered under the AQI monitoring:
 - a) districts with live AQI monitoring ((also include details like number of the monitoring station, type of monitoring at those stations, etc. if available) and
 - b) High-risk districts with no monitoring data
 - II. Enlist vulnerable areas for high air pollution levels as ‘hotspots’ in spatio-temporal trends as per CPCB or SPCB.
 - III. Document episodic event contributing to worsening of AQI like Crop residue burning or high bio-aerosol seasons.
 - IV. Periodically seek list and update hotspots as per data at CPCB or SPCB.
 - a. ***Vulnerable population***- Air Pollution affects all but the effects may vary. Vulnerable groups are identified as under-five children, adolescents, elderly, pregnant females, those with underlying medical conditions, outdoor workers, migrants and those working in areas close to emission sources. To compile
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and enlist the burden of diseases like respiratory, cardiac, cerebro-vascular diseases, allergies and other non-communicable diseases like diabetes etc.

- b. Information at State/ district/ sub-district level on disease burden and risk factors can be obtained various national surveys (NFHS, NCD Survey), programme data (NPCDCS), locally conducted research (from Medical colleges) should be periodically obtained.
- c. Document specific risk factors at population level such as tobacco use, salt intake, alcohol use, biomass fuel use, if identified, for the above said types of illnesses
- d. Vulnerability mapping: A preliminary assessment for risk factors may be made using AQI level, weather and other meteorological variables against illnesses reported.

Information of the following needs to be collected at district level

Health outcomes (Proportion and mortality)	Risk factors (prevalence/ proportion)
• Chronic Respiratory Diseases (COPD, Asthma) • Hypertension • Diabetes Mellitus • Myocardial infarction • Stroke	• Tobacco use • Alcohol use • Salt intake • Physical inactivity • Obesity • Use of biomass fuel for cooking • Stress levels

3. Resource mapping & Stakeholder analysis for providing healthcare services:

- i. **Health care Infrastructure:** enlist type of services available (PHC, CHC, District hospital, Tertiary care hospitals- Government as well as Private)
- ii. **Human resources:** availability of trained human resources to manage illnesses due to exposure to air pollution (Cardio-pulmonary-cerebro-vascular illnesses).
- iii. **Logistics:** Availability of essential equipments and technologies, drugs and supplies for managing illnesses. (may refer to NPCDCS programme operational manual for list of essential equipments and technologies at various levels of health facilities)
- iv. **Healthcare facilities** to avail the services at the health facility preferably for more accessibility to far off people and more cases are reporting or attending the facility
- v. **Mapping of potential stakeholders** (health & non-health) who may be contributing in reduction of AQI levels through the mitigation activities or providing support to the vulnerable population.

Expected Outcome of Situational analysis:

- Database of high-risk areas, frequently identified as hot spots as per AQI level (data available at CPCB /SPCB/ or app like SAMEER, SAFAR or Urban Emission).
- District Maps highlighting more vulnerable population in terms of demography (age, gender, occupation, residential area, work area),
- Health facilities where healthcare services are sought more, for examples - higher bed occupancy rate/ Emergency/OPD attendance rate etc.
- Episodic calendar indicative of various illnesses depicting the pattern of illnesses (respiratory, cardiovascular, cerebrovascular problems) in relation to AQI and weather variables.

B. Establish surveillance on illnesses due to air pollution to help understand the health problems in the area and establish a pattern

Some steps to conduct Sentinel Surveillance for illnesses in context of air pollution at the identified hospital like the emergency department of a hospital are as follows:

- a. Selection of sentinel surveillance cities
 - i. Prioritise the non-attainment cities as identified under National Clean Air Programme of the MoEFCC
 - ii. Prioritise to select cities in the state with higher AQI levels or of poorer air quality level from among the more air polluted cities

For example: Considering cities for the surveillance may be done if the previous data of the AQI in the city are available and as follows

High Priority Cities – Cities with Annual average AQI consistently in very poor or more categories for last three years

Mid Priority cities - Cities with Annual average AQI consistently in poor category for last three year

Low priority Cities - Cities with Annual average AQI occasionally goes in poor category for last three years

Cities with AQI value of poorer categories may be considered for at least a span of last one year if data are not available.

- iii. Refer SPCB or SAFAR, if state has ‘none of its city’ been listed under the Non-attainment cities’ list under NCAP of MoEFCC

b. Selection of sentinel surveillance hospitals

- i. Hospitals (Public/ Private) having a high footfall of patients in its emergency department especially due to respiratory and cardio-vascular diseases
 - ii. Medical/ tertiary care hospitals with facilities for treating respiratory and cardio-vascular emergencies
 - iii. District/ Civil hospital may be selected if it is the first referral centre for primary and secondary healthcare facilities.
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- iv. At least, 4-5 sentinel hospitals per city may be identified for representativeness of the city
- c. Conduction of surveillance in the sentinel hospitals
 - i. Sentinel hospital at present to collect daily data of respiratory emergencies for 24 hours and report against total attendance of patients in the emergency department for the corresponding day.
 - ii. Nodal Officer of sentinel hospital to send the report to Nodal Officer at District level, in format (annexed A-I, II, III)
 - iii. District Nodal Officer – Climate Change to collect and collate data of sentinel hospitals. DNO-CC must take the AQI level for the corresponding day (Annexure C). Similarly, data has to be collated and analysed at the State level against the AQI levels.
 - iv. A monthly report and the collected data to be sent to the NCDC before specified date.

(Details on the surveillance may be referred to the SOP on the surveillance in context of air pollution developed under the NPCCHH programme)

C. Public health management of illnesses: based on the reported pattern of illnesses, types and severity of illnesses reported by the health facilities, management plan of the available resources (human resources , materials and finances) to address the health problems **may be created**

- a. Appropriate allocation of human resources in the hospital / healthcare facilities
 - b. Enlisting of essential and desirable logistics, equipments, drugs, vaccine etc. for managing health problems reported to the healthcare facilities like acute respiratory illnesses, exacerbation of cardio-vascular illnesses or other allergic manifestations etc.
 - c. Emergency plan to be prepared with the roles and responsibilities of stakeholders (health & non-health)
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- d. Refer to NPCDS programme for management of non-communicable diseases.

D. Awareness generation through targeted IEC for vulnerable populations in locally acceptable language

- ❖ Develop/ translate communication messages for audio-visual and print media
- ❖ Mass campaign using print IEC or electronic messages (audio/ audio-visual)
- ❖ Advocacy and public awareness through Street Plays, folk methods, wall paintings, hoardings etc.
- ❖ Social mobilization (women's self-help groups, community leaders, NGOs, school children) for adaptive measures for health impacts of due to air pollution.
- ❖ Considerations of areas for IEC development may be follows:

Considerations for IEC development on Air Pollution and health

Air Pollution is recognised as greatest environmental and avoidable risk factor for human health and found to be associated with health problems, deaths, disabilities and reduced life expectancy.

- More vulnerable populations (children, women, elderly, underlying medical conditions etc.)
- More vulnerable cities or areas of exposures, months, diurnal variations of air pollutions
- Air quality, AQI and its alerts and associated health advisories
- Promotion of activities related to reduction of air pollution – Use of public transport, avoiding biomass burning, use of cleaner fuel for cooking, avoid firecrackers, crop and waste burning etc.
- Prevention of risk factor for illnesses like cardio-pulmonary diseases – promotion of healthy diet, physical activity, no use of tobacco and alcohol
- Other health adaptive measures to air pollution
- Do's and Don'ts as shared in the developed IEC under the NPCCHH and also, in

E. Operational Coordination with other stakeholders (Health & Non-health)

State and District Nodal Officers-Climate Change may coordinate with the Principal Secretary (Health) at the State level and District Magistrate / District Collector at the district level to ensure multi-sectoral involvements for development of state or district level health action plans in the State/District Task Force Meetings (Multi-sectoral).

The following Ministries/ Departments/ Agencies may be referred or involved for the multi-sectoral coordination for developing HAP related to air pollution and health:

- a. **MoEFCC**: for mitigation action information including revised plans and actions related to air pollution.
 - b. **Pollution Control Board**: CPCB/ State Pollution Control Board/ District Pollution Control Board for the air quality information or AQI in the city/area and its forecast.
 - c. **Ministry of Earth and Sciences**: informations from Indian Meteorological Department/ SAFAR related to forecasting or timely early warning of weather temperature, humidity, wind direction and speed etc.
 - d. **Agriculture**: Actions preferably to reduce stubble burning which is considered to aggravate air pollution; alteration in cropping pattern to reduce pollen count in an area
 - e. **Other national health programmes** - like Non-communicable diseases for managing cardiopulmonary illnesses (NPCDCS) etc. which also address health issues related to air pollution
 - f. **Medical Commissions and health related councils** to include curriculum on air pollution and its health impacts to increase awareness and capacity building of the health professionals-medical, dental, nursing and AYUSH professionals.
 - g. **Women and Child Development Department**: Advocate through Self Help Groups and Mahila Mandals for protection of the health of the women and children from significant exposure to smoke from biomass while inside the house. Awareness raising can be done to improve household ventilation to reduce smoke inhalation from lighting (ex. kerosene) or cooking fuels.
 - h. **Under the Ministry of Petroleum & Natural Gas**, initiatives like PM Ujjawala scheme to increase the availability of LPG and other cleaner fuels to the rural
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& tribal areas; expanding the piped natural gas network to reach out to a larger population and better target LPG subsidies to poorer households.

- i. **The Ministry of Road & Transport and Highways** ensure effective implementation of New Motor Vehicles Act (once approved) and to ensure proper engine checks for vehicles to assess pollution levels.
- j. **Panchayati Raj** may be preferably involve to create enabling conditions to facilitate community participation like self-help groups.
- k. **Academic institutes/ medical colleges** capacity building, operational and community-based research related to air pollution and related health intervention areas.

F. Timely issue of alerts/warnings on health risk factors related to the air quality level (AQI) and weather conditions like temperature, humidity etc. obtained from IMD/Pollution Control Boards to the health professionals and the people

To coordinate with other sectors like Indian Meteorological Departments, SAFAR, Pollution Control Boards in an area for information on the air quality level and weather conditions like AQI level, temperature, humidity, wind speed and direction in an area which are likely to increase the health issues among the more vulnerable groups of people. The information of the health risk factors may be conveyed in advance as an alert or early warning information as forecasted by the concerned Ministries/Departments.

G. Need-based Capacity Building of the health professionals and workers:

Trainings, workshops and meetings to sensitise and update on air pollution and its health impacts and its various health adaptation mechanisms.

Development of state level Training of Trainers (ToTs), District nodal officers, designated nodal officers related to surveillance in context of air pollution, Medical Officers and other health professionals like nursing officers, pharmacists and community health care workers such as ASHA in the health sector on the health problems of air pollution, the various health action plans to address the health issues of the more vulnerable people.

VII. Roles and Responsibilities of the Nodal Officers on Air Pollution and Health

The Nodal Officers-Climate Change under the National Program on Climate change and Human health are responsible for coordinating with the members of multi-sectoral State/District Task Force in the State to implement the programme.

1. State Nodal Officer- Climate Change at the State level
 2. District Nodal Officer- Climate Change at the District level
 3. Medical Officer at the block level
 4. Nursing officers, Pharmacists
 5. Community level Health professionals
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- **State Nodal Officer – Climate Change**

Roles and responsibilities of State Nodal Officer-Climate Change

1. To coordinate with the State level Task Force Meetings to develop a Health Action Plan on Air pollution and Health as part of the State Action Plan on Climate Change and Human Health (SAPCCHH)
2. To undertake Situational analysis of health impacts in the context of air pollution in the State:
 - a. Reports/Documents/Policies developed related to Air pollution and Health undertaken in various programmes and in other departments in the State.
 - b. AQI Monitors installed in State (CPCB/SPCB// SAFAR)
 - c. Hot spot sites in context of air pollution identified - CPCB/SPCB//SAFAR
 - d. AQI Monitors required in the non-attainment cities/ hot spot areas.
 - e. Identification and capacity building of Human Resources –
 1. Professionals from Medical Colleges, Directorate Health, Institutes working related to Air Pollution, NGOs etc.
 2. Notification of designated Nodal Officers at every levels- district / block
 3. Identification of nodal officers from the designated sentinel hospitals in context of air pollution
 4. Capacity Building of Nodal Officers and other health professionals and Community Health Workers- ASHAs, AWWs
3. IEC Development/Translation and Dissemination Plan
4. Development and Dissemination of Health Advisories
5. Surveillance establishment in context of air pollution
6. Hospital Preparedness related to air pollution
7. Timely issue of warnings to more hotspots areas, health professionals and more vulnerable and general population
8. To coordinate with the district nodal officers for overall periodic reviews, Supervision, Monitoring and Evaluation of the identified activities being carried out at all levels – State, Districts, Blocks, Towns and Villages/wards

Besides above, the nodal officers including the State nodal officers at various levels in the State have important roles to address increasing health problems related to the allergic health problems with the change in climate and weather in an area like temperature, humidity etc. Allergic health problems may also occur due to raised pollen counts which are known to vary with seasons, changes in seasons, dust storms, extreme weather events like cyclones, floods etc. The following considerations on health risk factors and adaptation plans may be done while addressing such health issues in an area-

1. Months known to have raised pollen counts which can increase the respiratory problems also in different regions in the country

Region of India	Pollen season which may aggravate allergic health problems
Northern India	February.-April and September.-November
Eastern India	August and March-July
Southern India	August-November and February.-April
Central India	March-Mid-May, September.-November. and December.-February.

2. During transitions between seasons, pollen counts may raise and can create more allergic health problems which may be as follows:
 - a. Winters seasons: more of acute exacerbation of allergic health problems due to indoor allergens
 - b. Winter to Spring change: increase in grass and tree pollens
Increase in outdoor moulds
 - c. Spring to summer change: grass pollens, mould spores peak in warm regions

3. When humidity levels in the atmosphere change, there can be an increase in the allergic health problems and these may be as follows:
 - a. High humidity and hot environment: increase in moulds and dust mites
 - b. High humidity and worsening of air quality: Increase in asthmatic attacks
 - c. Increase in ozone level and high humidity: increase in respiratory illnesses like asthma
 4. During and after extreme weather events like floods, thunderstorms, cyclones and natural disasters etc. and these events are increasing in frequency and magnitude with climate change, pollen counts may increase due to disruption of the environment and increased risk of exposures for allergic health problems including skin and respiratory problems etc.
 5. To address the above allergic health issues, the following health action considerations may be taken up to include at various levels in the state as follow:
 - Written SOPs to list out the allergenic months and seasons in an area in context of the climate change and to prioritize health problems particularly respiratory problems like asthmatic attacks at the healthcare facilities
 - Customized medication plans to treat allergic symptoms and health problems
 - Ensuring the availability of the drugs such as antihistamines, nasal sprays, inhalational medicines and vaccines to help reduce the allergic health issues
 - Before major festivals and episodic events like crop residue burning which are associated with air pollution and increasing health problems-
 - Awareness generation on prevention especially before festivals known to raise levels of pollutants and for seeking health advice
 - Enhanced Healthcare preparedness including logistics, drugs etc.
 - Increase public awareness on climate change and allergic problems
 - ✓ Secondary prevention of allergy
 - ✓ Maintaining adequate humidity levels at home
 - ✓ When to restrict outdoor activities
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- **District Nodal Officer-Climate Change**

The District Nodal Officer-Climate Change is responsible for the successful implementation of the programme at the district level and to coordinate with officials both health and non-health sectors.

Roles and responsibilities of the District Nodal Officer-Climate Change

- To develop a Health Action Plan on Air pollution and Health as part of the DAPCCHH
- To undertake Situational analysis on air pollution and health at district level
 - I. Reports/ Documents/Policies developed related to Air pollution and Health undertaken in the district
 - II. AQI Monitors installed in district (CPCB/SPCB/SAFAR or NCAP)
 - III. Hot spot sites identified - (CPCB/SPCB/SAFAR or NCAP)
 - IV. Monitors required in hot spots
 - V. Human Resource-
 - Professionals from Medical Colleges, Training Institutes
 - Notification of designated Nodal Officers at every levels
 - Capacity Building of Medical Officers, health professionals & workers
 - Community Health Workers- ASHAs, AWWs
- IEC Dissemination Plan
- Dissemination of Health Advisories
- Surveillance establishment and reporting (ARI Sentinel Surveillance at present)
- Healthcare facilities preparedness
- Timely issue of warning/ alerts to more hotspot's areas, health professionals and more vulnerable and general population
- Periodic reviews, Supervision and Monitoring of the identified activities-
 - IEC, Capacity Building, Surveillance, Preparedness of Healthcare facilities-
 - a. District
 - b. Block

c. Town	d. Village/ Ward

- **Block Medical officer**

Block Medical officer has the roles and responsibilities to implement the programme at the block level:

- Implementation of the identified activities on air pollution and health as per DAPCCHH or in consultation with DD-CC/SNO-CC
- Capacity Building of
 1. Medical officers
 2. Nursing officers
 3. Pharmacists
 4. Communities health officers/workers
- Integrate and coordinate to get support from Rashtriya Bal Swasthya Karyakram and Rashtriya Kishore Swasthya Karyakram
- IEC Dissemination for increasing awareness generation to public and officials
- Health advisories dissemination
- Hospital preparedness for public health emergencies related to air pollution
- Supervision and Monitoring of Surveillance activities if any sentinel hospitals are involved in the block area

Medical officer at the Primary Health Centre/ Urban Healthcare Centre level:

Medical officer is responsible for implementing Comprehensive Primary Healthcare Services through a network of Health and Wellness Centers that are envisaged in the Ayushman Bharat to provide promotive, preventive, and curative services etc. near the community through active participation of the whole team through following actions:

- I. Creating awareness at the healthcare facilities and at the community level

- II. Capacity building, developing village level health action plan related to air pollution.
- III. Management of outdoor cases of health problems, emergency services and their referrals for cases in context of air pollution
- IV. Outreach health action plans to deal health problems related to air pollution.
- V. Supervision and Monitoring of the activities implementing under the area.

Roles of the Nursing officers/Staff Nurses-

- a. Public awareness generation on promotive, preventive and control of health problems related to air pollution
- b. Patients attending Outdoor, emergency and immunisation areas etc. may be aware of adverse health impacts of air pollution particularly to children, women and pregnant women
- c. Capacity building of the community level Health workers on health problems
- d. Preparedness of the resources and logistics for managing of cases associated with air pollution particularly respiratory and cardiac cases etc. attending emergency, ward, outdoor departments etc.
- e. Coordinate with hospital administrators, doctors and staffs for managing of diseases related to air pollution

Roles of the Pharmacists:

Regarding procurement, stock maintenance, logistics supply including Medicines, Equipments, Ambulances etc for the health facility-

- a. To enlist required drugs and medications, stock and buffer maintenance and availability of drugs/ medicines required for managing diseases due to air pollution like Cardio-pulmonary Diseases and allergies.
- b. Prioritise procurement of logistics, drugs and medications, kits like antiallergic and respiratory medications, oxygen supply, nebulisers etc. which are required to deal with health problems due to air pollution also such as Cardio-pulmonary Diseases and allergies (Annexure E)

- c. To make functional of the equipments, proper maintenance and repair of the logistics like nebulisers, ventilators etc. to manage diseases such as cardio-pulmonary and allergic problems.

Community Health workers at the Village Level/ Ward Level

- Village Health Sanitation Nutrition Committee in Rural areas
- MAS (Mahila Arogya Samiti) in Urban wards
- Community level public awareness generation on health effects of air pollution, and ways to protect and prevent health problems

ASHAs are community level health workers who link between the community and the healthcare system. With their community outreach activities, following may be done.

- a. Awareness generation at the community level on the sources of air pollution, health problems and ways to protect and prevent air pollution
- b. Organize campaigns particularly on health problems of women and children related to air pollution.

AWWs – (Through CDPO): At the Anganwadi centres during immunisation sessions, awareness generation may be given on the sources of air pollution in the household and outside, its health problems particularly on women and children and ways to address them

Convergence of the programme with the other health implementing schemes :

1. Rashtriya Bal Swasthya Karyakram (Children upto 18 years)

- I. Visit of RBSK teams at government/ government-aided schools at the block level twice a year to create awareness among children at school
 - II. RBSK teams visit and sensitize on air pollution and health to Anganwadi Workers (AWWs). Women beneficiaries can be targeted through AWWs.
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2. Rashtriya Kishore Swasthya Karyakram (Adolescent Health)

- I. Identifies Peer Educators who are enthusiastic teenagers with good communication skills on air pollution and health
- II. To make them aware of the adverse impacts of air pollution on human health and measures to avoid health risks
- III. Inclusion of a chapter on air pollution and health in their training module.

VIII. Graded Health Response Action Plan according to the Air Quality Level (Air Quality Index categories)

Air pollution may affect the health of the people particularly the more vulnerable populations depending on the quality of the air, which is usually expressed in the Air Quality Index (AQI). Some health-related events like increased hospitalization are index of morbidity due to air pollution.

Health of the people may be affected according to the various AQI category levels depending on the vulnerability and hazard exposure as follows (as per CPCB):

AQI level (as per CPCB)	AQI level in relation to Health
<100	Good to Satisfactory
101-300	Moderate to Poor
301- 400	Very Poor
400- 500	Severe
> 500	Severe + or Emergency

Based on data and seasonality, States must be prepared to manage health issues arising due to worsening air quality. As a precautionary measure following activities can be planned

- Refresher training exercise of different stakeholders
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- Ensuring availability essential medicines, equipment and technologies at all health facilities
- Situation analysis
- Prepare schedule for awareness activities at community level like radio announcements, community announcements, news paper announcements

Based on the worsening of air quality (AQI) along with variation in temperature and humidity, health problems due to air pollution may vary and increase. The following health related measures may be taken up as responses by the health sector at various levels accordingly:

AQI: Good to Satisfactory (AQI <100) Temperature: Low, Humidity: Low	Clinical manifestation: Acute respiratory problems; Hypertension, Acute Coronary Syndrome, Heart failure and Indoor pollutants' allergies
AQI: Good to Satisfactory (AQI <100); Temperature: High, Humidity: High	Clinical manifestation: Grass pollen allergies, mold spore allergies, acute respiratory problems including asthmatic exacerbations and severe attacks; Heat related illnesses and stroke (death/ morbidity), dehydration, Chronic Kidney Disease,

Interventions to do on Air Pollution and Health	Intervention Agencies / Officials
1. State /District level Task Force Meetings (Multi-sectoral) to continue considering 'Air Pollution and Health' as important agenda with other Ministries and Departments helping to mitigate air pollution etc.	By State /District level Task Force and State/District Nodal Officer-Climate Change

• Forests (CPCB/SPCB/DPCB) • Agriculture • Transport • Construction • Power/coal-based power plants • Industries • Education (Schools/Colleges) • NGOs related to air pollution	
2.Coordination to get information on Air Quality (AQI) of non- attainment cities under NCAP and other hotspots identified and its forecast from CPCB/SAFAR/ SPCB/ DPCB etc. – website/mobile app. where daily AQI can be available and dissemination of the same with main stakeholders in health sector.	By State/District Nodal Officer-Climate Change, CMO/CMHO, Medical Superintendent, Block Medical Officer, Medical Officer of the Healthcare facilities in coordination with officials of the respective pollution control boards
3.Awareness generation on air pollution, health effects and ways to protect, prevent, control using acceptable modes of IEC creatives in local language- print, audio visuals wherever applicable, area Identification (Hotspots) for IEC campaigns, Involved Health personnels and target groups for IEC	By State/District Nodal Officer-Climate Change; CMO, MS, BMO, MO and Healthcare workers Healthcare facilities
Capacity building of health professionals to address illnesses due to air pollution like cardio-pulmonary problems, allergic health problems, NCDs etc.	By State/District Nodal Officer-Climate Change
Arrange manpower, logistics, drugs, kits for illnesses due to air pollution like cardio-pulmonary & allergic health problems	By State/District Nodal Officer-Climate Change

Sentinel Surveillance on air pollution related illnesses (ARI, CPD & Allergies)	By State/District Nodal Officer-Climate Change; Nodal Officers of Sentinel Surveillance Hospitals
Situational analysis, risk mapping and vulnerability assessment on Air Pollution and Health Mock-drill, if required, for health facility preparedness	By State/District Nodal Officer-Climate Change Head of the healthcare facilities

AQI: Moderate to Poor (AQI 101-300) <i>Concentration values of Ambient $PM_{2.5}$ ($61-120 \mu g/m^3$)/PM_{10} ($101-350 \mu g/m^3$)</i> Temperature: Low, Humidity: Low	Clinical manifestation: Acute Respiratory Illnesses, Dust Allergies, Asthma exacerbation, Rhino-ocular symptoms, Cardiovascular problems- Acute Coronary Syndrome
AQI: Moderate to Poor (AQI 101-300); <i>Concentration values of Ambient $PM_{2.5}$ ($61-120 \mu g/m^3$) or PM_{10} ($101-350 \mu g/m^3$)</i> Temperature: High, Humidity: High	Clinical manifestation: Acute Respiratory Illnesses, grass pollen allergies, mold spore allergies, Asthma exacerbation asthmatic attacks, cardio-vascular problems, Heat related illnesses and stroke (death/ morbidity), Dehydration, Chronic Kidney Disease,

Additional activities besides the above activities mentioned in the good to satisfactory categories of air pollution	Intervention agencies/officials (health sector)
Increase monitoring for implementation of the above activities weekly	By State/District Nodal Officer-Climate Change; CMO, MS, BMO, MO and Healthcare workers Healthcare facilities
More IEC activities to hotspot areas	

Increase coordination for sharing of AQI levels and its forecast information to health care facilities and health professionals/workers	By State/District Nodal Officer-Climate Change; CMO, MS, BMO, MO and Healthcare workers Healthcare facilities and coordination with the pollution control boards
Healthcare facilities to increase emergency and OPD services etc. and logistics availability to address the demands	By State/District Nodal Officer-Climate Change; CMO, MS, BMO, MO and Healthcare workers Healthcare facilities

AQI: Very Poor (AQI 301- 400); <i>PM_{2.5} (121-250 $\mu\text{g}/\text{m}^3$) or <i>PM₁₀ (351-430 $\mu\text{g}/\text{m}^3$)</i> Temperature: Low, Humidity: Low</i>	Clinical manifestation: Acute Respiratory Illnesses, Asthma exacerbation, Rhino-ocular symptoms, Acute Coronary Syndrome, dust Allergies,
AQI: Very Poor (AQI 301- 400); <i>PM_{2.5} (121-250 $\mu\text{g}/\text{m}^3$) or <i>PM₁₀ (351-430 $\mu\text{g}/\text{m}^3$)</i> Temperature: High, Humidity: High</i>	Clinical manifestation: Acute Respiratory Illnesses, Asthma exacerbation Heat stroke (death/ morbidity), dehydration, Chronic Kidney Disease, grass pollen allergies, mold spores allergies, asthmatic attacks, trigger for cardiovascular collapse.

Additional activities besides the above activities mentioned in the moderate to poor categories of air pollution	Intervention agencies/officials (Health sector)
Increase monitoring of the above activities daily wise	By State/District Nodal Officer-Climate Change; CMO, MS, BMO, MO and Healthcare workers Healthcare facilities
More IEC activities for the public	

including the hotspot areas and community outreach activities	To coordinate with the Pollution Control Boards for timely information
Increase coordination for sharing of the AQI levels and its forecast information to health care facilities and health professionals/workers	
OPD activities to increase including outreach services if required	CMO, MS, BMO, MO, Nursing Officers and Healthcare workers Healthcare facilities
Emergency Services/Indoor Services Logistics arrangements	
Healthcare facilities to strengthen its preparedness and services overall	

AQI: Severe (AQI 400- 500) $PM_{2.5}$ (~250 $\mu g/m^3$) or PM_{10} (430 $\mu g/m^3$) Temperature: Low, Humidity: Low	Clinical manifestation: Acute Respiratory Illnesses, Asthma exacerbation, Rhino-ocular symptoms, Acute Coronary Syndrome, dust Allergies, IHD
AQI: Severe (AQI 400- 500) $PM_{2.5}$ (~250 $\mu g/m^3$) or PM_{10} (430 $\mu g/m^3$) Temperature: High, Humidity: High	Clinical manifestation: Acute Respiratory Illnesses, Asthma exacerbation Heat stroke (death/ morbidity), dehydration, Chronic Kidney Disease, grass pollen allergies, mould spores allergies, asthmatic attacks, trigger for cardio-vascular collapse.
Intervention activities to do under the NPCCHH programme	Intervention agencies/ officials (Health sectors)

Increase Review/Monitoring of implementing activities on air pollution and Health Daily-wise. Increase coordination with other Ministries and Departments on the information of the actions to minimize air pollution etc. • Forests (CPCB/SPCB/DPCB) • Agriculture • Transport • Construction • Power/coal-based power plants • Industries • Education (Schools/Colleges) • NGOs related to air pollution	State/District level Task force By State/District Nodal Officer- Climate Change
Daily alert and update to coordinate on the information of AQI level and its forecasts from CPCB/SAFAR/ SPCB/DPCB to health officials if required for further actions and planning	By State/District Nodal Officer- Climate Change in coordination with pollution control boards
Continuous monitoring whether the Health Advisories Dissemination is in the hotspot area and vulnerable populations are reached	State/District Nodal Officer-Climate Change
IEC activities to increase for the public in the identified more Hotspot areas	Healthcare facilities and Community level health care workers (ASHA/AWW) School health team- Teachers may increase awareness generation to students in School / Colleges
Timely and Complete Reporting of sentinel surveillance data on health problems in context of air pollution to relevant officials for actions	Sentinel Hospitals, Hospital Nodal Officers, District/State Nodal Officer

Outreach OPD facilities and referrals related to illnesses due to air pollution	Health care professional team
Increase outreach OPD facilities and referral services if required for illnesses due to air pollution	Director/MS/CMO-IC/BMO/MO-PHC
Strengthening OPD services for Paediatrics/ Medicine/ Respiratory Medicine and other NCD Clinics	Nodal Officers of the Emergency Department
Strengthening Emergency Department for illnesses due to respiratory, cardiovascular emergencies	Pharmacists/Logistic Procurement section
Availability of Logistics, Drugs, equipments for cardiorespiratory emergencies- Drugs, Nebulisers, Ventilators, oxygen cylinders or supply, Ambulances etc.	Nursing Superintendents, Nursing Officers
More Community Outreach activities- awareness generation	Community level health workers (ASHA, AWWs)

AQI: Severe +/- Emergency (AQI > 500) <i>PM_{2.5} (300 µg/m³) or PM₁₀ (500 µg/m³) persisting for 48 hours or more</i> Temperature: Low, Humidity: Low	Clinical manifestation: Acute Respiratory Illnesses, Asthma exacerbation, Dust Allergies, Rhino-ocular symptoms, Acute Coronary Syndrome, Ischaemic Heart Diseases
AQI: Severe +/- Emergency (AQI > 500) <i>PM_{2.5} (300 µg/m³) or PM₁₀ (500 µg/m³) persisting for 48 hours or more</i> Temperature: High, Humidity: High	Clinical manifestation: Acute Respiratory Illnesses, Asthma exacerbation, Heat stroke (death/ morbidity), Dehydration, Chronic Kidney Disease, grass pollen allergies, mold spore allergies, asthmatic attacks, trigger for cardio-vascular collapse.

Activities to do under the programme**Intervention by health sector (Healthcare
Facilities + Community Outreach)**

Increase Review/Monitoring of activities related for the air pollution and health on a daily basis Increase coordination with other Ministries and Departments which help to mitigate air pollution etc. • Forests • Agriculture • Transport • Construction • Power/coal-based power plants • Industries • Education (Schools/Colleges) • NGOs related to air pollution	State/District level Task force By State/District Nodal Officer- Climate Change
Daily alert and update to coordinate on the information of AQI level and its forecasts from CPCB/SAFAR/ SPCB/DPCB to health officials if required for further actions and planning	By State/District Nodal Officer- Climate Change in coordination with pollution control board officials if required
Continuous monitoring whether the Health Advisories Dissemination is in the hotspot area and vulnerable populations are reached	State/District Nodal Officer-Climate Change
IEC activities to increase for the public in the identified more Hotspot areas	Healthcare facilities and Community level health care workers (ASHA/AWW) School health team- Teachers may increase awareness generation to students in School / Colleges

Timely and Complete Reporting of sentinel surveillance data on health problems in context of air pollution to relevant officials for actions	Sentinel Hospitals, Hospital Nodal Officers, District/State Nodal Officer
Increase outreach OPD facilities and referral services if required for illnesses due to air pollution	Health care professional team
Strengthening OPD services for Paediatrics/ Medicine/ Respiratory Medicine and other NCD Clinics	Director/MS/CMO-IC/BMO/MO-PHC
Strengthening Emergency Department for illnesses due to respiratory, cardiovascular emergencies	Nodal Officers of the Emergency Department
Availability of Logistics, Drugs, equipments for cardiorespiratory emergencies- Drugs, Nebulisers, Ventilators, oxygen cylinders or supply, Ambulances etc.	Pharmacists/Logistic Procurement section
Enhanced functional Emergency/Hospital Beds; Emergency Medicines/Drugs/Equipments Counselling/Awareness Generation to patients/families and relatives	Nursing Superintendents, Nursing Officers
More Community Outreach activities- awareness generation	Community level health workers (ASHA, AWWs)

IX. IEC materials related to Air pollution and Health under NPCCHH programme

The IEC materials are being developed in context of Air Pollution and Human Health under NPCCHH programme which are in the form of **Print, Audio- Visuals, Social media messages**. Certain IEC materials are being shared here.

States are to develop media action plan to organize and do campaign for public awareness generation on air pollution and health. States may do development, translation and dissemination planning of the related IEC creatives or may coordinate with the programme division for its support. While developing media action planning and

its dissemination, the states may take into considerations of types of media, culturally and acceptable languages, areas of hotspots to conduct and areas for more visibility and reaching the masses, the calendar months to increase the IEC campaigns for the public and these are usually more in the colder months starting September to February - March though air pollution occurs throughout the year and during seasonal spikes in an area. Village level media plan may consider for inclusion of air pollution and health consideration for the vulnerable areas, populations and the timing and duration of the days/months in a year. States may share their specific IEC developments with the programme division and this may help support other states also in their media plan and IEC organizing and campaigns.



स्वास्थ्य एवं परिवार कल्याण मंत्रालय
भारत सरकार



समझदार बनें... प्रदूषण के असर से बचें





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वायु प्रदूषण से अत्याधिक जोखिम वाले लोग



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5 वर्ष से छोटे
बच्चे



गर्भवती महिलाएं



बुजुर्ग लोग



श्वसन
रोग मरीज



हृदय रोग
के मरीज



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Consult Doctor for



Giddiness



Breathlessness



Cough



Chest discomfort



Irritation
in eyes

www.mohfw.gov.in



स्वास्थ्य एवं परिवार कल्याण मंत्रालय
भारत सरकार

प्रदूषित हवा स्वास्थ्य के लिए हानिकारक है

प्रदूषण का आपके स्वास्थ्य पर असर

- चक्कर आना
- साँस लेने में तकलीफ
- खाँसी
- छाती में तकलीफ
- आँखों में जलन



जरूरत पड़ने पर ही घर से बाहर निकलें



आँखों में जलन, साँस की तकलीफ या खाँसी होने पर डॉक्टर से सम्पर्क करें



दिल, फेफड़े एवं अन्य गंभीर बीमारी के रोगियों का विशेष ध्यान दें



धुआँ रहित ईंधन का प्रयोग करें



ज्यादा प्रदूषित जगहों पर ना जाएँ



घरों के खिड़की-दरवाजे सुबह व शाम बन्द रखें



सुबह व शाम की सैर टालें



पटाखे, कूड़ा, पत्तियाँ आदि न जलाएं



धूम्रपान से बचें

समझदार बनें...प्रदूषण के असर से बचें



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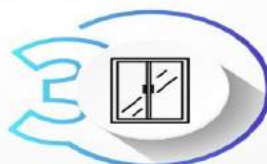
How to **protect yourself** from **AIR POLLUTION**



**Check
air quality index
before leaving**



**Avoid
congested
areas**



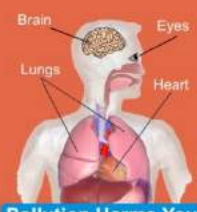
**Keep window
& door closed**



**Don't smoke
tobacco
products**

<https://app.cpcbcr.com/AQI India/>
MAPAN-SAFAR - <http://safar.tropmet.res.in/>

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Pollution Harms You

Air Pollution

Act to protect your health



Ministry of Health and Family Welfare
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Consult Doctor for

-  Giddiness
-  Breathlessness
-  Cough
-  Chest discomfort
-  Irritation in eyes

Don'ts

-  Avoid going to places with heavy traffic
-  Avoid opening doors and windows in early morning & late evening
-  Avoid going for morning walk
-  Don't burn firecrackers
-  Don't smoke tobacco products.

Do's

-  Remain indoors
-  Consult doctor in case of breathlessness, chest discomfort, irritation in eyes
-  Keep medications readily available for persons with airway, lung or heart illnesses
-  Use clean smokeless fuels for cooking and heating purposes.

www.mohfw.nic.in
www.mygov.in
www.pmindia.gov.in

YouTube mohfwindia
@MoHFW_INDIA

http://ncdc.gov.in/
@director_NCDC





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Air Pollution

Act to protect your health



Do's

-  Remain indoors
-  Consult doctor in case of breathlessness, chest discomfort, irritation in eyes
-  Keep medications readily available for persons with airway, lung or heart illnesses
-  Use clean smokeless fuels for cooking and heating purposes.

Consult Doctor for

-  Giddiness
-  Breathlessness
-  Cough
-  Chest discomfort,
-  Irritation in eyes

Don'ts

-  Avoid going to places with heavy traffic
-  Avoid opening doors and windows in early morning & late evening
-  Avoid going for morning walk
-  Don't burn firecrackers
-  Don't smoke tobacco products.

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YouTube mohfwindia
@MoHFW_INDIA

http://ncdc.gov.in/
@director_NCDC

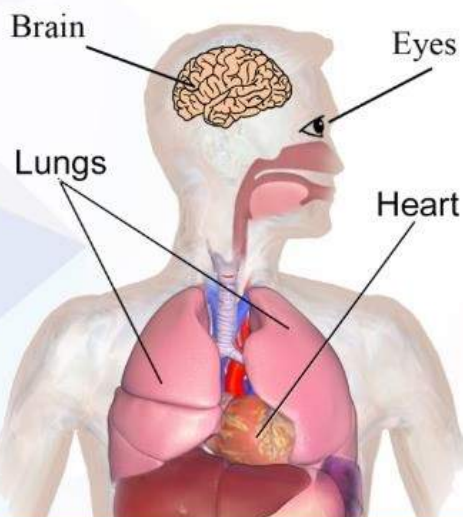








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Pollution Harms You

Air Pollution

Act to protect your health

Check the Air Quality Index Level

Air Quality Index (AQI)# (Pollution level)	Possible Health Consequences	Advice for	
		General Population	Vulnerable Population*
Good (0-50)	Low risk	No special precautions	No special precautions
Satisfactory (51-100)	Minor breathing discomfort in vulnerable population*	No special precautions	Reduce prolonged or strenuous outdoor physical exertion
Moderate (101-200)	Breathing or other health related discomfort in vulnerable population*	Reduce prolonged or strenuous outdoor physical exertion	Avoid prolonged or strenuous outdoor physical exertion
Poor (201-300)	- Breathing discomfort in healthy people on prolonged exposure - Breathing or other health related discomfort in vulnerable population* on short exposure	Avoid outdoor physical exertion	Avoid outdoor physical activities
Very Poor (301-400)	- Respiratory illness in healthy people on prolonged exposure - Pronounced respiratory or other illnesses in vulnerable population* on short exposure	Avoid outdoor physical activities, especially during morning and late evening hours	Remain indoors and keep activity levels low
Severe (401-500)	- Respiratory illness in healthy people on prolonged exposure - Serious respiratory or other illnesses in vulnerable population* on short exposure	Avoid outdoor physical activities	Remain indoors and keep activity levels low

* Vulnerable population (high risk): Elderly, children under 5 years, pregnant women, pre-existing illnesses like asthma and other airway or lung (respiratory) and heart (cardiovascular) diseases

#AQI= Air Quality Index; Check the daily AQI through the following websites before planning your day

CPCB - https://app.cpcbcr.com/AQI_India/

MAPAN-SAFAR - <http://safar.tropmet.res.in/>

www.mohfw.nic.in
www.mygov.in
www.pmindia.gov.in

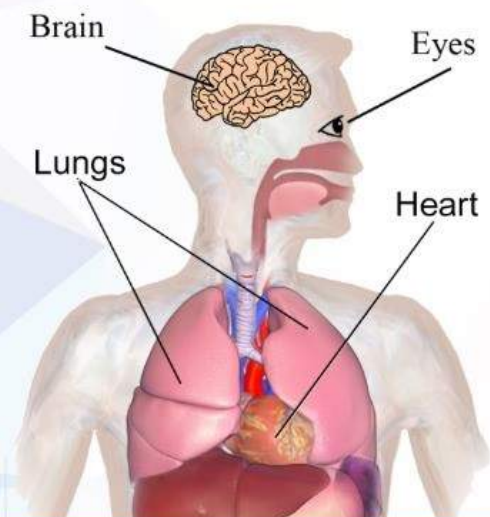
YouTube [mohfwindia](https://www.youtube.com/mohfwindia)
@MoHFW_INDIA

<http://ncdc.gov.in/>
@director_NCDC





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Pollution Harms You

Air Pollution

Act to protect your health

Don't

- ✗ Don't burn firecrackers, wood, leaves, agricultural products, garbage.
- ✗ Don't go to places with heavy traffic and industries.
- ✗ Don't go for morning and late evening walk, run, jog and physical exercise.
- ✗ Don't open doors and windows during morning and late evening; ventilate in afternoon (12 to 4 p.m).
- ✗ Don't smoke cigarettes, bidis and related tobacco products.

Do's

- ✓ Remain indoors or reschedule outdoor activities.
- ✓ Consult the nearest doctor in case of breathlessness, giddiness, cough, chest discomfort or pain, irritation in eyes (red or watery)
- ✓ Persons with airway, lung or heart illnesses should keep their medications readily available.
- ✓ Continue use of clean smokeless fuels (gas or electricity) for cooking and heating purposes.





Act to protect your health — from **AIR POLLUTION** —

Do's



Remain Indoor



**Consult doctor in case of
breathlessness, chest
discomfort, irritation in eyes**



**Keep medications readily
available for persons with
airway, lung or heart illnesses**



**Use clean smokeless fuels for
cooking & heating purposes**

Don'ts

**Avoid going to places with
heavy traffic & congested
places**



**Avoid opening doors & windows
in early morning & late evening**



**Avoid going for morning walk &
evening walk**



**Don't burn fir crackers, garbage
or waste**



Don't smoke tobacco products





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HEALTH EFFECTS OF AIR POLLUTION

SHORT TERM EFFECTS

Headache, Giddiness

Irritation in eyes

Coughing

Breathlessness

Skin Irritation

LONG TERM EFFECTS

Central Nervous System
(Stroke)

Cardiovascular Diseases
(Heart Attack)

Respiratory Diseases
(Asthma, Bronchitis)

Lung Cancer Risk



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Check the **Air Quality Index (AQI)** level of your area from

CPCB-<https://app.cpcbcecr.com/AQI India/>
MAPAN-SAFAR - <http://safar.tropmet.res.in/>

AQI - Pollution Level	Possible Health Consequences	What can you do	
		General Population	Vulnerable Population
Good (0-50)	Low risk	No special precautions	No special precautions
Satisfactory (51-100)	Minor breathing discomfort in vulnerable population	No special precautions	Reduce prolonged or strenuous outdoor physical exertion





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Check the **Air Quality Index (AQI)** level of your area from

CPCB-<https://app.cpcbcr.com/AQI India/>
MAPAN-SAFAR - <http://safar.tropmet.res.in/>

AQI - Pollution Level	Possible Health Consequences	What can you do	
		General Population	Vulnerable Population
Moderate (101-200)	Breathing or other health related discomfort in vulnerable population	Reduce prolonged or strenuous outdoor physical activity	Avoid prolonged or strenuous outdoor physical activity
Poor (201-300)	➤ Breathing discomfort in healthy people on prolonged exposure ➤ Breathing or other health related discomfort in vulnerable population on short exposure	Avoid outdoor physical exertion	Avoid outdoor physical exertion





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Check the **Air Quality Index (AQI)** level of your area from

CPCB-<https://app.cpcbcr.com/AQI India/>
MAPAN-SAFAR - <http://safar.tropmet.res.in/>

AQI - Pollution Level	Possible Health Consequences	What can you do	
		General Population	Vulnerable Population
Very Poor (301-400)	➤ Respiratory illness in healthy people on prolonged exposure ➤ Pronounced respiratory or other illness in vulnerable population on short exposure	Avoid outdoor physical activities especially during morning & late evening hours	Remain indoors and keep activity levels low
Severe (401 and above)	➤ Respiratory illness in healthy people on prolonged exposure ➤ Serious respiratory or other illness in vulnerable population on short exposure	Avoid outdoor physical exertion	Remain indoors and keep activity levels low

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Advisory on Air Pollution and Health

(In view of the AQI levels in the Delhi NCR regions crossing the severe plus category)
Generate awareness to prevent unhealthy effects of Air Pollution:

I. General Population:

Reduce risk from exposure to air pollutants by

DON'TS

1. Avoid places with high pollution like roads with slow & heavy traffic, areas near polluting industries, construction-demolition sites, coal based power plants and brick kilns etc.
2. On days with poor to severe AQI, avoid outdoor morning and late evening walk, run, jog and physical exercise. Do not open external doors and windows during morning and late evening hours, may ventilate if necessary between 12 p.m. to 4 p.m. in afternoon.
3. Avoid burning biomass such as wood, coal, animal dung, kerosene. Use clean smokeless fuels (gas or electricity) for cooking and heating purposes. If using biomass, use clean cook stoves.
4. Avoid burning firecrackers.
5. Avoid burning in open any form of wood, leaves, crop residues, and waste.
6. Do not smoke cigarettes, bidis and related tobacco products.
7. Avoid burning mosquito coils and incense sticks in closed premises.

DO'S

1. Remain indoors on days with poor to severe plus AQI. Reschedule outdoor activities as per AQI level.
2. Practice wet mopping instead of sweeping or vacuum cleaning inside homes. If you choose to use vacuum cleaner, use those which has High Efficiency Particulate Air (HEPA) filter.
3. Keep washing your eyes with running water regularly and do regular gargles with warm water.
4. Consult the nearest doctor in case of breathlessness, giddiness, cough, chest discomfort or pain, irritation in eyes (red or watery)
5. As a "no-regret" strategy, healthy diet, with fruit and vegetables rich in antioxidants, and adequate amount of hydration by drinking water is advocated.

II. Vulnerable Population – additional measures

Patients with chronic pulmonary or cardiovascular problems; pregnant women, young children and elderly should

1. Be more careful to avoid exposure to air pollution. Restrict outdoor movements as far as possible.
 2. Avoid any strenuous activity.
-

3. Keep a check on exacerbations of symptoms.
 4. Properly follow personal doctor's instructions on healthcare.
 5. Keep their prescribed medications readily available.
 6. Seek immediate medical advice if symptoms worsen.
- III. Optional choice:
1. If you choose to use face mask, the disposable N95 or N99 is useful provided user instructions are followed. These masks may help provided the period of exposure is short. Masks should have proper fitting on users' mouth and nose. Ensure to replace the masks after usage as instructed. Paper masks, handkerchiefs, scarves and cloth are not effective.
 2. If you choose to use air purifier, follow manufacturers' guidelines. Ensure to replace and clean filters as instructed. Avoid using an air purifier that works by generating ozone, as it increases pollution inside rooms.
 3. When operating air conditioners in buildings or vehicle, use in "re-circulate" mode to avoid contact with outside air.

IX. Reporting Formats(four) for ARI Surveillance at various levels under the NPCCHH programme

Surveillance of health problems particularly acute respiratory illnesses in the context of air pollution in the country is an important activity initiated under the programme since the month of November 2017 from the sentinel hospitals of Delhi. The surveillance is expanded to the other States and cities particularly those non-attainment cities identified under the NCAP.

Four reporting formats are being developed and shared for reporting of data and its analysis from the nodal officers of the designated sentinel hospitals and from district nodal officers in the States/UTs to the State Nodal Officers and the NPCCHH programme division at NCDC as shown below:

Annexure A: Hospital level ARI surveillance daily reporting format

Annexure B: Hospital level ARI surveillance monthly reporting Format

Annexure C: District level ARI Surveillance reporting Format

Annexure D: District level ARI Surveillance Analysis Graph

National Programme on Climate Change and Human Health (Annexure A: Hospital level ARI surveillance daily reporting format) ## (Daily Reporting of ARI Data format by Nodal Officers of the Hospitals)							
Cases of Acute Respiratory Illnesses Reporting to Emergency Departments (ED) of Sentinel Hospitals							
Name of the hospital:							
Name of the city & district:				Name of the state:			
Date of compiling report :		Date of cases visit to Emergency		Reporting Period (24 hrs)	Specify usual time :08:00hrs morning to 08:00hrs next morning or as per hospital considerations		
	Total Number of Emergencies Reported to ED	Total Number of Acute Respiratory illness* cases reported to ED (* check list of ARI overleaf)	Cases of Acute Respiratory illnesses reported to ED and requiring nebulisation	Cases of Respiratory Illnesses requiring admission	Cases of Respiratory Illnesses requiring Non-invasive ventilation	Cases of Respiratory Illnesses requiring Invasive ventilation	Name and Sign of OIC*
Internal Medicine ED							
Respiratory Medicine ED							
Paediatrics ED							
Total No. of cases (in ED) Name and Sign of hospital Nodal Officer							

To be daily filled by the Nodal Officers of the concerned emergency unit and to be further compiled together by Nodal Officer of the hospital to send to District Nodal Officer – Climate Change and be copied to State Nodal Officer – Climate Change and NCDC at npcchh@gmail.com To be retained in hospital for necessary checks.

* OIC is Nodal Officer responsible for reporting for the concerned department – Internal Med/Respiratory Med/Paediatrics

- This report is to be sent by each specialty department to Nodal Officer for ARI surveillance of the hospital.
- In this reporting format Name of the reporting unit is to be mentioned as specialty like medicine, pediatric or respiratory emergency department etc.
- In the name of the hospital head, enter the name of the sentinel surveillance hospital along with name of city.
- Date should be the one when this report is sent to the Nodal officer of the hospital
- Reporting period will be of 24 hours as per the combination of all the shifts of the emergency department. E.g. 8 am of the previous day to 8am of the next day.

Doctor of each specialty must fill this format under mentioned heads as given below:

1. Total Number of Emergencies Reported to ED-

Here, all kinds of emergencies attended by the treating physician like from accidents, medical-related, poisoning, burns, respiratory emergencies, etc. are to be entered. This will give the total count of emergencies at the emergency department.

2. Total Number of Acute Respiratory illness cases reported to ED –

Here all the emergencies of due to respiratory illnesses are to be included. This should include both infectious and non-infectious origin. This value will be a part of the total emergency reported to ED.

3. Cases of Acute Respiratory illnesses reported to ED and requiring nebulisation.

Here all the respiratory emergencies attended by the doctor and required nebulization at the same time in the emergency department are to be entered. This value will be the part of the total of all respiratory emergencies and its value should not be higher than point no. 2.

4. Cases of acute respiratory illnesses requiring admission.

Here out of all emergencies attended by the doctor, i.e., point no 2, those who are admitted are to be entered.

5. Cases of acute respiratory illnesses requiring non-invasive ventilation.

Some respiratory emergencies which are admitted require the need of Ventilation. In this head, all those admitted and put on a non-invasive ventilator are to be entered. This will be part of point no 5.

6. Cases of acute respiratory illnesses requiring invasive ventilation.

Those patients who are kept on an invasive ventilator are to be entered in this head. This value is also part of point no. 4

Annexure B: Hospital level ARI Surveillance reporting Format

National Programme on Climate Change and Human Health						
(Annexure B: Hospital level ARI surveillance monthly reporting format)						
# (Monthly Compiled ARI Surveillance date-wise data by Nodal Officers of the Hospital)						
Acute Respiratory Illness Cases Reporting to the Emergency Department (ED) of Sentinel Hospital						
Details of Nodal Officer of Hospital						
Name:		Designation:				
Department:		Mobile No.		Email id:		
Name of the State:	Name of the City		Name of the Hospital:		Date of forwarding report:	
(1) Date	(2) Total Number of Emergencies Reported to ED	(3) Total Number of Acute Respiratory illness cases reported to ED	(4) Cases of Respiratory illnesses requiring nebulization	(5) Cases of Respiratory Illnesses requiring admission	(6) Cases of Respiratory Illnesses requiring Non-invasive ventilation	(7) Cases of Respiratory Illnesses requiring invasive ventilation
01 st Day of the Month						
Last day of month						

th													
Last day of month													
Total per month													

To be sent before every 5th day of the Month by District Nodal Officer - CC to State Nodal Officer – CC and be copied to NCDC at npcchh@gmail.com. A copy to be retained by DNO-CC for necessary check. A copy to be sent to respective city hospitals as a feedback.

ARI Surveillance Data Analysis Report.

The following proportions are to be calculated from the data of Annexure A.

1. **ED(ARI)/ED %** = This will give the proportion of acute respiratory illness emergency cases out of the total emergency cases reported at the emergency department of the hospital.

N/ED(ARI)% = Number of patients given nebulization out of the total number of respiratory illness cases reported at the emergency department of the hospital. Following proportions are to be calculated from data of Annexure A.

2. **ED(ARI)/ED %** = This will give proportion of acute respiratory illness emergency cases out of the total emergency cases reported at emergency department of the hospital.
3. **N/ED(ARI)%** = Number of patients given nebulization out of the total number of respiratory illness cases reported at the emergency department of the hospital.
4. **Admit/ ED(ARI)%** = Number of patients admitted in the hospital out of the total number of respiratory illness cases reported at the emergency department of the hospital.
5. **NIV/ED(ARI)%** = Number of patients required non-invasive ventilation support in the hospital out of the total number of respiratory illness cases reported at the emergency department of the hospital.

6. **IV/ED(ARI)%** = Number of patients required invasive ventilation support in the hospital out of the total number of respiratory illness cases reported at the emergency department of the hospital.
7. **IV/Admit%** = Number of patients required invasive ventilation support out of the total number of respiratory illness cases reported at emergency department and admitted in the hospital.

Annexure D – District level ARI Surveillance Analysis Graph in context of Air Pollution

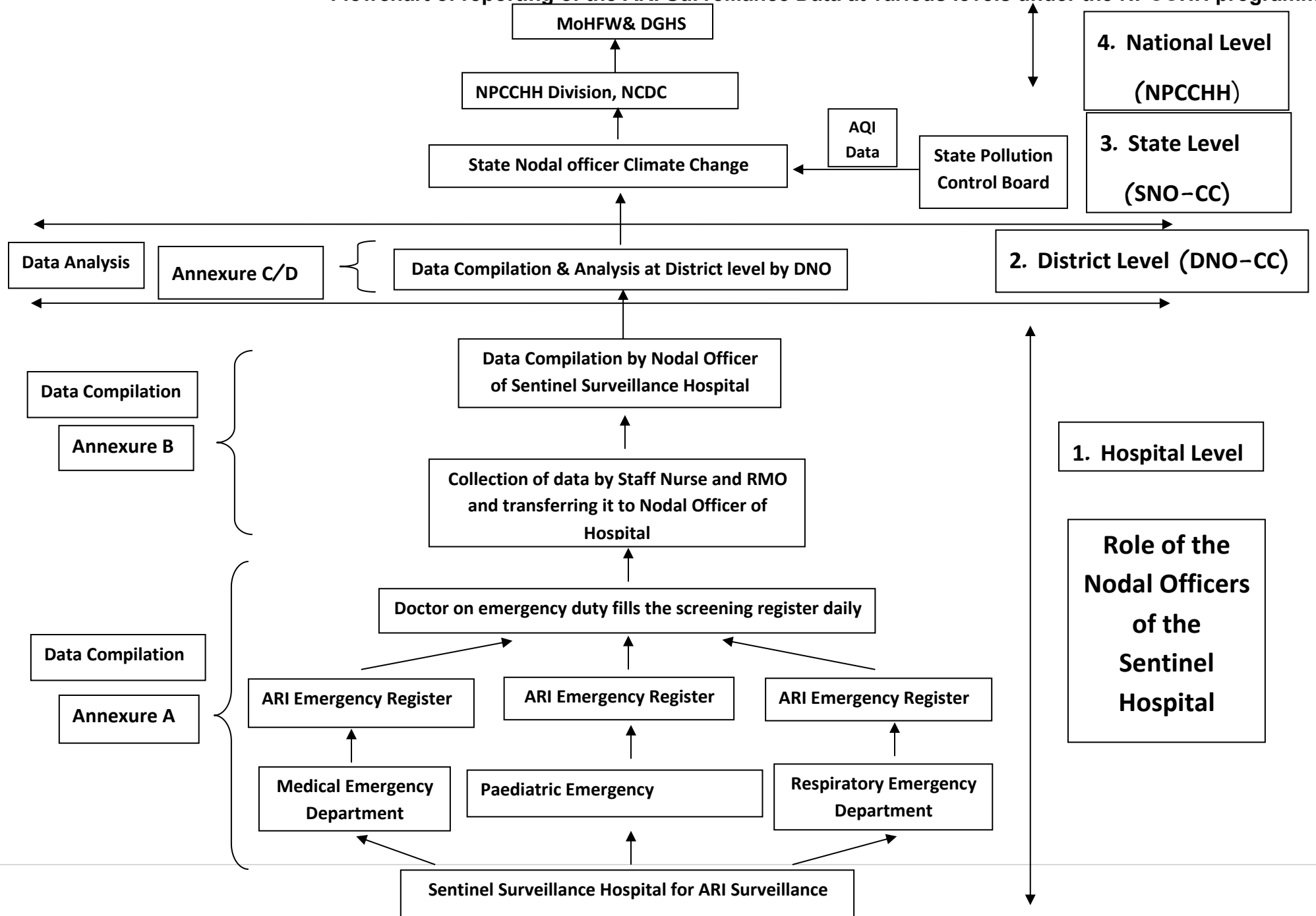
Analysis graph shows about the relationship between average AQI value of the district with proportion of ARI cases reported to the emergency department of the sentinel hospitals in the district. A graph is to be prepared between the air quality index (AQI) variable of the district in the primary x-axis and proportion of ARI cases reported to the emergency department of all the hospitals in the district on the secondary x-axis with the dates on y-axis.

Steps for preparing graph:

1. Select data of date, AQI and proportion of ARI cases attending ED and prepare 2D column graph.
 2. Select data of proportions of ARI cases attending ED and convert it as secondary axis by right click and selecting action format data series. Then convert this secondary axis data as 2D line graph by going to Insert and select line.
-

3. Select AQI data and plot linear line of average AQI by using add trendline option available after right-click.
 4. Select the proportion of ARI data and plot the linear line of its average by using add trendline option available after right-click.
 5. Insert primary and secondary vertical axis title by using layout section – Axis title
 6. Insert Chart title by using layout section – chart title.
 7. Shift legend at the bottom by using layout section – legend.
 8. Rename both the axis by using select data option available after right click option and then using edit name command.
-

Flowchart of reporting of the ARI Surveillance Data at various levels under the NPCCHH programme



Annexure E: List of essential medicines and technologies for implementing essential NCD interventions in primary care

Essential Medicines and Technologies list for management of cardio-pulmonary disorders at Primary Care level*

Medicines	Technologies
Thiazide diuretic	Thermometer
Calcium channel blocker (amlodipine)	Stethoscope
Beta-blocker	Blood pressure measurement device
Angiotensin converting enzyme inhibitor	Measurement tape
Statin	Weighing machine
Isosorbide dinitrate	Spacers for inhalers
Glyceryl trinitrate	Peak flow meter
Furosemide	Nebulizer
Salbutamol	Pulse oximeter
Ipratropium	Blood cholesterol assay
Amoxicillin	Lipid profile
Hydrocortisone (inj.)	Serum creatinine assay
Epinephrine	Troponin test strips
Heparin	Urine microalbuminuria test strips
Diazepam	Electrocardiograph
Magnesium sulphate	Defibrillator
Promethazine	
Dextrose infusion	
Glucose injectable solution	
Prednisolone	
Inhaled Budesonide	
Inhaled Tiotropium	
Aspirin	
Codeine	
Morphine	
Penicillin	
Erythromycin	
Sodium chloride infusion	
Oxygen	
Digoxin tablets/Inj. Potassium chloride	
Antiarrhythmics	

*Adapted from WHO Essential Package of NCD interventions for primary care

Glossaries

Acute effect: Short-lived effect

Adaptation: Adaptation to **climate change** refers to adjustment in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Aeroallergen: Any of various airborne substances, such as pollen or spores, which can cause an allergic response

Air Pollution: There is degradation of air quality with negative effects on human health or the natural or built environment due to the introduction, by natural processes or human activity, into the atmosphere of substances (gases, aerosols) which have a direct (primary pollutants) or indirect (secondary pollutants) harmful effect.

AQI: Air Quality Index is a tool for effective communication of air quality status to people in terms, which are easy to understand. It transforms complex air quality data of various pollutants into a single number (index value), nomenclature and colour. There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. Each of these categories is decided based on ambient concentration values of air pollutants and their likely health impacts (known as health breakpoints).

Capacity Building: In the context of climate change, capacity building is a process of developing the technical skills and institutional capability in developing countries and economies in transition to enable them to participate in all aspects of adaptation to, mitigation of, and research on climate change.

Chronic effect: Long-lasting effect

Climate: Usually defined as the “average weather” or more rigorously as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years.

The classical period is 30 years as defined by the **WMO**. These relevant quantities are most often surface variables such as temperature, precipitation and wind.

Climate Change : The **UNFCCC** defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”.

Flood: Temporary partial or complete inundation of normally dry areas caused by rapid runoff or overflow from lakes, rivers, or tidal waters.

IHD: Ischaemic heart disease, i.e. heart problems caused by narrowed heart arteries (also called coronary artery disease and coronary heart disease). Often causes chest pain known as angina pectoris and can ultimately lead to heart attack

Mitigation: Human intervention to reduce emissions or enhance the sinks of **greenhouse gases**

Monitoring: Performance and analysis of routine measurements aimed at detecting changes in the environment or health status of populations. Not to be confused with **surveillance** although surveillance techniques may be used in monitoring

Morbidity: Rate of occurrence of disease or other health disorder within a population, taking account of the age-specific morbidity rates. Health outcomes include: chronic disease incidence/prevalence, hospitalisation rates, primary care consultations and **Disability-Adjusted-Life-Years (DALYs)**.

Nitrous oxide (N₂O): A powerful **greenhouse gas** emitted through soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and **biomass** burning. One of the six greenhouse gases to be curbed under the **Kyoto Protocol**.

Ozone: Form of the elemental oxygen with three atoms instead of the two that characterise normal oxygen molecules. Ozone is an important **greenhouse gas**. The **stratosphere** contains 90% of all the ozone present in the **atmosphere** which absorbs harmful ultraviolet radiation. In high concentrations, ozone can be harmful to a wide range of living organisms. Depletion of stratospheric ozone, due to

chemical reactions that may be enhanced by **climate change**, results in an increased ground-level flux of **ultraviolet-B-radiation**.

ppm: Parts per million; unit of concentration often used when measuring levels of pollutants in air, water, body fluids, etc. One ppm is 1 part in one million by volume.

Primary air pollutants: Air pollutants produced as a result of the combustion of **fossil** and **biomass** fuels. They include: carbon monoxide, nitrogen oxides and sulphur dioxide

Primary health care: Essential health care made accessible at a cost the relevant country and community can afford, incorporating methods that are practical, scientifically sound and socially acceptable. This may include community education, promotion of adequate food supplies, basic sanitation and water, family planning and the prevention and control of locally **endemic** diseases.

Relative humidity: The ratio of the mass of water vapour in a given volume of air to the value of saturated air at the same temperature

Resilience: The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation.

Secondary air pollutants: Air pollutants formed by chemical and photochemical reactions of primary air pollutants and atmospheric chemicals

Sentinel site: Specific health facility, usually a general/family practice, which undertakes to maintain surveillance and report certain specific predetermined events such as cases of certain infectious diseases.

Stakeholder: Person or entity that has an interest or 'stake' in the outcome of a particular action or policy.

Surveillance: Continuous analysis, interpretation and feedback of systematically collected data for the detection of trends in the occurrence or spread of a disease, based on practical and standardized methods of notification or registration.

Vulnerability: The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity.

Health Adaptation Plan on Heat Related Illnesses

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1. Heat Related Illnesses and Heat waves

Introduction

Heat-related illnesses (HRI) encompass a spectrum of disorders from heat syncope, muscle cramps, and heat exhaustion to a life-threatening emergency such as heat stroke. These illnesses arise when there is a disruption in the regulation of the body's temperature because heat input from the environment and body metabolism is increased compared with output from the skin via radiation, evaporation, and convection.

In India, significant number of deaths occurred every year due to heat related illnesses. Integrated Disease Surveillance Programme (IDSP) at National Centre for Disease Control (NCDC) under Ministry of Health & Family Welfare, Government of India is collecting and reporting the morbidity and mortality data of HRI from heat vulnerable States since year 2015. A total of 3775 deaths were reported from year 2015-2019 (2040 deaths in year 2015, 1111 deaths in year 2016, 384 deaths in year 2017, 25 deaths in year 2018 and 215 deaths in year 2019).

These deaths occurred during heat wave period in India i.e., from March to July. In context of global warming, extreme weather events are on rise and among them heat waves are projected to increase in number, intensity and duration with consequent health risk.

In India, heat wave is considered if maximum temperature of a station reaches at least 40°C or more for plains, 37°C or more for coastal stations and at least 30°C or more for hilly regions. Following criteria are used to declare a heat wave:

A. Based on Departure from Normal

- *Heat Wave*: Departure from normal is 4.5°C to 6.4°C
- *Severe Heat Wave*: Departure from normal is >6.4°C

B. Based on Actual Maximum Temperature (for plains only)

- *Heat Wave*: When actual maximum temperature $\geq 45^{\circ}\text{C}$
- *Severe Heat Wave*: When actual maximum temperature $\geq 47^{\circ}\text{C}$

To declare a heat wave, the above criteria should be met at least at two stations in a Meteorological sub-division for at least two consecutive days. A heat wave will be declared on the second day.

2.1 Heat Related Illnesses: Clinical Manifestations

Clinical Entity	Cardinal Symptoms	Cardinal / Important Signs	Pertinent Negative findings
Heat rash/ Prickly heat/ Miliaria	Itchy Rash with Small Red BUMPS at pores in the skin. Seen in setting of heat exposure; bumps can sometimes be filled with clear or white fluid	Diffused Red Colour Skin Or Vesicular Rash , itching of the skin without visible eruption	Not Focally Distributed like a contact dermatitis
Heat Cramps	Painful Spasms of large and frequently used muscle groups	Uncomfortable appearance, may have Difficulty in Fully Extending Affected Limbs/Joints	No contaminated wounds/tetanus exposure; no seizure activity
Heat Exhaustion	Feeling overheated, light headedness, Exhausted And Weak , unsteady, feeling of Vomiting, Sweaty And Thirsty , inability to continue activities	Sweaty /diaphoretic; flushed skin; hot skin; Normal Core Temperature ; +/- dazed, +/- generalized weakness, slight disorientation	No coincidental signs and symptoms of infection; no focal weakness; no difficulty in swallowing food or speech; no drug/overdose history
Heat Syncope	Feeling hot and weak; light headedness followed by a Brief Loss Of Consciousness	Brief, generalized loss of consciousness in hot setting, short period of disorientation, if any	No Seizure Activity , no loss of bowel or bladder continence, no focal weakness, no difficulties in swallowing or speech
Heat Stroke	Severe overheating; profound weakness; Disorientation, Not Fully Alert, Convulsion, Or Other Altered Mental Status	Flushed, Dry Skin (not always), Core Temp $\geq 40^{\circ}\text{C}$ OR 104°F ; altered mental status with disorientation, incoherent behaviour, Coma, Convulsion ; tachycardia; +/- hypotension	No coincidental signs and symptoms of infection; no focal weakness; no difficulties in swallowing or speech, no drug/overdose history

2.2 Heat-related illnesses: Summary of Spectrum

Heat Related Illness	Clinical Presentation	Treatment
Heat edema	• Mild swelling of feet, ankle and hands • Appears in few days of exposure to hot environment • Does not progress to pretibial region	• Usually resolves spontaneously within days to 6 weeks • Elevate leg • Compressive stocking • Diuretics are not effective
Prickly Heat	• Pruritic, maculopapular, erythematous rash normally over covered areas of body • Itchiness • Prolonged or repeated heat exposure may lead to chronic dermatitis	• Antihistamine • Wear clean, light, loose fitting clothing • Avoid sweat generating situations • Chlorhexidine in a light cream or lotion base • Calamine lotion
Heat Cramps	• Painful, involuntary, spasmodic contractions of skeletal muscle (calves, thighs and shoulder) • Occur in individuals sweating profusely and only drinking water or hypotonic solutions • Limited duration • Limited to certain muscle group	• Fluid and salt replacement (IV or oral) • Rest in cool environment
Heat Tetany	• Hyperventilation • Extremity/s and circumoral paresthesia • Carpopedal spasm	• Calm the patient to reduce respiratory rate • Remove from hot environment
Heat Syncope	• Postural hypotension • Commonly in non-acclimatized elderly	• Rule out other causes of syncope • Removal from hot environment • Rest and IV drip
Heat Exhaustion	• Headache, Nausea, Vomiting • Malaise, Dizziness • Muscle cramps • Temperature less than 40°C or normal • May progress to heat stroke if fails to improve with treatment • No CNS involvement	• Remove the patient from heat stress area • Volume replacement • If there is no response to treatment in 30 minutes, then aggressively cool the patient to core temperature of 39°C
Heat Stroke	• Core body temperature greater than 40°C • Signs of CNS dysfunction: Confusion, delirium, ataxia, seizures, coma • Other late findings: anhidrosis, coagulopathy, multiple organ failure	• Remove the patient from heat stress area • Volume replacement • If there is no response to treatment in 30 minutes, then aggressively cool the patient to core temperature of 39°C (further details later in document)

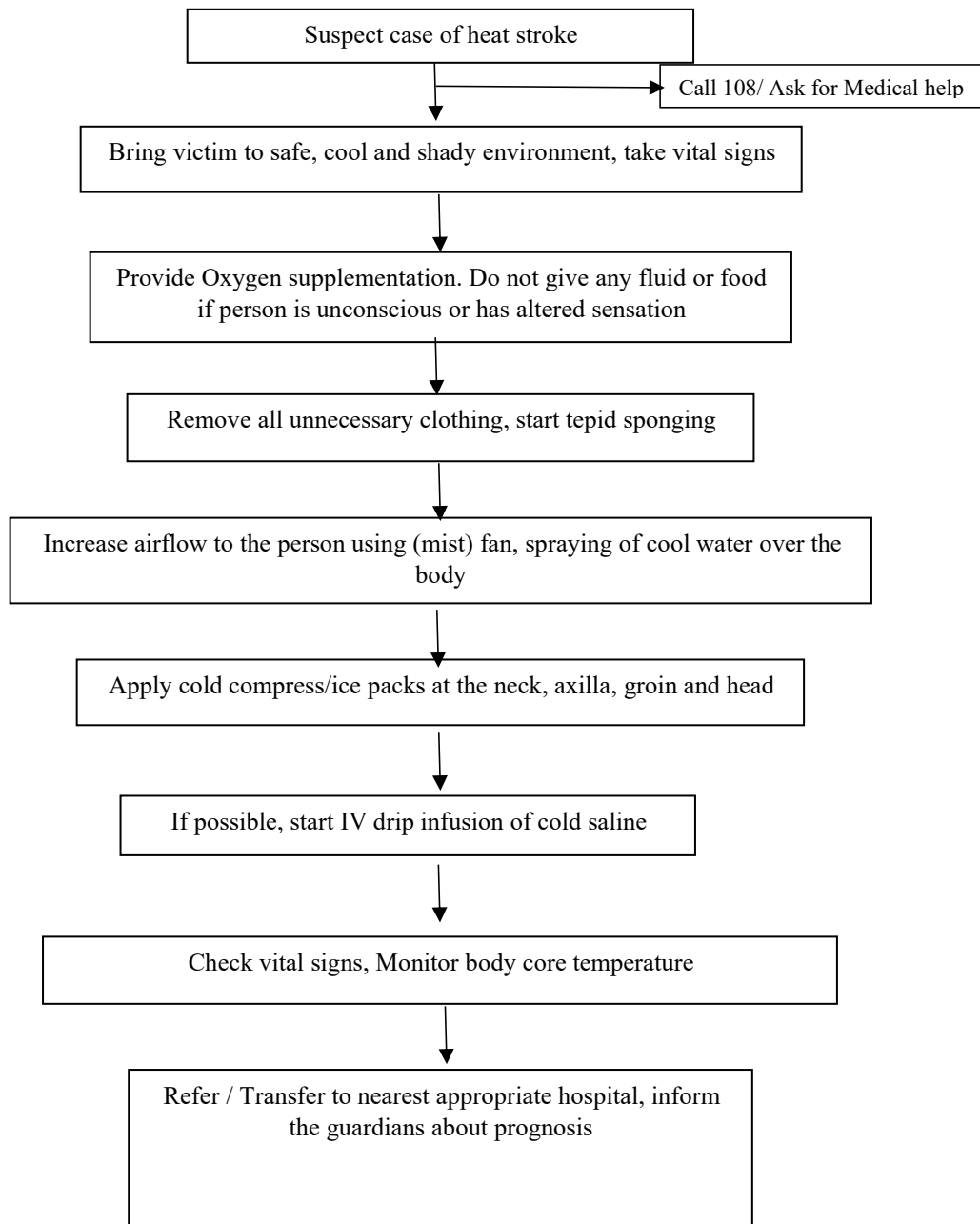
2.3 Heat stroke workup

There is no diagnostic test for heat stroke. However, laboratory tests are available for detection of end organ damage secondary to the metabolic derangement and ruling out other differential diagnosis of hyperthermia and CNS dysfunction. The following laboratory investigations need to be done

S.No	Laboratory investigation	Rationale
1	Arterial Blood Gases (ABG)	To detect hypoxaemia that can occur in patient with continuous seizure or inadequate respiration secondary to brain injury. Metabolic acidosis (due to lactic acidosis) can occur secondary to acute renal impairment
2	Random Blood Sugar	Exclude diagnosis of hypoglycaemia in unconscious patient and also hyperglycaemia in patient with underlying diabetes or undiagnosed diabetes
3	Serum Electrolytes	Sodium Detection of hyponatremia or hypernatremia due to reduced intake of fluid and dehydration, and guide the choice of fluid for resuscitation Potassium To detect hypokalemia or hyperkalemia that occurs in early phases of heat stroke, muscle damages and during treatment Calcium Hypocalcaemia occur due to binding of calcium to damaged muscles
4	Liver Function Test (LFT)	Hepatic injury is a consistent finding in patients with heatstroke. Aspartate aminotransferase [AST] and Alanine aminotransferase [ALT] levels commonly rise to thousands during the early phases of heatstroke and peak at 48 hours, but sometimes they may take as long as 2 weeks to peak. Jaundice may be striking and may be noted 36-72 hours after the onset of liver failure
5	Coagulation studies	Direct thermal injury also leads to denaturation of proteins exhibited by dysfunctional enzymes. Any

		derangement of coagulation is a sign of poor prognosis
6	Complete Blood Count	Thermal injury to vascular endothelium causes platelet aggregation and deactivation of plasma protein leading to platelet aggregation and decrease in clotting factor. Total white cell count (as high as 40,000/ μ L) may be elevated due of infection and thrombocytopenia. Also there is haemo concentration which is indicated by elevated PCV and Hb
7	Renal Function Test (RFT)	Acute kidney injury may be due to inadequacy of volume, dehydration, rhabdomyolysis, or direct thermal injury to renal parenchyma. Elevations in serum uric acid levels, blood urea nitrogen, and serum creatinine are common in patients whose clinical course is complicated by renal failure.
8	Cerebrospinal fluid analysis	Cerebrospinal fluid (CSF) cell counts may show a nonspecific pleocytosis, and CSF protein levels may be elevated as high as 150 mg/dL. This test may be considered in patients in whom CNS infection has been kept as a possibility
9	Muscle function tests	Creatinine kinase (CK), Lactate dehydrogenase (LDH), Aldolase, and Myoglobin are commonly released from muscles when muscle necrosis occurs. CK levels exceeding 100,000 IU/mL are common in patients with Exertional Heat Stroke(EHS). Elevations in myoglobin may not be noted despite muscle necrosis because myoglobin is metabolized rapidly by the liver and excreted rapidly by the kidneys
10	Electrocardiography (ECG)	Arrhythmias is one of the complications of heat stroke. Also rule out underlying cardiac disease / myocardial injury
11	Imaging studies	Chest X ray CXR carried out to detect presence atelectasis, pneumonia, pulmonary infarction and pulmonary oedema complementing clinical examination CT Scan CT scan can be performed once patient is hemodynamically stable and is helpful to rule out intracranial bleeding in patient who does not show improvement in neurological signs

2.4 Management workflow of Suspected Heat Stroke victims at PHC level before referral to higher centre

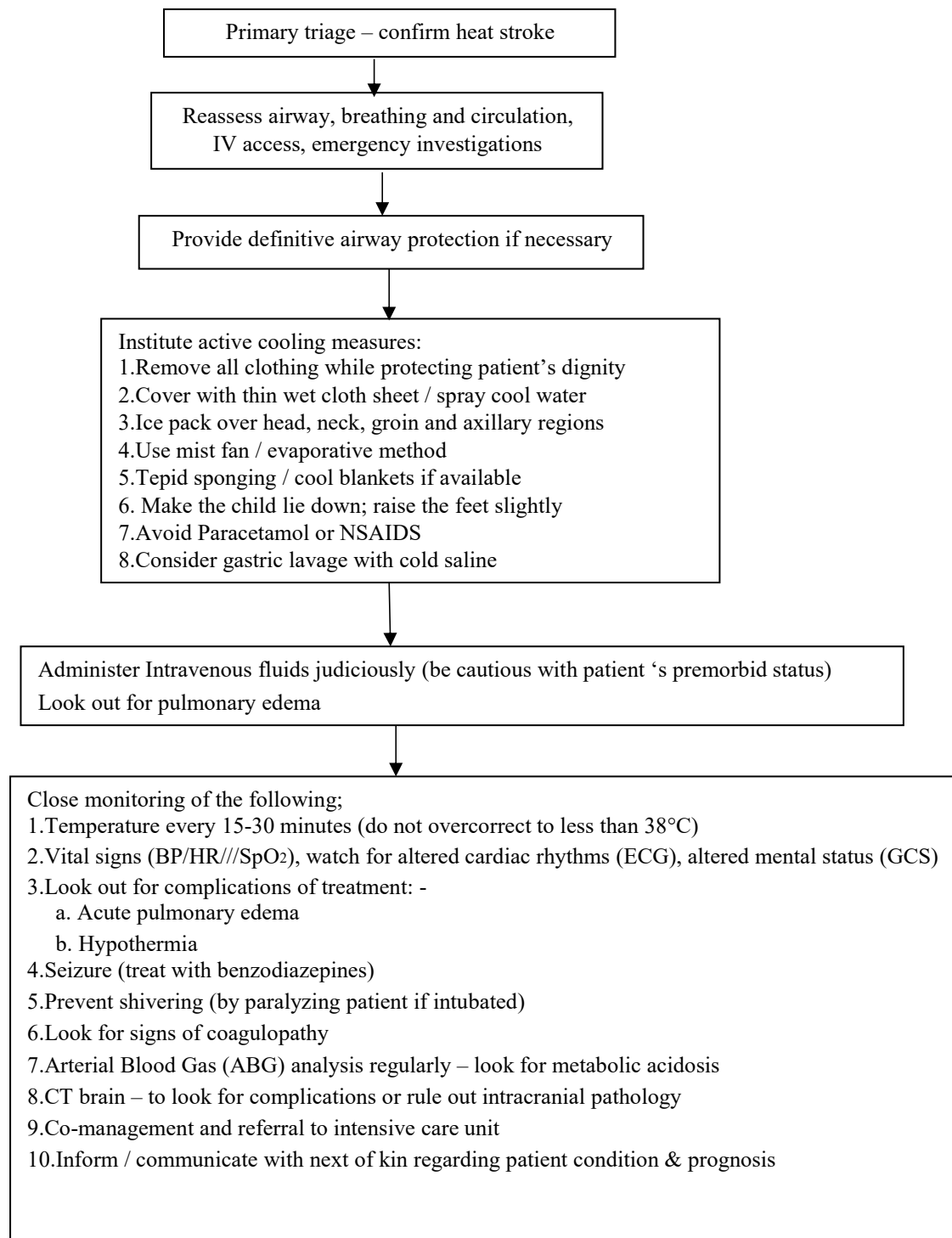


Consider heat illness in differential diagnosis if:

- a. Presented with suggestive symptoms and signs
- b. Patient has one or more of the following risk factors:
 - i. Extremes of age (infants, elderly)

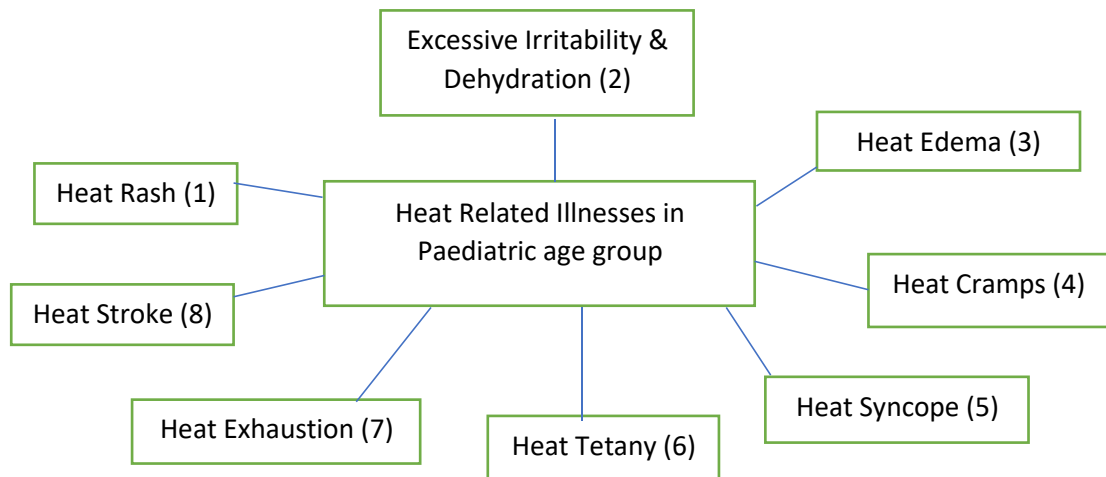
- ii. Debilitation/physical deconditioning, overweight or obese
- iii. Lack of acclimatization to environmental heat (recent arrival, early in summer season)
- iv. Any significant underlying chronic disease, including psychiatric, cardiovascular, neurologic, hematologic, obesity, pulmonary, renal, and respiratory disease
- v. Taking one or more of the following:
 1. Sympathomimetic drugs
 2. Anticholinergic drugs
 3. Barbiturates
 4. Diuretics
 5. Alcohol
 6. Beta blockers

2.5 Management Workflow in Emergency Department for Management of Heat Stroke Patient at tertiary level



3.1 Heat related illnesses in Paediatric age group

Heat-related illnesses (HRI) in paediatric age group encompass a spectrum of disorders from heat rash, heat syncope, and heat exhaustion to a life-threatening emergency such as heat stroke.



The treatment and preventive measure for HRI in paediatric age group are as follows:

1. Heat Rash/Milia Rubra/Prickly Heat
 - Treatment:
 - i. Place in cool environment
 - ii. Remove excess clothing
 - iii. Avoid application of lotions
 - Prevention
 - i. Use loose fitting clothing & remove excess cloth
 - ii. Avoid direct sunlight
 - iii. Avoid excessive heat
 - iv. Frequent breast feeding/fluids
2. Excessive irritability & dehydration
 - Treatment
 - i. Place in cool environment
 - ii. Remove excess clothing
 - iii. Frequent breast feeding/fluids
3. Heat Edema (more common in adults): swelling of feet/ankle/hands
 - Treatment
 - i. Remove from hot environment & place in cool environment
 - ii. Elevate the affected extremity
4. Heat Cramps: common in young athletes
 - Painful, involuntary, spontaneous contraction of muscle group of legs/calf/groin
 - Treatment
 - i. Remove from hot environment
 - ii. Rehydration (frequent oral fluids), if persist then intravenous fluid may help

5. Heat Syncope

- It is seen with prolonged standing in hot environments that causes vasodilatation and a fall in blood pressure due to venous pooling in the legs (which causes a decrease in venous return to the heart causing a fall in cardiac output) resulting in fainting or feeling light headed.
- Remove the child from hot environment
- Oral rehydration with salt containing fluids (ORS/Lassi/Nimbupani/Rice water/ Dal water/ Coconut water/Sattu etc)

6. Heat Tetany

- It can be differentiated from heat cramps by the fact that there is very little pain or cramps in the muscle.
- Treatment
 - i. Remove the child from hot environment
 - ii. Calm the child to decrease hyperventilation
 - iii. Intravenous calcium after admission

7. Heat Exhaustion

- After prolonged heat exposure, the body temperature rises upto 104 °F and leads to dehydration, tachycardia, vomiting, fatigue and headache with normal mental status (sometimes mild confusion may present).
- It requires admission and specialist care
- Treatment
 - i. Remove child from hot environment
 - ii. Oral rehydration with salt containing fluid
 - iii. Look for dyselektrolytemia
 - iv. Intensive care monitoring and intravenous rehydration
 - v. Rule out sepsis

8. Heat Stroke

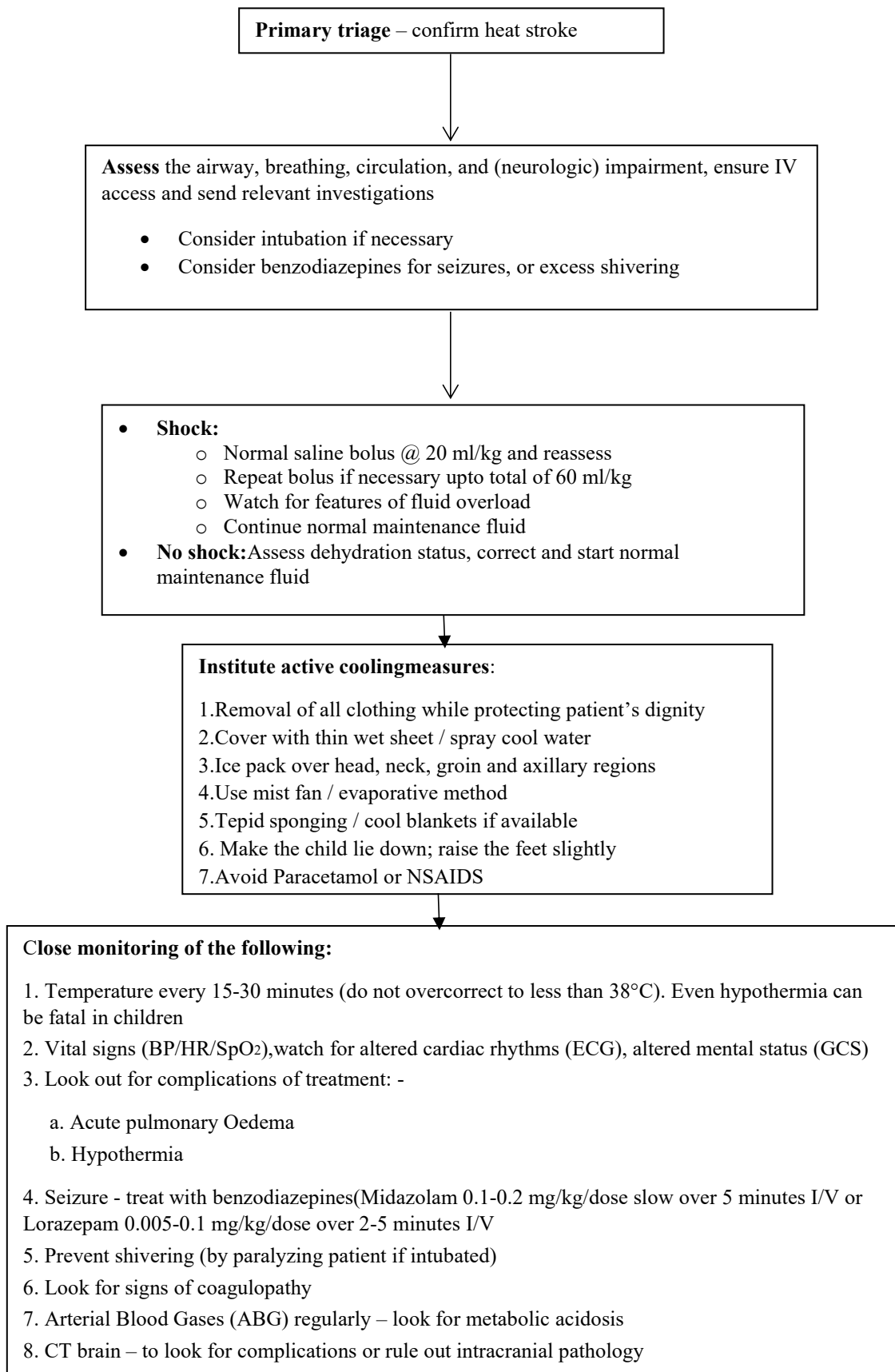
- Prolonged exposure to heat leads to core body temperature rising to $\geq 40^{\circ}\text{F}$
- Patient presents with stupor/coma/drowsiness/confusion/delirium/hallucination/seizures/ataxia
- Anhidrosis
- Coagulopathy
- Multi-organ dysfunction
- Treatment
 - i. Admission
 - ii. Check airway, breathing, circulation
 - iii. Give oxygen, intravenous fluid connection
 - iv. Do random blood sugar (RBS), arterial blood gas (ABG), electrolytes (Na/K/Ca), liver function test (LFT), renal function test (RFT), coagulation profile, neuroimaging to rule out CNS bleed, etc.

Danger signs

- Refusal to feed
- Excessive irritability
- Decreased urine output
- Dry oral mucosa & absence of tear/sunken eyes

- Lethargy/altered sensorium
- Seizures
- Bleeding from any site → seek immediate medical help if danger signs are present

3.2 Clinical Workflow in Emergency Department for Management of Heat Stroke in children



3.3 Guidelines for children going for sports activity during summer season

Those who come from a cooler climate to a hotter climate, especially during the heat wave season, are at risk. They should be advised not to move out in open for a period of one week. This helps the body get acclimatized to heat. They should also be advised to drink plenty of water. Acclimatization is achieved by gradual exposure to the hot environment during a heat wave.

American Academy of Paediatrics, National Collegiate Athletic Association, and the National Athletic Trainer's Association recommendations for prevention of exertional heatstroke in children

- 1. Screening**
 - a. All athletes to be screened by coaches/ doctors to identify any health conditions or medications that may predispose them to heat related illnesses.
 - b. Athletes with recent or current history of fever or gastrointestinal illnesses should not be permitted to participate
- 2. Acclimatization (changing zones for sports activities from cooler area to warmer area)**
 - a. Athletes should acclimatize to warm weather and increase activity over 1 to 2 weeks.
 - b. Physical activity in hot weather should be increased slowly.
 - c. Exercise sessions be shortened and made easier when it's hot
- 3. Athletic Gear and Garb**
 - a. Athletes should wear light coloured garments that are lightweight and loose-fitting.
 - b. Uniforms and practice gear should be made from open-weave or sweat-wicking materials to facilitate evaporative heat loss.
 - c. Sweat-saturated garments should be removed promptly.
 - d. The amount of athletic equipment should be worn in incremental steps
- 4. Hydration**
 - a. Athlete to be adequately hydrate before, during, and after physical exertion
- 5. Scheduling**
 - a. When weather is extremely hot, practices should be scheduled for mornings and evenings, when temperatures are generally cooler.
 - b. Contingency plans should be in place to reschedule practices or games if heat or humidity is expected to be severe.
- 6. Preparation**
 - a. Medical equipment and resources for rapid cooling (cold-water tubs, ice towels) should be available at athletic events.
 - b. An emergency action plan should be in place should any athlete develop signs or symptoms of heat exhaustion or heat stroke.

Suggested reading:

1. Mangus CW, Canares TL. Heat-Related Illness in Children in an era of extreme temperature. *Pediatr Rev.* 2019 Mar;40(3):97-107. doi: 10.1542/pir.2017-0322. Epub 2019 Mar 1. Review. Pub PMID: 30824495

3.4 First Aid Instructions on Heat Exhaustion and Heat Stroke in Children

The **symptoms** may develop after being in **high temperatures** (such as heat waves) or **after hard work or sports during hot weather**

Symptoms of Heat Exhaustion	Symptoms of Heatstroke
• Increased thirst • Weakness and extreme tiredness • Fainting • Muscle cramps • Nausea and vomiting • Irritability • Headache • Increased sweating • Cool, clammy skin • Body temperature rises, but less than 105°F (40.5°C)	• Severe headache • Weakness, dizziness • Acts or talks confused • Fast breathing and rapid heartbeat • Hard to wake up or can't wake up • Seizures • Flushed, hot, dry skin • Body temperature rises to 105°F (40.5°C) or higher



If the child has symptoms of heatstroke **Call for ambulance and take to the nearest hospital**

For cases of **heat exhaustion** or **while awaiting help** for a child with possible heatstroke:

- Bring the child indoors or into the shade immediately
- Remove the clothing of the child while maintaining the dignity of child
- Have the child lie down; raise the feet slightly
- Increase airflow to child using fan
- Spray normal tap water or do tepid sponging
- If the child is alert and awake, give frequent sips of cool, clear fluids
- If the child is vomiting, turn onto their side to prevent choking
- If child is unconscious, don't give them anything to drink/ eat

Prevention:

- Lookout for weather warnings issued by India Meteorological Department
- Teach kids to always drink plenty of liquids before and during any physical activity in hot, sunny weather even if they aren't thirsty
- Make sure kids wear light-colored, loose clothing in warm weather
- Remind kids to look for shaded areas and rest often, while outside
- Avoid activities during peak summer hour i.e., 12:00 noon to 03:00 pm
- Don't let kids participate in heavy activity outdoors during the hottest hours of the day
- Teach kids to come indoors immediately whenever they feel overheated
- Never leave a child alone, non- accompanied, inside a parked closed vehicle (look before you look)

4. Hospital Preparedness Plan

The hospital preparedness plan aims to provide a baseline framework for the preparation, implementation, coordination and evaluation of extreme heat response activities in health facilities in States.

There are three tables for planned activities during three different seasons i.e., pre heat season, during heat season and post-heat season.

The activities are divided in three broad categories i.e., infrastructure and logistics, capacity building and IEC/awareness for three different level of health facilities i.e., primary health centre (PHC), Community Health Centre (CHC) and District Hospital (DH)/Medical College (MC).

Table 1. HOSPITAL PREPAREDNESS CHART-PRE HEAT SEASON								
INFRASTRUCTURE AND LOGISTICS			CAPACITY BUILDING			IEC/AWARENESS		
PHC	CHC	DH/MC	PHC (MOs, nursing staff, paramedics, ASHA, ANM)	CHC (MOs, nursing staff, paramedics, ASHA, ANM, MPHW)	DH/MC (MOs, nursing staff, paramedics, MPHW)	PHC	CHC	DH/MC
• Check inventories for basic equipment and medicines required as listed in annexure A, • Ensure adequate arrangement of staff, • Explore creation of Ice pack dispensaries to increase access to vulnerable communities, • Adopt long term measures such as cool roofs and improving green coverage of health facility. • Identify Rapid Response Team (RRT) to respond to any exigency call outside the hospitals • May try to establish outreach clinics at various locations easily accessible to the vulnerable population			• A detailed action plan to tackle HRI (update annually) • Fresh/Refresher targeted training course -Maintaining hospital records, improve expedience of recording of cause of death, heat-focused examination procedures • Community involvement of trained staff to create awareness.			• Preparation of Targeted IEC-hoardings, banner, poster, leaflets, factsheets, information cards, media, miking, rallies, song/drama activities, street plays • Planning of dissemination as per assessment of vulnerable area/communities • Conduct sensitization meetings • Prepare handouts for health staff about heat illness • Ensure the availability of funds for above activities		
			• Mapping of susceptible villages (identify areas/population that are vulnerable)	• Mapping of susceptible PHCs (identify areas/population that are vulnerable)	• Mapping of susceptible blocks (identify areas/population s that are vulnerable)			

Table 2. HOSPITAL PREPAREDNESS CHART-HEAT SEASON

Table 2. HOSPITAL PREPAREDNESS CHART-HEAT SEASON								
INFRASTRUCTURE AND LOGISTICS			CAPACITY BUILDING			IEC/AWARENESS		
PHC	CHC	DH/MC	PHC (MOs, nursing staff, paramedics, ASHA, ANM)	CHC (MOs, nursing staff, paramedics, ASHA, ANM, MPHW)	DH/MC (MOs, nursing staff, paramedics, MPHW)	PHC	CHC	DH/MC
• Ensure adequate medical supplies available as indicated in Annexure A • Identify surge capacities and mark the beds dedicated to treat the heat stroke victims and enhance emergency department preparedness to handle more patients			• Ensure reporting of HRI cases on daily basis • Adopt HRI treatment and prevention protocols • Expedite recording of cause of death due to heat related illnesses			• Ensure IEC dissemination • Target the vulnerable area/communities followed by other areas. • Plan activities as per the Heat Wave alert issued by IMD		
• Increase ASHA/ANM/MPHW outreach in at-risk villages during a heat alert, if feasible.	• Increase ASHA/ANM/MPHW outreach in at-risk PHC during a heat alert, if feasible. • Ensure dedicated bed availability • Ensure ambulance availability	• Increase MPHW outreach in at-risk blocks during a heat alert, if feasible. • Ensure dedicated bed availability • Ensure ambulance availability • Dedicated heat corners • Increase staffing at DH/MCs to attend to the influx of patients during a heat alert, if feasible. • Have DNO-CC/SNO-CC visit CHCs to confirm proper preparation has been made for heat related illness and conduct case audits during heat season.	• Referral of patients to the higher facility only after ensuring adequate stabilization and basic definitive care (cooling and hydration)	• Prepare weekly reports of health impact for nodal officer • Conduct case review during heat season	• Prepare weekly reports of health impact for nodal officer • Conduct case review during heat season			

Table 3. HOSPITAL PREPAREDNESS CHART-POST HEAT SEASON

Table 3. HOSPITAL PREPAREDNESS CHART-POST HEAT SEASON								
INFRASTRUCTURE AND LOGISTICS			CAPACITY BUILDING			IEC/AWARENESS		
PHC	CHC	DH/MC	PHC (MOs, nursing staff, paramedics, ASHA, ANM)	CHC (MOs, nursing staff, paramedics, ASHA, ANM, MPHW)	DH/MC (MOs, nursing staff, paramedics, MPHW)	PHC	CHC	DH/MC
- Review to assess/identify gaps-if any e.g., - Any shortage of equipment, medicine, staff. - Any long term measures adopted and maintained - Enlist/document the lessons learnt for the next season			- Review to assess/identify gaps-if any e.g., - Any flaw/fault in reporting channel/format/efficiency - Number of deaths reviewed - Enlist/document the lessons learnt for the next season			- Review to assess/identify gaps-if any e.g., - IEC messages - Dissemination area/community - Efficient use of resources - Enlist/document the lessons learnt for the next season		

Basic equipment and medicines required as a part of Hospital preparedness for heat season

Primary Health Centre (PHC), Community Health Centre (CHC), District Hospital (DH) and Medical Colleges should ensure following requirements before the start of heat season:

1. Dedicated bed for HRI patients in cooler area of hospital,
2. Thermometer, ORS packets, Ice packs, BP apparatus,
3. Silver - sulphadiazine cream, Calamine lotion, Chlorhexidine in a light cream or lotion base
4. Cold IV Normal saline (0.9%), Dextrose 50% in water solution (D50W),
5. Glucometer and strip,
6. ECG equipment: ECG machine, Gel, electrodes, ECG paper
7. Cooling equipment: AC, Cooler, Fan as per requirement,
8. Water cooler,
9. Medicines: Lorazepam, diazepam,
10. Ambulance with ice packs and cold water,

5. Heat Related Illnesses Surveillance

The Heat Related Illnesses surveillance was started in year 2015. The Integrated Disease Surveillance Programme (IDSP) was conducting the surveillance at central, state and district level. Since year 2020 the National Programme on Climate Change and Human Health (NPCCHH) has started the surveillance.

Revised Formats

FORMAT 1 (A): HEALTH FACILITY FORMAT

Daily line List of **Suspected Heat Stroke CASES[#]** at Health Facility

(From Medicine, Paediatrics and Casualty/Emergency department)

(To be kept at health facility for record)

Name of health facility: _____						Date of reporting: __/__/__					
Block: _____ District: _____											
Type of health facility (Circle the applicable): 1. PHC 2. CHC 3. Taluka/Rural Hospital/Block Hospital											
4. Sub-district 5. District Hospital/Civil Hospital 6. Medical College & Hospital 7. Private hospitals with emergency facility 8. Other.....											
(A). Total no. of patients in department (Casualty/Emergency of Medicine + Paediatrics):											
Daily line List of Suspected Heat Stroke CASES[#] at Health Facility											
S.No	Hospital Registration No.	Name	Age*	Sex (M/F)	Address		Outcome within date of reporting (tick the box)				Remarks
					Block	District	Admitted	Died	Referred	Recovered	
Total											

*Age in completed years

Name of person filling the form:

Designation:

Signature:

Name of Facility In-Charge:

Signature of Facility In-Charge:

Date:

#Suspected Heat stroke: Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature $\geq 40^{\circ}\text{C}/\geq 104^{\circ}\text{F}$** , without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during heat wave season i.e., March to July)*

FORMAT 1 (B): HEALTH FACILITY FORMAT
Daily line List of **Suspected Heat Stroke DEATHS[#]** and **Confirmed CVD DEATHS^{*}**

(From Medicine, Paediatrics and Casualty/Emergency department)
(To be kept at health facility for record)

Name of health facility:_____					Date of reporting: <u> </u> ./ <u> </u> ./ <u> </u> ..			
Block:_____ District:_____								
Type of health facility (Circle the applicable): 1. PHC 2. CHC 3. Taluka/Rural Hospital/Block Hospital 4. Sub-district 5. District Hospital/Civil Hospital 6. Medical College & Hospital 7. Private hospitals with emergency facility 8. Other.....								
(A). Total no. of all cause deaths in health facility (Casualty/emergency of Medicine and Paediatrics):								
Daily line List of Suspected Heat Stroke DEATHS and Confirmed CVD DEATHS								
S.No	Registration number	Name	Age	Sex (M/F)	Address		Deaths (tick the box)	
					Block	District	Suspected Heat stroke death ^{##}	Confirmed CVD death
Total								

Name of person filling the form:
Designation:
Signature:

Name of Facility In-Charge:
Signature of Facility In-Charge:
Date:

Suspected Heat stroke: Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature $\geq 40^{\circ}\text{C}/\geq 104^{\circ}\text{F}$** , without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. (*definition is applicable during heat wave season i.e., March to July*)

##Suspected Heat Stroke Death: Is a death on account of suspected heat stroke patient.

***Cardiovascular death** includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV hemorrhage or death due to other CV

FORMAT 2: Health facility format for sending to DISTRICT

Daily numbers of Suspected Heat Stroke CASES[#] and All cause DEATHS^{*}

(Compilation of Format 1, A & B)
(To be sent to District Nodal Unit daily)

Name of health facility: Block: _____ District: _____				Date of reporting: __/__/__			
Type of health facility (Circle the applicable): 1. PHC 2. CHC 3. Taluka/Rural Hospital/Block Hospital 4. Sub-district 5. District Hospital/Civil Hospital 6. Medical College & Hospital 7. Private hospitals with emergency facility 8. Other.....							
Department (Circle the applicable): 1. Emergency Medicine 2. Emergency Paediatrics 3. Casualty							
Date	Total patients in the department	New Suspected Heat Stroke Cases (A)	Total Suspected Heat Stroke cases since 1 st March 2020 (B)	All cause deaths ^{**}			
				Suspected Heat stroke deaths ^{##} (a)	Confirmed CVD deaths (b)	Others including unknown (c)	Total deaths (a+b+c)
01-03-20							
02-03-20							

Form filled by (Name):
Designation:
Signature:

Name of Facility In-Charge:
Signature of Facility In-Charge:
Date:

^{**}**All cause death:** All of the deaths that occur in casualty/emergency of medicine plus paediatrics, regardless of cause.

[#]**Suspected Heat stroke:** Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature $\geq 40^{\circ}\text{C}/\geq 104^{\circ}\text{F}$** , without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during heat wave season i.e., March to July)*

^{##}**Suspected Heat Stroke Death:** Is a death on account of suspected heat stroke patient.

^{*}**Cardiovascular death** includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV hemorrhage or death due to other CV causes.

FORMAT 3 (A): DISTRICT FORMAT FOR DAILY COMPILATION

Daily numbers of Suspected Heat stroke CASES[#] and All cause DEATHS^{*}

(Compiled from Format 2)
(To be kept at District for record)

Cases and deaths due to heat related illness (HRI)- <i>District name</i> 2020					Date of reporting: <i>_./_./_.</i>				
S.No.	<i>Name & type of Health Facility</i>	Total patients of the day (Emergency Medicine + Emergency Paediatrics + Casualty)	New Suspected Heat Stroke cases (A)	Total Suspected Heat Stroke cases since 1 st March, 2020 (B)	All cause deaths**				Remarks
					Suspected Heat stroke deaths ^{##} (a)	Confirmed CVD deaths (b)	Others including unknown (c)	Total deaths (a+b+c)	
	<i>PHC1</i>								
	<i>PHC2</i>								
	<i>CHC</i>								
	<i>CH/DH</i>								
	<i>PVT1</i>								
	<i>PVT2</i>								
<i>Total for District 1</i>									

Total number of New Confirmed Heat Stroke Deaths* in the District on __/__/__:**

Total number of Confirmed Heat Stroke Deaths in the District since 1st March 2020:

[confirmed by committee (heat death committee/three men committee)]

Name of person filling the form:

Designation:

Signature:

Name of nodal officer:

Signature of nodal officer:

Date:

****All cause death:** All of the deaths that occur in casualty/emergency of medicine plus paediatrics, regardless of cause.

#Suspected Heat stroke: Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature $\geq 40^{\circ}\text{C}$ $\geq 104^{\circ}\text{F}$** , without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during heat wave season i.e., March to July)*

##Suspected Heat Stroke Death: Is a death on account of suspected heat stroke patient.

***Cardiovascular death** includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV hemorrhage or death due to other CV causes.

*****Confirmed Heat Stroke Death:** A suspected heat stroke death that is confirmed by death committee (heat death committee/three man committee) at district level.

FORMAT 3 (B): DISTRICT FORMAT FOR SENDING TO STATE

Daily numbers of Suspected Heat Stroke CASES[#] and All cause DEATHS^{*}

(Compiled from Format 3 A)

(To be sent to State Nodal Unit daily while keeping a copy for record)

Cases and deaths due to heat stroke- <i>District name</i> 20__					Date of reporting: __/__/__				
Date	Total patients of the day (Emergency Medicine + Emergency Paediatrics + Casualty)	New Suspected Heat Stroke Cases (A)	Total Suspected Heat Stroke cases since 1 st March, 20__ (B)	All cause deaths ^{**}				New Confirmed Heat Stroke Deaths ^{***}	Total Confirmed Heat Deaths since 1 st March 20__
				Suspected Heat stroke deaths ^{##} (a)	Confirmed CVD deaths (b)	Others including unknown (c)	Total deaths (a+b+c)		
01-03-20									
02-03-20									

Name of person filling the form:

Designation:

Signature:

Name of nodal officer:

Signature of nodal officer:

Date:

**** All cause death:** All of the deaths that occur in casualty/emergency of medicine plus paediatrics, regardless of cause.

[#]Suspected Heat stroke: Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature $\geq 40^{\circ}\text{C}/\geq 104^{\circ}\text{F}$** , without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. (*definition is applicable during heat wave season i.e., March to July*)

^{##}Suspected Heat Stroke Death: Is a death on account of suspected heat stroke patient.

^{*}Cardiovascular death includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV hemorrhage or death due to other CV causes.

^{***}Confirmed Heat Stroke Death: A suspected heat stroke death that is confirmed by death committee (heat death committee/three man committee) at district level.

FORMAT 4 (A): STATE FORMAT FOR DAILY COMPILATION (district wise)

Daily numbers of Suspected Heat stroke CASES[#] and All cause DEATHS^{*}

(To be sent to Central Nodal Unit daily while keeping a copy for record)

Cases and deaths due to Heat Stroke- <i>State name 2020</i>					Date of reporting: <i>_./_./_.</i>					
S.No.	Name of District	Total patients of the day (Medicine + Paediatrics + Casualty/Emergency)	New cases of Heat Stroke (A)	Cumulative total of Heat Stroke cases since 1 st March, 2020 (B)	All cause deaths ^{**}				New Confirmed Heat Stroke Deaths ^{***}	Total Confirmed Heat Stroke Deaths since 1 st March 2020
					Suspected Heat stroke deaths ^{##} (a)	Confirmed CVD deaths [*] (b)	Others including unknown (c)	Total deaths (a+b+c)		
1	<i>District 1</i>									
2	<i>District 2</i>									
3	<i>District 3</i>									
	Total									

Name of person filling the form:

Designation:

Signature:

Name of nodal officer:

Signature of nodal officer:

Date:

^{**}**All cause death:** All of the deaths that occur in casualty/emergency of medicine plus paediatrics, regardless of cause.

[#]**Suspected Heat stroke:** Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature $\geq 40^{\circ}\text{C}/\geq 104^{\circ}\text{F}$** , without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. (*definition is applicable during heat wave season i.e., March to July*)

^{##}**Suspected Heat Stroke Death:** Is a death on account of suspected heat stroke patient.

^{*}**Cardiovascular death** includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV hemorrhage or death due to other CV causes.

^{***}**Confirmed Heat Stroke Death:** A suspected heat stroke death that is confirmed by death committee (heat death committee/three man committee) at district level.

FORMAT 4 (B): STATE FORMAT FOR DAILY COMPILATION (day wise)

Daily numbers of Suspected Heat stroke CASES[#] and All cause DEATHS^{*}

(To be kept at State for record)

Cases and deaths due to Heat Stroke- <i>State name</i> 2020							Date of reporting: _./_./_.		
Date	Total patients of the day (Medicine + Paediatrics + Casualty/Emergency)	New cases of Heat Stroke (A)	Cumulative total of Heat Stroke cases since 1 st March, 2020 (B)	All cause deaths ^{**}				New Confirmed Heat Stroke Deaths ^{***}	Total Confirmed Heat Stroke Deaths since 1 st March 2020
				Suspected Heat stroke deaths ^{##} (a)	Confirmed CVD deaths [*] (b)	Others including unknown (c)	Total deaths (a+b+c)		
01-03-20									
02-03-20									
Total									

Name of person filling the form:

Designation:

Signature:

Name of nodal officer:

Signature of nodal officer:

Date:

^{**}**All cause death:** All of the deaths that occur in casualty/emergency of medicine plus paediatrics, regardless of cause.

[#]**Suspected Heat stroke:** Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature $\geq 40^{\circ}\text{C}/\geq 104^{\circ}\text{F}$** , without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. (*definition is applicable during heat wave season i.e., March to July*)

^{##}**Suspected Heat Stroke Death:** Is a death on account of suspected heat stroke patient.

^{*}**Cardiovascular death** includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV hemorrhage or death due to other CV causes.

^{***}**Confirmed Heat Stroke Death:** A suspected heat stroke death that is confirmed by death committee (heat death committee/three man committee) at district level.

6. Investigation of Suspected Heat-related illness Death

(To be filled by an epidemiologist/medical officer)

Unique ID:

Respondent's Name:

Relationship of respondent with deceased:

Residential address of respondent:

Section A: Deceased's identifier details

A.1. Name of deceased:		A.2. Age (in completed years & months):		Y	Y	M	M
A.3. Sex: Male / Female/Transgender:		A.4. Father's/Mother's/Spouse's name:					
A.5. Residential Address of deceased							
A.5.1 State:				A.5.2. District:			
A.5.3. Block/Taluka:				A.5.4. Ward/village:			
A.6. Does the deceased have following socio economic card				i. BPL ii. Antayodya iii. Annapurna iv. Other or equivalent (mention)..... v. None			
A.7. What was the last occupation of deceased:							

Section B: Death detail

No.	Questions	Coding categories	If no, Skip to
B.1	Was the deceased found unconscious or dead?	Yes.....1 No.....2 Don't Know.....3	B.3
B.2	Place where deceased was found unconscious or dead?	At home.....1 At work place.....2 At social gathering..3 On road.....4 Other (specify).....	
B.3	Location where deceased was found unconscious or dead		
	B.3.1 State:	B.3.2. District:	
	B.3.3. Block/Taluka:	B.3.4. Ward/village:	
B.4	Name of hospital and address where deceased was brought dead or died:		
B.5	Date and time of the death: (from medical record)	DD MM YYYY HH MM	

Section C: Clinical history in past 24 hr before death (from medical record followed by respondent)

C.1. Symptoms at the time of onset of illness:							
C.1.1. Was the skin hot and dry? (a. From Medical Record b. From Respondent c. both)				Yes.....1 No.....2 Don't Know.....3			
C.1.2 Was the deceased in altered mental sensorium? (a. From Medical Record b. From Respondent c. both)				Yes.....1 No.....2 Don't Know.....3			
C.1.3. What was the core body temperature? (from medical record only):							
C.1.4. What was the deceased's vitals? (from medical record only):							
a. Pulse rate:		b. Respiratory rate:		c. Blood pressure:			
C.2. Date and time of onset of first symptom of heat illness:		DD	MM	YYYY	HH	MM	
C.3. Place of onset of first symptom:				At home.....1 At work place.....2 At social gathering..3 On road.....4 School/college.....5 Other (specify).....			
C.4. Location of onset of symptoms							
C.4.1 State:				C.4.2. District:			

C.4.3. Block/Taluka:

C.4.4. Ward/village:

C.5. Did the deceased have alcoholic beverage within a day of onset of illness?

Yes.....1

No.....2

Don't Know.....3

Section D: Outdoor activities just before onset of illness

No.	Questions	Coding categories	If no, Skip to
D.1	Just before onset of illness, was the deceased present outdoors ?	Yes.....1 No.....2 Don't Know.....3	E.1
D.2	Was the deceased engaged in outdoor occupational activities?	Yes.....1 No.....2 Don't Know.....3	D.3
D.3	Was the deceased working under direct sunlight ?	Yes.....1 No.....2 Don't Know.....3	
D.4	Was the deceased working in peak hours of day i.e. 11 AM to 4 PM ?	Yes.....1 No.....2 Don't Know.....3	
D.5	Was the deceased working near heat source i.e., hot furnace, stove, gas fire, wood fire, steam, hot engines/machines?	Yes.....1 No.....2 Don't Know.....3	D.7
D.6	If yes to D.5, the type of heat source was:	Fire (hot furnace, stove, gas fire, hot engines).....1 Steam 2	
D.7	Was the deceased doing any physical exertional activity ?	Yes.....1 No.....2 Don't Know.....3	D.8
D.8	Was the deceased sitting in a vehicle ?	Yes.....1 No.....2 Don't Know.....3	D.12
D.9	If yes to D.8, was the vehicle parked in shaded area?	Yes.....1 No.....2 Don't Know.....3	
D.10	If yes to D.8, what was the approx. duration of sitting in vehicle?	0-1 hr.....1 >1 hr 2	
D.11	If yes to D.8, was the air-conditioner working?	Yes.....1 No.....2 Don't Know.....3	
D.12	Remarks on outdoor activity, if any:		

Section E. Indoor conditions just before the onset of illness.

E.1	Was the deceased INDOORS?	Yes.....1 No.....2 Don't Know.....3	F1
E.2.	If yes to E.1, were the following items i.e., ceiling fan, desert cooler, air conditioner present?	Yes.....1 No.....2 Don't Know.....3	
E.3	If yes to E.2, describe the item, its working condition and whether it was switched on or not? Description:		
E.4	Type of house/Room	Pucca house (house made with high quality materials throughout, including the floor, roof, and exterior walls).....1 Katcha house (House made from mud, thatch, or other low-quality materials).....2	
E.5	Windows in rooms	Yes.....1 No.....2 Don't Know.....3	

E.6	If there were windows in the room, were they open at the time of onset of symptoms	Yes.....1 No.....2 Don't Know.....3

Section F: Medical conditions recorded at first medical contact (as per medical record)

No.	Questions	Coding categories	If no, Skip to
F.1	Was the deceased suffering from any chronic medical condition?	Yes.....1 No.....2 Don't Know.....3	
F.2	Was the deceased suffering from any acute medical conditions prior to onset of current illness?	Yes.....1 No.....2 Don't Know.....3	F.4
F.3	If yes to F.2, list the illness and duration of suffering-		
F.4	Was the deceased taking any medications prior to onset of current illness?	Yes.....1 No.....2 Don't Know.....3	Section -G
F.5	If yes to F.4, list the medication and duration since taking-		

Section G: Weather data from India Meteorological Department

No.	Questions and Filters	Coding categories/Response	If no, Skip to
G.1	What was the Maximum temperature (Tmax) of area at/around time of onset of illness(or at time of death if onset unknown)?:		
G.2	What was the Maximum temperature (Tmax) for each day of past 3 days from date of death of patient?:	a. One day back: b. Two days back: c. Three days back:	
G.3	Was there a heat wave affecting the area/region on date of onset of illness?	Yes.....1 No.....2 Don't Know.....3	
G.4	Was there a heat wave in previous 3 days in the area where the onset of illness occurred?	Yes.....1 No.....2 Don't Know.....3	
G.5	What was the relative humidity of area at/around time of onset of illness(or at time of death if onset unknown)?:		
G.6	What was the relative humidity for each day of past 3 days from date of death of patient?:	a. One day back: b. Two days back: c. Three days back:	

Form filled by:

Name:

Signature:

Designation:.....

Date:

Guidelines to fill Heat related illness death investigation form

1. The heat related illness death investigation form should be filled by any of the following:

- a. Medical officer of Primary Health Centre or Community Health Centre.
- b. Doctor on duty in health facility/hospital where the suspected case of heat related illness died.
- c. Epidemiologist doing heat related illness death investigation.

2. Data sources to fill the form are as follows:

- a. Deceased's photo ID record: Aadhar card/Pan card/Voter ID/Ration card/driving licence etc.
- b. Respondent's photo ID record: Aadhar card/Pan card/Voter ID/Ration card/driving licence etc.
- c. Past medical records.
- d. Hospital medical record
- e. Interview with the relatives/care takers/neighbour/person brought or saw the ill or suspected deceased.
- f. Weather record from Indian Meteorological Department (IMD) website or IMD office.

3. Unique ID:

- a. The unique ID will be as local government directory available at <https://lgdirectory.gov.in/>

4. Section A: Deceased's personal details

- a. Section A.1 to A.6.: The name, age, sex, father's/spouse's name, residential address should be as per valid government ID. The information taken from government ID or relative or some other source should be mentioned in Remarks box.
- b. Section A.7: Current occupation: Within a week of death.

Note: The activities/occupational activities just before death/onset of symptoms will be mentioned in section D.

5. Section B: Death detail

- a) Section B.2.: Place where found unconscious or dead: The purpose of getting information on place where decedent was found dead is to know the circumstances in which the death of person occur and to correlate it with the weather condition of that area (*the weather condition will be recorded in section H*).
- b) The name of hospital where the deceased was brought dead or declared dead is for record purpose.

5. Section C: Clinical history in past 24 hr before death (from medical record and relatives)

- a. The answers for this section should be first track from medical records. If the information are not available from medical record then only the information may be sought from respondents/relatives.
- b. Symptoms at the time of onset of illness: for diagnosis purpose
- c. Date and time of onset: for correlating with climate variables of that day and time.

- d. Place of onset of symptoms: for correlating with climate variables of that place.
 - e. Did the deceased have alcoholic beverage within a day of onset of illness?: for contributing factors
- 6. Section D: Outdoor activities just before onset of illness:**
- a. Section D. requires the details whether the decedent was outdoor/indoor before/during onset of symptoms.
7. Section E: Indoor conditions just before the onset of illness
8. Section F: Other non-heat related questions i.e, chronic, acute and medication history.
- a. Medical record: Any public or private facility or pharmacy note
9. Section H: Weather data from India Meteorological Department
10. At the bottom of form give the details of person filling the form with his/her name, designation, signature and date of signing. The form should be filled as by the person mention in first point.

Annexures A

Heat wave Do's and Don'ts

Do's

For general population

- **Stay hydrated:**
 - Drink sufficient water as and when possible, even you are thirsty. Use Oral Rehydration Solution (ORS), and consume homemade drinks like lemon water, butter milk/lassi, fruit juices with some added salts.
 - Carry water during travel
 - Eat seasonal fruits and vegetables with high water content like water melon, musk melon, orange, grapes, pineapple, cucumber, lettuce or other locally available fruits and vegetables.
- **Stay covered:**
 - Wear thin loose cotton garments preferably light colored
 - Cover your head: use umbrella, hat, cap, towel and other traditional head gears during exposure to direct sunlight
 - Wear shoes or chappals while going out in sun.
- **Stay alert:**
 - Listen to Radio; watch TV; read Newspaper for local weather news. Get the latest update of weather on India Meteorological Department (IMD) website at <https://mausam.imd.gov.in/>
- **Stay indoors as much as possible:**
 - In well ventilated and cool places
 - Block direct sunlight and heat waves: Keep windows and curtains closed during the day, especially on the sunny side of your house. Open them up at night to let cooler air in.
 - If going outdoor, limit your outdoor activity to cooler times of the day i.e., morning and evening

For vulnerable population

- Although anyone at anytime can suffer from the heat-related illness, some people are at greater risk than others and should be given additional attention. These includes:
 - Infants and young children
 - Pregnant women
 - People aged 65 years or older
 - People working outdoors
 - People who have mental illness
 - Those who are physically ill, especially with heart disease or high blood pressure

Other precautions:

- Elderly or sick people living alone should be supervised and their health monitored on a daily basis.
- Keep your home cool, use curtains, shutters or sunshade and open windows at night. Try to remain on lower floors
- Use damp cloths to cool down body
- Take bath in cold water frequently
- If you or other feel unwell
 - Try to get help/ and medical attention if you feel dizzy, weak, anxious or have intense thirst and headache; move to a cool place as soon as possible and measure your body temperature
 - Drink some water or fruit juice to rehydrate
 - Rest immediately in a cool place if you have painful muscular spasms (particularly in the legs, arms or abdomen, in many case after sustained exercise during very hot weather),

and drink oral rehydration solutions containing electrolytes. Medical attention is needed if heat cramps last more than one hour

For Employers and workers

- Provide cool drinking water near work place and remind them to drink a cup of water every 20 minutes or more frequently to stay hydrated
- Caution workers to avoid direct sunlight
- Provide shaded work area for workers. Temporary shelter can be created at work site.
- Schedule strenuous and outdoor jobs to cooler times of the day i.e., morning and evening hours
- Increase the frequency and length of rest breaks for outdoor activities- at least every 5 minutes after 1 hour of labour work.
- Listen to Radio; watch TV; read Newspaper for local weather news and act accordingly. Get the latest update of weather on India Meteorological Department (IMD) website at <https://mausam.imd.gov.in/>
- Assign additional worker or slow down the pace of work
- Make sure everyone is properly acclimatized: it takes weeks to acclimatize to a hotter climate. Do not work for more than three hours in one day for the first five days of work. Gradually increase the amount and time of works.
- Train workers to recognize factors which may increase the risk of developing a heat related illness and the signs and symptoms of heat stress and start a “buddy system” since people are not likely to notice their own symptoms
- Trained First Aid providers should be available and an emergency response plan should be in place in the event of a heat related illness.
- Pregnant workers and workers with a medical condition or those taking certain medications should discuss with their physicians about working in heat.
- If working outdoors wear light coloured clothing preferably long sleeve shirt and pants, and cover the head to prevent exposure to direct sunlight.
- Awareness campaigns should be organized for employees
- Install temperature and forecast display at the workplace.
- Distribute informational pamphlets and organize training for employers and workers regarding health impacts of extreme heat and recommendations to protect themselves during high temperature.

Don'ts

- Avoid getting out in the sun, especially between 12:00 noon and 03:00 pm
- Avoid strenuous activities when outside in the afternoon
- Do not go out barefoot
- Avoid cooking during peak summer hours. Open doors and windows to ventilate cooking area adequately
- Avoid alcohol, tea, coffee and carbonated soft drinks or drinks with large amount of sugar- as these actually lead to loss of more body-fluid or may cause stomach cramps
- Avoid high-protein food and do not eat stale food
- Do not leave children or pets in parked vehicle

Danger signs- Seek immediate medical attention if any of the following is observed:

- Altered mental sensorium with disorientation: confusion and agitation, irritability, ataxia, seizure and coma
- Hot, red and dry skin
- Body temperature $\geq 40^{\circ}\text{C}$ or 104°F
- Throbbing headache
- Anxiety, Dizziness, fainting and light headedness

- Muscle weakness or cramps
- Nausea and vomiting
- Rapid heart beat
- Rapid, shallow breathing

Annexure B: Standard Operating Procedures for Heat related illnesses reporting formats

Standard Operating Procedures: Format 1(A)

1. **Format 1 (A)** is a daily line list format of **suspected heat stroke cases** to be filled at health facility.
2. It will be kept at health facility for record purpose.
3. It will be **used to compile line list Format 1(B) and daily reporting Format 2.**
4. **Suspected heat stroke (Case definition):** Altered mental status (including disorientation, delirium, seizure, obtundation) with **elevated core body temperature $\geq 40^{\circ}\text{C}/\geq 104^{\circ}\text{F}$** , without signs of stroke, history of infection, or signs of medication overdose **OR** Altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose. *(definition is applicable during heat wave season i.e., March to July)*
5. **Institute and department who will compile suspected heat stroke cases:**
 - a. All public hospitals with casualty/emergency.
 - b. All private hospitals with casualty/emergency.
 - c. Reporting Departments will be casualty/emergency of medicine and paediatrics.
6. **Data collection period:** In standard it will be from **March 01 to July 31, every year.** Further direction will be communicated at the start of the year if required.
7. **Case identification:**
 - a. **Person who will diagnose:** A qualified medical doctor will diagnose heat related illness case as per case definition.
 - b. **Where will the data be recorded:** A qualified medical practitioner will write the provisional diagnosis in the casualty/emergency register as suspected heat stroke.
 - c. **Data collecting person:** Pharmacist, multipurpose health worker-male (MPHW-M), staff nurse -either of the employee will collect the data of suspected heat stroke cases that were diagnosed on previous day from emergency/casualty of medicine and paediatrics department every day.
8. **Day of diagnosis and recording:** Date of diagnosis will be considered as day zero. Cases diagnosed on day Zero should be recorded on following day i.e., day One in **FORMAT 1 (A)**. Example: Cases diagnosed on Sunday (Day Zero) will be recorded on Monday (Day One).
9. **Data compilation:** A hard copy of each completed and signed **Format 1(A)** should be stored in a file **daily** in a proper order. A soft copy of the line list should be maintained as a single excel sheet which should be updated **weekly** to include all heat related cases. It should be ready to be submitted to District or State as per request.
10. **Reporting after a holiday:** A report which should have been prepared on a holiday (e.g. Sunday or gazetted holiday) must be compiled and filed on the next working day. For example, cases diagnosed on Saturday (Day Zero) must be recorded on **Format 1 (A)** on Monday (Day Two) along with a separate daily **Format 1 (A)** report of cases diagnosed on Sunday (Day One).
11. **Nil reporting is mandatory on the prescribed format.** No columns will be left blank, in case of nil reporting **“0”** should be written.

Standard Operating Procedures: Format 1 (B)

1. **Format 1 (B)** is a daily line list of **suspected heat stroke deaths** and **confirmed cardiovascular disease (CVD) deaths**.
2. Total number of all cause deaths in health facility (casualty/emergency of medicine and paediatrics) will also be recorded.
3. **Institute and department who will report suspected heat stroke cases:**
 - a. All public hospitals with OPDs & casualty/emergency.
 - b. All private hospitals having casualty/emergency.
 - a. Reporting Departments will be casualty/emergency of medicine and paediatrics.
4. **Date of death and recording:** Date of death will be considered as day zero. Cases died on day Zero should be recorded on following day i.e., day One in FORMAT 1 (B). Example: Cases diagnosed on Sunday (Day Zero) will be recorded on Monday (Day One).
5. **Data compilation:** A hard copy of each completed and signed **Format 1 (B)** should be stored in a file **daily** in a proper order. A soft copy of the line list should be maintained as a single excel sheet which should be updated **weekly** to include all suspected heat stroke deaths and confirmed CVD deaths. It should be ready to be submitted to district or state nodal unit as per request.
6. **Nil reporting is mandatory on the prescribed format.** No columns will be left blank, in case of nil reporting **“0”** should be written.

Standard Operating Procedures: Format 2
(Health facility format for sending to DISTRICT)

1. **Format 2** will be compiled from data of **Format 1 A** and **Format 1 (B)** by the nodal person at the health facility daily.
2. **Institute and department who will report heat related illnesses:**
 - b. All public hospitals with casualty/emergency.
 - c. All private hospitals having casualty/emergency.
 - d. Reporting Departments will be medicine, paediatrics and casualty/emergency.
3. **Time of reporting to district nodal unit: Format 2 compiled from Format 1 (A) should be reported to District nodal unit on following day (day one) by 12.00 hr (i.e. 12:00 noon).**
4. **Reporting person:** A nodal person identified for health facility will prepare the report.
5. **Data compilation:** A soft copy in the form of an excel sheet shall be e-mailed **daily** to district nodal unit through a proper channel. In places where internet facility is not available the report can be communicated by any possible means. A hard copy of each **Format 2** should be kept in a designated file daily at the institutions/health facility.
6. **Data collection period:** In standard it will be from **March 01 to July 31 every year**. Further direction will be communicated during start of the year if required.
7. **Nil reporting is mandatory on the prescribed format.** No columns will be left blank, in case of nil reporting “0” should be written.
8. **If not submitted on time:** Late report must be submitted within 48 hrs.

Standard Operating Procedures: Format 3 (B)
(District format for sending to state)

1. **Format 3(B)** will be compiled by a nodal officer **daily** at District nodal unit.
2. **Format 3 (B)** will be compiled from end row of **Format 3 (A)**.
3. **Time of reporting to state nodal unit:** Format 3 (B) compiled from Format 3 (A) should be reported to state nodal unit on following day (**day one**) by **04.00 PM**.
4. **Reporting after a holiday: Format 3 (B)** which should have been prepared on a holiday (e.g. Sunday) must be compiled and prepared on the next working day. For example, facility reports (Format 2) submitted to district on Saturday must be compiled on **Format 3(B)** on Monday along with a separate **Format 3(B)** for facility reports submitted to district on Sunday.
5. **Nil reporting is mandatory on the prescribed format.** No columns shall be left blank, in case of nil reporting “0” should be written.
6. **Confirmed heat stroke death:** a suspected heat stroke death is to be reported as and when the death is confirmed by death committee (heat death committee/three man committee) at district level.

Standard Operating Procedures: Format 3 (A)
(District format for compilation from health facility)

1. **Format 3(A)** will be compiled by a nodal officer **daily** at District nodal unit.
2. **Format 3 (A)** will be compiled from **Format 2** from all health facility.
3. **Format 3 (A) adaptation:** Modify relevant fields (in grey italic fonts) in given Format 3 (A) to add name of your district, to list **all** the government facilities and private reporting units in a proper order- from primary health centre (PHC), Community Health Centre (CHC), District Hospital (DH), Civil Hospital (CH) to Private. This will be the **standard Format 3(A)** for your district for daily data compilation during the whole reporting period of a year.
4. **Total patient of the day:** Against each health facility write the total patient of the day from emergency medicine, emergency paediatrics and casualty.
5. **Data compilation:** District nodal unit should receive Format 2 from health facilities by **12.00 hr (i.e. 12.00 noon) daily**. Format 3 (A) should be compiled daily from all submitted Format 2 reports. A date-wise soft copy of each daily Format 3 (A) report should be maintained digitally in a designated folder. A hard copy of the same should be printed and filed daily at district level.
6. **Data collection period:** In standard it will be from **March 01 to July 31 every year**. Further direction will be communicated during start of the year if required.
7. **No reporting by health facility:**
 - a. If a health facility report (**Format 2**) is not received on time, write “delayed” in the row for that facility.
 - b. If the facility reports to the district after the deadline of 12:00 noon, **Format 3 (A)** should be updated to reflect the change. Format 3 (A) for the given reporting period can be updated till 48 hrs and should show updated date of reporting, if applicable.
 - c. If the health facility does not submit **Format 2 at all or** submits it after 48 hrs of reporting deadline, Format 3 of that reporting period should be updated; “delayed” should be changed to “not available”.
8. **Reporting after a holiday: Format 3 (A)** which should have been prepared on a holiday (e.g. Sunday) must be compiled and prepared on the next working day. For example, facility reports (Format 2) submitted to district on Saturday must be compiled on **Format 3(A)** on Monday along with a separate **Format 3(A)** for facility reports submitted to district on Sunday.
9. **Nil reporting is mandatory on the prescribed format.** No columns will be left blank, in case of nil reporting “0” should be written.
10. **Confirmed heat stroke death:** a suspected heat stroke death is to be reported as and when the death is confirmed by death committee (heat death committee/three men committee) at district level.

Guidelines for Analysis of Suspected Heat Stroke Cases and Deaths

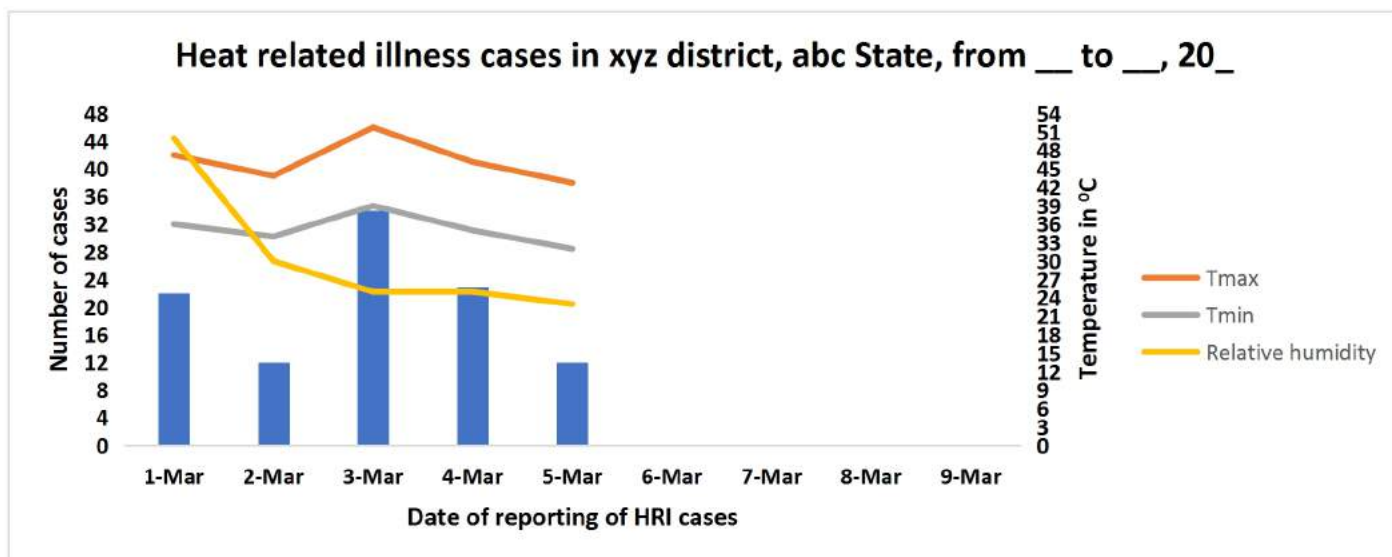
- a. Analysis should be done at District Surveillance Unit by the nodal officer.
- b. Periodicity of analysis will be weekly. Data from previous week, i.e. **Monday to Sunday**, should be analysed by Tuesday of the current week.
- c. Analysed report should be emailed to State Surveillance Unit by **Tuesday evening by 04:00 pm**.
- d. Analysis is to be done on time, place and person indicators as shown below.
- e. Use following formats depending on the analysis type required.

Analysis Type	Presentation	Data Source
1. Time distribution of heat related illness cases	Graph	• Format 1- line list submitted by health facilities • Temperature maximum and minimum data from Indian Meteorological department
2. Place distribution of heat related illness cases and deaths	Map	• Format 3 prepared at district level • District map with block (equivalent unit) boundaries
3. Age (person) distribution of heat stroke cases and deaths	Table or Bar Diagram	• Format 1- line list submitted by health facilities

1. Time distribution of heat related illness cases:

- a. Coordinate with Indian Meteorological Department at district level to get data for daily Temperature (maximum and minimum) and relative humidity.
- b. Plot temperature (maximum and minimum) against number of cases for your district.
- c. Prepare time distribution graph as shown below. You can prepare such a graph yourself. If you would like to use preformatted graph template, follow the steps explained below

Figure X. Distribution of heat related illness cases with Temperature (maximum & minimum) over a time period (--/--/20—to --/--/20--) in(Name of District)

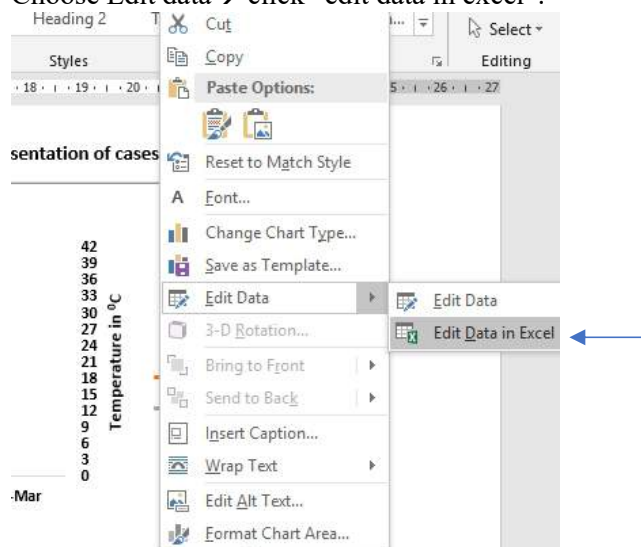


Steps for creating/ updating time distribution graph

- A. Use the Graph template to show the time distribution of cases or you can insert your own graph.

If using the same template:

- Click the graph → right click on outer border.
- Choose Edit data → click “edit data in excel”.



- In excel sheet, Fill the number of heat related illness cases under cases column according to **dates of their presentation (NOT by date of reporting)**.

	A	B	C	D
1		Cases	Tmax	Tmin
2	01-Mar	22	42	36
3	02-Mar	12	39	34
4	03-Mar	34	46	39
5	04-Mar	23	41	35
6	05-Mar	12	38	32
7	06-Mar			
8	07-Mar			
9	08-Mar			
10	09-Mar			

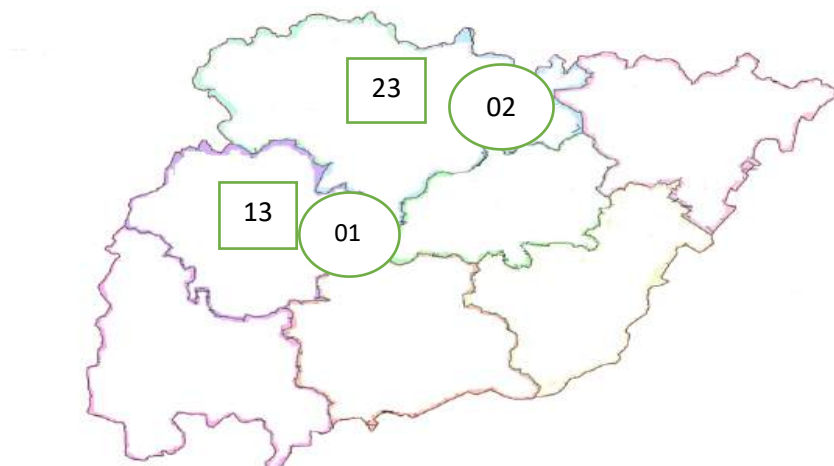
- Fill the maximum and minimum temperature under Tmax and Tmin and relative humidity.

- v. The graph will automatically update to reflect the inserted data.
- vi. Save the excel file and keep adding new data to generate weekly reports.

2. Place distribution of cases and deaths in the district map (weekly report)

Show weekly total of cases and **confirmed** deaths in your district for each block. Write total number of cases in a box and number of deaths in a circle shape as shown in the example below. Make sure that, total number of cases include those cases who have died. For example, 23 cases in a square also includes two cases who are dead, which shows that out of 23 cases two cases died (confirmed of heat related illness) in that block in a reporting week. You can prepare this map either digitally or on a hard copy and attach it in the report accordingly.

Example: Block-wise Distribution of Heat Related Illness Cases and Deaths in Tarn Taran district, Punjab, from xx/xx to xx/xx, 20xx



3. Age distribution of heatstroke cases and deaths in a reporting week. Use age groups mentioned below to analyse line list details for cases and deaths diagnosed with heatstroke

Age group	No of Heat Stroke Cases	No of Heat Stroke Deaths	Total
<1 year			
1-5 years			
6-15 years			
16-60 years			
≥ 61 years			
Total			

Standard Operating Procedures: Format 4 (A)
(State format for sending to centre)

1. **Format 4** will be compiled from data reported by all districts by nodal officer at state nodal unit daily.
2. **Districts** will report health facility-wise aggregate number of cases due to suspected heat stroke. Also the aggregate number of all cause deaths with segregation of suspected heat stroke deaths, confirmed CVD deaths and others.
3. **Time of reporting:**
 - a. Health facility to district nodal unit: **Cases diagnosed on day zero** (from 00.01 hr to 24.00 hr of a day) at health facilities to be reported to district nodal unit on day 1 (i.e. next day) at 12:00 noon **in Format 2**. The daily compiled report from district nodal unit (**Format 3**) should be submitted to Integrated Disease Surveillance Programme (IDSP) at district Surveillance unit (DSU) through proper channel by **01:00 pm** on day 1 (i.e. next day).
 - b. District to State: by **04:00 pm the day 1**.
 - c. State to Centre: by **05:00 pm the day 1**.
4. **Data compilation:** A soft copy of **Format 4** in the form of excel sheet shall be e-mailed **daily** to Central unit through proper channel. A date-wise soft copy of each daily **Format 4** report should be maintained digitally in a designated folder. A hard copy of **Format 4** should be kept daily in a designated file at the state level.
5. **Data collection period:** In standard it will be from **March 01 to July 31 every year**. Further direction will be communicated during start of the year if required.
6. **No report by a district:**
 - a. If a **Format 3** from a district is not received on time, write “**delayed**” in the row for that district.
 - b. If the district reports to the state after the deadline of 4.00pm, **Format 4** should be updated to reflect the change. **Format 4** for the given reporting period can be updated till 48 hrs and should show updated date of reporting, if applicable.
 - c. If a district does not submit **Format 3 at all or** submits it after 48 hrs of reporting deadline, **Format 4** of that reporting period should be updated i.e., “**delayed**” should be changed to “**not available**” for that district.
7. **Changing a filed report:** A submitted **Format 4** can be changed only if an update is generated by a health facility and communicated to District within 48 hrs of reporting

deadline. Updated **Format 4** for that reporting period should be submitted again to Central unit with new date of reporting if applicable.

8. **Reporting after a holiday:** A **Format 4** which should have been prepared on a holiday (e.g. Sunday) must be compiled and submitted on the next working day. For example, **Format 5** for Saturday must be compiled on Monday along with a separate **Format 4** for Sunday.
9. **Nil reporting is mandatory on the prescribed format.** No columns shall be left blank, in case of nil reporting “0” should be written
10. **If not submitted on time:** Late report must be filled within 48 hrs with correct date of reporting.
11. **Analysis:** Analysis of the data should be done on weekly basis according to the guidelines provided here.

Guidelines for Analysis of Heat Related Illnesses Cases and Deaths

- a. Analysis should be done at State Surveillance Unit by the nodal officer.
- b. Periodicity of analysis will be weekly. Data from previous week, i.e. **Monday to Sunday**, should be analysed by Tuesday of the current week.
- c. Analysed weekly report is to be kept at State Surveillance Unit.
- d. Analysis is to be done on time and place indicators as shown below.
- e. Use following formats depending on the analysis type required.

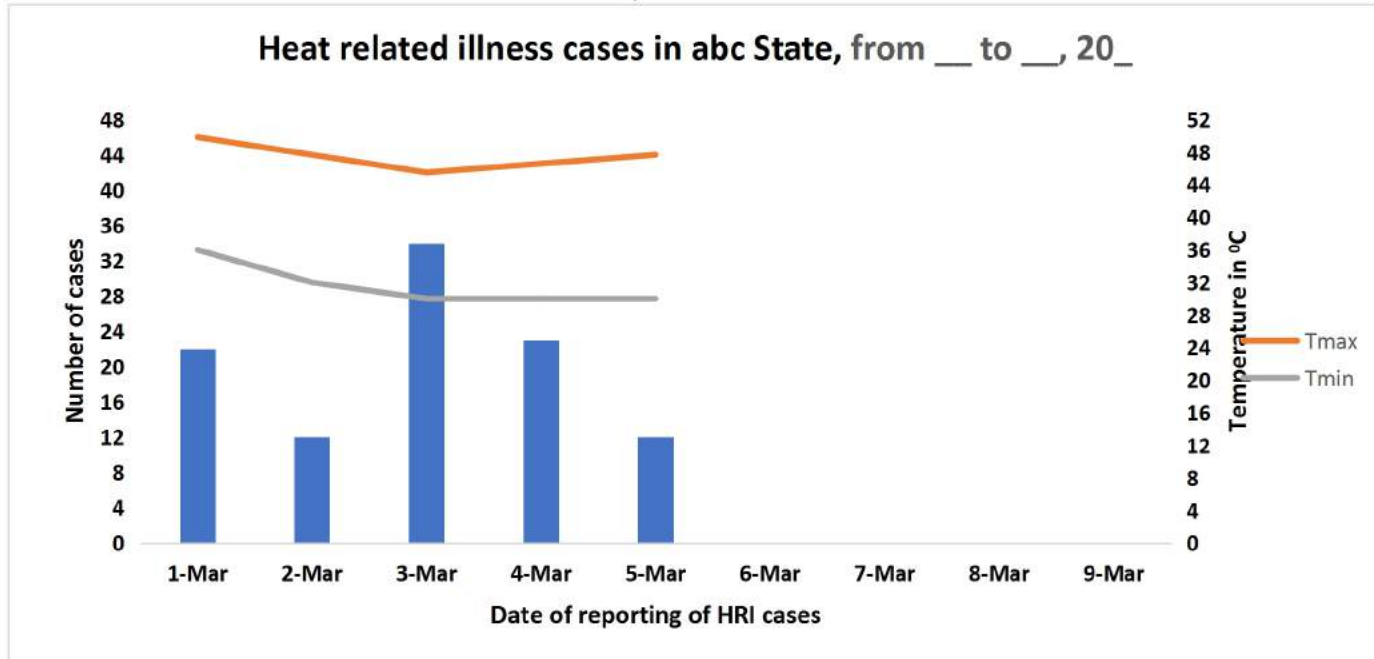
Analysis Type	Presentation	Data Source
1. Time distribution of heat related illness cases	Graph	• Format 4 submitted by districts • Temperature maximum and minimum data from Indian Meteorological department
2. Place distribution of heat related illness cases and deaths	Map	• Format 5 prepared at state level • State map with district boundaries

1. Time distribution of heat related illness cases:

- a. Coordinate with Indian Meteorological Department at state level to get data for Temperature (maximum and minimum) and relative humidity.
- b. Plot temperature (maximum and minimum) against number of cases for your district.
- c. Prepare time distribution graph as shown below. You can prepare such a graph yourself. If you would like to use preformatted graph template, follow the steps explained below

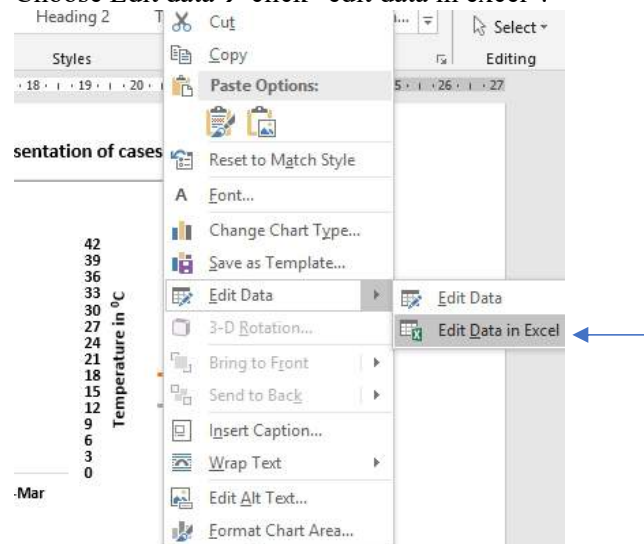
Figure X. Distribution of heat related illness cases with Temperature (maximum & minimum) over a time period (--/--/20—to --/--/20--) in(Name of

State).



Steps for creating/ updating time distribution graph

- Click the graph → right click on outer border.
- Choose Edit data → click “edit data in excel”.



- In excel sheet, Fill the number of heat related illness cases under cases column according to **dates of their presentation** (NOT by date of reporting).

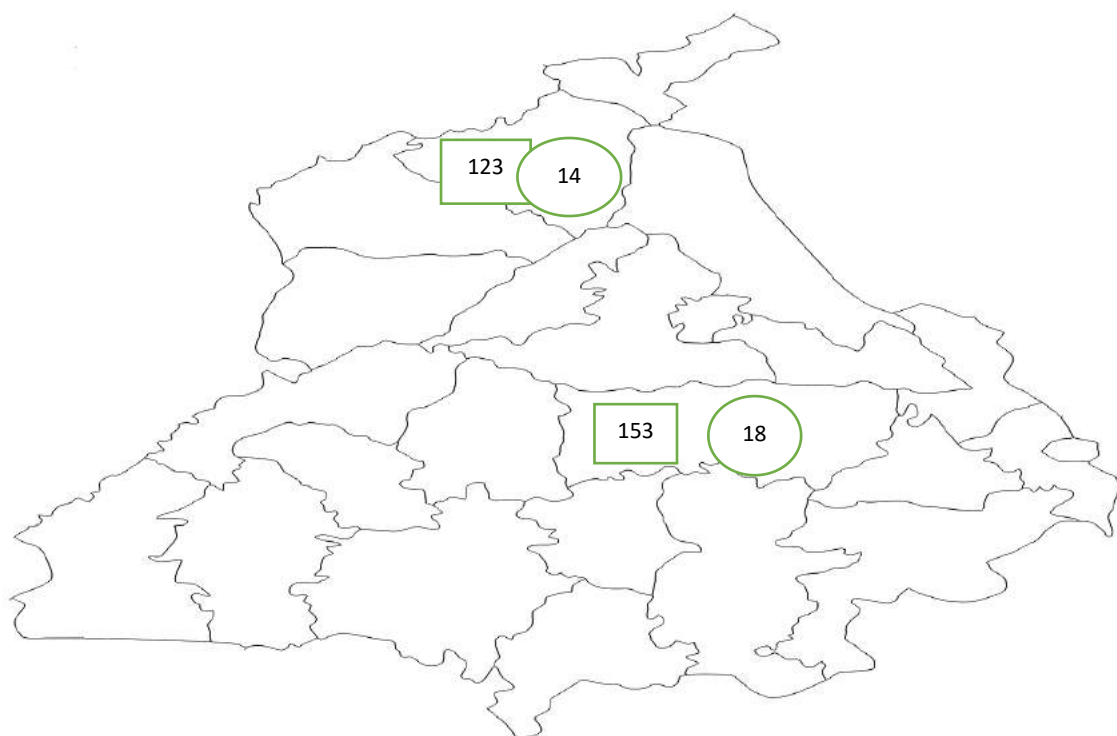
	A	B	C	D
1		Cases	Tmax	Tmin
2	01-Mar	22	42	36
3	02-Mar	12	39	34
4	03-Mar	34	46	39
5	04-Mar	23	41	35
6	05-Mar	12	38	32
7	06-Mar			
8	07-Mar			
9	08-Mar			
10	09-Mar			

- iv. Fill the maximum and minimum temperature under Tmax and Tmin.
- v. The graph will automatically update to reflect the inserted data.
- vi. Save the excel file and keep adding new data to generate weekly reports

2. Place distribution of cases and deaths in the **state map (weekly report)**

Show weekly total of cases and **Confirmed** deaths in your state for each district. Write total number of cases in a box and number of deaths in a circle shape as shown in the example below. Make sure that, total number of cases include those cases who have died. For example, 123 cases in a square also includes 14 cases who are dead, which shows that out of 123 total cases 14 died (confirmed of heat related illness) in that district in a reporting week. You can prepare this map either digitally or on a hard copy and attach it in the report accordingly.

Example: District-wise Distribution of Heat Related Illness Cases and Deaths in Punjab, from --/--/20—to --/--/20—



Annexure C: Old Reporting format for Heat Related Illnesses (from 2015 to 2019)

Reporting format for Heat Related Illnesses since year 2015

CASES AND DEATHS DUE TO HEAT RELATED ILLNESS - State 20--						Date --,--,20-- (Data up to --,--,20--)		
				Suspected Deaths		Confirmed Deaths		
	Name of the District	*New cases reported due to Heat Related Illness in the District since --,--,20-- to --,--,20--	Cumulative no of cases reported due to Heat Related Illness in the State since 15 March 20--	*New suspected deaths reported due to Heat Related Illness in the State since --,--,20-- to --,--,20--	Cumulative no of suspected deaths due to Heat Related Illness in the State since 15th March 20--	*New deaths reported due to Heat Related Illness in the State since --,--,20-- to --,--,20--	Cumulative no of confirmed deaths due to Heat Related Illness in the State since 15th March 20--	Remarks
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
TOTAL								

Annexure D: IEC on Heat and Human Health



स्वास्थ्य एवं
परिवार कल्याण विभाग
भारत सरकार



स्वास्थ्य एवं परिवार कल्याण विभाग
भारत सरकार



World Health
Organization
India

गर्मी से करें बचाव याद रखें ये सुझाव



सुरक्षित वातावरण बनाएं

 पानी के लिए ठंडे पानी की सुविधा	 रक्का पर प्रशिक्षित देखभाल
 बच्चों की देखभाल हेतु ठंडे और आरामदायक स्थान की सुविधा	 गर्मी उत्पन्न करने वाले इंधनोत्पादन और सील कर दें
 भारी भूमिक कार्यों के लिए कमजोरियों को पहचानें या उन्हें नष्ट करें	

प्रशासनिक उपाय

- घर या गर्मी वाले बाहरी क्षेत्र में काम करने वाले नागरिकों के लिए अधिकतर शिरांग नियमित करें
- भारी भूमिक या खुले में करने वाले अधिक कार्यों का सुन्दर एंव सामने की समय निर्धारित करें (जैसे सुबह 8-10 और सांय 5-8)
- सुरक्षित करें के बच्चों की देखभाल केन्द्र / शिशुमृत्यु में पीने के लिए ठंडे पानी की व्यवस्था, उपचित चारा और जो अगर एक गर्मजुद् हो
- कमजोरियों को स्वास्थ्य की निगरानी के लिए एक मित्र बनानी शुरू करें



आपराध/अपराधी (108)



[illegible]



स्वास्थ्य एवं
कुटुम्ब कल्याण
विभाग



स्वास्थ्य एवं
कुटुम्ब कल्याण
विभाग



Ministry of Health
and Family Welfare
India

गर्मी से करें बचाव याद रखे ये सुझाव

✓



वर्षाजल जलकणों को लें

✓



शरीर को ढाँके, सीधे सूर्य
तकले रंग के कपड़े पहनें

✓



शीघ्र दूध को
गाढ़र आगे से पीजें

✓



दिन में 12.00 बजे से
04.00 बजे तक पीछे रहें

✗



दिन में 07.00 बजे से
04.00 बजे तक
बाहर जाने से बचें

✗



गर्मी काटने लीने
कपड़ों का उपयोग न करें

✗



प्यास, ज्वर, कोली,
मलदोषित सीधे पेट भराने जग
नैन साँके येव भुजाने को पीसना ना करे

✗



प्युस में नहने पाप
ना कोने

स्वास्थ्य एवं कुटुम्ब कल्याण विभाग



संयुक्त रूप से
राष्ट्रिय स्वास्थ्य अभियंत्रण केंद्र
भारत सरकार

World Health Organization
India

हम पर ना पड़े भारी, गर्मी वाली बीमारी

सतर्क रहें बीमारी के लक्षणों को याद रखें और
सावधानी बरतें

रुई, लाल और
गुथी लगाएं

सर्दी का सामना
देकर ठंडीपना या
झुके ठंडा पड़ें

भारी या
छोटी

बहुत जल
पिए रहें

प्राकृतिक चीजों में
कमाली या
ऐल

घर पर ठंडा या
ठंडा ठंडा ठंडा
ठंडा ठंडा

अकस्मात् गर्मी
उठाने वाले, घोंघरी और
हवा निकालें

यदि आप या अन्य कोई अस्वस्थ महसूस करें तो

डक्टर को या अन्य कोई अस्वस्थ महसूस करें तो

डक्टर के पास जाएं या एम्बुलेंस को कॉल करें

बहुत गर्मी में
थोड़ा थोड़ा ही
आवारा खाते हैं

थोड़ी

करीब का सामान
देकर ठंडीपना या
झुके ठंडा पड़ें

जब भी
बारीक

108

अतिगर्भवती लक्षण

संयुक्त रूप से
राष्ट्रिय स्वास्थ्य अभियंत्रण केंद्र
भारत सरकार

World Health Organization
India

गर्मी के खिलाफ छेड़ें जंग कर्मचारियों का जीवन बनाए सुगम

आपातकालीन स्थिति में चिकित्सा सहायता

सुरक्षित कोटिंग्स /
सुरक्षित कोटिंग्स

रुई, लाल और
गुथी लगाएं

सर्दी का सामना
देकर ठंडीपना या
झुके ठंडा पड़ें

बहुत जल
पिए रहें

प्राकृतिक चीजों में
कमाली या
ऐल

घर पर ठंडा या
ठंडा ठंडा ठंडा
ठंडा ठंडा

अकस्मात् गर्मी
उठाने वाले, घोंघरी और
हवा निकालें

यदि आप या अन्य कोई अस्वस्थ महसूस करें तो

डक्टर को या अन्य कोई अस्वस्थ महसूस करें तो

डक्टर के पास जाएं या एम्बुलेंस को कॉल करें

बहुत गर्मी में
थोड़ा थोड़ा ही
आवारा खाते हैं

थोड़ी

करीब का सामान
देकर ठंडीपना या
झुके ठंडा पड़ें

जब भी
बारीक

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अतिगर्भवती लक्षण

संयुक्त रूप से
राष्ट्रिय स्वास्थ्य अभियंत्रण केंद्र
भारत सरकार

World Health Organization
India

Children love playing in the Sun heat should not spoil their fun

Symptoms of heat related illness

Fatigue

Muscle cramps

Seizures

Irritability

Headache

Increased sweating

Nausea, dizziness

Act or talk confused

Past breathing and heartbeat

Rashes and vomiting

Difficulty in waking up or can't wake up

Body temperature rises to 103°F (38.3°C) or higher

Be careful when child is

Walking/playing in Sun

School assembly

Playing basketball in Sun

First aid measures

Bring the child to shade or into the shade immediately

Loosen their clothing while maintaining body dignity

Have the child lie down with slightly raised feet

Use fan to increase airflow

If the child is alert and awake, provide frequent sips of cool, clear fluids

With child awake, have them orally rehydrate

If child is unconscious, don't give anything to drink or eat

Prevention

Stay hydrated

Cover your self

Play in shade

Don't look care with kids inside

If your child has any of severe symptoms, immediately visit nearest health care center or call ambulance

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People at risk

संयुक्त रूप से
राष्ट्रिय स्वास्थ्य अभियंत्रण केंद्र
भारत सरकार

World Health Organization
India

Beat the Heat

Do's

Stay hydrated

Stay covered

Block direct sunlight

Remain indoor during 12:00 PM - 04:00 PM

Don'ts

Avoid going out 12:00 PM - 04:00 PM

Avoid strenuous activity in Sun

Don't leave kids and pet unattended in vehicle

Avoid alcohol, tea, coffee, high sugary drinks and fizzy drinks

Avoid cooking 2:00 PM - 6:00 PM

Don't walk barefoot

People at risk

Symptoms of heat related illnesses

Be alert, remember the symptoms And take precautions

Hot, red and dry skin	Body temperature $\geq 40^\circ\text{C}$ or 104°F	Nausea and vomiting
Throbbing headache	Muscle weakness or cramps	
Rapid shallow breathing and rapid heart beat	Anxiety, dizziness, fainting & light headedness	

If you or others feel unwell

Hydrate yourself	Move to cooler place and take rest	Take cool shower

Visit doctor or call ambulance

Heat cramps lasts more than one hour	Unconscious	Body temperature $\geq 40^\circ\text{C}$ or 104°F	Symptoms get worse

108 People at risk

Battle the Heat, Let it not Defeat Workers

Provide medical help in case of emergency

Altered mental sensorium with disorientation	Hot, red and dry skin	Body temperature $\geq 40^\circ\text{C}$ or 104°F	Throbbing headache
Nausea and vomiting	Muscle weakness or cramps	Anxiety, dizziness, fainting and light headedness	Rapid heart beat and Rapid, shallow breathing

First aid steps in case of heat illness

Rest in shaded area, offer water	Lie down with raised feet, sponge with tap water, offer water

Take the affected worker to Nearest hospital or call an ambulance

- If worker is unconscious, don't try to give anything to drink or eat
- If the worker is alert and awake, provide frequent sips of cool water or fluids like ORS solution
- Remove safety gear
- Loosen their clothing while maintain their dignity
- Slowly splash or sponge with tap water
- Increase the air flow by using a fan
- In case of vomiting, turn the worker onto their side to avoid choking

108 People at risk

Safeguard Workers from Heat

Provide safe working environment

Cool drinking water facility	Timely medical care	Frequent breaks in comfortable rest area
Cool and comfortable area for child care	Insulate and shield hot equipment	Assign additional workers or slow down work pace

Administrative measures

- Schedule mandatory breaks for those working under direct sun
- Schedule strenuous and outdoor work for cooler time of the day i.e. morning or evening hours
- Ensure that baby care / crèche center has cool drinking water proper shade, cooling mechanism and ORS solution
- Start a buddy system to monitor health of workers

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Annexure E: For further information kindly refer to following:

- IEC Material on Environmental and Occupational Health. National Centre for Disease Control: <https://ncdc.gov.in/index1.php?lang=1&level=2&sublinkid=500&lid=430>
- Guidelines for preparation of action plan- prevention and management of heat wave, 2019. National Disaster Management Authority, Government of India. Available at: <https://ndma.gov.in/images/guidelines/heatwaveguidelines.pdf>
- Guidelines on prevention and management of heat related illness, 2015. Emergency Medical Relief, Ministry of Health and Family Welfare. Available at: <http://health.bih.nic.in/Operational%20guideline/EMR%20Mohfw%20heat%20illnesses%20-2015.pdf>
- Ahmedabad heat action plan 2017. Guide to extreme heat planning in Ahmedabad, India. Amdavad Municipal Corporation. Available at: <https://www.nrdc.org/sites/default/files/ahmedabad-heat-action-plan-2017.pdf>
- Heat action plan for Odisha 2019. Available at: <https://www.osdma.org/preparedness/one-stop-risk-management-system/heat-wave/> .
- World Health Organization. Public Health Advice on preventing health effects of heat. Available at: http://www.euro.who.int/_data/assets/pdf_file/0007/147265/Heat_information_sheet.pdf?ua=1

Health Adaptation plan for Cardio-Pulmonary Diseases

Team and Areas of Expertise at CoE

Name and Designation	Department	Expertise
Prof. Randeep Guleria	Director & Prof. Pulmonary, Critical Care and Sleep Medicine	Pulmonary Disorders
Prof. Anand Krishnan	Professor, Community Medicine	Public Health – Surveillance, Health Systems
Prof. Ambuj Roy	Professor, Cardiology	Cardiology
Dr. Karan Madan	Assistant Professor Pulmonary, Critical Care and Sleep Medicine	Pulmonary Disorders
Dr. Harshal R Salve	Assistant Professor, Community Medicine	Public Health – Training, Environment

Purpose of this document

This is a guiding document for State Nodal Officer- Climate Change for development of their State Level Climate and Health Action Plan. This covers What actions needs to be undertaken; When to initiate the actions and Who all shall be involved.

It is also recognized that **disease specific guidance must be feed into a larger generic Health Action Plan. Overall approach for all** diseases is similar. This document provides only those inputs which are specific to Cardio-pulmonary Diseases.

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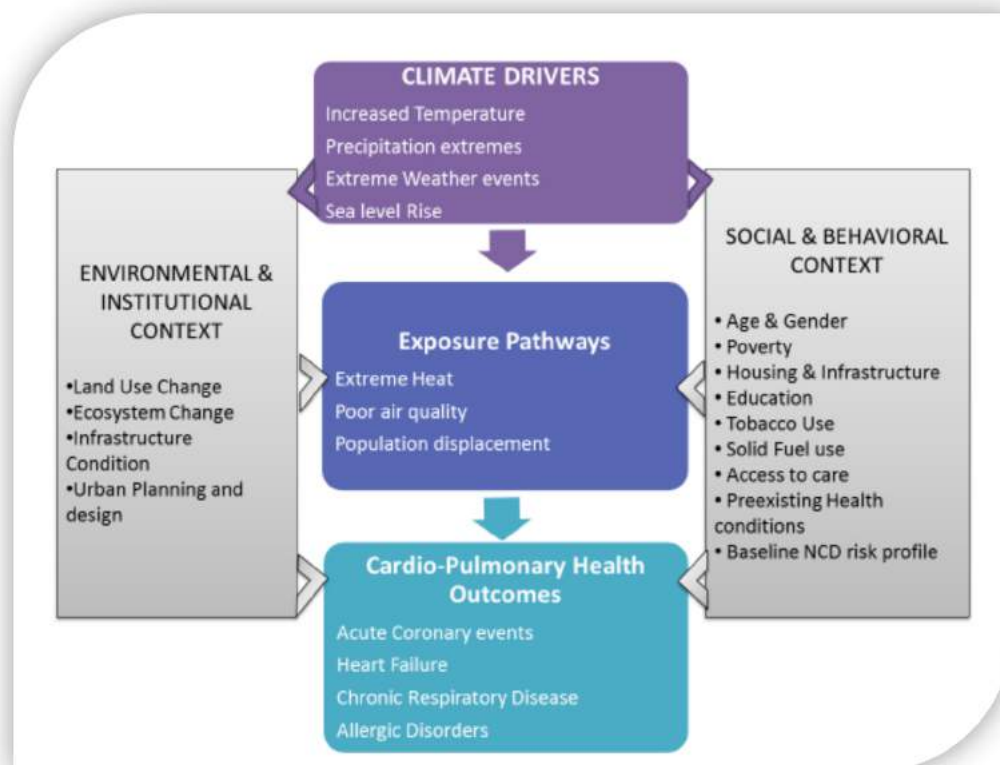
1. Introduction

Changes in climate and climate variability affect the environment that provides us with our basic needs - clean air, food, water, shelter, and security. As climate change is likely to worsen over the next century, certain existing health threats will intensify, and new health threats would emerge. An understanding of how climate is changing and how those changes would affect human health could inform decisions about addressing climate change, prioritize actions for protecting public health, and help identify research needs.

Impact of Climate change on Cardio-pulmonary Health

Climate change can affect human health in two main ways:

1. By changing the severity or frequency of health problems that are known to be affected by climate or weather factors; and
2. By creating unprecedented or unanticipated health problems or health threats in places where they have not previously occurred.



Comment: In the figure – under the section Cardio-pulmonary health outcomes, we may also add – “Acute respiratory conditions like Acute respiratory infections and Asthma exacerbations”

Figure 1: Pathways for cardio-pulmonary outcomes of climate change (Modified from ¹)

The pathways and context of occurrence of CPDs is shown in Fig 1. Various scientific studies have reported impact of climate change on cardio-pulmonary health^{2,3,4,5}.which are summarized in Table 1.

Table1: Impact of Climate change on cardio-pulmonary health

Exposures	Cardiac conditions	Pulmonary disorders
Temperature changes – Extreme Heat	Heat Stroke (Death/morbidity) Dehydration	
Temperature changes Extreme cold exposures	Chronic Kidney Disease Heart failure	
	Rise in blood pressure Trigger for Acute Coronary Syndrome	
Outdoor-air quality	Trigger for Acute Coronary Syndrome	Asthma Asthma exacerbations Acute respiratory infections Irritative rhino-ocular symptoms COPD
	Trigger for Heart Failure decompensation Impact drug compliance	Acute Asthmatic attack, Allergies
Extreme Weather Events – Floods		
Changing Rainfall patterns		Respiratory infections
	IHD	
Chronic changes–	Migration, changing crop patterns	

¹USGCRP, 2016: The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 312 pp. <http://dx.doi.org/10.7930/J0R49NQX>

²Curriero FC, Heiner KS, Samet JM, Zeger SL, Strug L, Patz JA: Temperature and mortality in 11 cities of the eastern United States. Am J Epidemiol2002;155:80–87.

³Keatinge WR, Donaldson GC, Cordoli E, et al: Heat-related mortality in warm and cold regions of Europe: observational study. BMJ 2000;321:670–673

⁴Pan WH, Li LA, Tsai MJ: Temperature extremes and mortality from coronary heart disease and cerebral infarction in elderly Chinese. Lancet 1995;345:353–355

⁵Sun S, Laden F, Hart JE et al Seasonal temperature variability and emergency hospital admissions for respiratory diseases: a population-based cohort study. Thorax. 2018 Apr 5. pii: thoraxjnl-2017-211333.

2. Action Plan for Addressing Cardio- Pulmonary Disorders (CPD)

The actions are divided into following five major pillars. (Figure 2) The detailed action plan is given below. Each of the five pillars is described briefly.



Figure 2 – Pillars for implementation of action plan

2.1 Situational Analysis

Situation analysis includes three components - Burden, Risk and Vulnerability Mapping; Resource Mapping; Stakeholder Analysis. Situation analysis includes regular mapping of burden risk, manpower, material and finances. This also includes assessment of burden of cardio-pulmonary diseases in the State as part of routine health related surveys and health system reporting. A draft template for situation analysis of climate resilient health system is described in Annexure 1. The concept of “Who’s Doing What, Where, and When (4W)” is useful for identification of potential overlaps or gaps in response. These mapping exercises need to account for the often severely reduced capacity of local providers in emergency settings. With respect to cardio-pulmonary diseases characteristics of vulnerable population is described in Box 1. These vulnerable groups should be focused during situation analysis.

Box 1. The vulnerable population to climate change/pollution

Vulnerable Population Groups

- Elderly (> 60 years of age)
- **Can consider adding young children as they bear the brunt of the harmful effects of air pollution (especially related to development of asthma, worsening asthma and poor lung function development)**

- People living in disaster prone area
- Workers in occupations requiring heavy physical work

Vulnerable Individuals

- Patients with pre-existing Ischemic Heart Disease, chronic respiratory diseases
- Heart Failure patients
- Patients on diuretic (vulnerable to Heat Stroke)

Some guidance in vulnerability mapping specific to CPDs is given below. After vulnerability assessment at State level, respective State can be categorized as high, medium and low vulnerability for effect of climate change on Cardio-pulmonary Health. The indicators given below are indicatives, States can decide with wider consultation the cut-offs of the indicators in each category.

	Vulnerability Level		
Indicator	High	Moderate	Low
Geographical location	Desert, Coastal region	Heavy rainfall or drought prone	Plain
Tobacco use (adults)	> 35 %	25 – 10 %	< 10 %
Health system preparedness	Good	Fair	Poor
Obesity prevalence	> 10	10 – 5	< 5
Air Quality zone (SAFAR)	Red	Yellow	Green
Any other indicator can be added with expert consultation at State level			

As regards to air quality, a large majority of states shall be in High vulnerability level.

2.2 Risk Reduction Strategies

While the major activities in this domain are related to reduction of climate change risk and mitigation, as this is generic and not specific to CPDs, these are not being mentioned in this action plan. Activities specific to risk reduction are those related to reducing the levels of major risk factors for CPDs namely – tobacco, alcohol, diet and physical inactivity. Thus, health promotion becomes a major activity and this has to be aligned with the National NCD prevention efforts.

2.3Co-ordination, Advocacy and Communication

Multi-stakeholder approach is key for implementation of prevention activities at State level. State Program Officer has to engage with all counterparts of Ministry of Health, Ministry of Women and Child Development, Ministry of Human Resource Development, Panchayat Raj Institutes in the State. Annexure 2 describes specific roles and responsibilities of different major stakeholders which need to be adapted to the state context.

Advocating the cause of climate change in general and CPDs in specific to policy makers and decision makers is an important activity proposed under the plan. The ultimate stakeholders of this plan are the population and the patients of CPDs. It is important to communicate these messages to them about how to prevent as well as mitigate the diseases.

Box 2: Focus area for awareness generation activities at community level

1. What is climate change?
2. Why climate change is happening?
3. What are the impacts of climate change on health?
4. Steps to be take in day to day life to reduce carbon foot print
5. Preparation/ response during emergency or disaster

2.4Health System Strengthening

Availability of trained manpower and climate resilient health system are key to successful implantation of climate related actions. Systematic training activity for State Level as well as District level concern officers should be developed. Box 3 describes the focus area training activities at State level. Training on Climate Change and CPD can be held in co-ordination with training under NPCDS programme at State/ District Level. Training of trainers approached should be taken up in the State. District level programme officers, General Duty Medical officers Block Medical Officers, medical officers and Staff Nurses should be trained in batches at State level.

Box 3: Focus area for Training activities

- Burden, risk factors, vulnerability assessment for cardio-pulmonary diseases in the State
- Climate based risk factors such as extreme heat, extreme cold, air pollution for cardio-pulmonary diseases
- Strengthening of health care system on lines with NPCDCS guidelines with respect to cardio-pulmonary diseases.
- Measurement, availability of climate parameters at State level
- Linkages of climate and health data with respect to cardio-pulmonary diseases.
- Monitoring and surveillance
- Communication and advocacy

State Program officer should ensure availability essential medicines and equipments at levels of health care system i.e. primary, secondary and tertiary. Annexure 3 describes the essential medicines, instruments and services that should be made available at all primary care facilities in the State. All these essential medicines and technology will ensure effective management of CPD at primary care level. At secondary and tertiary care level guidelines from Indian Public Health Standards and NPCDCS should be followed for ensuring medicines, equipments and services.

Traditionally, health emergency response has largely been seen within the prism of prevention of communicable diseases. Due to increasing burden of CPDs, there is growing realization that emergencies also impact life of people living with CPD. Annexure 4 describes actions to be taken by State Programme Officer at State level for integration of CPD management during emergency. In order to integrate NCDs into the rapid response it must be ensured that:

At least one person in the rapid assessment team is familiar with the issues of NCDs during emergencies.

Baseline profile of NCDs and health system preparedness is available to the response team.

In the Key Informant module of Community Level Assessment, questions related to burden and access to CPD health care are included. In the key informant interviews should include a person with a chronic condition.

WHO has come out with a detailed guidelines for integration of NCDs into emergency response which can be used by states. During emergency / disaster, public information should be customized and focused. Key IEC messages to be disseminated to the public during emergency / disaster are mentioned in Box 4.

Box 4: Information to be provided to patients for emergency

- Keep an identity card with treatment plan including diagnosis and names of medicine and place of treatment
- Keep a stockpile of seven days of treatment wrapped in water – proof manner in the emergency evacuation kit
- Keep key contact numbers of immediate relatives and health care providers
- Keep record of treatment safe at home in water-proof manner and if possible store digitally

2.5 Monitoring and Surveillance

Actions related monitoring and surveillance are important aspects of climate action plan. It is important to measure what is being done as well as impact of the activities done. The draft action plan defines the key outcome indicators for each of the activity identified. Necessary mechanisms have to be established for regular monitoring of the implementation of action plan.

DRAFT STATE HEALTH ADAPTION PLAN FOR CARDIO-PULMONARY DISORDERS

Pillar 1: Situational Analysis

Activity	Specific actions	Time Line	Agencies involved	Tools/guidance	Key Outcomes
Burden, Risk and Analysis Mapping	- Identify state level institutions to conduct situation analysis. - Contract out the situational analysis of CPDs to the identified institution. It should include burden of CPDs, risk factors for CPD including air pollution - Conduct vulnerability assessment of population using climatic conditions, demographic variables	First Six months	- State Directorate of Health Services - Institutions identified - IMD - CPCB - Medical colleges	- Vulnerability Assessment Tool (Annexure 1) - Categorization of zones/ districts in the state as per vulnerability to climate change (Annexure2)	- State level CPD burden - List of vulnerable districts/populations / individuals
Resource Mapping	- Conduct Health System preparedness Assessment for managing CPDs - Mapping of human resource, material and financial resources	First six months	- State Directorate of Health Services - Institutions identified	- WHO Service Availability and Readiness Assessment tool - Indian Public Health Standards for health facilities	Report on Health System Preparedness and identification of gaps
Stakeholder Analysis	Conduct a stakeholder mapping exercise	First six months	As per list attached	Draft list attached	Stakeholders identified

Pillar 2: Risk Reduction Strategies

Climate change risk reduction	This is generic and not restricted to CPDs and therefore not being elaborated.				
Risk reduction for CPDs	Strengthen Tobacco control strategies	Throughout the period	State Tobacco control Cells, State	NPCDCS guidelines	Prevalence of NCD risk factors

	Strengthen Health Promotion efforts aimed at other risk factors for NCDs		NPCDCS program Officer		
Pillar 3: Co-ordination, Advocacy and Communication					
Co-ordination	- Setting up inter-departmental steering committee for climate actions - Setting up a state level expert committee on CPDs - Conduct a meeting to finalize the roles and responsibilities of all stakeholder - Regular holding of State and District level inter-departmental co-ordination meetings	Three months Three Months Six months Throughout	- All identified departments - Directorate of Health Services - State Nodal Officer Climate Change		- Roles and responsibilities of all stakeholders defined and accepted. - Inclusion of CPD related actions in State level Disaster Management plan
Advocacy	- Development of a Policy Brief on CPDs and Climate change - Inclusion of agenda of climate change impact on CPD in state level meetings with political leadership and other policy makers	First six months Throughout	- State Climate Change Cell - State Nodal Officer NPDCCS		- Availability of a policy brief - Climate change mentioned in minutes of the meeting and activities defined.
Communication	- Develop CPD specific IEC materials for populations and patients - Conduct awareness campaigns for general population about heat alert,	First six months Throughout	Identified communication agencies Ministry of I & B	IEC materials by central MoHFW	Coverage and Recall of IEC campaign

	air pollution alert& risk of CPDs				
Pillar 4: Strengthening Health System					
Ensure the availability of essential health technologies and medicines in all health facilities	• Develop/Adopt state specific CPDs treatment protocols for different levels of health system • Procure/indent essential technologies and medicines at state level and send to health facilities	First Year	Expert Group State Directorate of Health Services	• WHO-PEN Package • NPCDCS guidelines	• Availability of state level STPs protocols for CPDs management • % of health facilities at each level which have essential technologies and medicines
Capacity Building of Human Resources	• Develop a training manual for all HR for management of CPDS • Draft and implement a training plan to cover all human resource for management of CPDs	Two years	• Directorate of Health Services • Medical Colleges • State Medical Association	• NPCDCS training manuals	• % of different HR trained in CPD management
Integrate CPD management into health system response for emergencies	• Developing SOPs for management of CPDs during emergency situation/ natural disasters (Annexure - 3) • Creation of emergency response team	First Year	• State Directorate of Health Services • State and District Disaster Management Authorities	• WHO guidelines on integration of NCDs into Emergency Response	• Availability of SOPs for CPD management in emergency response

Pillar 5: Monitoring and Surveillance					
Monitoring	• Develop a monitoring framework with indicators for CPDS • Hold six monthly meetings with all stakeholders to review progress based on identified indicators	First Six months Throughout	• State NCD cell • State Climate Change Cell	National NCD Monitoring Framework	• Regular monitor meetings held
Surveillance	• Integrate climate/air quality and CPD surveillance data systems • Provide annual reports on all the three parameters	Throughout	• State NCD cell • State Climate Change Cell • CPCB/IMD		• Annual reports made available • Data on CPDs and climate variables available in public domain

3. Annexures

Annexure – 1: Template for Situation analysis of state level climate resilient health system

Domain	Specific action	Current Status
Leadership and Governance	Climate change and health focal points designated within the health ministry, with specific programme of action and budget allocated.	
	State level strategy on health and climate change is developed	
	State level strategy on health and climate change implemented	
	Responsibilities of various stakeholders are identified by Ministry of Health	
	Health representations in State Climate Action Plan	
	Development of communication strategy for advocacy related climate change and its health impact for capacity building of various stakeholders	
	Forum available for stakeholder engagement	
Health Workforce Development	Conduction of training courses on climate change and health topics targeting health personnel	
	Contingency plans for the deployment of sufficient health personnel in case of acute shocks, such as extreme weather events and outbreaks developed at the relevant level (i.e. state, district).	
Vulnerability Assessment	Assessment and availability of baseline rates, and climate sensitivity of health conditions, allowing selection of priority risks, and continuous monitoring of changing risk conditions and health status	
	Identification of most vulnerable or high risk population in the state	
	Execution of health impact assessment of any mitigation strategy/ plan/ activity	
Health system capacity assessment	Baselines on existing human resources, technical and health service delivery capacity established, with identification of weaknesses.	
	Recommendations made for addressing gaps and building	

	health systems capacity	
Adaptation capacity	Development of plan for prioritization of allocation of resources as per vulnerability assessment	
	Established review mechanism	
Integrated risk monitoring and early warning	Mapping/ tracking of Geographic and seasonal distribution of health risks and outcomes	
	Early warning systems for relevant extreme weather events and climate-sensitive diseases (e.g. heat stress, zoonotic diseases, undernutrition) established.	
Health and climate research	Access to, and linkage of, data on meteorological information, health determinants and outcomes enabled	
	Multidisciplinary research partnerships, knowledge management networks and rosters of local experts established.	
Climate resilient and sustainable technologies and infrastructure	Specifications for siting and construction of health facilities, and energy, water and sanitation provisions revised in line with projected climate risks	
	Training and recommendations for prescription of pharmaceuticals during extreme heat conditions revised.	
	Promotion of new technology in the health system	
Management of environmental determinants of health	Integrated monitoring systems allowing collection and analysis of data on environmental hazards, socioeconomic factors and health outcomes exist	
Climate-informed health programmes	Climate actions identified in the PIP	
Emergency preparedness and management	Mitigation measures to be carried out in the emergency situation in the state are well identified	
	Existence of plan/ strategy for community Participation in case of extreme weather events	
Climate health financing	Budget allocation related to climate actions in the annual PIPs	

Annexure 2 – Roles and Responsibilities of stakeholders

Sr. No	Stakeholder	Task	Roles and actions
1	State Programme Officer (SPO)	Steering/ coordination of climate action plan	Specific actions are mentioned in previous section

2	MOECH State Nodal Officer, NPCDCS	Integration of health action plan with climate action plan	• Work closely with SPO (MOECH) for implementation of health related actions. • Training of all health care provider in management of CPD • Ensuring availability of medicines and technologies for management of CPD at health systems • Ensuring guidelines for management of CPD in state • Conduct vulnerability assessment in State in co-ordination with SPO (MOECH) • Ensure availability of IEC material • Co-ordinating advocacy activities with community representatives and policy makers
3	Medical colleges	Provide institutional continuity and scientific rigor	• Conduct situation analysis and vulnerability assessment • Conducting operations research/ community based research in climate change and CPD • Conducting capacity building activities
4	Disaster Management Authority	Integration of climate action plan in disaster management plan	• Include actions related CPD management in State Disaster management Plan • Vulnerability assessment of State with respect to natural calamity
5	Meteorological Department	Providing Climate data	• Sharing climate forecast, alerts with SPO, MOECH, SPO NPCDCS • Contribute in developing climate based early warning system for CPD • Contribute in vulnerability assessment with respect to climatic factors
6	Pollution Control Board	Providing Air quality data	• Contribute in vulnerability assessment with respect to air quality • Share alerts with respect to air quality

7	Community Leaders	Ensuring community participation	• Carry out community level awareness activities for climate change and its health impacts • Promoting green good deeds for mitigation of impact of climate change
8	Professional organizations	Advocacy with policy makers	• Provide scientific content for IEC campaign, programme implementation • Advocacy with policy makers
9	Media – TV, print, Folk, Social Media	Awareness generation in the community	• Carry out campaigning for impact of climate change, mitigation measures in the general community • Publicize climate alerts, air quality alerts in the community • Vigilance on health system for ensuring climate actions
10	District Collector	Starring district level actions	• Chairman of District Level Programme steering committee • Ensuring multi-sectoral coordination

Annexure 3. List of essential medicines and technologies for implementing essential NCD interventions in primary care

Essential Medicines and Technologies list for management of cardio-pulmonary disorders at

Primary Care level*

Medicines	Technologies
Thiazide diuretic	Thermometer
Calcium channel blocker (amlodipine)	Stethoscope
Beta-blocker	Blood pressure measurement device
Angiotensin converting enzyme inhibitor	Measurement tape
Statin	Weighing machine
Isosorbide dinitrate	Spacers for inhalers
Glyceryl trinitrate	Peak flow meter
Furosemide	Nebulizer
Salbutamol	Pulse oximeter
Ipratropium	Blood cholesterol assay
Amoxicillin	Lipid profile
Hydrocortisone (inj)	Serum creatinine assay
Epinephrine	Troponin test strips
Heparin	Urine microalbuminuria test strips
Diazepam	Electrocardiograph
Magnesium sulphate	Defibrillator
Promethazine	
Dextrose infusion	
Glucose injectable solution	
Prednisolone	
Inhaled Budesonide	
Inhaled Tiotropium	
Aspirin	
Codeine	
Morphine	
Penicillin	
Erythromycin	
Sodium chloride infusion	
Oxygen	
Digoxin tablets/Inj	
Potassium chloride	

*Adapted from WHO Essential Package of NCD interventions for primary care

Annexure 4: SOPs for management of CPDs during emergency situation

Preparedness phase

1. Identification of priority conditions for inclusion in emergency response.
2. Preparation of pre- emergency profile of NCDs.
3. Assessment of Health Facility Preparedness.
4. Establishment of a health system co-ordination/contingency plan.
5. Ensuring Availability of Essential Medicines and Technologies.
6. Preparation of Individualized Emergency Plans.

Emergency Response Phase

1. Integrating NCDs in Initial Rapid Assessment.
2. Map NCD service provision.
3. Organize NCD services delivery with a focus on primary health care.

Post-emergency phase or in slow-onset emergencies

1. Debrief on lessons learnt from the crises.
2. Strengthen health system response.
3. Strengthen public health response to NCDs.
4. Monitoring and evaluation of Emergency Response to NCDs.

Health adaptation plan for Allergic Diseases

CLIMATE CHANGE AND ALLERGIC DISEASES

HEALTH ACTION PLAN

What actions needs to be undertaken

Action for reduction of allergic disease by climate changes

The change in climate leads to increase the severity of allergic diseases, exacerbation of stable disease and development of new allergic symptoms. This leads to increases disease burden, increases healthcare facilities and unwanted out-patients department (OPD) and emergency visit.

The various methods to reduce risk of allergic diseases are:

1. Increasing access to Health care and Medication
2. Education to public
3. Training and Research
4. Air pollution and it control

AT PRIMARY CARE LEVEL

I. Increasing Access to Health Care and Medications:

5. Access to appropriate health care and medications is central to the management of allergic respiratory diseases such as asthma. For example, every asthmatic should have a written Asthma Action Plan. All allergic patients (like allergic rhinitis and asthma) should have knowledge about changes in his/her symptoms and emergency medication during change in climate. In the case of aeroallergens, ensuring complete and equitable access to available medications will be increasingly important with climate change. This can be done by
6. Training of medical officer about climate change and allergic diseases at primary care level.
7. Early action plan for exacerbation of allergic disease during pollen season.
8. Reporting and recording of different allergic diseases monthly and seasonally.
9. Policies for introducing flu vaccine for high risk group.
10. Increase the number of health care provider and emergency services during pollen and dust storm season.

II. Education the public:

Many aspects of allergic respiratory disease education have become increasingly important. In the case of aeroallergens, stronger education programs directed at allergen avoidance are important. The trend to earlier pollen season starts should also be clearly communicated to those with allergic respiratory disease and their care takers and related health care professionals.

Following action can improve the education and awareness of climate changes and allergic diseases are:

1. General public lectures at different colleges and hospitals at regular basis on
 - a. Allergic diseases
 - b. Climate changes and it health effects
 - c. Pollen and its health effects
 - d. Air pollution
2. Poster and digital display on allergic disease symptoms, factors, prevention and treatment at public places.
3. Lectures on allergic diseases at school and colleges.
4. Drama, skit and short film show on world allergy day/ world asthma day at different places.
5. Chapter on allergic disease in school and college books
6. Videos, poster and articles on social media.
7. Website on allergic diseases and health effects.
8. Knowledge and training regarding allergic diseases, aeroallergen, allergic plants, weeds and geographic correlation.
9. Regular workshop on diagnosis and management of allergic diseases at different part of country on regular basis.
10. Different graduate and postgraduate degree/ diploma course in allergic diseases, aerobiology and climate changes and it health effect in different university and colleges.
11. Department of allergy diseases in every medical college.

A. Content for IEC

Content should emphasize on

1. Common signs and symptoms allergic diseases
2. Risk factors and triggers of allergic diseases
3. Methods of allergen avoidance
4. Precautions during climate change
5. Effect of air pollution and pollens on allergic diseases
6. Importance of action plan

B. Time to release such awareness material

1. During transitions between seasons
2. During major changes in weather variables like temperature, humidity, wind speed etc.
3. Before major festivals
4. During and after floods and natural disasters

AT TERTIARY CARE LEVEL

III. Training and Research:

Training is important part of any programme. There is limited training programme on allergic diseases and climate changes in the country. For the early and better management of

allergic diseases and prevention of harmful effect of climate change, there should be regular training to health care provider. The research on allergic diseases is also limited at few institutes in our country. There should be separate fund for research on climate changes and its effect on allergic diseases. There should be involvement of different institutes from different parts of the country for research. As India is a large country with different geographical areas with fauna and flora. So the climate change over different parts of the country varies and its effect on health and allergic diseases also different according to the area.

Following action can improve the training and research section of climate changes and allergic diseases are:

1. Training of medical officer and primary health care provider about climate change and allergic diseases from all primary care level at regular interval from every state according to their fauna and flora.
2. Research on changes in pattern of allergic diseases with climate change.
3. Training regarding the heating, ventilation and air conditioning.
4. Multicentric research on allergic diseases
5. Research on different aeroallergen concentration and major air pollutant in different part of India.
6. Involvement of different department for research and training programme.
7. Formulation of national guideline for diagnosis and management different allergic diseases.

IV. Air pollution and its control:

A change in air pollution is commonly seen after climate change. The climate change leads to changes in both the indoor and outdoor air pollution. The change leads to increases in allergic diseases or exacerbation of stable allergic disease. The control of air pollution is one of important step in allergic diseases prevention and control. There is no standard air pollution policy in our country.

Following action can take for air pollution control and its effect on allergic diseases are:

1. Multi sectorial committee
2. To develop guidelines for reduction of toxic substances and air pollutants, building codes, and allocate economic incentives.
3. Data on aeroallergen concentrations and major air pollutants
4. Amended air quality and emissions standards
5. Indoor air quality standards issued
6. Draw plans to replace allergenic trees with non-allergenic trees street sides
7. Shifting to hybrid system vehicles
8. Measures to reduce ground level ozone and other air pollutants
9. Strengthen inspection of car exhaust emissions
10. Promote and encourage solar energy applications
11. Long-term aeroallergen monitoring system
12. Real-time air quality monitoring system
13. Identify vulnerable areas and groups with increased levels of air pollution

When to initiate the actions

Action should be initiated

1. **Prior to commencement of pollen season which have been defined in various parts of India**

Area	Pollen season
Northern India	Feb.-April and Sept.-Nov
Eastern India	August and March-July
Southern India	Aug-Nov and Feb.-April
Central India	March-mid May, Sept.-Nov. and Dec.-Feb.

2. **During transitions between seasons**

Each season brings with it specific allergens.

During winter, indoor, rather than outdoor, allergies are usually an issue.

As winter turns to **spring**, grass and tree pollens becomes more abundant, and spores begin being released by outdoor molds.

When **summer** rolls around, grass pollen is problematic, and mold spores peak in warm regions

3. **When humidity levels change**

Heat and humidity usually occur together. Humidity can make air quality worse

Humidity can increase levels of mold and dust mites. They are known to be asthma triggers.

Ozone levels can rise along with humidity, triggering asthma symptoms.

4. **Measures should be taken before major festivals**

Known cases of allergic diseases like asthma should confine outdoor activities during major festivals like Diwali.

5. **During and after floods and natural disasters**

Changes in meteorological parameters substantially increase allergic morbidity and mortality. Extreme heat and high humidity trigger asthma symptoms. Cyclones have also been related to asthma. Thunderstorms occurring during the pollen season have been observed to induce severe asthma attacks in pollen sensitive patients.

Actions to be undertaken by SNO-CC

- I. **Customized medication plans** for ones who suffer allergy symptoms at different times of year that includes

Increasing certain medications during the times of year when they tend to experience allergies

Increasing certain medications when they are traveling to areas where they are likely to be exposed to the allergens that affect them.

- II. **Ensuring availability of the drugs during increased demand particularly**

1. Emergency drugs
2. Anti-histaminics

3. Nasal sprays
4. Inhalation medications
5. Vaccines

III. Increase public awareness on climate change and allergic diseases

Educate about

1. Secondary prevention of allergy
2. Maintaining adequate humidity levels at home
3. When to restrict outdoor activities

Involved departments in the communication channel and for operational coordination

S.No	Stakeholder	Task/activities	Probable time/ duration for initiate actions	Responsibilities
1.	Ministry of health and family welfare	Ensuring implementation monitoring, supervision & evaluation of activities.		Coordination with other stake holder government departments of Govt. of India and states/UTs
2.	Ministry of environment, forest and climate change	Ensuring plantation of non-allergenic trees Avoidance of deforestation Identifying allergenic plants in areas with high prevalence of allergy		Coordination with other stake holder government departments
3.	Meteorological department	Ensuring recording, maintaining and broadcasting of important weather variables		Coordination with other stake holder government departments
4.	Ministry of agriculture	Communication with meteorological department to ensure the favourable climatic conditions for crop burning. Providing early information of rains and other climatic conditions		Coordination with other stake holder government departments
5.	Ministry of information and broadcasting	Providing early information of rains and other climatic conditions Broadcasting of important weather variables		Coordination with other stake holder government departments
6.	National medical	Early diagnosis of allergic		Coordination with

	commission	diseases Primary and secondary prevention of allergy		other stake holder government departments
7.	Academic institutions	Conducting trainings Formulating guidelines for diagnosis and management of allergic diseases Research activities		Co-ordination with all above mentioned stakeholders

Intervention proposed

Aeroallergen Monitoring:

There is a need of improvement in the surveillance or monitoring of atmospheric pollen and mould spore concentrations. Installation of pollen monitoring station is important factor for reduction in allergic diseases. There is lack of aeroallergen monitoring in India expect one pollen count public display in VPCI Delhi. The aero allergen monitoring system can be increased by:

1. Increase pollen monitoring station at public places in Delhi
 - a. Hospitals
 - b. Colleges
 - c. Schools
 - d. Metro-station
 - e. Railway/ bus station
 - f. Airport
2. Installation of minimal one pollen monitoring station in each metro cities and state capitals.
3. Display of allergen avoidances techniques
 - Digital display or poster at public places
 - Advertisement via TV and radio
 - Short audio or video on social media
4. Identify the vulnerable area of allergic diseases

Aeroallergen Forecasting:

Aeroallergenforecasting currently limited to some parts of developed countries. There is lack of aeroallergenforecasting in our country. Local aeroallergen monitoring and forecasting potential is required so that management and prevention of allergic respiratory symptoms can occur.Increase the Aeroallergenforecasting by

- Display of forecast at different public places (like hospital, school, metro station etc)
- Forecasting daily through local TV and radio
- Early warning system for pollen season and dust storm through
 - Through local TV and radio during these season
 - Short audio or video clip, notice and picture on social media
 - Advertisement and article in local newspaper during season

- Display on digital monitor or poster at public places.

Planting policies and practices

Allergenic plant management

Training and research

Air pollution and its control

Health Adaptation Plan for Vector Borne Diseases

ICMR-NATIONAL INSTITUTE OF MALARIA RESEARCH, DELHI

**Health Adaptation Plan for Vector Borne Diseases in
view of Climate Change**

1. Conditions favouring disease transmission (It is desired that the conditions which favor disease initiation and propagation or threshold, be highlighted so that they can be communicated to the States for timely action)

Vector borne diseases (VBD) are climate sensitive as the arthropod vectors like mosquitoes, sand flies, ticks and mites are cold-blooded creatures. The development of vectors is affected by the temperature, rainfall and Relative Humidity (RH). At lower temperature, the rate of development is slow while at higher temperature the life cycle of vectors gets completed in a shorter time. However, there are particular thresholds for development. The biological activities of mosquitoes are known to cease at 6⁰ C while at >40⁰ C. mosquito cannot survive for more than one day. Rainfall helps in creation of breeding ground for mosquitoes, while the RH helps in survival and longevity of vectors. Further, there are thresholds for development of parasite/virus in the body of vectors (Table 1). For example, the thresholds of malaria parasite in vector are 14.5-16 °C as lower threshold for *Plasmodium vivax* while 16-18⁰ C for *P. falciparum*. The upper threshold for both the parasites is 32 °C. Therefore, the areas having less than 16°C temperature do not have suitability for transmission of malaria. In Himalayan region, some districts are not suitable for transmission of malaria even for a month due to lower temperature than 16⁰ C. However, climate change poses a risk for such areas, as the unsuitable areas are likely to become suitable with the projected rise in temperature.

Table 1: Thresholds of temperature and Relative Humidity for development of pathogen in vector.

VBD	Conditions favouring disease initiation/outbreak	Threshold
Malaria	Rainfall related disease in	Threshold of T and RH for

	most part of the country.	transmission are : 18-32° C T and >50 % RH for P falciparum and P vivax both
Dengue	Rainfall is crucial for transmission by creating suitable RH and or breeding grounds in peri-domestic habitats	T 13-35 °C and 50-90% RH
Chikungunya	Similar to dengue	13-34° C, T and 50-90% RH
Japanese encephalitis	Presence of rice fields; peak transmission during rainy season	Thresholds not known clearly, however, 20-32°C T and >50% RH
Leishmaniasis: (Visceral)	Alluvial soil, high subsoil water support suitability. Urbanization may reduce VL.	Temp 7-32 °C and RH >70%
Kyasanur Forest Disease	Forested area having heavy rainfall. Transmission season is from November to May (non-rainy season)	Rainfall > 1500mm (June to October) T: 21-30° C
Scrub typhus	Not known clearly. Being studied	

HAP shall be a guiding document for State Nodal Officer- Climate Change and hence should address actionable points like:

2.

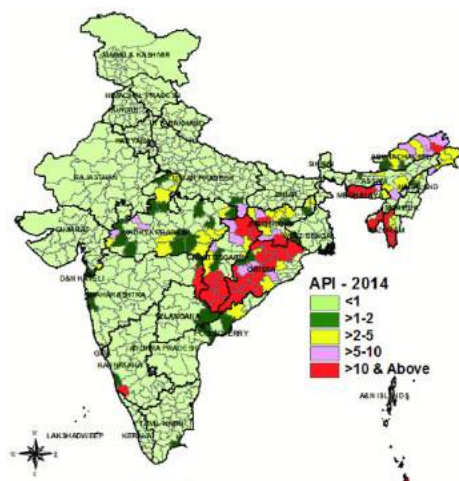
4. Who all shall be involved in the communication channel and for operational coordination: Flow charts already provided by NCDC are given at 5.16 and 5.17. Secretary DHR and DG, ICMR should also be included in the flow chart.

The guidance and policy formulation for control of vector borne diseases (VBD) in India is undertaken by National vector Borne Disease Control programme (NVBDCP) while the intervention measures are implemented by the state governments. There is well-established set up at the Centre (overall controlled by National Health Mission (<https://nhm.gov.in/>)) and states, therefore, separate communication channel is not required..

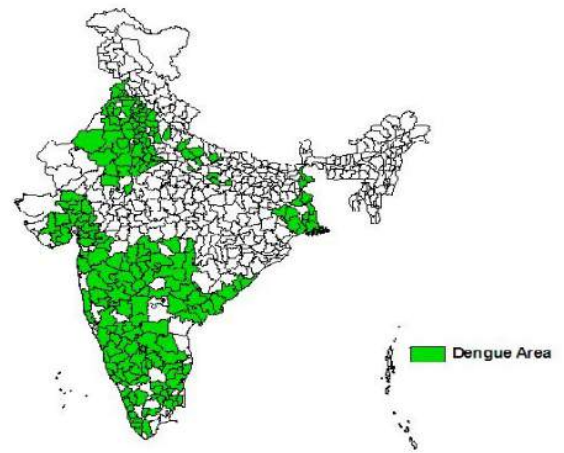
5. Framework for Health Adaptation Plan- Vector Borne diseases

5.1 State or region wise mapping considering factors in Epidemiologic triad (colour coding with number of outbreaks or cases), dengue (distribution of cases) etc. The institute may expand the list.

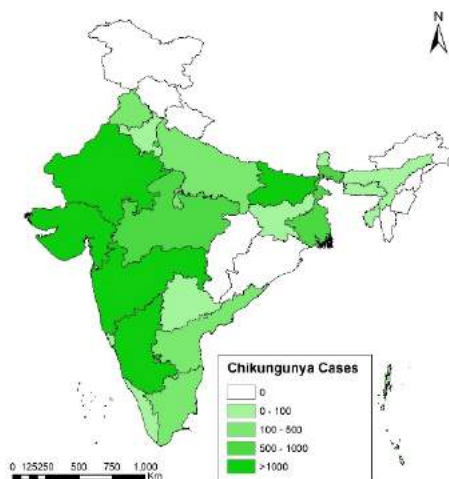
NVBDCP collates and compiles national data on the incidence and mortality of six major VBDs , malaria, Dengue, Chikungunya, Lymphatic filariasis, Japanese encephalitis and Visceral leishmaniasis, the distribution of which are shown in Fig 1.



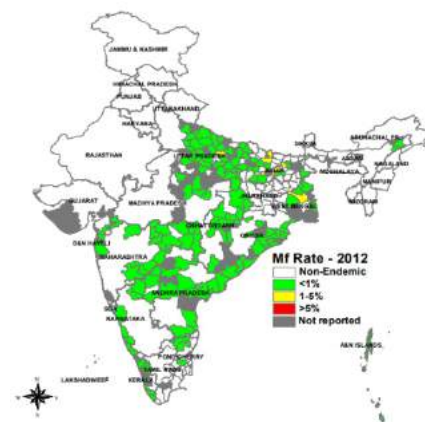
a. Malaria (2014)



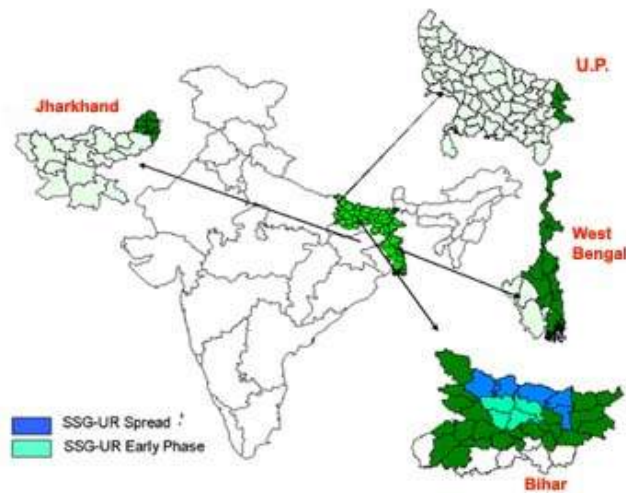
b. Dengue



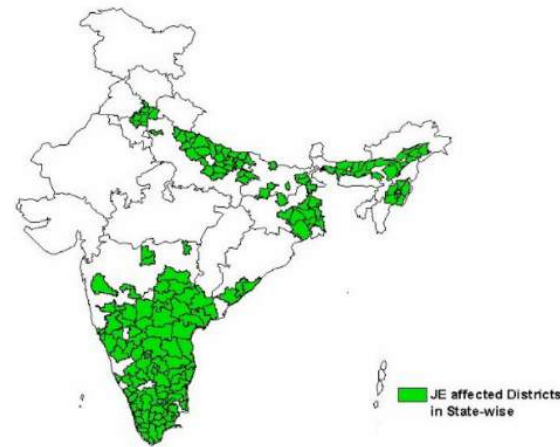
c. Chikungunya (2017)



d. Filariasis (2012)



e.Kala-azar



f. Japanese encephalitis

Fig 1 Distribution of major vector borne diseases in India (Source: NVBDCP) (for malaria: Source: Dhiman, Sunil & Veer, Vijay & Dev, Vas. (2018). declining transmission of malaria in India: accelerating towards elimination for malaria).

5.2 Trend of VBDs: Of six major vector borne Diseases, malaria, kala-azar and Lymphatic Filariasis (LF) are in elimination mode. Kala-azar and LF are targeted to be eliminated by 2020 and 2021 respectively. Malaria is targeted to be eliminated in phases, starting from 2020 to 2030. The cases of dengue and chikungunya are increasing spatially as well as temporally. There is little change in the distribution of Japanese encephalitis. Details of each disease are given below:

Malaria: The causative agents of malaria are five species of Plasmodium parasites, i.e. *P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale* and *P. knowlesi* and transmitted by anopheline vectors. The foci of malaria are reducing gradually and the overall incidence has come down to <1 million since 2017 (Fig 2 & 3). Based on the Annual Parasite Incidence (API), different states of India have been categorized into three categories. The category I has 15 states, category II, 11 states while in category III there are 10 states, which are slated for elimination of malaria from 2020 to 2030 (Fig 4). The states under category I and II are more vulnerable to climate change.

The overall trend in most parts of the country is reducing and in 2019 only 338494 cases were reported with 77 deaths(www.nvbdc.gov.in). The major foci are confined to tribal and forested areas of Jharkhand, Chhattisgarh and Northeastern states. The northern states viz. Punjab, Haryana, Himachal Pradesh, Uttarakhand, Rajasthan, Gujarat, parts of Karnataka and Brahmaputra valley, being unstable malarious areas are outbreak prone.

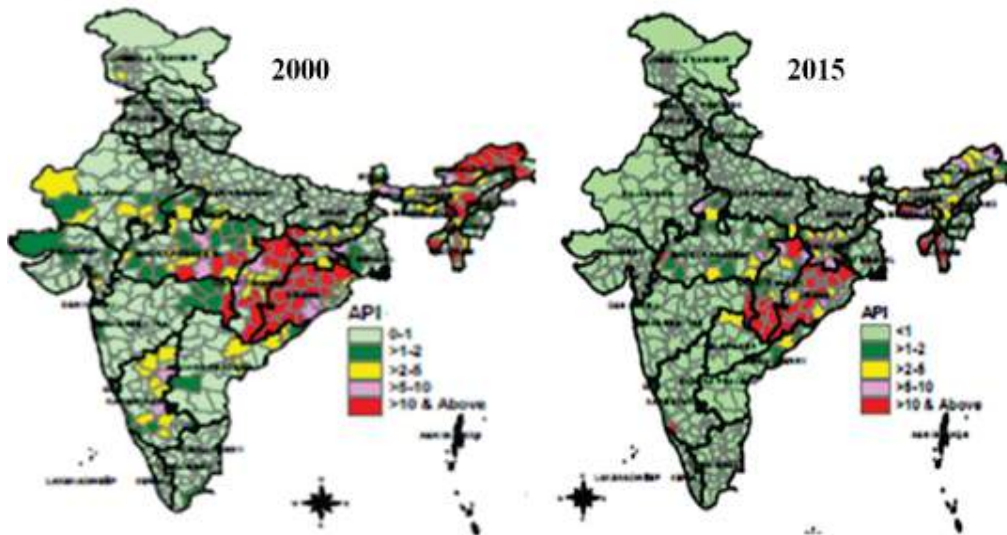
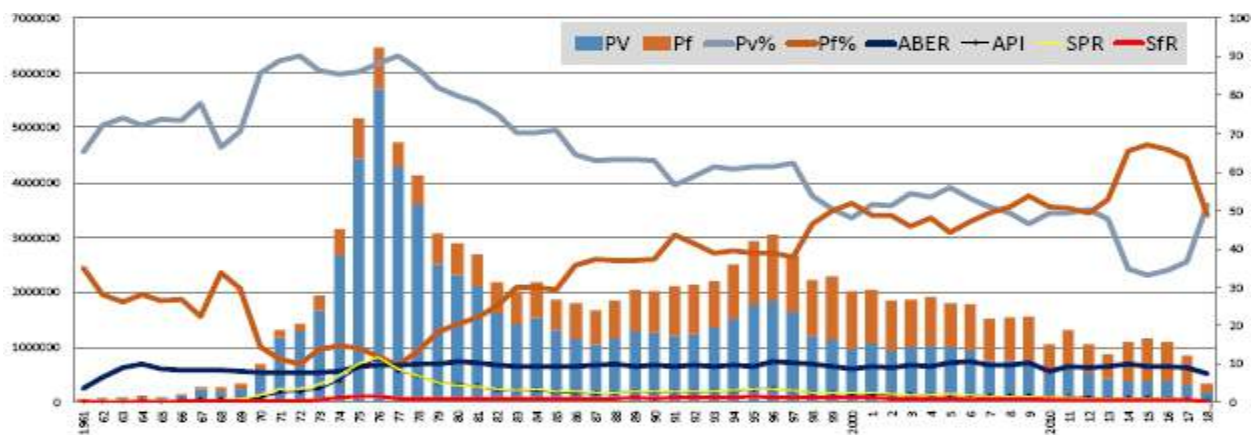


Fig.2 Trend of malaria in India (2000 versus 2015) showing reduction in high malaria endemic foci (Source: National Strategic Plan, MALARIA, NVBDCP,2018).



Annual malaria incidence in India, 1961–2018. Source: National Vector Borne Disease Control Programme.

Fig.3 Malaria cases and malariometric indices in India (1961 to 2018). IJMR 2019; Vol 149

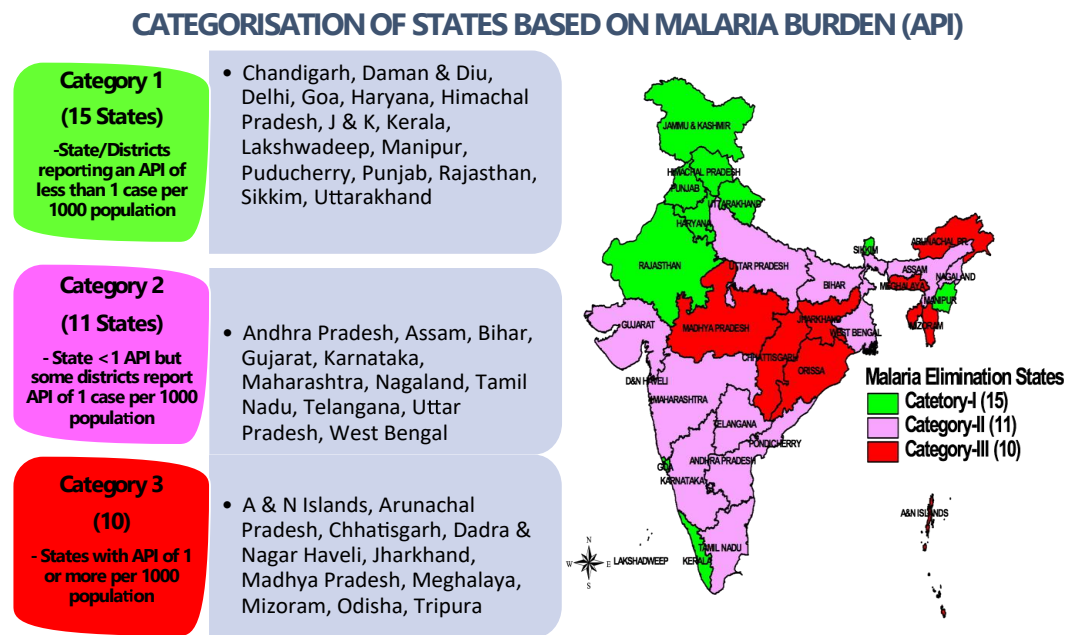


Fig 4 Categorization of states for malaria elimination based on malaria endemicity (Source: NVBDCP, 2016)

Dengue: The cases of dengue are increasing throughout the country. In the year 2001, there were 3306 cases while in 2017 the cases have increased to 180000 (Fig 5). In 2019 there were 136422 cases and 132 deaths (up to November 2019).

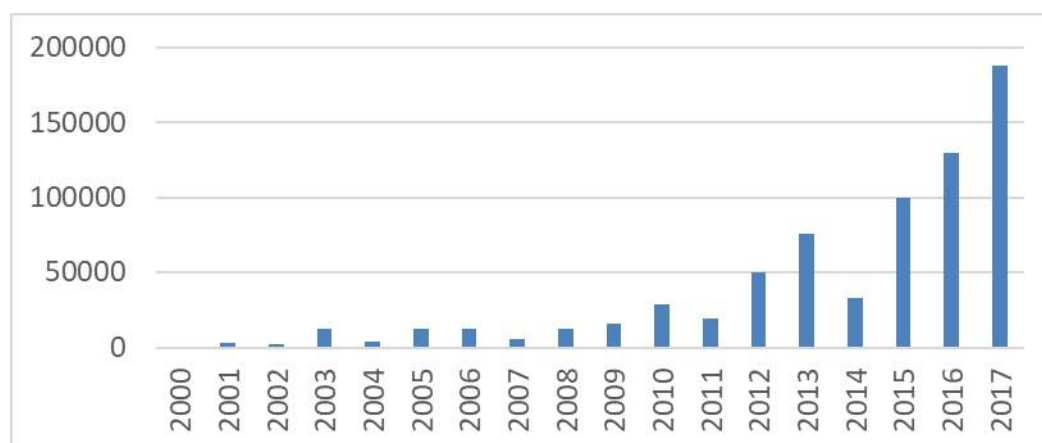


Fig.5 Dengue cases in India (2000-2017) (Source: NVBDCP)

Visceral leishmaniasis (Kala-azar): As regards kala-azar, India expects to eliminate the disease by 2020. The cases have come down to <10000 in 2015. In 2019, there were only 2143 cases with no deaths in the country. However, Cutaneous leishmaniasis (CL), which is endemic in Rajasthan, Himachal Pradesh and parts of Kerala, is still a problem requiring investigation of foci for proper containment.

Chikungunya: Like Dengue, the incidence of chikungunya is also increasing . In 2015 there were only 3342 confirmed cases while in 2019, there were a total of 9477 cases in India.

Japanese encephalitis: The incidence of JE remains fluctuating. In 2014 there 1661 cases and 293 deaths while in 2019, 2545 cases and 266 deaths occurred.

Filariasis: Lymphatic filariasis is also in elimination phase and the microfilaria rate is gradually reducing. There has been gradual reduction in the elimination of foci and 257 districts are endemic in 21 States/ Union Territories.

5.3 Emerging diseases: Kyasanur Forest Disease and scrub typhus are re-emerging and their distribution is expanding. Similarly, Crimean Congo Hemorrhagic Fever (CCHF) is also reported from new areas than Gujarat, from where it was reported first time in India. Cutaneous Leishmaniasis is being reported from new areas in Rajasthan and from the states of Kerala, Himachal Pradesh and Jammu & Kashmir.

5.4 Mapping of risk to identify vulnerable areas, population (health infrastructure and resources):

Vulnerability due to climate change: Vulnerability of Himalayan states in terms of new foci of malaria has been projected by Dhiman et al (2011) using PRECIS climate model by the year 2030 as well as recently using CORDEX climate model (Fig 6) by Sarkar et. al (2019). The gist of findings is that some parts of Uttarakhand, Jammu & Kashmir and Arunachal Pradesh are likely to open transmission windows in new districts with increase in 4–6 months' category of transmission. In the northeastern states, intensity of transmission is projected to increase from 7–9 months to 10–12 months.

Fig.7 shows the change in number of months of transmission of malaria. The projected emergence of new foci/extension of foci is given in Table 4. The Himalayan states mainly Himachal Pradesh, Uttarakhand, Jammu & Kashmir are more vulnerable.

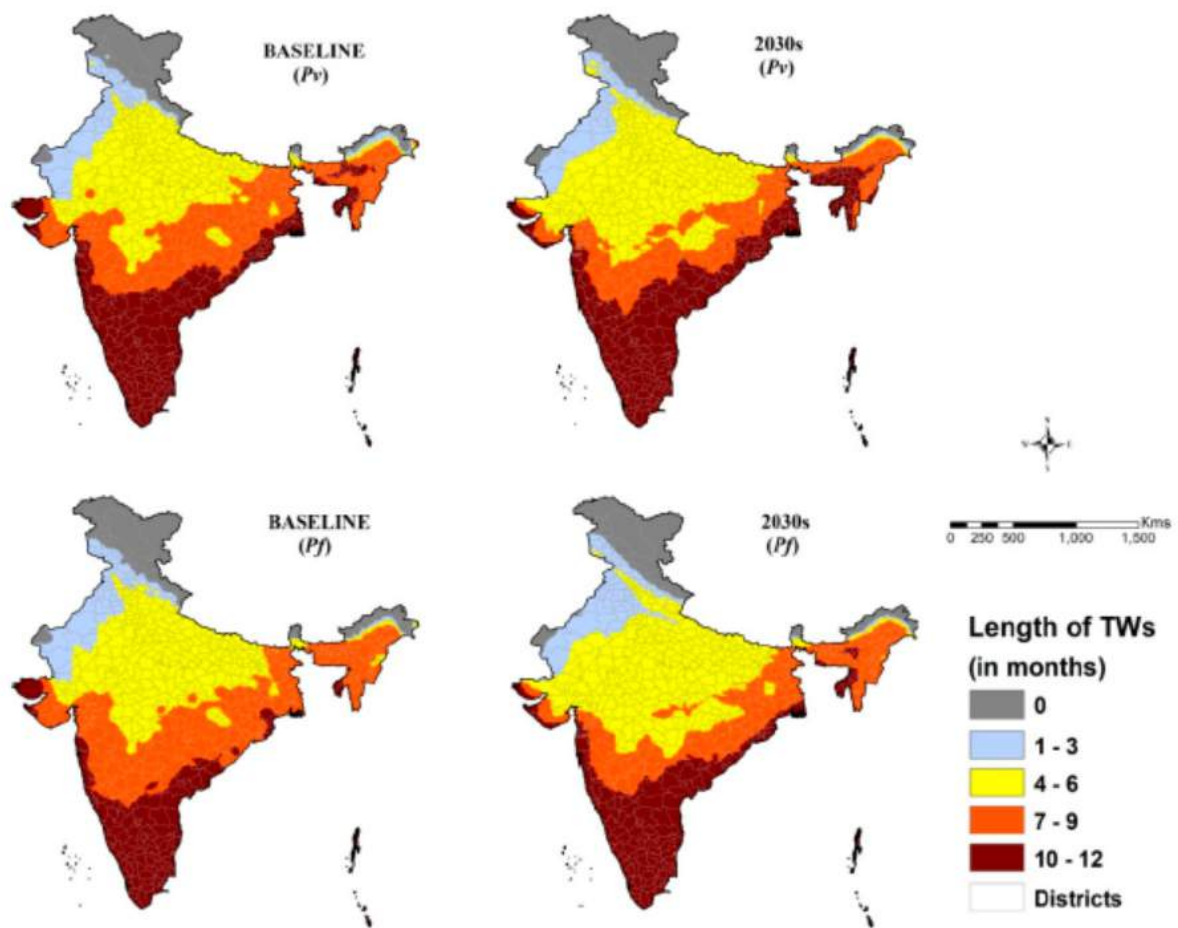


Figure 6. Composite climate suitability map for malaria transmission for the baseline and projected 2030s. For *P. vivax*, new foci of transmission are visible in parts of Jammu & Kashmir, Uttarakhand and Himachal Pradesh. Increase in the number of months of TWs in northeastern states and reduction in parts of Orissa and Gujarat states are also seen. In the case of *P. falciparum*, few foci in Jammu & Kashmir and Uttarakhand; an increase in transmission months in northeastern states and reduction in parts of Orissa and Gujarat states are visible (Sarkar et al Int. J. Environ. Res. Public Health 2019, 16, 3474; doi:10.3390/ijerph16183474)

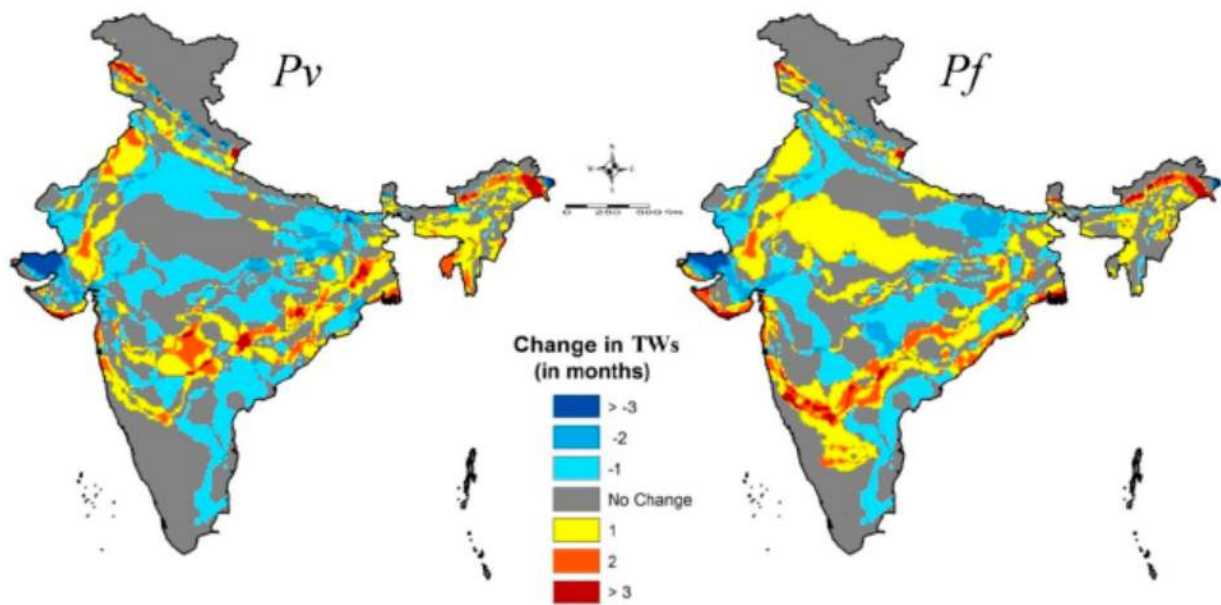


Figure 7. Projected changes in a number of months in the Transmission Window (TW) for malaria (Pv and Pf) transmission by the 2030s as compared to baseline years. New foci of malaria transmission in the states of Jammu & Kashmir, Uttarakhand and Himachal Pradesh particularly for *P. vivax*, while a reduction in parts of Orissa and Gujarat are visible. Increase in the transmission of *P. falciparum* by one month in the central part of India is discernible (Sarkar et al. Int. J. Environ. Res. Public Health **2019**, 16, 3474; doi:10.3390/ijerph16183474)

Table 4 : Districts having projected new foci for *P. vivax* malaria transmission (TWs in months).

STATE	DISTRICT	No. of months	Projected months
Jammu and Kashmir	Pulwama	upto 1	July
	Srinagar	upto 1	July
Kashmir	Baramula	upto 1	July
	Bagdam	upto 1	June, July
	Anantnag	upto 3	June, July, August
	Supiyan	upto 2	June, July
	Kulgam	upto 3	June, July
	Doda	Upto 2	June, July
Himachal Pradesh	Chamba	upto 1	July
	Kullu	upto 1	July
	Mandi	upto 1	July
Uttarakhand	Chamoli	upto 2	June, July
	Bageshwar	upto 2	June, July
	Pithoragarh	upto 2	June, July

Vulnerability of dengue due to climate change: The transmission windows of dengue in view of climate change have also been projected by the year 2030s (Dhiman, unpublished work). It has been found that RCP 4.5 & 8.5 scenario of CORDEX climate model, an increase in the number of transmission months (from 7-9 to 10-12 months) in some districts of Uttar Pradesh, Uttarakhand, HP & MP are expected.

5.5 What actions needs to be undertaken (before disease, during outbreak and post outbreak):

Climate change is likely to alter the change in peak of vector density and opening of new foci of transmission. therefore, the time of IRS should be decided before one month of peak of malaria cases. The management of new foci of transmission should be done in the same way as other endemic areas. However, in view of projected opening of new foci or increased intensity of transmission, the State Programme Officers (SPO) and District malaria Officers (DMO) should initiate surveillance so as to pick up emergence of new foci of disease transmission.

Actions are well defined by NVBDCP for control of six major vector borne diseases in India (www.nvbdc.gov.in) , therefore there is no need of reproducing the guidelines. The details of preparedness and containment of outbreaks of malaria are given in operational manual for malaria elimination by NVBDCP (2016). However, a few specific actions are highlighted as under:

Malaria: Operational manual for implementation of national programme in India, 2009 and Operational Manual for Malaria Elimination in India ,2016) have been documented by the NVBDCP for national guidelines. Routine surveillance, treatment and vector control activities are undertaken as per guidelines referred above. There are guidelines for Indoor residual spray about scheduled dates which are mentioned below:

Indoor Residual Spray for control of adult vectors of malaria : Spraying is usually started to coincide with the build up of vector populations and before peak malaria transmission. The recommended state-wise spray schedule for DDT and synthetic pyrethroids is given below (Table 2). Two rounds of spray are done for DDT and synthetic pyrethroids while three rounds of Malathion.

Table 2: Time schedule for Indoor Residual Spray in different states of India

States	1 st Round (form)	2 nd Round (form)

Andaman and Nicobar Islands	1 March	18 May
Arunachal Pradesh, Assam , Karnataka, Manipur, Meghalaya, Mizoram, Nagaland, Tripura	15 march	1 June
Himachal Pradesh , Pondicherry	1 April	1 July
Tamil Nadu	16 April	1 July
Sikkim, Punjab	16 April	1 August
Daman & Diu	1 May	16 June
Andhra Pradesh, Bihar, Chandigarh, Chhattisgarh, Goa, Gujarat, Jammu & Kashmir , Jharkhand, Madhya Pradesh, Orissa, Uttarakhand, Uttar Pradesh	1 May	16 July
Dadra & Nagar Haveli, Haryana	15 May	1 July
Rajasthan, West Bengal	15 May	1 August
Maharashtra	1 June	16 July

(Source: Operational manual for implementation of Malaria programme In India, 2009, NVBDCP)

Note: The states mentioned in bold letters are more vulnerable to climate change being in Himalayan region of the country.

1. **Dengue and chikungunya:** There is no strategy for control of adult vector, i.e. Aedes mosquitoes, but larval control is undertaken with NVBDCP approved larvicides (https://nvbdcp.gov.in/WriteReadData/1892s/dengue_1_Director_Desk_DGHS_meeting_OCT06.pdf accessed on 17 July 2020).
2. **Leishmaniasis:** Control of adult sand flies is undertaken simultaneously with control of malaria vectors in the states of Bihar, Jharkhand, Uttar Pradesh and West Bengal. No control of immature stages has been adopted by the programme (www.nvbdcp.gov.in/WriteReadData/1892s/opertional-guideline-KA-2015.pdf).
3. **Japanese encephalitis:** [www.nvbdcp.gov.in/WriteReadData/1892s/JE-AES-Prevention-Control\(NPPCJA\).pdf](http://www.nvbdcp.gov.in/WriteReadData/1892s/JE-AES-Prevention-Control(NPPCJA).pdf)

4. **Lymphatic filariasis:**

<https://nvbdcp.gov.in/WriteReadData/1892s/43461824631532409675.pdf>

Accessed on 17 July 17, 2020

5.6 **When** to initiate the actions (calendar – for most common disease)

VBD	When to initiate action
Malaria	Action time will vary from area to area. However, May/June are the critical months for preparedness. The states of Uttarakhand, Himachal Pradesh and Jammu & Kashmir are most vulnerable to climate change. Therefore the SNO should be vigilant since the Month of June to November
Dengue	May
Chikungunya	May
Japanese encephalitis	June
Leishmaniasis: VL CL	Actions are well defined owing to disease being in elimination phase

5.7 Enlist various measures and methods for Hot-spots identification in various regions of the country for VBDs: The mapping of distribution of disease at district/sub district level is desirable. The SNO CC should ensure periodic mapping of disease using GIS software at least at yearly interval so as to identify the hot spots of a particular VBD. The Chief Medical Officer/District Malaria Officer should generate PHC/sub-centre level maps of disease so as to identify emerging hot spots.

The identified hotspots of malaria are given in Fig.8. It is suggested that the State Programme Officers (VBD) of vulnerable states should map district wise distribution of cases every year for detection of new foci of transmission. Similarly, the District Malaria Officers (DMO) should map the distribution of cases at PHC level/sub centre for identification of new foci.

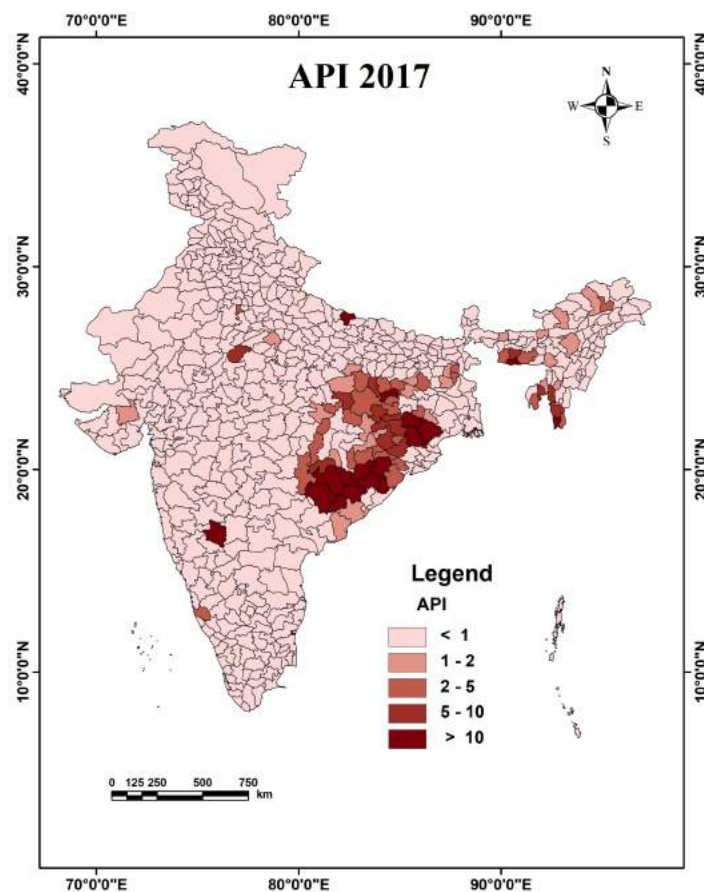


Fig 8. District wise distribution of Annual parasite Incidence of malaria (2017)

5.8 List the stakeholders with defined roles and responsibilities (Govt & non-Govt): operational coordination in flow chart preferably depicting partnership by involving citizens, organizations and businesses/corporate.

The NVBDCP is the policy-making organization at National level to guide the state governments in devising strategies for interventions measures to control six major VBDs. Climate change impacts do not require de novo stakeholders. The existing infrastructure at State level is sufficient to undertake the roles and responsibilities to control VBDs(Table 5). However, a particular state govt. can decide the need of stakeholders from other sectors like agriculture, water and public health engineering.

Table 5: Task and responsibilities of stakeholders for VBDs control

S.No	Stakeholder	Task/activities	Responsibilities
1.	NVBDCP	Overall guidance and policy formulation	To guide and the state governments in resurgence and

			containment of any VBD.
2	ICMR-NIMR and other related institutes	To provide technical expertise to find out solution to any outstanding research question related with epidemiology and control of VBDs.	ICMR-NIMR to work in close collaboration with NVBDCP/vulnerable state in analysis of relationship between climatic parameters and a particular VBD. To help in identification of micro foci of transmission.
3	State Nodal Officer, Climate Change	To supervise the state govt. in control of VBDs particularly in climate sensitive states.	To supervise the action taken in consultation with SPO.
4	India Meteorological Department	To provide meteorological data as and when required	To help the state govt. in collaboration with any research institute, in analysis of relationship between climatic factors and a particular VBD so as to forewarn the impending outbreaks.
5	NGO at state and district level for reach to community	Health education at community level	It to conduct workshops for IEC activities for different level of staff in the identified areas in consultation with the state govts.
6	State Programme Officer	Overall planning and execution of surveillance and intervention measures to control VBDs.	To supervise and guide the DMOs in control of VBDs

7	State Entomologist	To provide guidance in vector control.	To generate data on fortnightly fluctuations in density of vector species so as to guide the state government in choosing appropriate time of IRS activities. To generate data on susceptibility status of disease vectors for using appropriate insecticide for IRS/larvicide for vector control
8	Chief Medical Officer/District Malaria Officer/Disease Surveillance officer	Execution of task assigned by the SPO	To supervise and guide surveillance and intervention measures for control of VBDs in the district.
9	Media	To be vigilant for report of any upsurge/outbreak of any VBD.	To impart health education to masses through print and audiovisuals means.

5.9 Identify and list the resources required:

- Region specific resources list may be suggested (state will take a call based on your suggestions) **Please see 5.11 and 5.12**
- The states under category I of malaria elimination are the ones having API <1. These states are also outbreak prone. The following activities must be undertaken in these states:
 - *Immediate notification of each case detected.*
 - *Interruption of malaria transmission.*
 - *Detect any evidence of continuation of malaria transmission*
 - *To find out the underlying reasons of residual transmission*

- *Forecast and prevent any upsurge in malaria; ensure epidemic preparedness and respond in a timely and efficient manner to outbreak situations (Please refer operational manual for malaria elimination by NVBDCP,2016)*
- *Prevent re-establishment of local transmission*
- *Ascertain elimination of malaria.*

Operational guidelines have been provided by NVBDCP, the details of which are given below:

1. Malaria: www.nvbdc.gov.in/WriteReadData/1892s/Malaria-Operational-Manual-2009.pdf and www.nvbdc.gov.in/WriteReadData/1892s/5232542721532941542.pdf
2. [Operational Manual for Malaria Elimination in India 2016 \(Version-1\) https://nvbdc.gov.in/WriteReadData/1892s/5232542721532941542.pdf](https://nvbdc.gov.in/WriteReadData/1892s/5232542721532941542.pdf)
Accessed on 17 July 2020
3. [Guidelines for Integrated Vector Management for Control of Dengue/Dengue Haemorrhagic Fever https://nvbdc.gov.in/WriteReadData/1892s/dengue_1_Director_Desk_DGHS_meeting_OCT06.pdf](https://nvbdc.gov.in/WriteReadData/1892s/dengue_1_Director_Desk_DGHS_meeting_OCT06.pdf) accessed on 17 July 2020
4. Kala-azar: www.nvbdc.gov.in/WriteReadData/1892s/opertional-guideline-KA-2015.pdf
5. [National Programme for Prevention & Control of JE/AES \(NPPCJA\) JE/AES: /www.nvbdc.gov.in/WriteReadData/1892s/JE-AES-Prevention-Control\(NPPCJA\).pdf](http://www.nvbdc.gov.in/WriteReadData/1892s/JE-AES-Prevention-Control(NPPCJA).pdf)
6. [Guidelines on Filariasis Control in India and its Elimination \(2009\) https://nvbdc.gov.in/WriteReadData/1892s/43461824631532409675.pdf](https://nvbdc.gov.in/WriteReadData/1892s/43461824631532409675.pdf)
Accessed on 17 July 17, 2020
7. Overall guidelines on VBDs by NVBDCP: www.nvbdc.gov.in/

5.10 Identify actions for risk reduction that are acceptable in various parts of the country or if possible region wise (Enlist action points for SNO-CC which can be undertaken within limited resources for measures to control or prevent VBD).

5.10.1 Himalayan region: Strengthen surveillance for malaria specially in projected vulnerable areas in new foci in Jammu & Kashmir, Himachal Pradesh

and Uttarakhand given in Table 4 above and in publication of Dhiman et al 2011 (*National and regional impacts of climate change on malaria by 2030 Current Science 101(3): 372- 383*). However, surveillance in other endemic regions of Uttarakhand, Himachal Pradesh and Jammu & Kashmir for malaria and dengue is also desired.

Health education to communities about preventive measures for malaria and dengue in respective area should be the priority so as to nip the resurgence of any VBD particularly malaria and dengue.

In hill areas, the climatic conditions vary within a distance of 5-10 kilometers. Therefore, SNO CC should also help analyse link between temperature, RH and Rainfall generated at sub district level so as to identify the suitable new foci /expanded foci of transmission.

5.10.2 Northeastern states:

1. Generate graph of seasonal fluctuation in cases of malaria and plan indoor Residual Spray before two months of peak of malaria.
2. Rescheduling of IRS in strengthened transmission of 10-12 months in Assam, Meghalaya, and Mizoram.
3. Deploy Lab Technician as per norms of NVBDCP.
1. Entomological survey in June/July month for Aedes mosquitoes to identify preferred containers for breeding as well to determine Breteau index for giving alert for threat of dengue (if BI is >10 for alert ; BI is >50 high alert for outbreaks)

5.10.3 The integrated vector management should be adopted by all the states under category I and II for keeping the vector population under control (Annexure I).

5.10.4 : Epidemic preparedness and response: The low endemic states under Category I and II or some districts without transmission have threat of outbreaks particularly of malaria. The guidelines for preparedness and rapid response are given in Operational Manual for Malaria Elimination in India (NVBDCP,2016), which should be followed in the event of impending outbreak.

5.11 Logistics required at the health care facilities

List of equipment, kits, reagents, drugs etc. for ready ref by SNO-CC (refer respective prog.)

S.No	Resource	Suggested Quantity	Cost (approx)

1	Infrastructure		
2	Human Resource (with TOR & R&R)	State Entomologist with six Insect collectors	State Govt will provide
3	List: Drugs, Testing kits, reagents	NS1 kits for rapid test for dengue; bivalent RDK for malaria. No. to be decided based on prevalence of disease in last year plus buffer stock for outbreaks	
4	Equipment: essential & Desirable	Minor entomological equipment like suction tubes, Plastic bowls of 250/500 ml, enamel trays, Barraud cages, larval dippers (as per WHO guidelines (WHO, 1975) Arc GIS software with dedicated computer at district level (at least in vulnerable districts) for generation of maps	
5.			

5.12 Preparedness of health system and personnel (Enlist action points for SNO-CC for preparedness related activities in reference to VBD):

1. Four teams comprising of one Entomologist and two Insect Collectors.
2. Minor equipment for entomological surveys.

3. Health education material in local language
4. Rapid diagnostic kits for malaria, dengue, leishmaniasis
5. Availability of drugs.
6. Indoor Residual Spray as per schedule
7. Distribution/replacement of ITN/LLIN before the onset of transmission season.
8. Dedicated vehicle with driver for fieldwork.

5.13 List activities for prevention of illnesses (IEC, pamphlets, advisories, training, workshop etc.) (Based on your widespread research, suggest the following):

Content for IEC, pamphlets, advisories (suggest template, guide States for development):

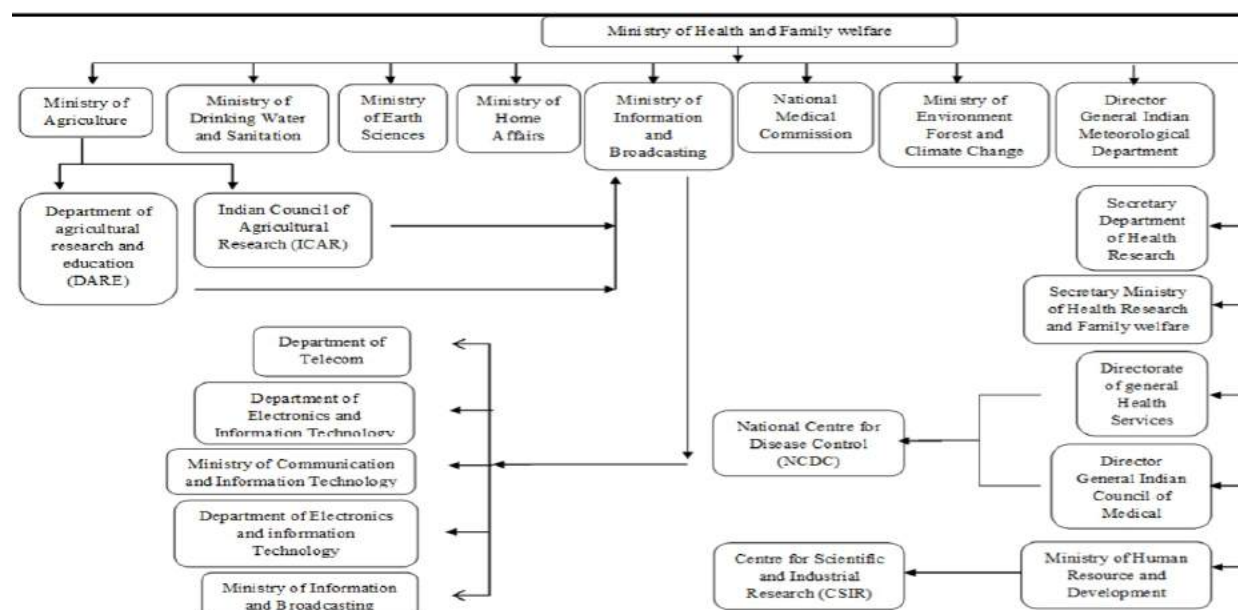
Time to release such awareness material (Handholding of state to list activities in their calendar of activities):

VB Disease	J	F	M	A	M	J	J	A	S	O	N	D
Malaria					√							
Dengue					√							
Chikungunya					√							
Japanese encephalitis					√							
Leishmaniasis: VL CL	Throughout the year preferably before the onset of monsoon											
Lymphatic Filariasis	Throughout the year preferably before the onset of monsoon											

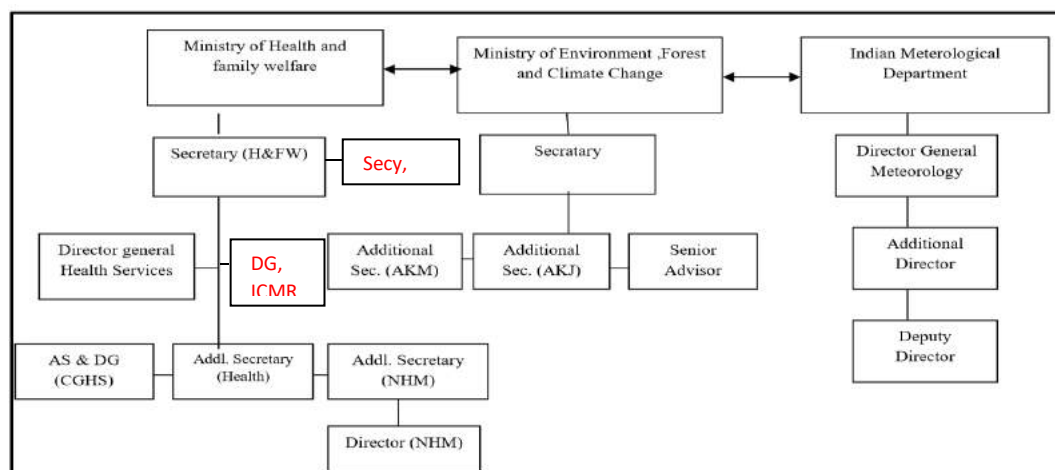
5.14 Parameters to assess Training Need Assessment: Since no such training about the potential impact of Climate Change and health has been initiated by the Ministry, training to all new incumbents (SPOs and Entomologists at state level while DMO/Surveillance Officer/entomologist/VBD consultant at district level) and refresher training after a period of five years would be required. Training module for field supervisory staff should also be developed in regional language.

5.15 Development of training module for Health Officers as well as Paramedical workers: ICMR-NIMR has already developed a module for workshop under the aegis of DST-ICMR Centre of Excellence for Climate Change and Vector Borne Diseases to cater the need of researchers from different disciplines. Such module can be used for officer level training at state level.

5.16 Operational Coordination:



5.17 Operational Communication Channel



Annexure I

Integrated Vector management (IVM)

(SOURCE: Operational Manual for Malaria elimination, 2016 NVBDCP)

The malaria vectors, transmission potential and endemicity levels differ from area to area and therefore the intervention measurers are also tailored for implementation.

The prioritization for implementation of vector control measures in India is broadly based on the API of the area. Stratification for IVM activities is required to be done up to sub Centre level which is the unit for IVM. The category-wise vector control measures recommended are given in table below.

Table Category-wise vector control measures

Category of subcentre	Vector Control measures
Category 0	Mapping of potential vector breeding sites

(No Case)	• Regular adult vector monitoring (prevalence and density). • Environmental management and modification in rural areas through village Health, Sanitation & Nutrition Committee (VHSNC), MNREGA & Swachh Bharat Abhiyan and in rural areas by desilting, deweeding, channelizing, larviciding, through Urban VBD scheme. • Biological control- Larvivorous fish • Foci based adult vector control interventions – in and around 50 houses of positive case- Space spray followed by IRS
Category 1, 2 and 3 States	
Subcentres with API < 1	• Same as in category 0 above
Subcentres with API > 1	• Universal coverage with LLINs of all subcentres with API > 1 • In sub centres with API>1, if not covered with LLIN, two regular rounds of supervised IRS (sub centre as unit) • In LLIN covered subcentre, if there is upsurge of cases, efforts to be made to increase the compliance rate if LLIN Usage. • In outbreak situations- additional round of IRS • Anti larval measures in urban areas with main focus in slim clusters. In outbreak situation Slum clusters can also be covered with IRS. • Larval control through source reduction and biological and environmental measures
• Low endemic sub centres i.e. with 0 or <1 API should be treated as under Category 1 activities.	

Health adaptation plan for Water Borne Diseases

Draft Adaptation and Mitigation Plan for Water-Borne Diseases Affected by Climate Change

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1. Introduction

Climate change has a detrimental impact on health outcomes globally, but is likely to affect the low- and middle-income countries the most given the limited adaptation and mitigation plans in place (Confalonieri et al., 2007; Kuhn, Campbell-Lendrum, Haines, & Cox, 2005). This document particularly deals with the impact of climate change in the dissemination of water borne diseases and the adaptation and mitigation strategies that need to be adopted to ward off such negative impacts.

Climate related impact on physical systems could potentiate health problems like malnutrition, which has been seen to be associated with an increased preponderance for diarrhea and other water-borne diseases. Extreme weather events, like floods, droughts or heat waves can disrupt the provisions and availability of clean, potable water, precipitating water-borne illnesses like cholera and other diarrheal diseases. Further, dilapidation of public health infrastructure due to extreme weather events can also cause outbreaks of infectious diseases, especially those like cholera, which can spread rapidly once a critical mass of infections have been reached in a susceptible population. These climatic cataclysms are expected to increase in intensity and frequency in the coming decades, thus making it essential to have mitigation and adaptation plans in place (Intergovernmental Panel on Climate Change (IPCC), 2007).

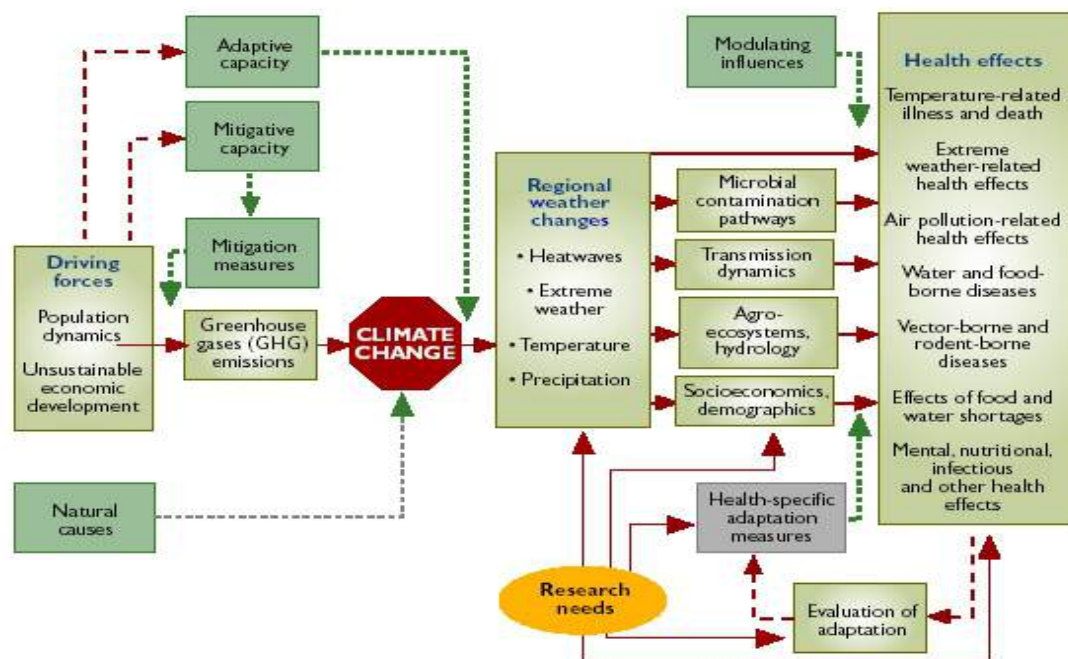


Figure 1: Climate change and health –causal pathways (WHO Guidance)

To address the impact of climate change on water borne diseases in man, it is essential to address the existing vulnerabilities, while investing in building capacity in multiple sectors, health included, to deal with indolent and cumulative climate change as well as catastrophic climate events. In this document, we address and identify the

existing gaps and proffer a national action plan to mitigate the impact of climate change on health. Although there is some uncertainty about the rate at which climate change is likely to occur, and the extent to which human health issues can be attributed to cumulative climate change, there is no doubt that in the long term, it would be in the interest of the well-being of the citizens of India to invest in a comprehensive mitigation and adaptation package for addressing water borne diseases affected by climate change (World Health Organization, 2009).

1.1 Potential Risks of Water-Borne Diseases due to Climate Change

Models developed based on conservative estimates suggest that by 2039, there is likely to be an 8-11% increase in cases of diarrhea in the tropical and sub-tropical areas which can be directly attributed to climate change (Kolstad & Johansson, 2011). Water borne diseases are likely to afflict warmer areas as a wide spectrum of pathogens can emerge in such situations, especially when water purification systems perform at suboptimal levels or are overwhelmed by floods or high demands. Diseases like cholera, giardiasis, salmonellosis and cryptosporidiosis emerge in such situations (McMichael et al., 2003). This is particularly of concern since diarrhea, along with pneumonia, remains the single largest cause of death in children aged less than five years in India (Million Death Study Collaborators et al., 2010). Additionally, it is hypothesized that with increasing temperatures, bacterial survival and proliferation should increase, resulting in a corresponding rise in the occurrence of diarrheal diseases of bacterial etiology (Checkley et al., 2000).

Increasingly, variable rainfall patterns are likely to affect the supply of fresh water. A lack of safe water can compromise hygiene and increase the risk of diarrheal disease, which kills approximately 21% children aged under-5 out of the Global under-five deaths every year. By the late 21st century, climate change is likely to increase the frequency and intensity of drought on a regional and global scale. Diarrheal infections vary greatly in frequency, severity, and duration, and the occurrence in different parts of India is dynamic. Outbreak pattern of diarrhea varies with season, mainly with heavy rainfall leading to waterlogging and lack of potable water; the socioeconomic, environmental and the climatic factors are closely related in a complex web of causation, which eventually results in poor health outcomes for the community (Cash BA et al 2014).

Two remote drivers of inter annual climate variability, the El Niño–Southern Oscillation (ENSO), sea surface temperatures (SSTs) and chlorophyll a in the Bay of Bengal, have been proposed to influence cholera case loads (Koelle et al 2005). There is evidence of an increased role of inter-annual climate variability on the temporal dynamics of cholera as well as shigellosis based on the time-series analyses of the relationship between ENSO and disease prevalence. Recent cholera and shigellosis outbreak series with different epidemiological characteristics have been observed to have similar correspondence to local maxima in ENSO and climate variability.

In a retrospective case review of diarrhea during 1990-1991, it was hypothesized that ENSO-influenced ocean warming and its associated hyper growth of plankton contributed to the dispersal of *Vibrio cholerae* and other enteropathogenic bacterial

organisms along the Pacific coast of Peru(Checkley et al., 2000). Supplementary factors like ENSO (El NiñoSouthern Oscillation), North Atlantic oscillation, sunlight, temperature, pollution, level of rainfall, and some human socio economic and demographic changes do also contribute for outbreaks (Lipp EK et al 2002)

Floods are also increasing in frequency and intensity; the frequency and intensity of extreme precipitation is expected to continue to increase throughout the current century with changing climates and global warming. Floods contaminate freshwater supplies, heighten the risk of water-borne diseases, and create breeding grounds for disease-carrying microbes and insects such as mosquitoes.

Several tools and models were used in the past like satellite imaging to show association of cholera with sea surface height and sea surface temperature (Lobitz et al 2000). Host pathogen dynamics suggested in 2005, measure associations between seasonal drivers rate of transmission of the disease (Koelle et al 2005).

The major cause for water borne diseases remains the lack of clean, potable water supplied in adequate amounts per capita. India has invested heavily in provision of clean water to rural areas; however, a large proportion of the population, especially those residing in rural areas or in urban slums, remains beyond the coverage of adequate water. In the long run, it is expected that climate related challenges in water provision are further likely to impact this, resulting in proliferation of water-related diseases.

1.2 Mapping of Risk Management, Infrastructure and other Resources Available to Help Mitigate the Effects of the Risks

Risk maps help to provide targeted surveillance and deploy control measures in high risk areas. They can also be used to evaluate how the overall impact on human health can result from changes in one parameter, or in a set of parameters, in the model. Additionally, disease risk maps are an efficient manner of communicating information to decision makers and lay audiences alike. Further, mapping of infrastructure available for risk mitigation can help in identifying resources that may be mobilized in times of need.

Either biological (or process-based) models or statistical models may be used to develop disease risk maps. Whilst the understanding of disease dynamics and a set of hypotheses drive biological models, statistical models are data-driven. Both the approaches have their strengths and weaknesses. Whilst biological models may provide a better understanding of the processes in action, if they are based on erroneous hypotheses, the models will themselves be misdirected. Statistical models are more flexible and adaptable, but need robust data for their structuring.

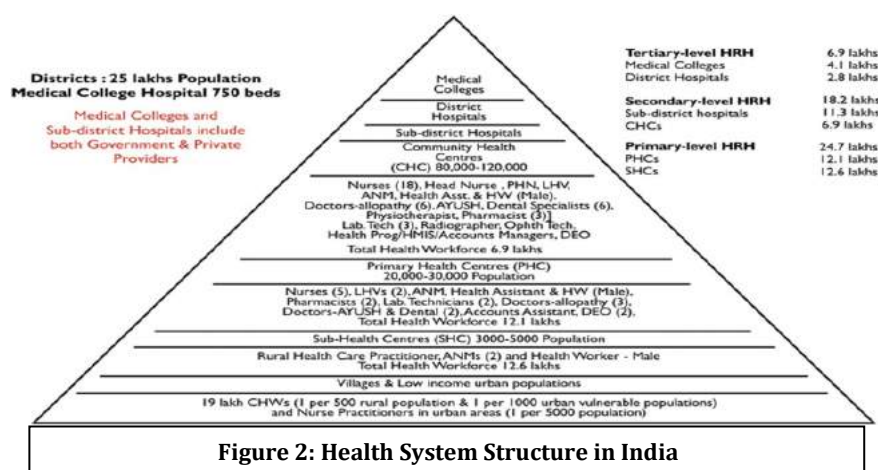


Figure 2: Health System Structure in India

In India, provision of care in the public health sector occurs through the Sub Health Centers (SHC) to the level of Community Health centers (CHC) and district hospitals. Figure 1 above summarizes the healthcare delivery system and the proposed provision of Human Resources for Health (HRH) at different levels. On the basis of the distributional pyramid, currently there are 722 district hospitals, 4833 CHCs, 24 049 PHCs and 148 366 SCs in the country (Human resources for health. National Rural Health Mission. Ministry of Health and Family Welfare, Government of India. Child Health Division, Ministry of Health and Family Welfare).

Although health systems and infrastructure mapping have been undertaken as part of developing the Indian Public Health Standards, it lacks the identification of resources that can be made available for addressing cumulative as well as catastrophic climate change issues. Additionally, these need to be stratified according to projected climate data sets and ensembles of global climate models (GCMs) if they have to adequately inform the decision making process for capacity building in health systems to respond to health challenges due to climate change. To that end, there is a necessity to undertake a systematic modeling and mapping exercise, based on available and projected climate data sets, to identify areas with weak public health infrastructure and potential areas of capacity building there in.

Key Research-Policy Gap 1:

Developing models based on available and projected climate data set ensembles to identify areas, which are at high risk of human health crises arising from climate change, vis-à-vis public health infrastructure that can be deployed in response or in mitigation of those effects.

The steps involved in the process of disease risk mapping, as recommended by the World Bank, are outlined in Appendix 1.

2. Current Status

Climate change is a global phenomenon, but its effects are most intensely

Text Box 1: Research-Policy Gap

experienced in local areas. For example, although changes in precipitation are driven by global temperature and humidity fluctuations, the resultant disruption due to floods or droughts are most intensely experienced over a relatively small geographic area.

2.1 Morbidity, Mortality and Related Statistics

Approximately 11.7 million acute diarrheal cases and 1323 diarrheal deaths have been reported from across all the states in India in 2014 compared to 11.4 million acute diarrheal cases and 1629 diarrheal deaths in 2013 as per fact sheet published by the National Health Profile published by the Central Bureau of Health Intelligence.

Toxigenic *Vibrio cholerae* is autochthonous to aquatic environs and is intricately associated with the microflora and fauna of aquatic environs. Cholera has the ability to spread as worldwide pandemics and currently the seventh pandemic of cholera, which started in 1961, is ongoing. In some South Asian countries it is endemic, in some parts like Africa and South America sporadic outbreaks occur, which is also a common feature in the endemic areas. Past studies have shown how cholera varies with seasons (Mookerjee 2014, Colwell RR 2000).

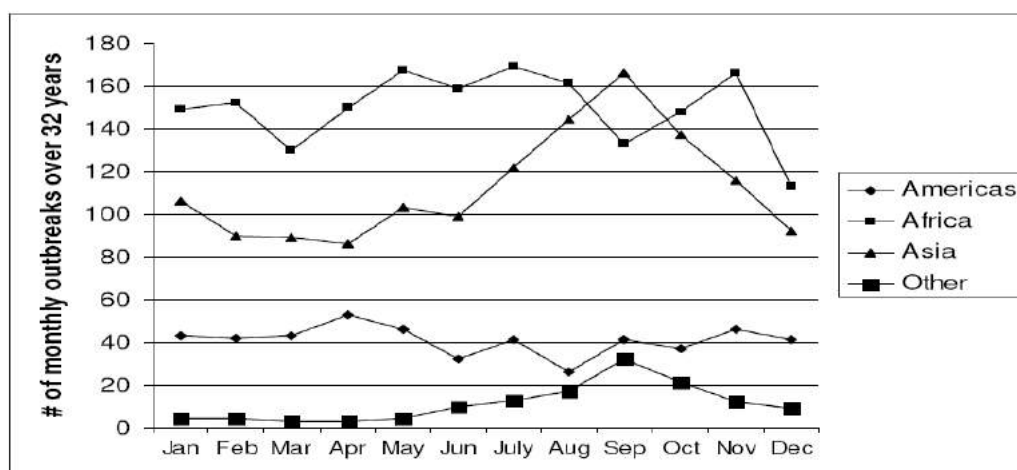


Figure 3: Monthly outbreaks of cholera by regions (from Emch, 2008)

However, robust estimates of what proportion of the caseloads of water borne diseases in India is attributable to climate related factors are not available. To that end, it is essential to establish surveillance mechanisms with a wider set of parameters to identify the burden of water borne disease, either as outbreaks or as endemic diseases.

Key Research-Policy Gap 2:

Obtaining robust estimates of the proportion of water borne diseases that can be attributed to climate change, either directly or indirectly, through establishment of routine surveillance mechanisms.

2.2 Classification of

Text Box 2: Research-Policy Gap

Possible Risks

The relationship between climate and diarrheal diseases is multifaceted due to multiple number of confounding variable and transmission routes that can affect disease rates and the fact that diarrhea is caused by an array of diverse pathogens. Additional factors like ENSO (El Niño Southern Oscillation), North Atlantic oscillation, sunlight, temperature, pollution, level of rainfall, and some human socio economic and demographic factors are responsible for outbreaks (Lipp EK 2002). Inverse correlation between environmental phage concentration (post flood and post monsoon period) and epidemics has been also postulated (Faruque SM 2005).

The frequency and intensity of extreme climate events such as droughts, floods and cyclones have a direct impact on the prevalence of diarrheal diseases and with the gradual warming of the atmosphere these diseases are expected to increase. Studies from developing countries show that there are strong seasonal variations of diarrheal diseases in cases of hydrological extremes such as water shortages and flooding. According to the conceptual model developed by the Intergovernmental Panel on Climate Change (IPCC) 2014, there are three primary exposure pathways via which climate change affects health. They are:

- Direct meteorological parameters like rainfall, heat, floods, storms. They can play a vital role in either contamination of existing water sources or overwhelming of clean water provision systems, leading to the propagation of diarrheal diseases
- Indirectly, through the proliferation of disease vectors or pathogens
- Pathways mediated heavily by human activities, like undernutrition.

The locally prevalent environmental conditions influence the extent to which the climatic changes affect human health. The box on the left indicates drivers of such conditions. The existing public health systems play a major role on cushioning the impact of climate change on human health by providing adaptation and mitigation strategies. The box on the right shows such drivers. Additional complexity is added to the issue since there may be feedback control, both positive and negative, between societal factors, climate change issues, public health infrastructure and adaptation measures adopted, which might further modulate the impact of climate change on human health. Although the IPCC has adopted this model to illustrate the impact on general health conditions, but it remains valid in the construct of diseases spread through water as well.

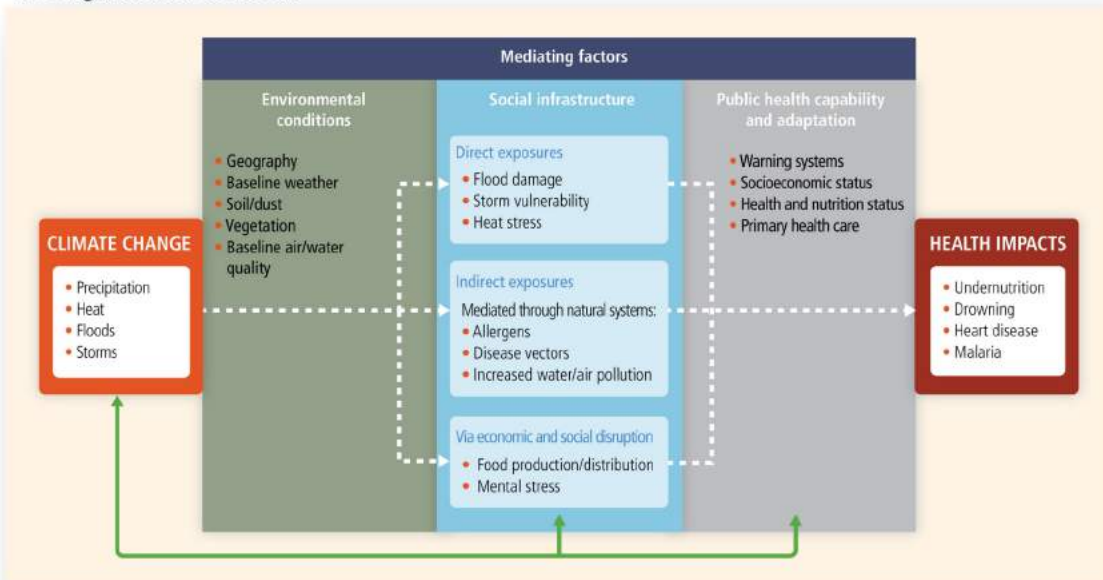


Figure 4: Climate Change and its Health Impact

3. Rationale or Need for Mitigation Plan

Climate change has become an unavoidable reality of the human condition. Since it is inevitable, preparedness provides more effective and less costly recourse than reactive activities. In addition, the rate of cumulative climate changes are rough estimates and the actual changes may occur at a greater pace; further, the calamitous climate events are easier to predict and prepare for if a preparedness, adaptation and mitigation strategy is already in place. Further, addressing climate change can provide several co-benefits, like increased focus on strengthening health systems, improving general health awareness, developing robust surveillance systems and installing efficient outbreak response mechanisms. Thus, although in the Indian context a formal cost-effectiveness evaluation of climate change policies and interventions is yet to be conducted, all indicators suggest that investing in developing climate change preparedness, adaptation and mitigation plan is likely to improve human health in the mid- to long-term.

Since climatic changes can have adverse impacts on countries by increasing the occurrence and outbreaks of water borne diseases, including changes in pathogen characteristics, all countries should hone their national capacity for formulating and implementing preparedness and response plans against such threats. This includes a national plan of action that needs to be regularly monitored by a designated authority comprising of representation from different sectors. In the context of climate change and water borne diseases, regular feedback from an efficient and well-coordinated surveillance system forms the basis of such monitoring.

4. Mitigation Strategy and Action Plan

In 2010, WHO conducted a review of the National Adaptation Program of Action in the small island states and least developed countries, and out of 41 responding nations, an overwhelming 39 identified health to be a vital criteria, and a key sector that was likely to be affected adversely by climate change. This realization was also reflected in the Indian policy when the National Mission on Health was introduced in addition to the initially identified eight missions as a part of the National Action Plan on Climate Change. Out of the multitudes of health impacts, water borne diseases remain a vital vulnerability in India, given its extensive coastlines, areas of grave water deprivation, and its inability to provide universal and adequate access to safe, potable water.

This mitigation strategy is based on the best available evidence in the Indian context. Areas where there are critical evidence gaps have also been identified and should act as priority areas to receive support to address the evidence needs for making an evidence based climate change adaptation and mitigation policy. This has built on existing health services infrastructure, wherever possible, and opportunities for horizontal integrations with existing programs have been indicated.

4.1 Threats and Hazard Identification

A robust diarrhea surveillance system may allow early detection of an epidemic and it might be difficult to accurately predict the onset of an epidemic using the surveillance data alone. However, when used in conjunction with climate data, it may be possible to forecast the occurrence of an outbreak in a specified area as well. For establishing prediction models, statistical iterations based on empirical data on the association of climate and trends of water borne diseases may be developed based on comprehensive surveillance data and climate data, including predictions of climate data. Establishing and testing of thresholds for outbreak predictions may be done based on these parameters to identify parsimonious models, which can be deployed for efficient prediction and control of water borne diseases.

It is essential to evaluate the sensitivity, specificity and predictive values for such models by cross-validation methods, including real observations in future (and also in the past, if sufficient data are available for validation). Often these models take shape of a complex multivariate model that considers various environmental and other factors affecting the risk of water borne diseases. In addition to generating prediction models it is vital to initiate vulnerability and adaptation assessment at the district level. For this purpose, an accepted and valid method of Vulnerability and Adaptation assessment may be deployed. Appendix 2 includes the outline of the steps proposed by the WHO in 2008 to conduct vulnerability and adaptation assessment.

This systematic approach can help districts to identify the populations that are most vulnerable to different detrimental health effects due to climate-sensitive diseases. It also helps to identify the broad weaknesses in the systems, which can be strengthened to protect the vulnerable classes. The method also provides insights, which may be used to identify specific interventions to protect the most vulnerable classes. Such analyses may be conducted multiple times over time to provide a baseline assessment of the linkage between climate and human health, and present an understanding of how it has evolved over time. Such systematic analysis of the conditions also provides policymakers with the opportunities to build capacity where it is most needed, and identify priority areas for investment in health protection.

4.2 Hazard/Risk Resilience Assessment

The ten key components of the operational framework(WHO) for building climate-resilient health systems are:

- Environmental risk management
- Climate smart health programming
- Emergency preparedness and management
- Research
- Communication
- Assessment
- Integrated risk management
- Cross sectoral governance and collaboration
- Public health services and systems
- Capacity development



Figure 5: Ten key components for building climate resilient systems

To achieve the optimum level of risk resilience to climate-sensitive water borne diseases, it is essential to have a coordinated and functional cooperation between the multiple sectors and institutions that share a common goal of water and sanitation management. Cooperation between the respective governance structures dealing with health, drinking water provision, environmental health, disaster response, agriculture and animal health needs to be established through the creation of cross-sectoral committees that facilitate sharing of data and expedited, evidence-based decision making.

4.3 Planning

A national plan of action with regularly monitoring by a designated authority comprising of people from different sectors, including the private sector, wherever appropriate.

- Continuous monitoring of the changes of the different climatic factors and the change of the pathogenic profile of the infectious organisms has to be undertaken to keep an update on the mode of treatment and control of the infectious diseases.
- Establishment of sub-regional response centers within a country, along with formulation of core action committees that would facilitate appropriate and timely actions whenever there is an adverse outcome like outbreak or possibility of an impending threat.
- A contingency stock of relevant items, including drinking water, halogen tablets, bleaching powder, drugs, vaccines, IV fluids and ORS.

In the context of climate change and water borne diseases, regular feedback from an efficient and well-coordinated surveillance system forms the basis of evidence based mitigation strategies. Establishment of sub-regional response centers, along with formulation of core action committees and facilities for seamless communications among them, would facilitate appropriate and timely actions whenever there is an adverse outcome (e.g. an outbreak) or the impending threat of one.

These centers should maintain contingency stocks of relevant items, including drinking water, halogen tablets, bleaching powder, drugs, vaccines, IV fluids and ORS, with periodic replacements if expiry date is reached. Local health care facilities may be identified to take care of cases during outbreaks and staff therein should be adequately trained to tackle such situation. In addition, identifying and mitigating factors that negatively influence the climate itself need to be considered for long-term prevention efforts. This also requires periodic monitoring through a coordinated multi-sectoral approach, which can be strengthened by formulating and implementing relevant laws and regulations.

4.4 Community Resilience and State Mitigation Capabilities

Minimum requirements to deal with water borne diseases, climate change and related factors at different levels of preparedness would principally encompass three aspects:

- **Detection** of negative impacts of water borne diseases, including diarrhoea or cholera, especially during (or prior to) outbreaks
- **Combat** consequences of outbreaks of water borne diseases
- **Prevent** (or delay) the occurrences of climate-sensitive water borne diseases

State Epidemic Control programme implementation group need to coordinate the response but if no Committee is in place, one should be set up quickly. Many of these activities can be done at the same time, by different people. In a small health centre, though, one or two people may be responsible for doing nearly everything. A tentative list of the items essential to combat an epidemic situation is given below:

- Availability of warehouse at BMOH level for stockpiling of emergency supplies
- Stockpiling of recommended drugs, ORS, vaccines & other supplies

- Identification of drug distribution centers in case of emergencies
- Identification of hospitals / hospital bed reserves for emergencies
- Formation of core committees / teams with adequate training
- Construction and maintenance of temporary shelters for displaced people in cases of calamities as a consequence of climate changes
- Request additional training in case management
- Request assistance from the Mobile Control Teams

More details of the preparedness plan at the institutional or district level is presented in Appendix 3. This preparedness plan may be modified based on the local or regional compulsions, which need to be identified through a systematic vulnerability and adaptation assessment as outlined above.

4.5 Public Information and Early Warning Systems

Currently, infrastructures for early warning systems are present as part of routine outbreak surveillance within the mandate of the Integrated Disease Surveillance Program (IDSP) without any positive bias for areas known to be more vulnerable to climate events. These areas, like flood-prone or drought-prone areas, or mountain or hill areas which are vulnerable to avalanches, are especially susceptible to suffer from outbreaks of water borne diseases in the aftermath of a catastrophic climatic event. However, since climate-sensitive water borne diseases can be modeled to be associated with certain meteorological parameters, it is possible to predict such health events and thus mitigate the adverse outcomes associated with such events. The concept of using climate-related variables for the establishment of an early warning system (EWS) has thus long been of interest for researchers and policymakers alike.

Based on the framework adapted by the World Bank, the following approach may be locally modified for deployment of EWS related to climate-sensitive water borne disease outbreaks or address the impending threats of an outbreak.

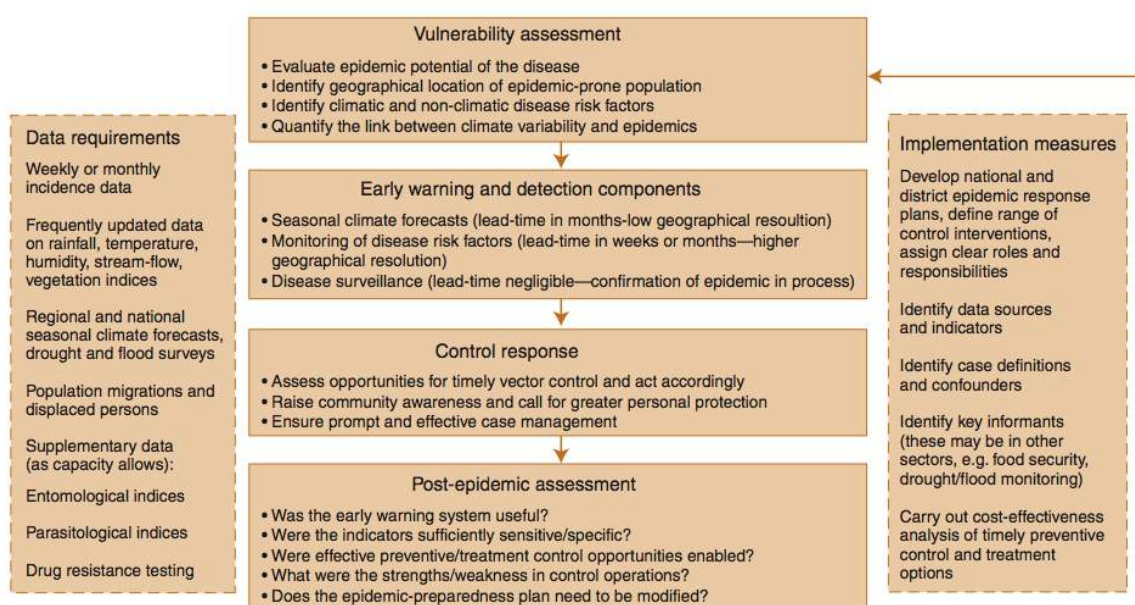


Figure 6: Framework for developing early warning system for climate sensitive diseases

Monitoring and surveillance of an index disease for water-borne pathogens may provide an early suspicion for an impending outbreak. This can then be supplemented with climate data, which can be obtained through cross-sectoral collaboration with meteorological departments that can share data through expedited channels, using online tools. Additional parameters can be estimated using remote sensing and GIS technology. Digital maps of vulnerable populations, presence of topographic features known to be associated with outbreaks of climate-sensitive water borne diseases (like arid, desert areas; low-lying, flood-prone areas; areas near the coastlines or riversides) and presence of known disease reservoirs for particular climate sensitive diseases (like animal sources of zoonotic water borne diseases) can provide ancillary intelligence to further increase the accuracy of the triggers of the EWS.

Table 1: Factors to be addressed at the inception of Early Warning Systems for climate-sensitive water borne diseases(adapted from the World Bank report #84956-GLB)

A. Developing the Early Warning System and its Protocols
1. Identify the priority diseases or triggers to be activated by the EWS.
2. Identify a multidisciplinary expert group to develop and update the protocols for EWS.
3. Identify an existing framework within the IDSP or develop a framework to enact and implement the EWS.
4. Continuous evaluation of the triggers of EWS to assess their sensitivity, specificity, predictive values and cost effectiveness.
6. Develop the EWS at the district or state level to allow for local customization based on vulnerability and adaptation assessment for climate-sensitive water borne diseases.
B. Early Warning System Messaging
1. Identify the target audience (based on vulnerability to climate-sensitive water borne diseases) to whom the EWS signals have to reach.
2. Identify the best avenues for reaching the target population.
3. Develop a policy to assess the role of new and emerging media in the dissemination of EWS messages
4. Evaluate the source of information of the target audience.
5. Identify strategies to incorporate the EWS messages within the current response framework of the IDSP or develop a mechanism to transmit the EWS messages to the target audience.

4.6 Long-term Vulnerability Reduction

To address the issue of water borne diseases in the long term, it is imperative to take a multi-sectoral approach at mapping and mitigation of vulnerability to the same. Towards that end, the following policy directions can be adopted at the appropriate levels to address existing shortcomings and vulnerabilities

1. Creation of climate-sensitive disease libraries

- a. Identify a multi-disciplinary body responsible for collection and collation of disease data and climate data.

- b. Identify or develop a repository for storing and sharing such data with appropriate stakeholders.
- c. Develop end user licenses and systems that enable stakeholders to access the data readily.
- d. Develop a policy for keeping the databased updated. Identify a nodal person for the same.
- e. In the short term, identify currently existing data sources that can be drawn from to create such a library.

2. Deployment of mapping, GIS and modeling software for improved prediction

- a. Identify the currently existing capacity at the central and state level for the systematic deployment of such tools. If current capacity is inadequate to launch this, develop a policy for capacity building.
- b. Identify the software and hardware requirements to deploy these tools in the short term.
- c. Identify a coordinating institution or a multidisciplinary committee under whose guidance these tools may be piloted in select high-vulnerability areas to assess their accuracy and feasibility.
- d. Develop a policy for translation of data collected using these methods into policies.

3. Develop Hydro-meteorological data services for health outcomes

- a. Identify the currently existing databases of hydro-meteorological databases.
- b. Identify the existing policies for integration of such databases with human health services. If such policies are absent, develop data sharing protocols.
- c. Develop and test predictive models in vulnerable areas and identify additional parameters that need to be measured for development of more precise prediction models.
- d. Evaluate the cost of action (developing and expanding the hydro-meteorological databases) versus inaction with respect to cost effective reduction in burden of water borne diseases and other climate-sensitive health conditions.

4. Capacity building

- a. Evaluate the current capacity in the workforce that can respond to water borne disease outbreaks caused by climate change.
- b. Identify the gaps in training across various sectors (human health, animal health and agriculture, environmental sciences, social sciences) in equipping professionals with the skills to predict and respond to water borne disease threats due to climate change.
- c. Identifying institutions which can provide the required training.
- d. Developing an evidence based, practice oriented curricula for capacity building across sectoral boundaries to develop a cadre of climate related experts.

- e. Identification of existing training modalities which can be further developed to address climate related water borne disease concerns. A robust system will allow for studying of climate-sensitive water borne diseases both at the macro level in relation to the prevailing regional climate and land/surface phenomena, as well as at the micro level, where detailed information on wetland, ponds and their uses, settlements, source of drinking water supply, sanitation, vegetation conditions, cropping pattern, rainfall, extent and duration of inundation, drainage condition and tidal phenomena can be used. Analysis will help establish bio-geo-climatic models that help predicting vulnerability of an area to climate-related water borne disease outbreaks and to develop an early warning system for impact minimization.

4.7 Operational Coordination

Given the multi-disciplinary nature of the problem of water borne diseases affected by climate change, it is essential to have stakeholder engagement at all levels to initiate effective policy interventions. Partnerships involving the conventional health care system, public health infrastructure and policy making mechanisms may not be enough for the successful intervention in this complex socio-bio-geo-medical problem. To this end, it is essential to have extensive partnerships involving the citizens, non-governmental organizations, and businesses in order to shape up effective programmatic interventions to minimize the impact. To that end, it becomes vital to establish collaboration mechanisms at the sub-national and national levels through cross-sectoral working groups which act in a coordinated fashion to address water borne disease risks mediated by climate change.

Table 2: Developing cross-sectoral coordination mechanisms for stakeholder engagement

Developing coordinated collaborative cross-sectoral committees for action against water borne diseases mediated by climate change
1. Identification of existing mechanisms for cross-sectoral collaboration at sub-national, national and regional levels which can be further developed to address climate change related water borne diseases. 2. In the absence of a local mechanism, identification of models which can advise the process of developing a coordinated mechanism for cross-sectoral committees for action against climate-sensitive water borne diseases. 3. Stakeholder mapping and analysis to identify the relevant agencies who have a stake in the prevention, prediction, control and mitigation of climate-related water borne diseases. 4. Developing terms of references for the committees at various levels, including details of their memberships, expected roles to be fulfilled and outcomes expected. 5. Developing sustainable funding mechanisms to support the activities of such cross sectoral committees in mediating climate-related water borne disease risks. 6. Developing a monitoring and evaluation plan to assess the role of such a cross-sectoral committee in addressing the issues.

5. Resources Required

5.1 Finance needs and gaps

Illustrative budgetary outline which can be adopted as per local priorities and requirements:

Table 3: An outline of minimum requirements to implement preparedness activities for a population of 50,000 for 1 year.

Budget items	No. / Quantity	Cost per unit / month (approx. INR)	Total cost in 12m (approx. INR)	Subtotal (INR)
Personnel:				
Program coordinator	2	75,000	18,00,000	
Health workers	20	10,000	24,00,000	
Health assistants (supervisors)	6	12,000	8,64,000	
Laboratory technician	2	15,000	3,60,000	
Laboratory attendant	2	10,000	2,40,000	
Data entry operator	2	15,000	3,60,000	
Programmer	1	25,000	3,00,000	
Attendant / Field attendant	2	10,000	2,40,000	
Subtotal				65,64,000
Stationeries, including specimen labels etc.			2,00,000	2,00,000
Consumables - General			25,000	25,000
Consumables & test kits - Laboratory				
Specimen containers*	40,000	20	8,00,000	
Specimen carriage basket	20	500	1,20,000	
Lab. consumables			2,00,000	

Disposal system			2,50,000	
Work station furniture & fittings			1,,00,000	
Subtotal				14,70,000
Control Room facilities*	1	30,000	30,0000	
LCD TV* (For video conference facilities)			1,50,000	
Computers with UPS	2	75,000		
Printer - Laser	1	50,000	50,000	
Storage media for back-up			30,000	
Furniture, including file cabinets etc.			2,00,000	
Internet	1		50,000	
Software - Antivirus	1	30,000	30,000	
Software – Analytical/ Statistical	1	7,00,000	7,00000	
Sub total				15,10,000
Training, meeting & training materials, SOPs			75000	75000
Transportation	2	50000	12,00,000	12,00,000
Communications		25000	25000	25000
Miscellaneous		25000	25000	25000
TOTAL				1,10,94000

*Only approximate number and will vary according to local situations. The calculations are to be based on certain assumptions:

Assuming incidence of diarrhea in total population as 1 episode per person per year, total no. of expected episodes = 50,000; assuming 70% case-capture, total containers required = 35,000 (plus an additional 20% for wastage).

Finance needs and gaps:

- Comprehensive plan involving decisions makers at all possible levels
- Identification of definite cell or manpower for combating natural calamities including ministry of health, public health engineering, local and nad national level administrative bodies
- Regular monitoring system of climatic factors and integration of disease surveillance
- Development of early warning system, through establishment of disease surveillance network
- Establishment of sentinel surveillance of diarrhoeal disease network across the nation, especially in the vulnerable areas, for which fund should allocated for manpower, logistics and setting up of laboratory

5.2 Domestic Measures

Assessment of preparedness in view of climate change at national level should focus on eliciting information on: National Action Plan for climate change; infrastructure for meteorological stations; Research Institutions for undertaking impact assessments, interventions and new tools for control strategies; Disaster Management Plans; Early warning systems; strengthening of capacity building and Allocation of resources.

Health facility survey should be conducted by discussion with stakeholders like national disease control programs, research institutes and Ministry of Health for health infrastructure and research issues and corresponding ministries or departments for relevant issues. Need for having specialized institutions for surveillance, providing meteorological data and management of disasters for tackling the challenges posed by climate change should also be identified.

Action points at the national level

- Action plan for climate change
- Nodal person in the Govt. agency
- Action plan of MoH & FW
- Identification of responsible institutions and networking
- Integration with other sectors
- Preparedness & Response Plan
- Disaster Management Plan
- Assessment of Health system
- Data management: Disease, Met data
- Allocation of funds

State level:

Preparedness plan should be developed in each state depending on the occurrence of climate sensitive diseases and vulnerability, which should be assessed at baseline

and then at specified intervals using a validated and accepted methodology as outlined in appendix 2 below.

Assessment of health facilities

Current health infrastructure at primary, secondary and tertiary level should be evaluated in terms of availability of health facilities for surveillance, diagnosis and treatment facilities, and ability to respond to and control outbreaks of water borne infections. Review of vertical disease control programs should be conducted to assess their impact on moderating the impact of climate change on human health. Issues like availability of infrastructure, drugs, manpower, training, information education and communication needs, monitoring and evaluation, and acceptability of facilities by communities need to be evaluated on a priority basis.

Representative states from different ecotypes of diseases (e.g. desert, tribal, forest, and urban) should be selected for assessment of health facilities. NIMR has undertaken In-depth review of Malaria for NVBDCP in 2006-07 comprising of household and health facility survey, which may be emulated for assessment of health facilities (IDR, 2007 available at www.mrcindia.org) at district level.

District level:

District level plan should be developed for vulnerable districts. Since it is a plan for grass root levels, it should be robust and realistic keeping in view the ground situation. This district level action plan should be based on the findings of the vulnerability and adaptation assessment and to ensure continuity with public health policies, it should be integrated with the district health action plan in principle and in execution.

Assessment of societal capacity and needs:

It has been accepted that districts with highest or lowest climate sensitivity under the projected climate scenarios may not necessarily be the most vulnerable (O'Brien et al 2004). Therefore, initially macro level adaptive capacity of country should be determined based on climate sensitive parameters, socioeconomics of communities and technological infrastructure should be determined following initial vulnerability and adaptation assessment. Local case studies are also required for ground truthing of the macro analysis and identification of local level institutions, coping capacities, strategies and policies for finalizing the preparedness plans.

Socio-ethnographic surveys to elicit the present Knowledge, Attitude, Practices and Belief (KAPB) of the communities about climate sensitive water borne diseases, health seeking behavior and coping capacity of communities need to be determined through systematic research studies. Based on the current knowledge and practices followed by communities in different paradigms of diseases, preparedness plan to

Key Research-Policy Gap 3:

Macro level (district) assessment of vulnerability and adaptation using standard methods and tools.

Micro level (household) assessment of KAPB related to climate-sensitive water borne diseases and ethnographic survey methods.

bridge the gaps and possible adaptive capacity may be devised.

5.3 International Cooperation and Coordination

Climate change is a global problem, which needs concerted and collaborative response from global players. To that end, it is critical to establish links with international agencies with a stake in the mediation of human health effects of climate change. There is robust evidence to support the establishment of international liaisons to combat anthropogenic climate change.

The international arena for cooperation on climate change has become increasingly diverse over the past two decades. Some of the existing frameworks with which formal or informal collaborations may be established to mitigate climate change effects on human health are tabulated below.

Table 4: Exploring international collaborations to address climate change – An illustrative list

Agencies	Roles and Significance
Transborder Agencies	
United Nations Framework Convention on Climate Change (UNFCCC) http://unfccc.int/	Remains the primary international forum for climate negotiations. Can provide policy guidance and documentations, including case studies and reports to advise climate change policy making. Invests in and develops governance structures on climate change. Universal membership makes it a truly global, transboundary agency.
Intergovernmental Panel on Climate Change (IPCC) http://ipcc.ch	This international body to assess the science related to climate change was established by the World Meteorological Organization and the United Nations Environment Program (UNEP) in 1988. It develops and ratifies evidence-based approaches to governance and policy making in climate change and underlies the UN Climate Conference organized by the UNFCCC. There are three broad working groups evaluating the evidence and generating sound policy directives: Working Group I: the Physical Science Basis; Working Group II: Impacts, Adaptation and Vulnerability; and Working Group III: Mitigation of Climate Change – and the Task Force on National Greenhouse Gas Inventories (TFI)
World Meteorological Organization (WMO) http://public.wmo.int	UN-based agency for cooperation amongst national member states on all issues related to the climate, including its detrimental effects on human health. WMO provides the framework for global cooperation on reaping

	the benefits from the application of meteorological forces.
United Nations Environment Programme (UNEP) http://web.unep.org	It is the leading global environmental authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system and serves as an authoritative advocate for the global environment.
The World Bank http://www.worldbank.org/en/topic/climatechange	The World Bank Group's Climate Change Action Plan of April 2016 aims to help developing countries accelerate efforts to tackle climate change and deliver on their national climate plans submitted for Paris.
Other Non-UN Agencies	• International Energy Agency (IEA) • Organization for Economic Cooperation and Development (OECD) • The Cartagena Dialogue for Progressive Action • Climate and Clean Air Coalition • Major Economies Forum on Energy and Climate Change (MEF)
Resource Mobilization and Development Partnerships	
NAMA Partnership http://namanews.org/	Nationally Appropriate Mitigation Actions (NAMA) Partnership is a global partnership geared to address national priorities in climate change. Successful implementation provides scalable and replicable models for other countries to follow, saving vital time and resources in the efforts to address climate change.
Adaptation Fund https://www.adaptation-fund.org/	The Adaptation Fund finances projects and programmes that help vulnerable communities in developing countries adapt to climate change. Initiatives are based on country needs, views and priorities. The Adaptation Fund was established under the Kyoto Protocol of the UN Framework Convention on Climate Change, and has committed US\$ 357.5 million in 63 countries since 2010 to climate adaptation and resilience activities.
The Green Climate Fund http://www.greenclimate.fund/	The GCF mission is to expand collective human action to respond to climate change. The Fund aims to mobilize funding at scale to invest in low-emission and climate-resilient development. Created by the United Nations Framework Convention on Climate Change (UNFCCC), the Fund aims

	to support a paradigm shift in the global response to climate change.
National Institute of Environmental Health Sciences, Center for Climate Change and Human Health Research https://www.niehs.nih.gov/research/supported/centers/climate/	The NIEHS Climate Change and Human Health program funds research aimed at understanding the health impacts of climate change and how strategies used to adapt to or lessen climate change might affect health adversely; to identify populations who are vulnerable to climate change, produce methods and models for studying climate change, and advance knowledge about how to best provide communication and education about risks tied to climate change.

These international agreements and collaborations represent a common cause commitment to impede the climate change and mitigate the adverse impacts, including those on human health, through water borne diseases, amongst others. The IPCC has illustrated the length and breadth of the existing agreements and international collaborations on climate change in its fifth assessment report (AR5).

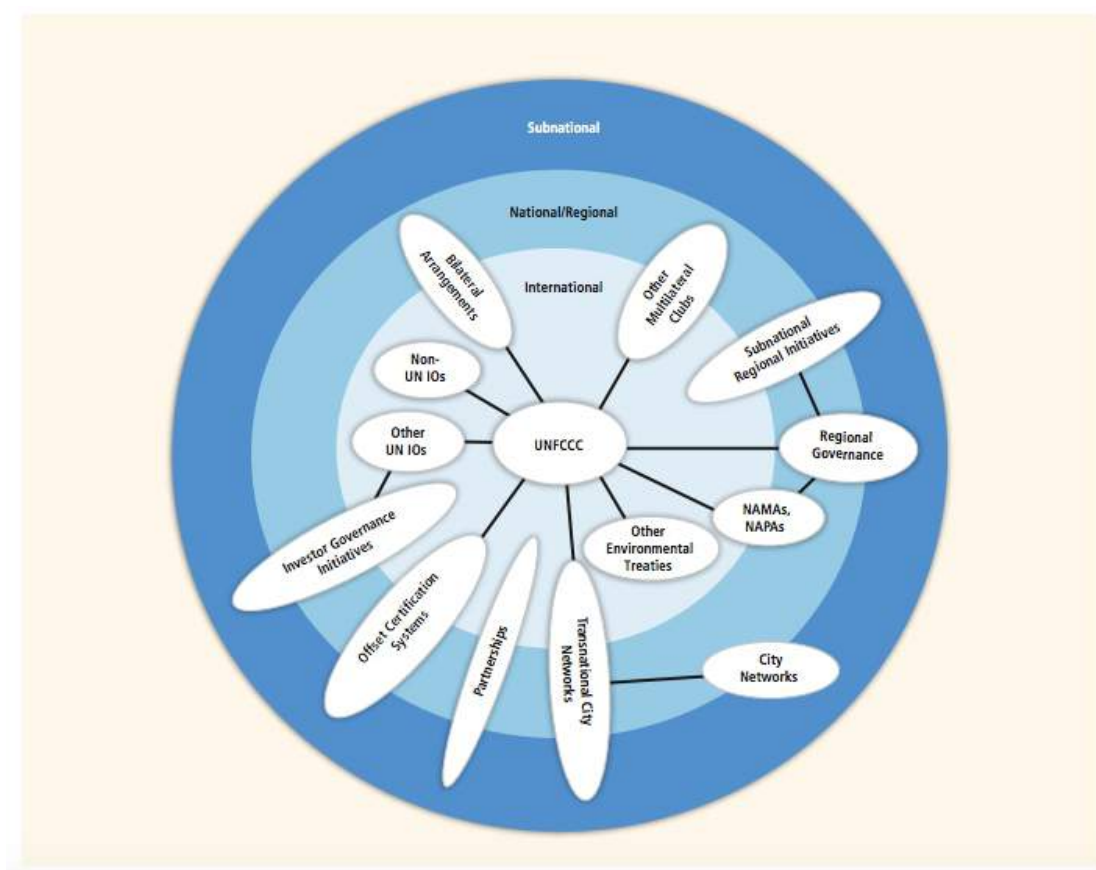


Figure 7: Landscape of agreements and international collaborations on climate change (from IPCC AR5)

6. Implementation and Coordination

6.1 Establish Coordinated Response Mechanisms

As soon as an epidemic/outbreak is suspected, we should:

- **Treat patients** for their illness using standard treatment guidelines made available by respective disease control programs
 - *Appropriate treatment of cholera will save lives.*
- **Immediately send** a report to the designated officer, or the next referral level.
 - *Report all suspected cases.*
- **Brief the staff on** what is to be done.
- **Send stool specimens** to the designated laboratories.
 - Linkage of peripheral health centers (district hospitals or community health centers) with laboratory network
- **Begin and maintain line-listings** (register), tables, graphs, maps for the affected areas.
 - Develop microplans, in line with polio vaccine delivery program
- **Activate the Epidemic/Outbreak Control Committee**
 - In appropriate cases, trigger Rapid Response mechanisms embedded in IDSP.
 - In case such a committee is non-existent, one should be framed under the guidance of an institution with experience of handling such outbreaks
- Organize and carry out **simple investigations**
- Begin to **carry out control measures**.
- **Check essential supplies and equipment.**
 - Including management of supply chain to ensure continued availability of essential supplies
- **Request additional training in case management** for health workers, if necessary.
- Request assistance from the **Mobile Control Teams** if additional help is needed.

6.2 Increasing education and awareness of threats and hazards, as well as their risks

Preparing for an outbreak with the community

- Setting up the Control Committee
- Setting up the Preparedness Plan
- Making aware the community of any forthcoming natural calamity and required preparedness through public address systems (Microphones etc.)
- Meeting with Block level health officials/CHW/Anganwadi workers etc.
- Meeting with Councillors/Village head/Sarpanch /Panchayat Pradhan (Mukhia Ji) etc.

The UNFCC has outlined the critical components necessary for developing successful products to intervene at the community level for mitigation of climate

related effects on the occurrence of water borne diseases. Following careful problem definition, six common components frequently comprise the approaches taken to develop and deliver climate products and services for health. These include

- activities to create an enabling environment,
- build capacity,
- conduct research,
- develop and deliver products and services,
- apply the knowledge, and e
- value the products and user experience.

Each component serves a specific goal in the overall process. These components are not necessarily sequential, but very often must occur simultaneously to design, develop, and apply useful weather and climate services.

Further, the UNFCCC outlines the need to engender a sense of partnership and co-opt the target communities, especially vulnerable ones, in the process of mitigation of climate related effects on water borne diseases. This is vital for the success of mitigation strategies since programs or interventions, which are unacceptable in the target society, are unlikely to yield successful outcomes. Five common actions that have helped the necessary partnerships flourish include:

- Spend time to define the problem and the knowledge needs;
- plan so as to create not only a reliable climate product, but also a support system, which can sustain the product or service until it becomes a mainstreamed health application;
- pursue co-development to help create relevant and reliable products that are fit-for-purpose and have the greatest utility and impact;
- build adequate financial and human resources to sustain the services;
- include informed communication planning to ensure the information is actionable.

7. Monitoring and Evaluation

There should be a robust monitoring and evaluation framework in place to assure that the mitigation activities are aligned with the national priorities and adhere to the standards of quality established by the global norms. To achieve this, it is essential to establish a set of indicators, which are specific to the impact of climate change on human health. The M&E framework needs to be developed in line with the guidelines established by the WHO in its guidance to develop adaptation planning to climate change in human health.

The indicators to be developed for the M&E framework should cover a wide spectrum of vulnerability and risks from climate change and should be based on evidence and analyses of the causal pathway through which climate changes lead to adverse health outcomes. The image below summarizes such a causal pathway.

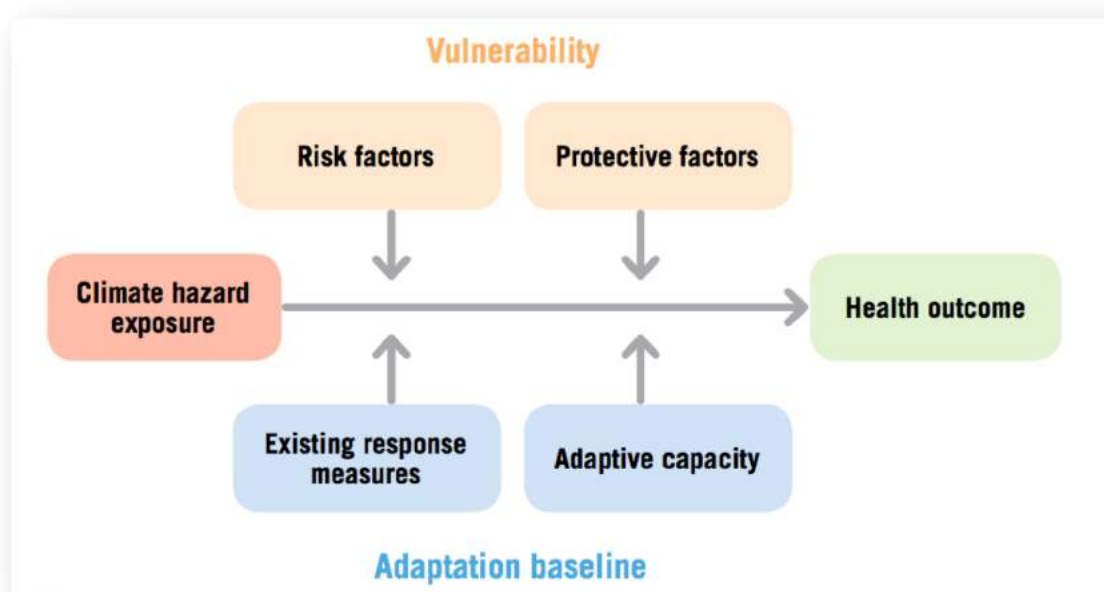


Figure 8: Categories of indicators on the causal pathway from climate change to adverse health outcomes (WHO guidelines)

Indicators should be able to develop disaggregated data, which can provide better estimates of vulnerability profiles and thus help in designing targeted, specific interventions. An illustrative list of indicators has been provided in the table below. A more complete list needs to be developed, based on evidence and priorities related to India.

Table 5: Illustrative list of indicators for the monitoring and evaluation of programs for mitigation of climate-sensitive water borne diseases

Sector	Factor	Indicator
Environment	Water	- Proportion of population accessing improved drinking-water sources and sanitation - Increased availability of at least 20l per person per day from a source within 1km of user's dwelling - Proportion of households using piped water on premises for the last 12 months
Socioeconomics	Poverty	Proportion of population with income below US\$1 per day
	Health expenditure	- General government expenditure on health as a percentage of total government expenditure - Per capita total expenditure on health (US\$)

Health		• % of out-of pocket per capita expenditures on health
	Health interventions and adaptation responses	• % of children with diarrhoea receiving oral rehydration therapy and continued feeding
	Infant and Young Child Feeding	• % of infants under 6 months of age who are exclusively breastfed • % of infants aged 6–8 months who receive solid, semi-solid or soft food • % of children aged 6–23 months who receive a minimum acceptable diet
	Food borne illnesses	• Prevalence of foodborne diseases • Incidence of foodborne disease outbreaks • Proportion of foods marketed that comply with international trade standards for hormone, pesticide, antibiotic residues as well as other chemical, microbiological food safety parameters.
	Nutrition status	• Proportion of undernourished (as a percentage of the total population) • Proportion of adolescent girls with anemia

Further, in line with the WHO guidance, cross cutting issues need to be addressed. These could include the following:

- Environmental determinants of health (e.g. different geographical settings, urban vs rural environments, and housing).
- Gender, equity and other social determinants of health.
- Resilience of health systems (e.g. availability and accessibility of health services, climate-resilient and health promoting strategies in health care facilities, new climate-resilient hospitals built, built environments not prone to flooding).
- Review and rehearse the plans for **Temporary Treatment Centers**.
- Intensify **health education** efforts.
- Community & district empowerment to scale up intervention strategies
- However, looking at the pace of achievements of the targets that are required to be achieved, we need to focus more on framing of the policies in terms of building capacity of existing human resources, enhancing further allocation of finances dedicated toward climate sensitive disease specific mitigation plan
- Identifying areas through operational research, which can enhance quantity and quality of plan for climate sensitive diarrheal disease in India.

To ensure complete integration of the process of mitigation of climate change effects on human health, it is vital to periodically communicate the progress made to the various stakeholders, including those from the community level partnerships, to ensure continued involved and transparent dealings.

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9. Appendices

Appendix 1: Inputs, Analytical Processes and Outputs Typically Involved in Disease Risk Mapping

Based on the recommendations from the World Bank report #84956-GLB: Reducing Climate Sensitive Disease Risks.

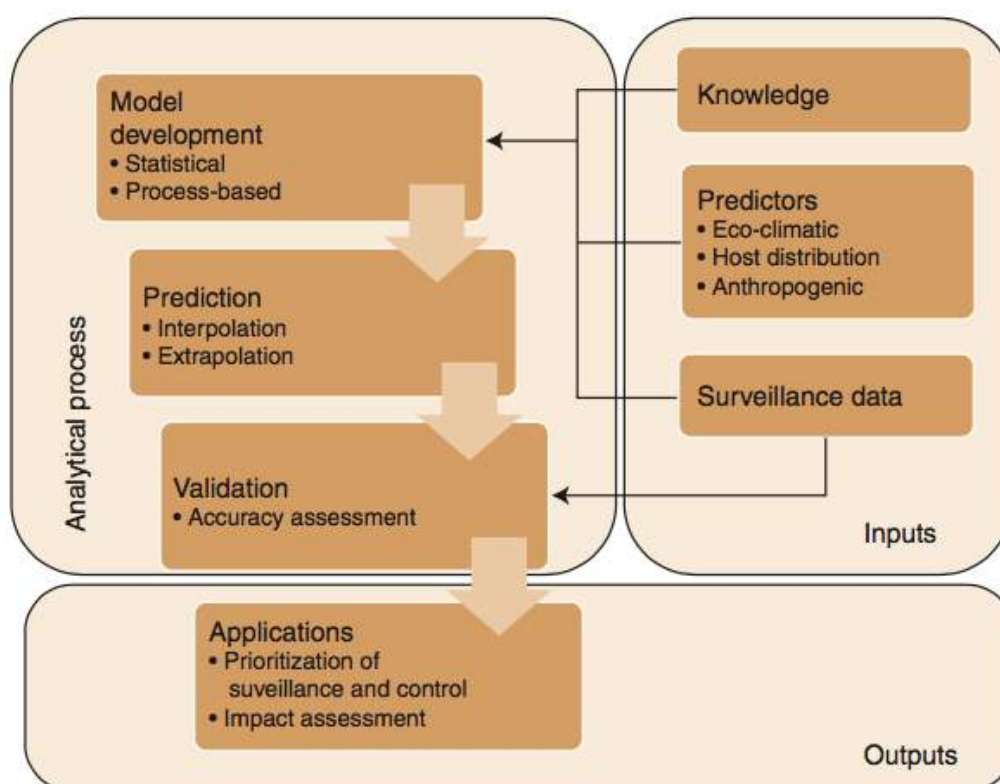


Figure 9: Inputs, analytical processes and outputs typically involved in disease risk mapping (World Bank Report #84956-GLB).

Appendix 2: Vulnerability and Adaptation Assessment

This tool is adapted from the WHO Guidance to Protect Health from Climate Change through Health Adaptation Planning.

The steps in conducting an assessment should be responsive to the country context and needs, which will determine what steps to conduct and the appropriate order. The basic components of an assessment are:

1. Frame and scope the assessment:

- a. Define the geographical area and health outcome of interest

- b. Identify the questions to be addressed and steps to be included
 - c. Identify the policy context for the assessment
 - d. Establish a project team and a management plan
 - e. Establish a stakeholder mapping and analysis process
 - f. Develop a communication plan
- 2. Vulnerability assessment: Describe the human health risks of current climate variability and recent climate change, and the public health policies and programs to address the risks. This includes:**
- a. Describing the current risks of climate-sensitive health outcomes, including the most vulnerable populations and regions
 - b. Describing the current capacity of health and other sectors to address the risks of climate-sensitive health outcomes
- 3. Impact assessment: Project future health risks and impacts under climate change. This includes:**
- a. Describing how the risks of climate-sensitive health outcomes, including the most vulnerable populations and regions, may change over the coming decades, irrespective of climate change
 - b. Estimating the possible additional burden of adverse health outcomes due to climate change
- 4. Adaptation assessment: Identify and prioritize policies and programs to address current and projected health risks. This includes:**
- a. Identifying additional public health and health care policies and programs to prevent likely future health burdens
 - b. Prioritizing public health and health care policies and programs to reduce likely future health burdens
 - c. Identifying human and financial resources needed for implementation and potential challenges to be addressed
 - d. Estimating the costs of action and inaction
 - e. Identifying possible policies and programs to reduce the potential health risks of adaptation and greenhouse gas mitigation policies and programs implemented in other sectors
- 5. Establish an iterative process for monitoring and managing the health risks of climate change**

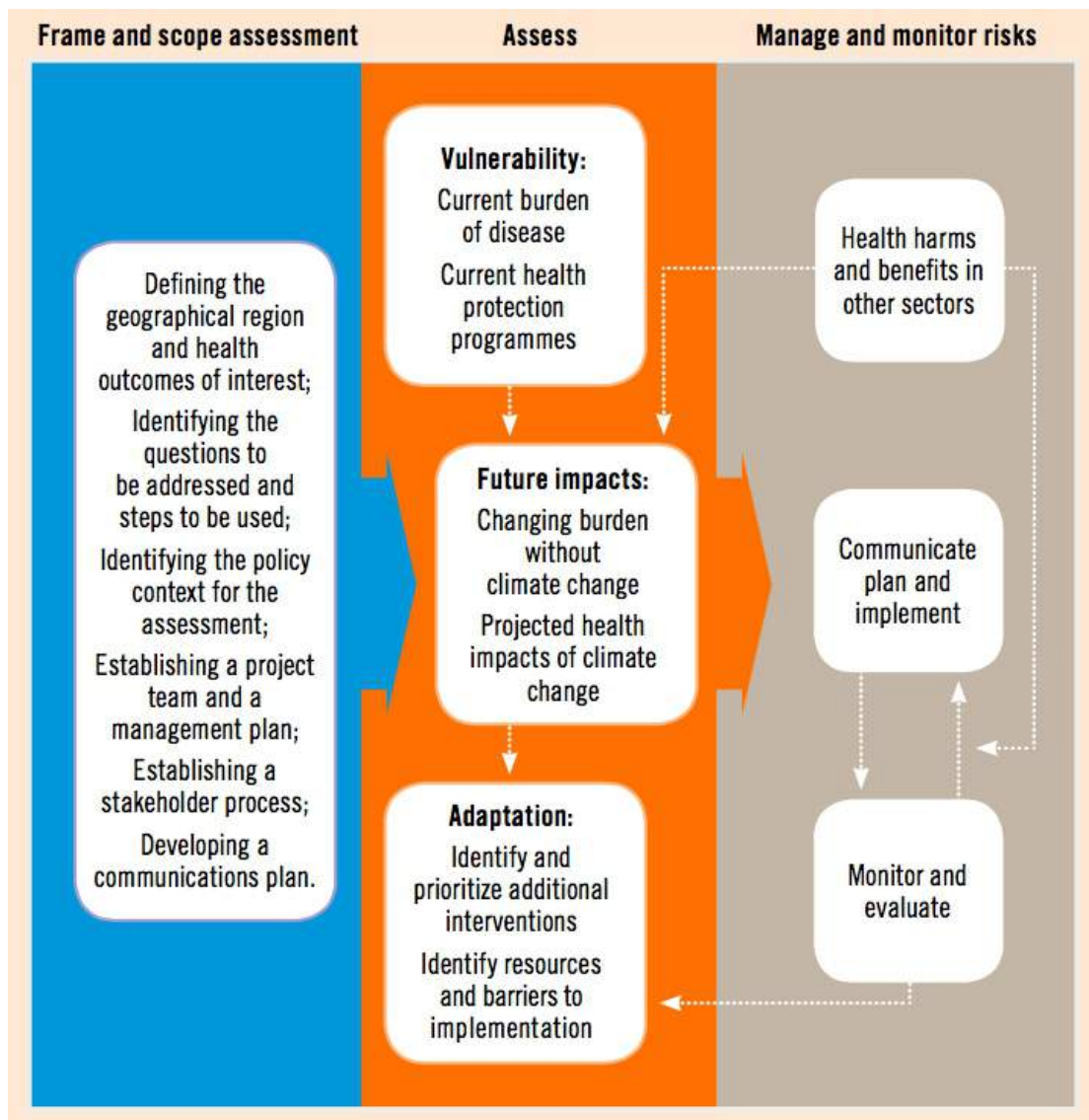


Figure 10: Vulnerability and Adaptation Assessment Process

Appendix 3: Preparedness Plan for Climate-Sensitive Water Borne Diseases

This plan should be adapted to suit the needs of the district at the level of which this has been deployed. Based on the list of priority activities identified at the district level vulnerability and adaptation assessment, more activities can be identified in this list, or those that are redundant may be pruned.

Activity	Person responsible / Alternate	Resources & Supplies needed	Time of activity
Surveillance			
Report cases/deaths			
Investigate rumours			
Outbreak detection			
Identify risks			
Map cases			
Supplies			
- list needed supplies			
- maintain reserves			
- request supplies			
Coordination			
- set up Emergency Preparedness Plan			
Logistics			
- obtain transport			
Control			
- sanitation			
- health education			

As an illustrative example of the plan, some of the activities have been filled in the following table:

Activity	Person responsible (and alternate)	Resources/Supplies needed	When (Time for activity)
Report suspected cases	Medical Officer & Nurse	Phone/Fax/Use of Police radios etc.	Immediately as soon as a case is suspected
Send specimens	Laboratory technician & Attendant	Transport media, Cold box for Cholera specimens, Forms, Transport to laboratory	Send 10-20 samples when they can be collected
Make safe water available	Head teacher / Village Sarpanch / Mukhia (Head)	Chlorine containers	Through epidemic

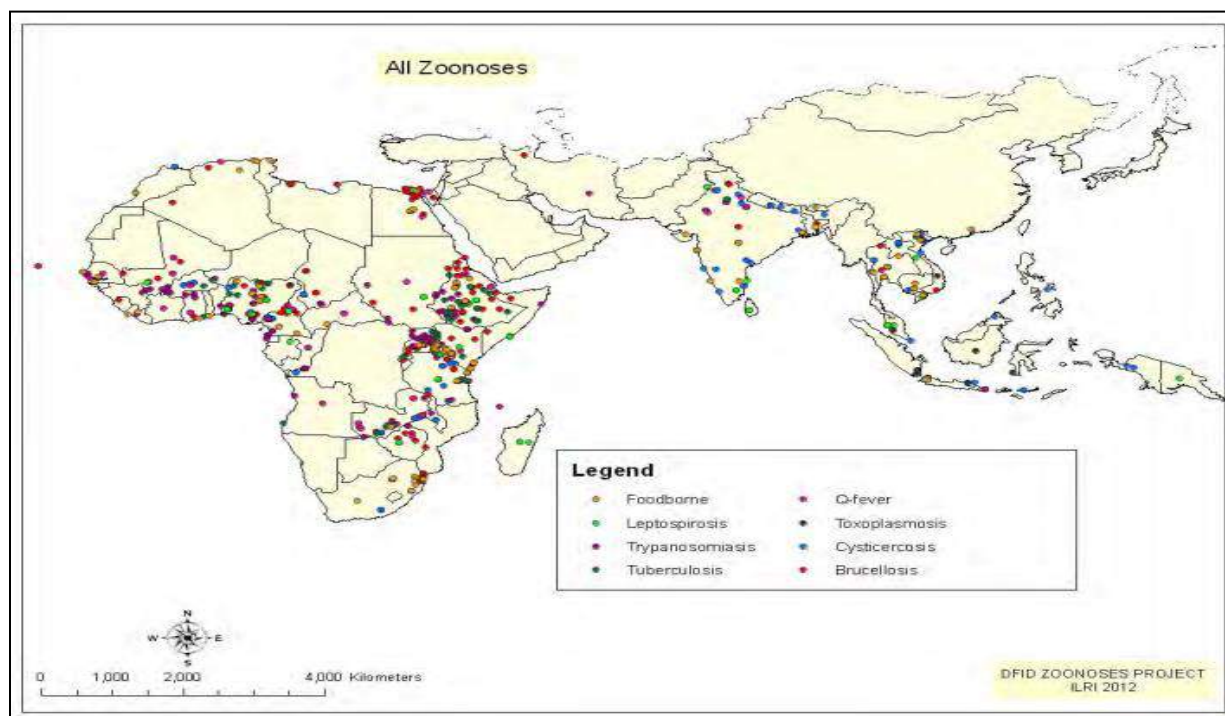
“One Health Action” plan for Climate Sensitive Zoonotic Diseases

“One Health action” plan for Climate Sensitive Zoonotic Diseases

Introduction -

Burden of Zoonotic Diseases: Global

Zoonoses are the disease and infection that are transmitted between animals and humans. Emerging zoonotic diseases are increasingly recognized as a serious challenge with potentially serious human health and economic impacts. Globally one billion cases are reported with are of Zoonotic origin, out of which millions of people die every year(WHO, 2015). Almost 60% of all human infections and 75% of newly emerging infectious diseases are of zoonotic origin(WHO, 2020). Of every ten infectious diseases that are identified in humans, six are “zoonotic” diseases – diseases originating in animal populations. In total, they profoundly affect human wellbeing, occupations, animals and environments. It is estimated that the effect of zoonotic illness in low and middle developing countries, 20% of human mortality and morbidity was because of zoonoses or

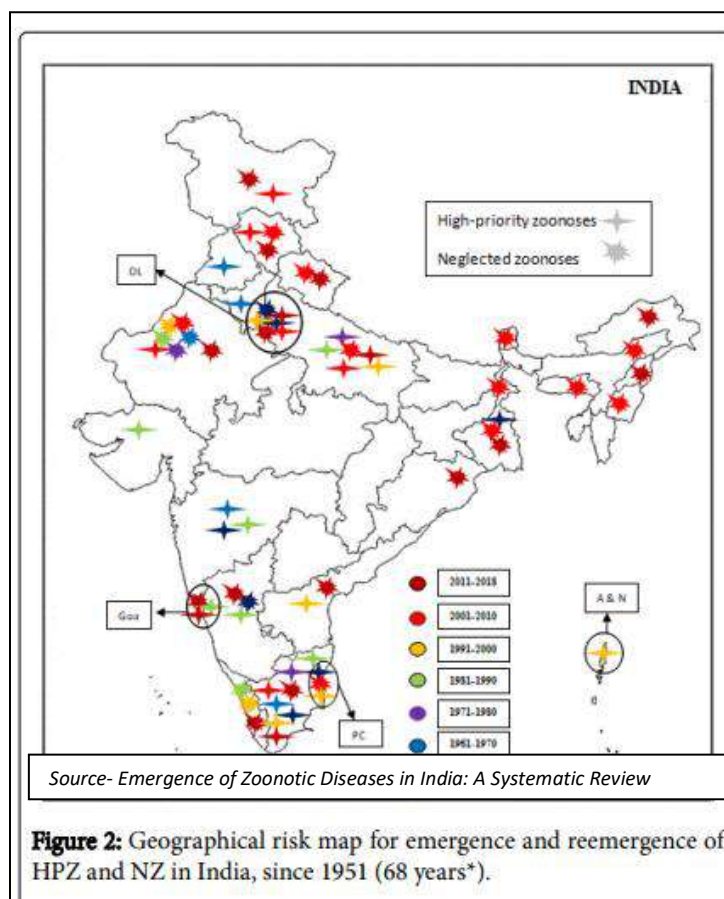


illnesses as of late hopped species from animals to individuals(Department for International Development, UK, 2012). The emerging zoonoses are a growing public health threat in the last two decades; emerging zoonotic diseases have been reported from 18 out of 22 countries in the region, often, with explosive outbreaks and high fatalities. Examples include Rift Valley fever, SARS, pandemic

influenza H1N1 2009, Yellow fever, Avian Influenza (H5N1) and (H7N9), West Nile virus and the Middle East respiratory syndrome coronavirus (MERS-CoV) reported in the recent past(WHO, 2015).

In India-

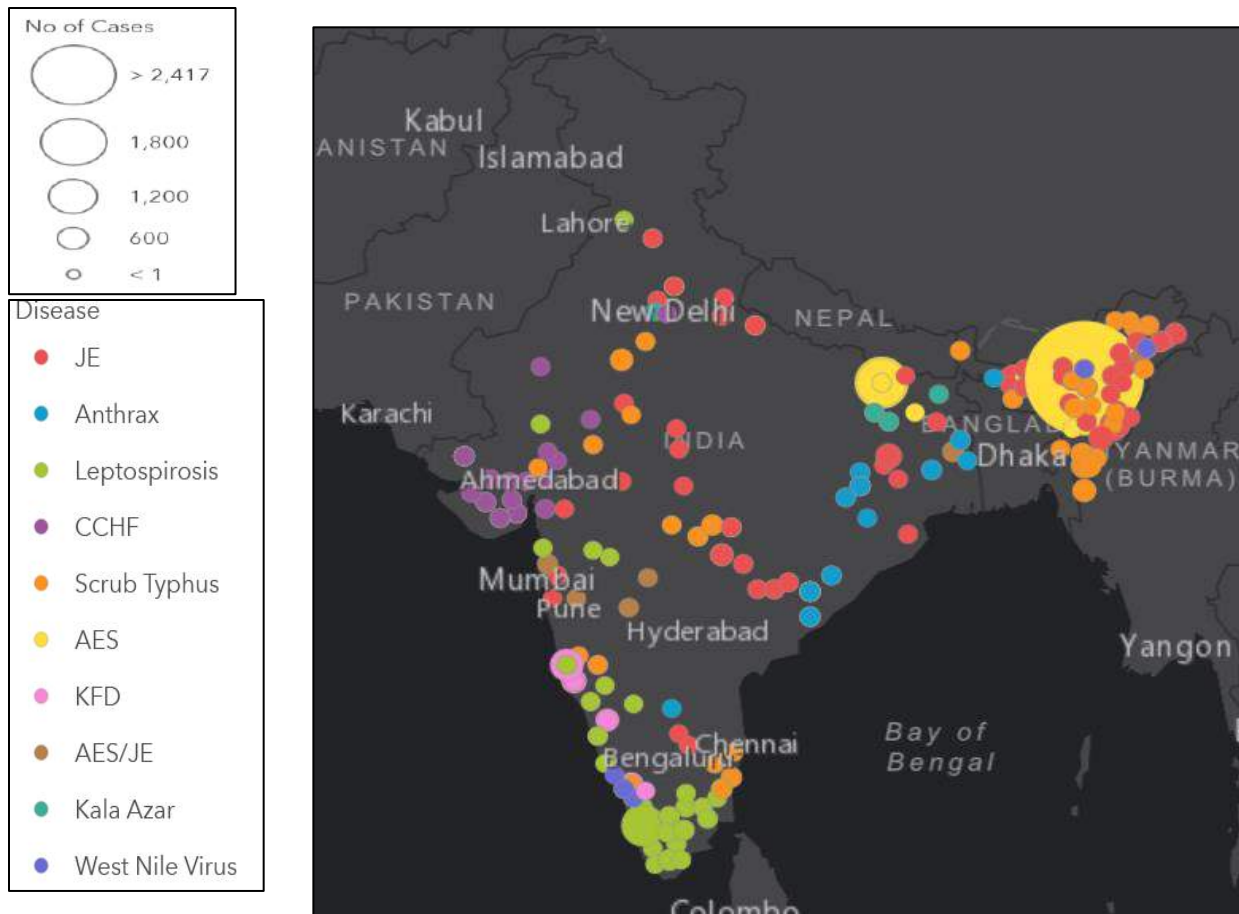
Zoonotic Disease are major public health issue in several countries of the world and India is among the top geographical hotspots for such diseases. With ever-increasing human intrusion into natural ecosystems, the growing demand for animal-based food products, international trade, international travel, and other factors, human exposure to zoonotic diseases has never been higher. Increasing numbers and severity of infectious disease outbreaks over the last two decades, such as NIPAH, ZIKA, KFD, Highly Pathogenic Avian Influenza in India and disease like Ebola globally had profound impacts on human health, caused severe burdens on human livelihoods and economies, and posed global security threats(C Dhiman and Tiwari, 2018).



In India, major public health zoonotic disease are Rabies, Brucellosis, Toxoplasmosis, Cysticercosis, Echinococcosis, JE, Plague, Leptospirosis, Scrub typhus and KFD. New emerging disease of public health importance is Avian Influenza, Nipah, Trypanosomiasis, CCHF and H1N1. Since the country has vector, susceptible host and conducive environment it also faces potential threat from Yellow fever, SARS, Hanta virus, Rift valley fever, Ebola and Marburg.

As per IDSP Information, Zoonotic Disease like Brucellosis have been emerged from Assam, Kerala and Rajasthan; Japanese Encephalitis from

Tamil Nadu to Uttar Pradesh; Leptospirosis from Maharashtra to Punjab; Melioidosis from Assam, Karnataka, whereas neglected ZD like Cutaneous Leishmaniasis had been emerged from Delhi to Rajasthan to Jammu and Kashmir; Kyasanur Forest Disease from Karnataka to Kerala, Tamil Nadu and Goa; NipahVirus from West Bengal to Kerala; Scrub typhus from Arunachal Pradesh to Tamil Nadu. Extension of these ZD to non-endemic areas has increased the complexity of their forecast.



Climate Change and Zoonotic Diseases

Climate change is the most serious challenge facing human and animal populations, as it affects population dynamics of wild animals, reproductive success and population densities of some species. Moreover, climate variability may also expand the current limits of agricultural activities, increasing the chance of contact between species that have not normally interacted in that area. Livestock excrete many micro-organisms which have zoonotic potential. These pathogens can be transmitted by water and food and the risk of transmission to humans is increased if food crops are watered with contaminated water. Densely crowded urban environments, especially those without adequate sanitation, are of great public health concern because they are sources of disease epidemics. These climate changes have tremendous effect on prevalence of zoonotic diseases. The changes in climate may increase the insect vectors, prolong transmission cycles or increase the importation of vectors or animal reservoirs. It may also have an adverse effect on biodiversity, distribution of animals and microflora which may lead to emergence of zoonotic disease outbreaks.

Leptospirosis is an emerging outbreak-prone disease which is associated with flooding. Major Environmental factors shown to affect the epidemiology of leptospirosis include heavy rainfall and flooding, high temperatures, exposure to animals, poor sanitation, and poor waste disposal.

Climate change might affect other diseases endemic to India, such as **chikungunya and dengue**, parasitic diseases such as leishmaniasis, lymphatic filariasis and onchocerciasis, and tickborne diseases. Some of this disease may exhibit changes in transmission intensity or shifts in their geographical ranges due to the impact of climate on the relevant vector populations.

For Tick-borne diseases, temperature accelerates the development cycle, egg production, population density, and distribution of ticks. For example, the distribution of the bacterial spirochete *Borrelia burgdorferi*, the causative agent of **Lyme borreliosis**, may extend into the Himalayan region as climate change causes a shift to milder temperatures. The disease is transmitted to humans during blood feeding by hard ticks of the genus *Ixodes*, and in a survey carried out in northeast India, 65 out of 500 people (13%) were positive for *B. burgdorferi*-specific immunoglobulin G. Seropositivity to *B. burgdorferi* suggests infection by the organism and the presence of Lyme disease in these areas.

Kyasanur Forest Disease The status of the forest ecosystem of the world is threatened by conversion of agricultural development, timber extraction, road development, etc. This brings drastic changes in infectious diseases in the local population, especially one like KFD where the virus exists naturally in the wild ecosystem and circulates among wild animals and tick vectors. Many researchers have documented deforestation as a major reason for the spread of Kyasanur Forest disease. Environmental degradation may have a substantial effect on wildlife and increases the probability of tick transmission leading to the KFD spread.

Scrub typhus has been endemic in India for several decades. In recent years, it has been increasingly reported and has become a significant health concern. The incidence of scrub typhus, a vector-borne disease, is influenced by the density of rats and changes in climate. The projections on climate change indicate an increase in average temperature of between 2.5°C and 5°C, and an overall increase in the intensity of rainfall of between 1 mm and 4 mm/day, except for small areas in north-west India. It is thought that such changes in the climate may affect several characteristics of vector-borne disease, namely: – their survival and reproduction rates – the intensity and temporal pattern of vector activity – the rates of development, survival and reproduction of pathogens within vectors.

Mosquito-borne diseases e.g Japanese encephalitis in the last decade, there has been a major upsurge of Japanese encephalitis in many states. It is currently endemic in 135 districts in 15 states and union territories of India. It is very likely that climate change will further extend the range of the mosquitoes to temperate zones such as Himachal Pradesh and other northern states.

Other mosquito-borne diseases that have been reported in India include zoonotic simian malaria (which emerged in the union territory of the Andaman and Nicobar islands) and **West Nile fever**, which has spread into new regions as the virus has been introduced into competent vector habitats, possibly as a consequence of climate changes

Bacterial Infection e.g Anthrax is survive in the environment for decades, owing to their resistance to extremes of pH and temperature, desiccation and some chemical agents. Certain environmental conditions appear to produce ‘anthrax belts’, in which the soil becomes heavily contaminated with anthrax spores. These prerequisites include soil rich in organic matter (with pH > 6.0) and weather changes which include abundant rainfall followed by prolonged, significantly dry conditions.

The evolution of emerging zoonotic diseases had led a demand for interdisciplinary communication between health professionals, veterinarians, environmental scientists, ecologists, geographers and economists seeking to understand climate change will be key to protecting people in India and worldwide against these threats

Rationale - “One health action “for climate sensitive zoonotic disease is required to combat zoonotic diseases as changes in climatic condition leads to rise in zoonotic disease. Heavy rains, High Temperature, Natural disasters- floods, Cyclones leads to rise in zoonotic diseases due to increased contact of humans with wild and domestic mammalian reservoir or Changes in behavior, reservoir density of infected animals. For example. Diseases such as anthrax increase in warm weather while leopotospirosis increases in rainy season etc. Hence every state needs to identify zoonotic diseases prevalent in the state and related climatic condition which can affects the incidence of this diseases subsequently develop specific “ One Health “action plan for addressing them.

Developing health adaptation plan for climate change and zoonosis : It is essential that health sector needs to come forward for addressing the issue of climate change and related impact on zoonotic diseases. Health department at all levels (National, State and District level) need to prepare the health adaptation plan for climate sensitive zoonotic diseases .The broad objectives of developing the action plan are as under

Objectives -

- Strengthen capacity of healthcare system to address the climate sensitive zoonotic diseases prevalent in the respective region.
- Asses the vulnerability of health system for zoonotic diseases and improve preparedness and response mechanisms
- Create awareness regarding impacts of climate change on zoonotic diseases among community and high risk population
- Develop partnerships and create synchrony/ synergy with other stakeholders for joint response .

Health department has to carry out **the vulnerability assessment** using data compiled under diseases surveillance system i.e IDSP, HMIS, NADRS and NVBDCP. Based on the parameters from surveillance system , nodal officer need to asses ,rrecent trend for Enzootic diseases ,Emerging and re-emerging diseases, any shift in Months/ season of transmission, new foci- geographical area, human population at risk, animals’ population, change in density of vector, reservoir etc

After **identification of high risk areas/population** prevalent in the particular region , health department o may undertake joint exercise with other relevant department for mapping of stakeholder’s (i. e Veterinary department , , Meteorological department, dept. Of agriculture, Urban planning dept./Panchayat raj dept., Department of Environment & forest department etc. Health department may convene the meeting of zoonosis committee involving above **stakeholders** and undertake the activates as e.g •Defining roles and responsibilities actions required for risk reduction and Operational mechanism.

Based on vulnerability assessment health department may find out areas of need urgent attention and prioritize the issues. Based on prioritization each stakeholder may be communicated to address the issue.

For developing insights on the field level issue pilot areas i.e district, blocks, villages may be identified and risk of climatic condition with relevant zoonosis may be communicated to respective field unit.

Thereafter, detailed action plan with checklist containing components such as Logistics required at health care facilities, training components for health personnel, IEC activities, Data recording and maintenance, Surveillance (real-time, sentinel) information sharing plan concerned departments and stakeholders may be outlined. Emergency response Plan in case of any disaster or an outbreak also need to be chalked with stakeholders. (details list at Annexure-1)

For institutionalization of ONE health mechanisms health department need to regularly interact with veterinary department for Prevention and control of diseases in animals, Strengthening of Surveillance for diseases among animal reservoir, improving the laboratory capacity in animal disease labs. Health department need to develop for Sharing of relevant data on cases & deaths among animals, Vaccination of animals. Strategic plan should be undertaken with vet department in cases of zoonotic diseases Rabies for population control of stray animals. Joint IEC activities should be undertaken in the community for Safe handling and check-on activities for prevention of infection through 'food' of animal origin

With the help of Meteorological dept. Health department may develop Early Warning System for forecasting of climate sensitive zoonotic diseases and Integrate Meteorological/climate /geo- spatial data with data of diseases in human, animals

Community awareness and community ownership is essential for successful implementation of health adoption plan hence community level intervention for IEC activities need to be undertaken. It included awareness on maintain personal hygiene, consumption safe water and food, proper disposal of sewage to avoid contamination, barriers for human dwellings to keep stray animals away by fencing the residential areas near forests areas, self protection measures like protective clothing etc while handling carcasses or during occupational exposure

Medium and long measures in the form of research for Climate threshold –determining diseases pathogen, vector or reservoir, Intervention measures such as source reduction, filling and drainage operations, planned water management, and proper disposal of refuse and other excreta may be undertaken with relevant stakeholders.

Details of List of activities to be undertaken at various under health adaptation plan for climate sensitive zoonosis is placed at annexure-1

List of activities to be undertaken at various under health adaptation plan for climate sensitive zoonosis

State level - Specific Activities to be undertaken with Roles and responsibilities				
	Specific Activities to be undertaken		Roles and responsibilities	
C	For routine surveillances and control	Level	Responsible stakeholder/ Division	Frequency
C.1	Regular meeting of stakeholders (DHS, State veterinary department ,State agriculture and forest Department, representative of medical & veterinary institutes, district representative) as a part of state level zoonosis committee or any other committee.	State	SSO-IDSP , DHS (member secretary of state zoonosis committee)(Principal Chief Conservators of Forests (PCCF)),representative of meterological dept. representative of agriculture dpet, representative of drinking water & sanitation dept.	Twice a year
C.2	Joint surveillance and action: 1.Sharing of Diseases wise data on Zoonotic diseases. 2. Identification of priority zoonosis in the state based on the endemicity of zoonotic diseases. 3. Information sharing with stakeholders on zoonotic diseases and initiate measures to integrate the information for early action. 4. Identifying the emerging zoonosis as a future public health threats in the state.	State	DHS, State veterinary department ,State agriculture and forest Department, representative of medical & veterinary institutes ,representative of meterological dept. representative of agriculture dpet, representative of drinking water & sanitation dept.	Real Time (online/ offline platform)
C.4	Periodic analysis of data on zoonotic diseases data & recommendation to responsible stakeholders for action	State	SSO- IDSP, State vet officer	Every week
C.5	Identification of early warning signals & information to responsible counterparts	State	SSO- IDSP, State vet officer, wild life& forest representatives (Principal Chief Conservators of Forests (PCCF)),	Real Time
C.6	Monitoring and Review: Review of activities under Intersectoral coordination programme	State	State level zoonosis committee comprising of SSO- IDSP, State vet officer, wild life& forest representatives (Principal Chief Conservators of Forests (PCCF)),	Every year
C.7	Forecasting requirement of infrastructure, logistics, manpower etc. for control of zoonotic diseases and taking appropriate measures to earmark the funds to address the issues.	State	DHS, Director state animal husbandry, state level wild life representatives ADG forest at state level, state level zoonosis committee	Every year
C.8	Communication: 1.Identification of Nodal Officer responsible in medical, veterinary and wildlife sectors for communication under intersectoral coordination programme and circulation of information on activities conducted in a year under ISC with all stakeholders. 2. Communication on zoonotic outbreaks with community.	State	DHS, Director state animal husbandry, state level wild life representatives ADG forest at state level, environment ministry of state	Every year (month : January)

C.9	Capacity Building : Accessing the training needs and Organising a joint training workshop for master trainers at state level for capacity building of medical, veterinary and wildlife professionals for prevention and control of zoonotic Diseases.	State	DHS, Director state animal husbandry, state level wild life representatives(Principal Chief Conservators of Forests (PCCF)), ADG forest at state level, environment ministry of state	Every year
C.10	Laboratories support: 1. Mapping of Laboratories expert working in the field of zoonosis understate health department, state animal husbandry department, ICAR and forest department and sharing of information on integrated platform. 2. Mapping of laboratory experts working in the field of zoonosis understate health department, state animal husbandry department, ICAR and forest departmentand sharing of information on integrated platform. 3. Forecasting the requirement of laboratories (infrastructure , kits , re-agents, etc.) and taking problem specific measures to address the issues.	State	DHS, Director state animal husbandry, state level wild life representatives,ICMR institutes in the state, ICAR institutes in the state, state veterinary lab. In the state, wild life sector lab. In the state,	Every year
C.11	Environmental aspects of Zoonosis: Identifying the issues pertaining to climate change and its impact on emerging and re- emerging zoonosis and taking measures to address the issues through consultation with relevant stakeholders.	State	DHS, Director state animal husbandry, state level wild life representatives(Principal Chief Conservators of Forests (PCCF)),Environmental ministry in the state representative of meterological dept. representative of agriculture dpet, representative of drinking water & sanitation dept.	Every year
C.12	Operational research: Identifying the areas in the field of zoonosis requiring research and consultation with relevant stakeholders for undertaking joint research and circulation of final report with relevant stakeholders for improving the control measures for zoonosis	State	State level zoonosis committee, DHS, Director state animal husbandry, state level wild life representatives(Principal Chief Conservators of Forests (PCCF)),	Every year
D. In Emergency and Outbreaks:				
D.1	Identification of trigger points: Based on the endemicity of zoonotic diseases in geographical areas trigger points are identified for all zoonotic diseases i.e. increase reports of zoonotic disease above particular threshold. Information on specific trigger points for all zoonotic diseases to be circulated to all relevant stakeholders.	State	SSO IDSP, , state veterinary officer, state level zoonosis committee, Principal Chief Conservators of Forests (PCCF)	Every year/ Real time
D.2	Circulation of Information on Outbreak: As soon as outbreak is suspected under existing surveillance system (IDSP, NADRS, NADRES, etc.) or media reports, other informal channels and if confirmed, information to be circulated to relevant	State	SSO IDSP, , state veterinary officer, state level wild life representative (Principal Chief Conservators of Forests (PCCF)), nodal officer of	Real Time

	stakeholders.		NADRS, NADRES	
D.3	Initiation of outbreak control measures: 1. As soon as information is received responsible officer in the relevant ministry to constitute joint team of experts (Medical, Veterinary, Wildlife, etc.) including state representatives for investigating outbreak. 2. Directions to be issued to respective states/ districts under relevant ministries for coordination with counterparts for containment measures of outbreak. 3. Provision of requisite logistic (Drugs, Diagnostics, PPE, etc.) to respective state / District authorities under relevant ministries.	State	DHS, Director state animal husbandry, state level wild life representatives(Principal Conservators of Forests (PCCF)), Environmental ministry in the state	Real Time
D.4	Sample collection during outbreak. 1. Need of sample collection decided by expert microbiologist / FSSAI representative/ wild life sector microbiologist . 2. Sample collection Procedure to followed as per requirement of respective zoonotic diseases detected	State	State level medical institute, state level veterinary labs, ICAR, IVRI, WLI, FSSAI Representative, Microbiologist form central govt. medical/ vet. Institutions	Real Time (as soon as outbreak detected)
D.5	Joint monitoring of outbreak: 1. Joint meetings of ministries/ stakeholders to be conducted for review of containment measures and relevant issues are addressed through consultation. 2. Reports on containment measures shared with relevant stakeholders	State	State level zoonosis committee, DHS, Director state animal husbandry, state level wild life representatives, Environmental ministry in the state	Real time Weekly during Outbreak.
D.6	Assessment of Outbreak impact measures on community, livestock, wildlife: 1. After the outbreak relevant ministries to assess the impact of outbreak in terms of socio-economic loss. 2. Circulation of information on impact to the relevant stakeholders. 3. Identifying the gap areas in coordination between the medical veterinary and wildlife officials	State	State level zoonosis committee, DHS, Director state animal husbandry, state level wild life representatives, Environmental ministry in the state	After every major outbreak in the state.
E. SOP's at District level				
E	For routine surveillances and control	Level	Responsible stakeholder/ Division	Frequency
E.1	Regular meeting of stakeholders (DHO/CMHO, District veterinary department , District agriculture and forest Department, representative of medical & veterinary institutes, as a part of District level zoonosis committee or any other surveillance committee.	District	DSO-IDSP , CMHO/DHO (member secre representative of meterological dept. representative of agriculture dpet, representative of drinking water & sanitation dept.tary of district zoonosis committee)	Twice a year
E.2	Joint surveillance and action: 1. Sharing of Diseases wise data on Zoonotic diseases. 2. Identification of priority zoonosis in the district based on the endemicity of zoonotic diseases. 3. Information sharing with stakeholders in the district on zoonotic diseases and initiate measures to integrate the information for early	District	CMHO/DHO, district veterinary department , district agriculture and forest Department, representative of medical & veterinary institutes, representative of meterological dept. representative of agriculture dpet,	Real Time (online/ offline platform)

	action.		representative of drinking water & sanitation dept.	
E.3	Periodic analysis of data on zoonotic diseases data & recommendation to responsible stakeholders for action	District	DSO- IDSP, district vet officer	Every week
E.4	Identification of early warning signals & information to responsible counterparts	District	DSO- IDSP, district vet officer, wild life& forest representatives	Real Time
E.5	Monitoring and Review: Review of activities under Intersectoral coordination programme	District	district level zoonosis committee comprising of DSO- IDSP, district vet officer, wild life& forest representatives	Every year
E.6	Forecasting requirement of infrastructure, logistics, manpower etc. for control of zoonotic diseases and taking appropriate measures to earmark the funds to address the issues.	District	CMHO/DHO, Director district animal husbandry, district level wild life representatives ADG forest at district level, district level zoonosis committee	Every year
E.7	Communication: 1.Identification of Nodal Officer responsible in medical, veterinary and wildlife sectors for communication under intersectoral coordination programme and circulation of information on activities conducted in a year under ISC with all stakeholders. 2.Communication on zoonotic outbreaks with community.	District	CMHO/DHO, Director district animal husbandry, district level wild life representatives ADG forest at district level, environment ministry of district	Every year (month : January)
E.8	Capacity Building : Assessing the training needs and Organising a joint training workshop for master trainers at district level for capacity building of medical, veterinary and wildlife professionals for prevention and control of zoonotic Diseases.	District	CMHO/DHO, Director district animal husbandry, district level wild life representatives, ADG forest at district level, environment ministry of district	Every year
E.9	Laboratories support: 1. Mapping of Laboratories expert working in the field of zoonosis in the district under state health department, state animal husbandry department, ICAR and forest department and sharing of information on integrated platform. 2. Mapping of laboratory experts working in the field of zoonosis understate health department, state animal husbandry department, ICAR and forest departmentand sharing of information on integrated platform. 3. Forecasting the requirement of laboratories (infrastructure , kits, re-agents, etc.) and taking problem specific measures to address the issues.	District	CMHO/DHO, Director district animal husbandry, district level wild life representatives,ICMR institutes in the district, ICAR institutes in the district, district veterinary lab. In the district, wild life sector lab. In the district,	Every year
E.10	Environmental aspects of Zoonosis: Identifying the issues pertaining to climate change and its impact on emerging and re- emerging zoonosis and taking measures to address the issues through consultation with relevant stakeholders.	District	CMHO/DHO, Director district animal husbandry, district level wild life representatives, Environmental dept in the district , representative of meterological dept. representative of agriculture dpet, representative of drinking water & sanitation dept.	Every year
E.11	Operational research: Identifying the areas in the field of zoonosis requiring research and	District	district level zoonosis committee, CMHO/DHO, Director district animal	Every year

	consultation with relevant stakeholders for undertaking joint research and circulation of final report with relevant stakeholders for improving the control measures for zoonosis		husbandry, district level wild life representatives	
E. In Emergency and Outbreaks:				
E.12	Identification of trigger points: Based on the endemicity of zoonotic diseases in geographical areas trigger points are identified for all zoonotic diseases i.e. increase reports of zoonotic disease above particular threshold. Information on specific trigger points for all zoonotic diseases to be circulated to all relevant stakeholders.	District	DSO-IDSP, , district veterinary officer, district level zoonosis committee	Every year/ Real time
E.13	Circulation of Information on Outbreak: As soon as outbreak is suspected under existing surveillance system (IDSP, NADRS, NADRES, etc.) or media reports, other informal channels and if confirmed, information to be circulated to relevant stakeholders.	District	DSO-IDSP, , district veterinary officer, district level wild life representative, nodal officer of NADRS, NADRES	Real Time
E.14	Initiation of outbreak control measures: 1. As soon as information is received responsible officer in the relevant department to constitute joint team of experts (Medical, Veterinary, Wildlife, etc.) including district representatives for investigating outbreak. 2. Directions to be issued to respective blocks under relevant departments for coordination with counterparts for containment measures of outbreak. 3. Provision of requisite logistic (Drugs, Diagnostics, PPE, etc.) to respective district / District authorities under relevant ministries.	District	CMHO/DHO, Director district animal husbandry, district level wild life representatives, Environmental ministry in the district	Real Time
E.15	Sample collection during outbreak. 3. Need of sample collection decided by expert microbiologist / FSSAI representative/ wild life sector microbiologist . 4. Sample collection Procedure to followed as per requirement of respective zoonotic diseases detected	District	district level medical institute, district level veterinary labs, ICAR, IVRI, WLI, FSSAI Representative, Microbiologist form state govt. medical/ vet. Institutions	Real Time (as soon as outbreak detected)
E.16	Joint monitoring of outbreak: 1. Joint meetings of stakeholders to be conducted for review of containment measures and relevant issues are addressed through consultation. 2. Reports on containment measures shared with relevant stakeholders	District	district level zoonosis committee, CMHO/DHO, Director district animal husbandry, district level wild life representatives, Environmental dept in the district	Real time Weekly during Outbreak.
E.17	Assessment of Outbreak impact measures on community, livestock, wildlife: 1. After the outbreak relevant ministries to assess the impact of outbreak in terms of socio-economic loss. 2. Circulation of information on impact to the relevant stakeholders. 3. Identifying the gap areas in coordination between the medical veterinary and wildlife officials	District	district level zoonosis committee, DHS, Director district animal husbandry, district level wild life representatives, Environmental dept in the district	After every major outbreak in the district.
F. Drafts SOP's at Block level				

F	For routine surveillances and control	Level	Responsible stakeholder/ Division	Frequency
F.1	Regular meeting of stakeholders Medical officer in charge, block level veterinary department, block agriculture and forest Department, representative of medical & veterinary institutes, block representative.	Block	Medical officer in charge, (member secretary of block zoonosis committee)	Twice a year
F.2	Joint surveillance and action: 1.Sharing of Diseases wise data on Zoonotic diseases. 2. Information sharing with stakeholders in the block on zoonotic diseases and initiate measures to integrate the information for early action.	Block	block veterinary department , block agriculture and forest Department, representative of medical & veterinary institutes	Real Time (online/ offline platform)
F.3	Periodic analysis of data on zoonotic diseases data & recommendation to responsible stakeholders for action	Block	Medical officer in charge, block vet officer	Every week
F.4	Identification of early warning signals & information to responsible counterparts	Block	Medical officer in charge, block vet officer, wild life& forest representatives	Real Time
F.5	Monitoring and Review: Review of activities under Intersectoral coordination programme	Block	block level zoonosis committee comprising of Medical officer in charge,block vet officer, wild life& forest representatives	Every year
F.6	Forecasting requirement of infrastructure, logistics, manpower etc. for control of zoonotic diseases and taking appropriate measures to earmark the funds to address the issues.	Block	Medical officer in charge, block vet officer, wild life& forest representatives	Every year
F.7	Communication: 1. Identification of Nodal Officer responsible in medical, veterinary and wildlife sectors for communication under intersectoral coordination programme and circulation of information on activities conducted in a year under ISC with all stakeholders. 2. Communication on zoonotic outbreaks with community.	Block	Medical officer in charge, block vet officer, wild life& forest representatives	Every year (month : January)
F.8	Capacity Building : Accessing the training needs and Organising a joint training workshop for master trainers at block level for capacity building of medical, veterinary and wildlife professionals for prevention and control of zoonotic Diseases.	Block	Medical officer in charge, block vet officer, wild life& forest representatives	Every year
F.9	Laboratories support: Sample to be send to labs at the district level (Medical veterinary wild life) for confirmation of diagnosis	Block	Medical officer in charge, block vet officer, wild life& forest representatives	Every year
F. In Emergency and Outbreaks:				
F.10	Identification of trigger points: Based on the endemicity of zoonotic diseases in geographical areas trigger points are identified for all zoonotic diseases i.e. increase reports of zoonotic disease above particular threshold. Information on specific trigger points for all zoonotic diseases to be circulated to all relevant stakeholders.	Block	Medical officer in charge, block veterinary officer, block level zoonosis committee	Every year/ Real time

F.11	Circulation of Information on Outbreak: As soon as outbreak is suspected under existing surveillance system (IDSP, NADRS, NADRES, etc.) or media reports, other informal channels and if confirmed, information to be circulated to relevant stakeholders.	Block	Medical officer in charge, block veterinary officer, block level wild life representative	Real Time
F.12	Initiation of outbreak control measures: 1. Directing the health workers, para – vets to visit the site of outbreaks and guide them for necessary measure. 2. confirming the outbreaks by visiting the site of outbreaks and initiate the containment measure. 3. Provision of requisite logistic (Drugs, Diagnostics, PPE, etc.) to respective block authorities under relevant ministries.	Block	Block animal husbandry, block level wild life representatives, Environmental dept in the block	Real Time
F.15	Sample collection during outbreak. 1. Need of sample collection decided by expert Sample collection Procedure to be followed as per requirement of respective zoonotic diseases detected	Block	block level medical institute, district level veterinary labs	Real Time (as soon as outbreak detected)
F.16	Joint monitoring of outbreak: 1. Joint meetings of stakeholders to be conducted for review of containment measures and relevant issues are addressed through consultation. 2. Reports on containment measures shared with relevant stakeholders	Block	block level medical institute, district level veterinary labs, level wild life representatives, Environmental dept in the block	Real time Weekly during Outbreak.

Health Adaptation Plan for Nutrition Related illness

Health Adaptation Plan for Climate Sensitive diseases

Actionable Plan for the Health Officer at the State Level

Identification, Prevention of occurrence of Nutritional Related Diseases/Deficiencies in the state- Action Plan for the Health Officer.

(i) Understanding the extent of occurrence and Assessment of Nutritional status

Objective: To Impart Knowledge and Training to the Health Officer Regarding Nutritional Related Diseases/Deficiencies that may occur in short/Mid/Long term duration.

Action Plan: To conduct Training/Orientation program for State Health Officers of one to two weeks duration on

1. Types of Nutritional diseases, identification, causes, and prevention using dietary approaches.
2. Nutritional Assessment Methods (Anthropometry, Dietary surveys, Biochemical parameters)
3. Assessing Quality of Water and Food grains and Milk

(ii) Create Awareness among food distribution centres (ICDS/MDM/PDS etc) and beneficiaries on Nutrition related diseases and means to prevent them

Objective: To Facilitate the Health Officer in Creating Awareness among food distribution centres (ICDS/MDM/PDS etc) and beneficiaries on Nutrition related diseases through IEC Activities.

Action Plan:

1. To generate Awareness on Nutrition Dense foods available in the Local region and ways of consuming them.
2. To Demonstrate using IEC materials on the Types of Nutritional diseases, their identification, causes, and prevention using dietary approaches.
3. To Plan for Awareness programs to be conducted at defined time intervals based on the extent of understanding of the beneficiaries.

(iii) To Conduct Surveillance on the occurrence of Nutritional deficiency diseases.

Objective: To Plan Monitoring and Surveillance programmes on the occurrence of Nutritional deficiency diseases in the Local region by the Health Officer.

Action Plan:

1. To Conduct surveillance of occurrence of Nutritional deficiency diseases at predefined time intervals to assess seasonal & geographic variation through engagement of Health and Nutritional functionaries.
2. To generate database on the seasonal and geographical prevalence of Nutritional diseases/deficiencies occurring in the Local regions.

(iv) Ensure supply and accessibility of Nutritive dense foods/crops.

Objective: To Ensure supply and accessibility of Nutritive dense foods/crops by the Health Officer under any unfavourable climatic conditions

Action Plan:

1. The Health officer must ensure that supply of Nutritionally dense foods/crops is not disrupted under unfavourable climatic conditions specially to vulnerable sections of the region (children, pregnant and lactating mothers, elderly)
2. The Health officer must ensure that Nutrition Dense foods of importance that may be available locally or can be transported from neighbouring places such as
 - seasonal fruits and vegetables,
 - Protein foods (Eggs, Pulses, milk, nuts and oil seeds)
 - Other foods of Dietary Importance (Cereals, spices, etc.,)

(v) Ensure quality of water and food grain distributed to the beneficiaries.

Objective: To Ensure that the Water and Food grains as well as perishables foods distributed are of reasonably good quality that conforms to the government specifications so as occurrence of Food borne diseases can be prevented.

Action Plan:

1. The Health officer must ensure that Water used for drinking is of potable nature and that used for cooking meets the minimum criteria of safety.
2. The Health officer must ensure that the Quality of Food grains meets the minimum criteria to prevent Insect and mould damage.
3. The Health officer must ensure that perishables such as Eggs, Milk and Fruits and Vegetables are to be supplied in as much fresh state as possible.

Health Adaptation Plan for Mental Health

Climate change and mental health

Attribution of mental health outcomes directly to specific climate change risks remains challenging, and more empirical research in this domain will advance our understanding.

Yet, we do know that the risks and impacts of climate change on mental health, are:

- a. manifested in several direct, indirect, and overarching effects, that
- b. disproportionately affect those who are most marginalized (including special populations – children, the aged and women) and
- c. occur alongside other physical-medical, social and economic consequences of climate change.

Mental health refers not just to mental illness, mental problems, and mental disorders, but includes *states of mental wellness, emotional resilience, and also psychosocial wellbeing* (i.e. interplay between social and psychological conditions that shape human welfare).

In India, the prevalence of mental health issues is extremely high even without considering the added mental health consequences of a changing climate, and that there is already a very high treatment gap of over 80-90% for most severe and common disorders (National Mental Health Survey 2017).

Mental health interventions, thus need to focus on first strengthening the available pathways to care, especially in populations at high risk for climate outcomes and need to be co-ordinated with other health and social welfare interventions to be effective.

Mental health problems in addition to other health and livelihood problems can arise due to:

A] Extreme weather events—which are more frequent, intense, and complex under a changing climate—can trigger post-traumatic stress disorder (PTSD), major depressive disorder (MDD), anxiety, depression, complicated grief, survivor guilt, vicarious trauma, recovery fatigue, substance abuse, and suicidal ideation

B] Incremental climate changes - such as rising temperatures, rising sea levels, and episodic drought, can change natural landscapes, disrupt food and water resources, change agricultural conditions, change land use and habitation, weaken infrastructure and give rise to financial and relationship stress, increase risks of violence and aggression, and displacement of entire communities. Apart from causing despair and hopelessness, these can add to long term changes in rates of suicide, violence anxiety-depression and other common mental disorders including alcohol and other substance use disorders.

C] Climate change anxiety –especially among young people

Adaptation strategy and action plan for mental health problems sensitive to climate variability

A] Embed climate change-mental health response strategies within existing health delivery frameworks and promote inter-agency sharing of intervention strategies, IEC materials etc.

List of Stakeholders

- 1] Psycho-social Support and Mental Health Services (PSSMHS) in Disasters [National Disaster Management Authority]
- 2] District Mental Health Programme delivery structures
- 3] Ayushman Bharat- Health and Wellness Centres
- 4] National Health Mission Elements

- A] Non-Communicable Disease Control Programmes – especially National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS), and National Programme for the Health Care of Elderly” (NPHCE)
- B] Reproductive, Maternal, New-born, Child and Adolescent Health [RMNCH+A] – (developmental interventions for infants, children and adolescents)
- C] Rashtriya Bal SwasthyaKaryakram(RBSK)–(awareness, early detection and coping skills)
- 5] Human Resource Development Education department -School and College; NCERT (awareness, climate mitigation responses in curriculum)
- 6] Directorate General Labour Welfare; National Skill Development (reskilling and employment)

B] Aim to reach

1. Populations affected by disaster and acute climate events
2. Populations at high risk a] due to living in zones affected by climate change
b] due to marginalisation – urban poor; children-adolescents; women; aged
c] workers – organised and unorganised

C] Sensitise and train 1) Nodal health officers in states; b] Health delivery personnel; c] counsellors in various schemes (NCD counsellors, DMHP staff, Anganwadi workers, ASHA workers, Village Rehabilitation Workers, HIV counsellors, Tobacco counsellors etc)

D] In Order to provide

1. Universal interventions: These interventions shall be a part of promoting mental wellbeing for the whole population. The interventions shall focus on sensitization, knowledge attitudes, practices and positive health strategies
2. Selective interventions: These interventions shall be a part of preventing occurrence of mental disorders among at risk population. The interventions shall focus on sensitization and building resilience in addition to positive health strategies and well-being
3. Indicated interventions: These interventions shall be targeted for individuals suspected to have mental disorders among the said population. The interventions shall include screening-brief intervention – referral for treatment using stepped care with special focus on CMDs (esp depression-anxiety), suicide/ violence, substance abuse, psychological well-being – including pharmacological and non-pharmacological treatments

The materials for providing the above-mentioned interventions have been provided below (in the PDF file attached) that shall include psychosocial and non-pharmacological treatments.



Brochure 12 nos.pdf

4. Early warning-Surveillance and audit mechanisms and developing CC-MH Observatories. The Observatories shall be manned by the District Mental Health Program (DMHP) Team that shall deliver the essential services. The Program Officer of the DMHP shall conduct an audit half yearly on the following indicators/parameters:



AUDIT_indicators & parameters.docx

4.1. Candidate observatories: a] Disaster prone areas-Coastal Odisha/WB, Uttarakhand; b] Areas facing desertification and rising sea levels; c] existing mental health cohorts e.g. cVEDA, etc.

4.2. a]Examining the process and enablers of resilience to climate change using social ecological model of resilience (file containing elaboration attached below); b] People's perception of climate change and its impact on their mental health, patterns of coping behaviours related to climate change and their correlates, perceived barriers to engaging in behaviours that facilitate adaptation to climate change; c] Examining the role of preventive and promotive interventions to enhance self-care for mental health and adaptive coping and enhance engagement in volunteering actions related to creeping climate change and positive mental health outcomes



social ecology of
resilience.docx

E] Utilising existing infrastructure and personnel

1. Personnel: see above

2. Infrastructure:

2.1. National Digital Academy (NDA) for Mental Health training and telementoring under DMHP

2.2. State NHM and DMHP

3. Training and IEC material:

3.1. a) Training manuals for Community Health Workers [WHO-India]; b) DMHP and Disaster – Mental Health training modules and material; c) NDA training modules

3.2. Focusing on:

Positive Mental Health Strategies- Enhancing wellbeing and resilience, enhancing community engagement; Stress Reduction and Yoga techniques- Brief stress reduction /management interventions for vulnerable population/those at risk

Life skills education: Dealing with Anger-Sadness-Boredom-Anxiety; Conflict resolution and Problem solving; Psychological First Aid- Brief modules for individuals in distress (experiencing depressive/anxiety symptoms) Therapeutic skills training – how to help another; Deliberate self-harm – suicide and violence; Alcohol and substance misuse
Mitigating Climate Change at personal and local levels -Psychological adaptation

Detailed action plan:

1. Logistics required at the health care facilities

Resource	Suggested Quantity
Infrastructure	Dedicated space in the District Hospital to house DMHP staff; wellness centres Broadband networks
Human Resource (with TOR & R&R)	Medical Officers of Primary Health Centres Staff of DMHP (Same TOR applicable for Medical officers of PHCs) (Word files attached below the table containing the TOR) Government Psychiatrists of medical colleges and the Health Departments;

	Private medical colleges Other paramedical and mental health professionals including NCD counsellors, Anganwadi workers, ASHA workers, Village Rehabilitation Workers, HIV counsellors, Tobacco counsellors, counsellors in Ayushman Bharat Wellness Centres
List: Drugs including list of psychological first aid, Testing kits, reagents	Drugs available in DMHP – Essential Drug List under NMHP as per the notification of the Ministry of Health and Family Welfare, Govt. of India dated 08.05.2018: (attached below the table as PDF) List of psychological first aid: Document attached below the table containing material on psychological first aid
Equipment: essential & Desirable	Telemedicine set up in all Health and wellness Centres, Primary Health Centres (essential), taluk hospitals



All DMHP Staff TOR with qualifications.doc



TOR for Social Workers under Taluk



Essential Drugs List under NMHP.pdf



list of psychological first-aid.doc

2. Preparedness of health system and personnel

TASKS FOR NODAL OFFICER IN THE STATE

1. IDENTIFY

- 1.1. Identify climate sensitive zones in state, ie. areas where a] repeated extreme weather events occur; or b] Incremental climate changes are occurring
- 1.2. Identify and create linkages between existing (mental) health care delivery facilities at primary-secondary-tertiary levels, which can be potentially used to form a stepped care network – especially from catchments in climate sensitive zones
 - a. Tertiary facilities-mental health centres (under DMHP); Medical college departments of psychiatry; designated/empanelled private psychiatrists to treat severe, treatment resistant and referred cases
 - b. Primary-secondary and tertiary health facilities for early detection-brief or early intervention –and referral for treatment if necessary. Early detection should occur via screening for common mental disorders (depression-anxiety– suicide/self-harm) -post traumatic stress disorders – alcohol and substance use disorders during while consulting for trauma, NCD etc.
 - c. Agencies capable of raising awareness and sensitisation especially to at-risk groups
- 1.3. Identify personnel available for mental health interventions – both trained mental health professionals and trainable personnel (for potential task shifting and skilling)

2. ARRANGE

- 2.1. Arrange Training of trainers (local mental health professionals and regional experts) and subsequent training of doctors- and counsellors under NHM-NCD, Ayushman Bharat- Health and Wellness Centres for limited exposure to sensitization/screening and basic counselling skills and coping skills

- 2.2. Arrange Training of counsellors from various NHM schemes (and counsellors working in NGOs)- higher level training in the Health and Wellness skills for counselling, appropriate treatment of CMD, PTSD, SUDs and Positive Mental Health processes; arrange for availability of medicines through NHM.
- 2.3. Arrange Training by utilising existing resources and protocols
- Existing in the state
 - Training protocols for Disaster and Mental Health [NIMHANS]
 - Training and distance learning protocols for mental health intervention [National Digital Academy – NIMHANS Bangalore, LGBRIMH Tezpur, CIP Ranchi, AIIMS New Delhi, PGIMER Chandigarh]
- 2.4. Arrange training of trainers for Raising awareness and sensitisation with a focus on schools/colleges, NGOs working in community development and financial uplift to promote sensitisation workshops repeated at discreet intervals and focusing on:
- Positive Mental Health Strategies- Enhancing wellbeing and resilience, enhancing community engagement
 - Stress Reduction and Yoga techniques- Brief stress reduction /management interventions for vulnerable population/those at risk
 - Life skills education: Dealing with Anger-Sadness-Boredom-Anxiety; Conflict resolution and Problem solving
 - Psychological First Aid- Brief modules for individuals in distress(experiencing depressive/anxiety symptoms); Deliberate self-harm – suicide and violence
 - Alcohol and substance misuse
 - Mitigating Climate Change at personal and local levels - Psychological adaptation
 - Therapeutic skills training – how to help another
3. AUDIT
- The Program Officer of the DMHP shall conduct an audit half yearly on the indicators/parameters that has been mentioned already in Sub-Section 'D' under the section 'Adaptation strategy and action plan for mental health problems sensitive to climate variability'. The audit shall fulfil the following 2 major aims:
- 3.1. Patterns and trends of mental health in different climate sensitive zones and following climate events; risk and resilience factors;
- 3.2. Working of the stepped care network and sensitisation efforts



AUDIT_indicators &
parameters.docx

TASK FOR COE

1. IDENTIFY

- 1.1. Identify the team to work on Climate Change and Mental Health at the COE and assign responsibilities, as well as potential partners to develop resources

INTRA MURAL	Department	Role
Prof. Vivek Benegal	Psychiatry	Co-ordination; Surveillance
Prof. K. Sekar	Psychiatric Social Work	Disaster & Mental Health
Dr.Jaikumar	Psychiatric Social Work	Disaster & MH; Surveillance

Prof. C Naveen Kumar	Psychiatry - Community	DMHP & Climate MH; Dissemination
Prof. Suresh Badamath	Psychiatry - Community	DMHP & Climate MH; Legal-Advocacy
Prof. Prabhat Chand	National Digital Academy	Distance education & dissemination
Prof. Pratima Murthy	Psychiatry	Training of Medical Officers' Manual
Dr. Gautham MS	Centre for Public Health	Public Health and surveillance strategies
Prof. Shivaram Varambally	Centre for Integrated Medicine	Yoga and Integrated Medicine
Prof. Seema Mehrotra	Clinical Psychology	Positive Mental Health
Prof. Paulomi Sudhir	Clinical Psychology	Counselling skills
Dr. Senthil Reddi	Psychiatry	Suicide
Dr. Lekhansh Shukla	Centre for Addiction Medicine	SUDS; Long term MH impact
Dr. Jayant Mahadevan	Centre for Addiction Medicine	SUDS; IEC
Dr. KS Meena	Health Education	Information, Education, Communication
Dr. Eesha Sharma	Child and Adolescent Psychiatry	Children and Adolescents
Dr. Santhosh Loganathan	Geriatric Psychiatry	Elderly
EXTRAMURAL PARTNERS		
Dr. Rajani Partha Sarathy	Deputy Director Health, NHM GoKar	State Level Dissemination and Suggested Nodal Officer for Karnataka
Dr. Geetha Narayanan	Director, Srishti School of Art and design, Bangalore	IEC strategies

2. ARRANGE

- 2.1. Arrange resources for training and monitoring; website for storage of electronic training / monitoring resources and dissemination; Creation of public awareness and training material
- 2.2. Arrange for training and monitoring processes and personnel
- 2.3. Arrange for demonstration project(s) in consultation with state partners (NHM, Karnataka)

3. AUDIT

- 3.1. Audit and evaluate working of programme annually on the indicators/parameters already mentioned elsewhere



AUDIT_indicators &
parameters.docx

- 3.2. Conduct longitudinal assessment of the impact of climate change on mental health in India utilising existing population cohort studies and research studies on specific aspects of mental health and climate change.

Health Vulnerability Assessment in context of Climate Change

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Background

Climate change adversely affects human health by increasing exposure and vulnerability to climate related stresses and decreasing capacity of health systems. IPCC AR5 concluded with high to very high confidence that climate change will lead to greater risks of disease and death due to intense heat waves, increased risks of under nutrition.

N- HAP is the roadmap for adaptation, to deal with the health risks and impacts posed by climate change. Under National programme on Climate Change and Human Health (NPCCHH) the states and union territories have to work in coordination with other sectors and line departments to prepare health systems and action plan against climate change.

N- HAP will act as a guiding document for the state- specific action plans for dealing with illnesses due to climate change. The N-HAP conceptualises the following 'pathways' for India's adaptation to deal with health impacts due to climate change.

- i. Assessment of climate- related impacts on health in various geo-climatic regions of the country;
- ii. Health vulnerability assessment and risk mapping of vulnerable population and healthcare infrastructure;
- iii. Develop data information systems which would assist in tracking trends and estimating climate linked health burden, including feedback loops to prompt action;
- iv. Linking and networking information systems to enhance access to life supporting and referral of health care facilities and services during extreme weather for development of adaptation and response plan;
- v. Develop communication strategy and IEC materials;
- vi. Hand holding of states and UTs;
- vii. Development of training module and conduction of training, meetings and workshops for capacity building and for sharing best practices/ experiences with states and UTs;
- viii. Documenting progress in the country with respect to health sector resilience.

H-NAP shall be a guiding document for State Nodal Officer- Climate Change and hence should address actionable points like

1. **What** actions needs to be undertaken (for vulnerable group, general population, for prevention and mass prevention or specific measures)
2. **When** to initiate the actions (calendar based on threshold of geo-climatic parameters preferably– for most common disease)
3. **Who all** shall be involved in the communication channel and for operational coordination

The framework of N-HAP will help to develop best practices on early warning systems and climate adaptation. This health action plan is one of the first comprehensive early warning system and preparedness plan for extreme weather events and climate health illnesses in India. N- HAP outlines immediate and long- term actions to increase preparedness with warning systems, information- sharing and response coordination to reduce the health impacts of climate change on vulnerable populations.

Objectives of N- HAP

1. The *health adaptation plans* to act as guide for preparation of state specific action plan for climate change and human health.
2. To prepare a *disease calendar* for four to five (preferably) geo-agro-climatic zones *based on type of occupation, socio-economic status, customs, culture dietary practices in regions like plain, hilly and mountainous regions (various heights), desert, coastal* so that the States can refer the same to initiate appropriate action in advance.
3. Suggest trend of CSD as per age groups to be focused and common disease to prioritize actions.
4. It is desired that the conditions or risk factors which favor disease initiation and propagation, the threshold, if any, be highlighted so that they can be communicated to the States for timely action.

Climate Change and Health Adaptation in India

According to the estimates of World Health Organization (WHO), due to the changes in the climate pattern with warming temperatures and precipitation a loss of 150,000 lives per year is expected. And, this risk of death and disease from climate change is going to double in the next 20 years. (WHO report).

Global climate change poses an even greater threat for the health of people in the developing nations of the world. Though the developed countries produce most of the world's greenhouse gases (GHGs) but with the lack of infrastructure and resources and geographical location the health of the developing nations suffers the most. Human health is affected by change in the weather patterns and other aspects of climate change- direct and indirect effects.

Intergovernmental Panel on Climate Change (IPCC) defines climate change as “a change in the state of the climate that can be identified by changes in the mean and/or variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity”.

The definition provided by UNFCCC has a slight difference, as it emphasizes on “a change that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods”.

As climate change is seen to influence the spread of epidemic diseases (NRC, 2011) The IPCC in its 2007 report, pointed out that climate change may contribute to expand risk factors and areas for diseases such as dengue and other infectious diseases and may also increase the burden of diarrhoeal diseases by putting more people at risk (IPCC, 2007).

The increased temperatures and extreme climatic conditions due to the climate change are already contributing to the worldwide burden of illnesses and premature deaths. The changed climatic conditions are anticipated to influence the transmission of infectious diseases.

Climate Change is strongly associated with human activities which affect the long- term changes in the climate. These changes are now better understood due to improvement in meteorological data and enable the prediction of when and where climate- sensitive diseases outbreak may occur using Climate modelling.

States should become climate-resilient through assessment, planning and implementation, which considers climate risks, hotspots areas and vulnerable groups. The states should be

redesigned and programmed by taking in to account both current climate variability and projected future climate change.

Geo- Climatic Zones and Climatic Profile of India

Geo- Climatic Zones

India possesses an incredibly complex and diverse variety of climatic conditions and regions, ranging from extremely dry and hot desert plains in western India to severe cold conditions in the high altitude Himalayan north region. Also, humid tropical regions supporting rain-forests in the southern and north- eastern parts of India. The climate across India mainly ranges from equatorial in the far south to alpine in its upper regions. So, temperature profile differs drastically from one part of the country to another giving rise to different micro-climatic zones.

India is a union of 29 states and 7 union territories, which are further sub- divided into districts and villages. According to the Koppen system, with different geography and climatic conditions across India, it can be divided into the following six geo- climatic zones.

The Northern Mountains

The northern mountains include the highest mountain range of the world- Himalayas. They display an extreme cold, snow and rugged topography. And, the climate ranges from tropical at the base of the mountains to tundra with permanent ice and snow at high elevations. The northern mountainous zone includes Trans Himalaya (5.62%), Himalaya (6.41%) and North-East zone (5.21%) of India with a total area of 566,836 sq. km. that is approximately 17.24% of India's total geographical area. (WII, 2009)

Major states: This zone includes majorly states of Jammu and Kashmir, Uttarakhand, Himachal Pradesh, Sikkim and the North- eastern states namely Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland and Tripura.

Climate: Like the rest of the country, this region mainly experiences two seasons: summer and winter. In the Himalayan valleys average summer temperature is about 30 °C and winter temperature is 18°C. While in the elevated regions the summer temperature is around 15-18°C and for winters it is below freezing point. The alpine climate varies with the altitude and changes very quickly.

However, the north- east India which lies in the tropics displays to a large extent the character of tropical climate. This region has a monsoon climate with heavy to very heavy rains, between the months of June and September. The north- east India has no region which receives rainfall less than 1000 mm. (Dikshit and Dikshit, 2014)

Prevalent climate- sensitive diseases: Cold waves are quite prevalent in the Trans-Himalayan and Himalayan region while the north- east region due to extremely high precipitation rates and humid conditions has more of vector- borne diseases, water- borne and food- borne diseases.

The North Indian Plains

The North Indian Plains are large alluvial fertile plains dominated by three main rivers- the Indus, Ganges and Brahmaputra which drain most of northern and eastern India. Also, known as the Indo- Gangetic Plains, they run parallel to the great northern mountains and lie between the mountains and the peninsular plateau, with a total landmass of 354,848 sq. km. which is around 10.79% of India's geographical area. (WII, 2009)

Major states: The northern plains involve the states of Punjab, Haryana, National Capital Territory of Delhi, Uttar Pradesh, Bihar, West Bengal and parts of Rajasthan. (India-WRIS)

Climate: The northern plains of India have continental type of climate with extreme climate characterized by very harsh, hot and humid summers followed by monsoon season between the months of July and September. And, then comes winter season with extreme cold temperatures.

Prevalent climate- sensitive diseases: Heat stress during the summer season; vector-borne, water and food- borne prevalent in the monsoon season and respiratory health illnesses and cold waves are prevalent in the winter months of the year.

The Peninsular Plateau

The peninsular plateau region is a tableland which covers across most of the Central India. Its characteristic features include shallow valleys and rounded hills, made of igneous and metamorphic rocks. This region is broadly divided into two regions: the **Deccan Plateau** region which stretches across eight states of India and **the Central Highlands**. The central highlands consist of Malwa Plateau, Chotanagpur Plateau, Meghalaya Plateau, Vindhya Range, Satpura Range and Aravali Range.

The Western Ghats and the Eastern Ghats mark the western and the eastern edges of the Deccan Plateau respectively.

Major states: Central highlands include the parts of the states of Madhya Pradesh, Uttar Pradesh, Rajasthan and Gujarat. Deccan Plateau encompasses the states of Maharashtra, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Telangana, Chhattisgarh, Jharkhand and Odisha.

Climate: The weather of this region is semi-dry in the north much drier than the nearby coasts and differs to tropical in majority of the areas with both moist and arid periods. Precipitation takes place from June to October during the monsoon months. The period between March and June is quite warm with temperature going over 40°C on a constant basis.

Prevalent climate- sensitive diseases: Heat stress is prevalent during the summer months predominantly in the states of Gujarat, Rajasthan and UP while also includes vector-borne diseases, water- borne and food- borne diseases especially in the coastal states.

The Indian Desert

The Indian desert is situated towards the western margins of the Aravali Hills. The Thar desert is the only desert in India and it forms a significant portion of western India and most of its part lies in the state of Rajasthan. It is an undulating sandy plain covered with sand dunes which receives very low rainfall below 150 mm per year. This zone of India suffers from climate- sensitive issues like water scarcity and draught.

Major states: It covers a large part of Rajasthan and extends to Gujarat, Haryana and Punjab.

Climate: It has arid climate with low vegetation cover. Streams appear during the rainy season. Soon after they disappear into the sand as they do not have enough water to reach the sea

Prevalent climate- sensitive diseases: Heat stress, water- borne diseases, respiratory health illnesses and malnutrition.

The Coastal Plains

The coastal plains lie between the Arabian Sea in the west to the Bay of Bengal in the east. They are divided into the Eastern and the Western coastal plains.

The eastern coastal plains lie between the Eastern Ghats and the Bay of Bengal and the rivers which flow in this region are Krishna, Kaveri, Godavari and Mahanadi. The area

between Krishna and Mahanadi Rivers (West Bengal and Odisha) form the Northern Circars and the Coromandal coast lies between Krishna and Kaveri (Andhra Pradesh and Tamil Nadu).

The western coastal plain is sandwiched between the Western Ghats and the Arabian Sea. This region is mainly divided into four parts -- Konkan coast (Mumbai, Goa), the Malabar Coast (Kerala), the coast of Gujarat and the Kannada plains

Major states: The eastern coastal plains stretch from Tamil Nadu to West Bengal and pass through the states of Andhra Pradesh and Odisha. The western coastal plains extend from Gujarat in the north and cover the regions of Maharashtra, Goa, Karnataka and Kerala.

Climate: The coastal region of the country is where the temperature remains more even throughout the year with frequent precipitation.

Prevalent climate- sensitive diseases: Vector- borne and water- borne diseases along with morbidities and mortalities due to extreme weather calamities like floods, cyclones and storms in this zone of the country.

The Islands

India has two main groups of islands which are the Andaman and Nicobar islands in the Bay of Bengal and the Lakshadweep islands in the Arabian Sea.

Lakshadweep covers an area of 32 sq. km. It comprises of about 35 coral islands and islets rich in flora and fauna. The Andaman and Nicobar Islands are larger in size and has a total of 572 islands. Andaman is located in the north and Nicobar is located in the south.

Major states: It includes the union territories (UTs) of the Andaman and Nicobar islands in the Bay of Bengal and the Lakshadweep islands in the Arabian Sea. Also involves Daman and Diu next to the state of Gujarat, Majuli – a river island in Brahmaputra, Assam, Salsette Island which is an island in Maharashtra, Sriharikota in the Bay of Bengal and forty- two islands in the Gulf of Kutch constitute the Marine National Park

Climate: The islands are located close to the equator that is why they experience an equatorial type of climate. It has a very humid weather with no winter season.

Prevalent climate- sensitive diseases: Vector- borne, water- borne diseases along with morbidities due to extreme weather conditions.

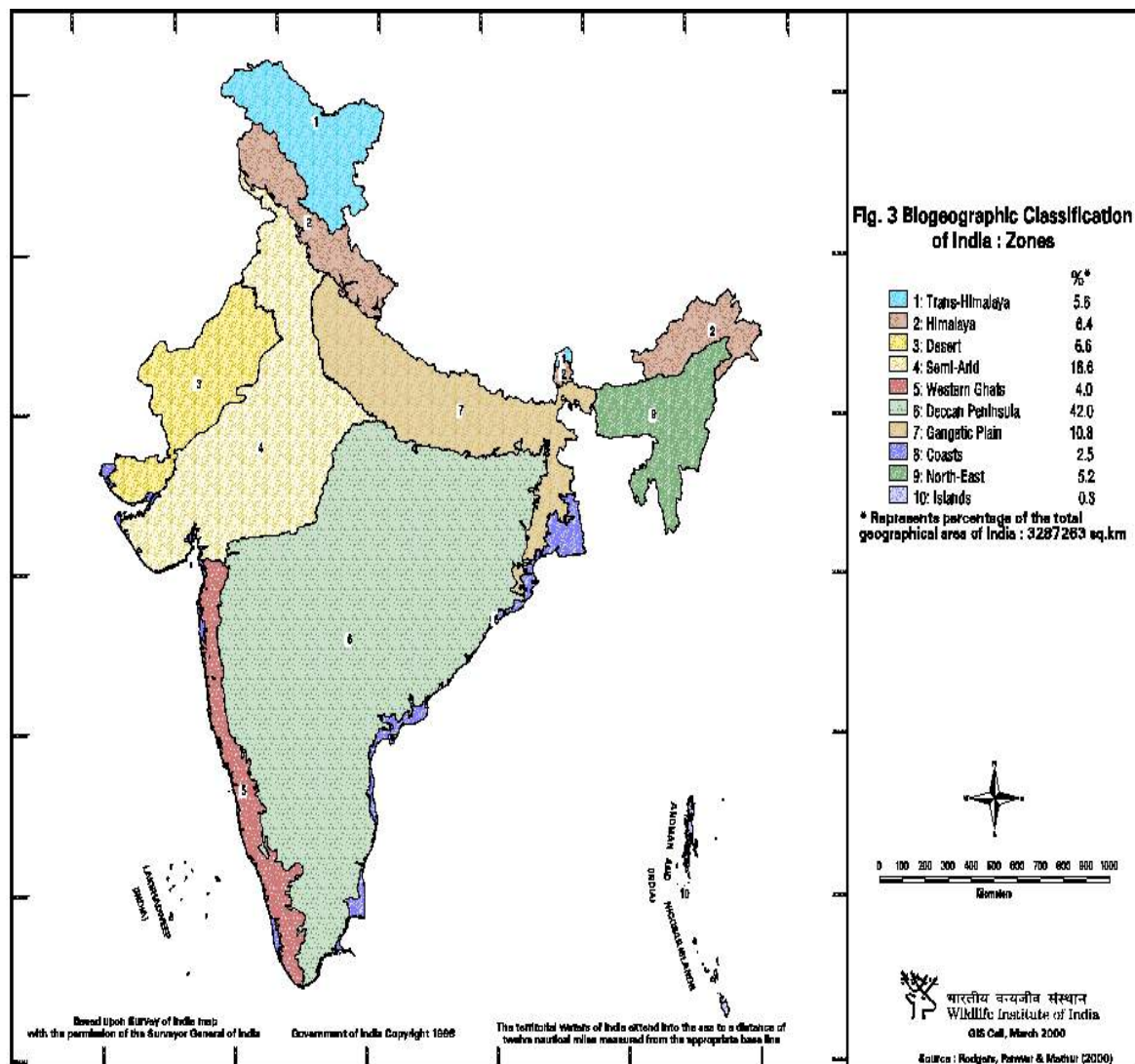


Figure
Map showing the different physiographical zones of India

1

Climatic Profile of India

India is home to extraordinary variety of climatic conditions, ranging from arid desert in the west; temperate and alpine to glaciers in the north; to humid and tropical regions in the south supporting rainforests in the southwest and the island regions in the country. The nation's climate is strongly affected by the presence of Himalayan mountains in the north which acts as a barrier to the frigid winds flowing from the Central Asia and the Thar desert in the west. They are in complete contrast to the coastal regions of the country where climate is warm and rains are very frequent.

India has four seasons: winter (January- February), summer (March- May), monsoon (June- September) and post- monsoon or winter period (October- December).

Rainfall: The rainfall over India has huge spatial as well as temporal variation. The rainfall pattern also varies across the country with different regimes, varying from humid in the northeast with roughly about 180 days rainfall a year and where no area receives rainfall less than 1000 mm (Dikshit and Dikshit, 2014), to arid in the west, i.e., Rajasthan with 20 days rainfall in a year. (see Annexure 1)

In India, mean monthly rainfall during July is highest and contributes about 24 per cent of the annual rainfall. However, during August mean rainfall is slightly lower with a contribution of 21 per cent. The mean southwest monsoon rainfall has the largest contribution of about 74 per cent in the annual rainfall. The variation of rainfall during the months of November to February is very high.

Temperature: India is characterised by high temperature variations during different seasons ranging from mean temperature of 10°C in winter to about 32°C in the summer season across different parts of the country. The temperature during winters in general goes on decreasing from south to north of India from 24°C to 10- 15°C respectively. (see Annexure 2)

India Meteorological Department (IMD) station data analysis for the period 1901- 2009 suggests rise in the annual mean temperature by 0.56°C over that period. The spatial pattern of trends in the mean annual temperature shows significant increase in temperature over most parts of the country except over parts of Rajasthan, Gujarat and Bihar. (IMD annual climate summary, 2009)

Climate Sensitive Diseases (CSDs) in India

According to the estimates of World Health Organization (WHO), due to climate sensitive diseases linked with changes in the climate pattern with warming temperatures and precipitation a loss of 150,000 lives per year is expected. And, this risk of death and disease from climate change is going to double in the next 20 years. (WHO report).

The increased temperatures and extreme climatic conditions due to the climate change are already contributing to the worldwide burden of illnesses and premature deaths. Climate change is linked to increase in a wide range of non-communicable diseases and to influence the spread of epidemic diseases (NRC, 2011; Portier et. al.,2010) The changed climatic conditions are anticipated to influence the transmission of infectious diseases and new conditions may emerge or existing illnesses may extend their range into unaffected areas, i.e., food- borne infections.

IPCC reported that climate change may contribute to expand risk factors and areas for diseases such as dengue and other infectious diseases and may also increase the burden of diarrhoeal diseases by putting more people at risk (IPCC, 2007).

There are broad health risks from climatic pressures by different **exposure pathways**, such as extreme heat and cold waves, water availability and contamination, changes in vector ecology, increasing allergens, air pollution- PM_{2.5} and O₃, food supply insecurity and quality and population displacement.

The most commonly experienced climate- sensitive diseases are as under:

1. Heat stress and cold waves:

- **Heat waves based illnesses:** hyperthermia, heat stroke, heat exhaustion, heat syncope, heat cramps, and heat rash.
- **Cold Wave based illnesses:** respiratory problems such as cough, throat infection, chronic obstructive pulmonary disease (COPD), bronchitis, asthma, pneumonia, chronic bronchitis, rotavirus diarrhoea, skin diseases etc.

Defining criteria for heat stress and cold waves

As per the definition by **Indian Meteorological Department (IMD)**

“Heat wave is considered when normal maximum temperature of a station reaches at least 40°C for Plains and at least 30°C for hilly regions”.

“Cold wave is defined on the basis of wind chill temperature. For any given station with normal temperature above 10°C, a decrease of -5°C to -6°C is below normal is considered as a cold wave. And, for stations whose normal temperature is below 10°C a decrease of -4°C to -5°C is considered as a cold wave”.

India has limited data on heat and cold temperature based mortalities and health risks, most of the work done is based on small studies done in limited parts of the country (Fu et. al, 2018;

De et al.,2004). More than 2400 people died in the heat waves of 2015 (National Disaster Management Authority, 2016). Heat-wave during the period from 1998 to 2000 caused an estimated more than 2000 deaths in the state of Orissa (Mohanty and Panda, 2003) and heat waves in 2003 in Andhra Pradesh, India, caused more than 3000 deaths (Government of Andhra Pradesh, 2004). Azhar et al. (2010) have reported the city of Ahmedabad have reported 1,344 deaths during the month of May.

The cold waves mainly affect the areas to the north of India but in association with large amplitude troughs, cold wave conditions are also reported from states like Maharashtra and Karnataka as well. States of Bihar and UP rank the highest in cases of cold waves due to lack of infrastructure the outdoor workers are more prone in these states. (IMD Disastrous weather Event annual reports; EMDAT)

2. Vector- borne or Zoonotic diseases: Malaria, Dengue, Lyme disease, Yellow fever, Rift valley fever, Japanese Encephalitis (JE), kala-azar (Visceral leishmaniasis), Onchocerciasis, Trypanosomiasis, Plague, Hanta virus, Nipah virus etc.

Vector- borne diseases such as malaria, dengue, chikungunya, Japanese Encephalitis etc. are likely to be affected by the change in the climate pattern (Singh and Dhiman, 2012). The changes in the transmission of different malaria vector species are predicted for geographical range as well as duration window of India (Bhattacharya et al., 2006).

Impact of Climate Change:

- Rainfall variability increases the variability of the disease, where it is endemic.
- A significant increase in the abundance of vectors as extreme temperature is more favorable for their survival.
- Monthly parasite incidence is positively correlated with temperature, precipitation and humidity.

Indian Challenge:

- India contributes **70% of malaria cases** and 69% of malaria deaths in the South-East Asia Region. (WHO, 2015)
- The National Vector Borne Disease Control Programme (NVBDCP) envisages **achieving malaria-free status** in the country by 2030. (MOHFW, 2017)
- Priority States (high malaria incidence): Odisha, Meghalaya, Chhatisgarh, Mizoram, Jharkhand, Tripura

3. Water- borne diseases: Typhoid, hepatitis, dysentery, cholera, schistosomiasis, shigellosis, rotavirus, salmonellosis etc. are some climate- sensitive infectious diseases that are likely to change in occurrence with disease exposure in India. Extreme weather events such as floods, cyclones and storm surges lead to contamination of water sources and spread of water infections as in West Bengal have led to large cholera

epidemics and increase occurrence of diarrhoeal disease in India (Mondal et al., 2001; Morgon, 2004).

Impact of Climate Change:

- Heavy rainfall or flooding can increase water- borne parasites sometimes found in the drinking water, which can cause gastrointestinal disorders
- Storm water runoff due to heavy rainfall events may contaminate water bodies
- Most common illness contracted from contamination at beaches is gastroenteritis

4. **Food- borne diseases:** Due to rise in global air and water temperatures and altered weather patterns may increase or extend its influence in transmission of food- related infections such as infections from E. coli, Vibrio species, Staphylococcus, Salmonella species etc. (Panic and Ford, 2013; Ian Lake, 2015). Extreme heat and weather events contribute to decline in crop yields resulting in increase of food prices, leading to increase hunger and malnutrition (Rudolph L, 2015).

Under 1.5 C of warming, significant risks are **for crop yield reduction and nutrition** (protein, micronutrient, and Vitamin B) content in some regions (high confidence).

The rise of tropospheric ozone has already reduced yield of wheat, rice, maize and soyabean ranging from **3 to 16% globally**.

The CO₂ concentrations alone during the 21st century are therefore expected to have a negative impact on global food security (medium confidence). Therefore, CC will negatively affect childhood under nutrition and stunting through reduced food availability.

Impact of Climate Change:

- Higher temperatures can cause increase of salmonella and other bacteria- related food infections as they grow more rapidly in warm environments.
- Floods, cyclones and heavy rainfall events cause contamination of fresh water sources with pathogens that can further contaminate food crops

Indian Challenge:

- Childhood underweight at 36%, stunting at 38% (NFHS-4, 2015-2016)
- Anaemia (Haemoglobin in <11.0g/dl): Women 15-49 years = 53% ; Children under 5 years = 58% (NFHS-4, 2015-2016)
- Priority States: Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Uttar Pradesh (by exhibiting significantly larger proportion of under 5 year age under nutrition compared to country average)

5. **Extreme weather- related health impacts:** Extreme weather events such as floods, cyclones, draught etc. can directly impact health through associations with injuries and in some cases deaths due to drowning and other injuries, infectious diseases, hypothermia and other problems.

Health is also affected indirectly through prolonged infrastructure damage (e.g. malnutrition, food security and infections), mental health issues (e.g. post-traumatic stress disorder), population displacement, and disaster-related healthcare system failures. These events interrupt communication, utility and damage health care services.

Indian Challenge:

- Indian coast line: A coast line of 7516 km (5400 km along the mainland, 132 km in Lakshadweep and 1900 km in Andaman and Nicobar Islands) is exposed to nearly 10% of the world's Tropical Cyclones.
- There are 13 coastal states/UTs encompassing 84 coastal districts which are affected by cyclones

- Population at risk: 1980-2000 data shows that on an average, annually 370 million people are exposed to cyclones in India
- Priority States: Four States (Andhra Pradesh, Odisha, Tamil Nadu and West Bengal) and one UT (Pondicherry) on the East Coast and One State (Gujarat) on the West Coast are more vulnerable to cyclone disasters.

Impact of Climate Change:

- Changes in temperature and precipitation, as well as draughts and floods, will affect agricultural yields and reduce availability of fresh food and water.
- These events may compromise food security and threaten human health through malnutrition, infections and disease outbreaks.

6. Air pollution and aeroallergens based respiratory tract infections

Respiratory tract infections based on air pollution are related to increase in the fine particulate matter (PM_{2.5}) and increase in ozone and other secondary pollutant levels in the atmosphere formed by different photochemical reactions involving precursor hydrocarbons and oxides of nitrogen. With warmer temperatures enhance these photochemical reactions and cause increase in ozone levels (Metz et al. 2007).

Both ozone and airborne particles are associated with premature mortality and a wide range of adverse health effects. The health vulnerability is also aggravated from exposure to high outdoor and household level air pollution. As nearly 80% of Indian population resides in the rural households which continue to use biomass as predominant cooking fuel causing air pollution (NSSO Report, 2012).

Ozone formation is temperature dependent, ozone related morbidity (respiratory illness/ asthma) and mortality (high confidence) will increase with additional warming. Reduction in precursor emissions (NO_x and volatile organic compounds) would reduce ozone concentrations.

Indian Challenge:

- Global Burden of Disease (2015) report attributes 107,770 annual deaths in India to **ozone** (254,000 deaths globally) (estimates not based on *Indian evidence*)
- In 2017, long-term exposure to ambient PM_{2.5} contributed for India 673,000 deaths and 21.3 million DALYs (SOGA, 2019)

Table 1 List of identified priority regions (region-wise states) and vulnerable groups of major Climate- sensitive diseases (CSDs) in India

S. No.	Climate- sensitive disease (CSD)	Priority regions in India:	Vulnerable Groups
1	Heat stress and Cold waves	Heat wave based risk areas: Andhra Pradesh, Telangana, Orissa, Gujrat, Rajasthan, MP, UP, Vidarbha region of Maharashtra, Bihar, Jharkhand and Delhi¹. Cold wave based risk areas: States included in the Trans- Himalayan and Himalayan range: J& K, HP and Uttarakhand along with parts of northern plains in Delhi, Haryana, Punjab and UP, Maharashtra and	Young children, older adults, outdoor workers, people with medical conditions and the poor are more vulnerable

S. No.	Climate- sensitive disease (CSD)	Priority regions in India:	Vulnerable Groups
		Karnataka.	groups.
2	Vector - borne diseases (VBDs)	Extreme risk: Majorly in the hot and humid parts of the country including North- east and parts of peninsular plateau that receive high rainfall, including Odisha, Meghalaya, Chhattisgarh, Mizoram, Jharkhand, Tripura. Moderate or low risk: VBDs pose a bigger risk during the monsoon season in the northern plains including Haryana, Punjab, Delhi and Uttar Pradesh.	All age groups are equally susceptible to VBDs, especially people residing in coastal and humid regions and near low lying water sources.
3	Water- borne diseases	High risk areas include coastal areas including states of Odisha, Meghalaya, Chhattisgarh, Mizoram, Jharkhand, Tripura and the island regions.	Infants, elderly, malnourished people along with organ transplant recipients, cancer patients and people living in coastal regions with flood and cyclone- prone areas
4	Food- borne diseases	Priority states involve regions with risk of extreme weather conditions such as floods, cyclones and storm surges along with food insecure states like Bihar and UP and the islands.	Infants, elderly, malnourished people along with organ transplant recipients, cancer patients and people living in coastal regions with flood and cyclone- prone areas
5	Extreme weather- related health impacts	Extreme weather events based high risk areas including flood, draught and cyclone- prone areas including states of coastal and food- insecure regions.	Young children, older adults, people with medical conditions and
	a) Malnutrition	Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh,	

S. No.	Climate- sensitive disease (CSD)	Priority regions in India:	Vulnerable Groups
	b) Mental illnesses (e.g., Post-traumatic stress disorder)	Uttar Pradesh (by exhibiting significantly larger proportion of under 5 year age under nutrition compared to country average.	the poor especially living in flood, draught-prone and coastal regions.
	c) Extreme weather based physical injury and deaths due to drowning and infections	Four States (Andhra Pradesh, Odisha, Tamil Nadu and West Bengal) and one UT (Pondicherry) on the East Coast and one State (Gujarat) on the West Coast are more vulnerable to cyclone disasters. ²	
6	Respiratory tract infections	The states and cities falling in the Indo- Gangetic plain including Delhi, Haryana, Punjab, UP, Bihar and parts of Rajasthan and humid regions of the country	Children, elderly, outdoor workers and those with asthma and other chronic lung diseases are especially vulnerable groups

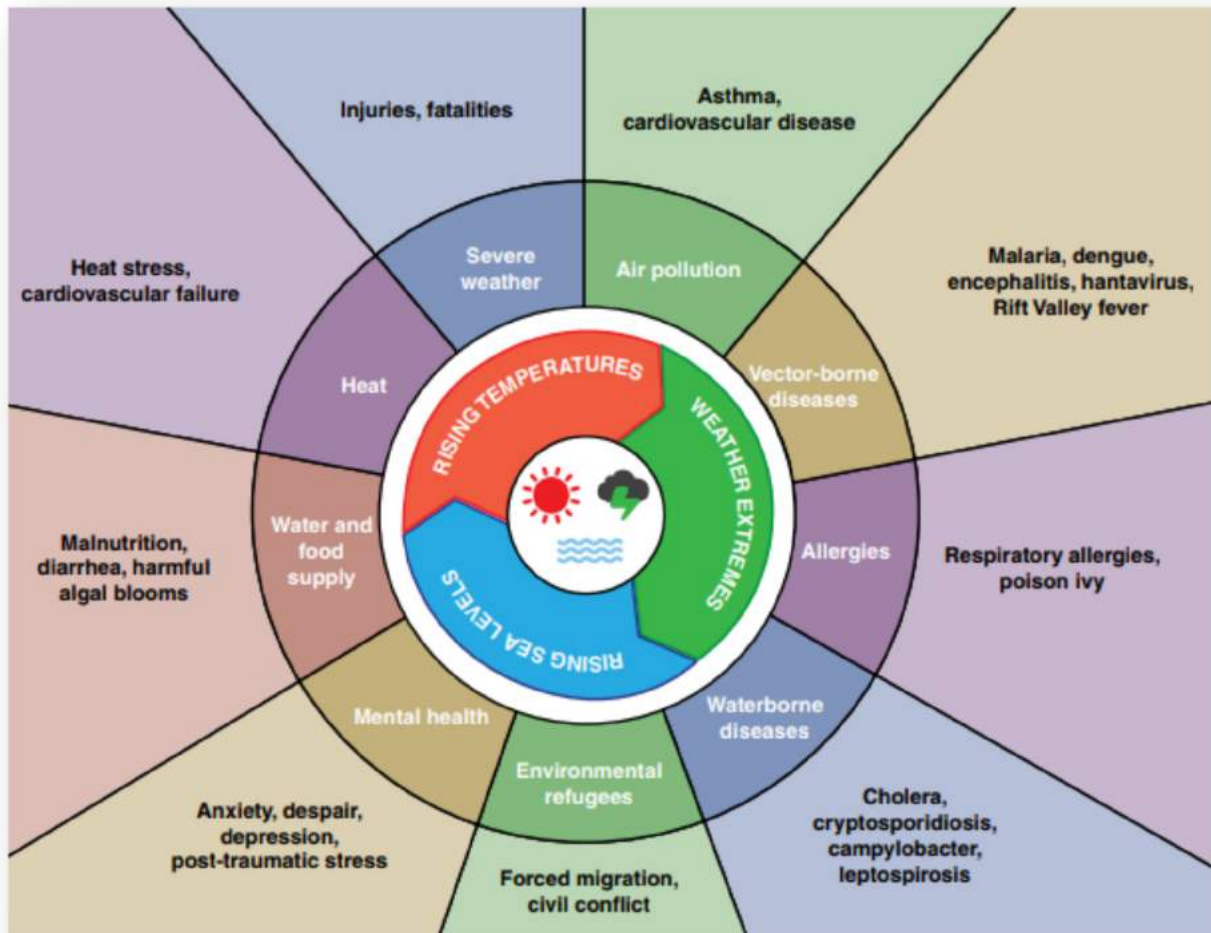


Figure
Impact of climate change on human health

2

Source: Adapted from J. Patz. National Oceanic and Atmospheric Administration
(<https://toolkit.climate.gov/image/505>)

Climate and Health Vulnerability Assessment

Health Adaptation Plan (HAP) aims to provide the framework for the implementation, coordination and regulation of climate response activities at the national level in order to reduce the adverse health impacts due to climate change. The prime objective is to assess local vulnerabilities related to health impacts associated with climate change keeping in mind the different vulnerable zones and age groups in order to reduce their disease burden and implement targeted public health interventions.

According to the fourth assessment report of IPCC, 2007 defines vulnerability to climate change as “the degree, to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.” (IPCC, 2007)

And, ‘vulnerability’ in the context of public health is more appropriately defined as “the degree to which a system is susceptible to injury, damage or harm” (**Smit et al.,2001**).

A climate and health vulnerability assessment allows the policy makers and health departments to identify the regions and vulnerable groups under their jurisdiction that are more susceptible to adverse health impacts associated with climate change. This approach is further used to implement targeted public health interventions and to develop capacity and resilience in order to reduce the burden of climate- sensitive diseases.

The basic steps involved in the Vulnerability and Adaptation Assessment are mentioned here. (WHO, 2013)

1. Frame and scope of the assessment:

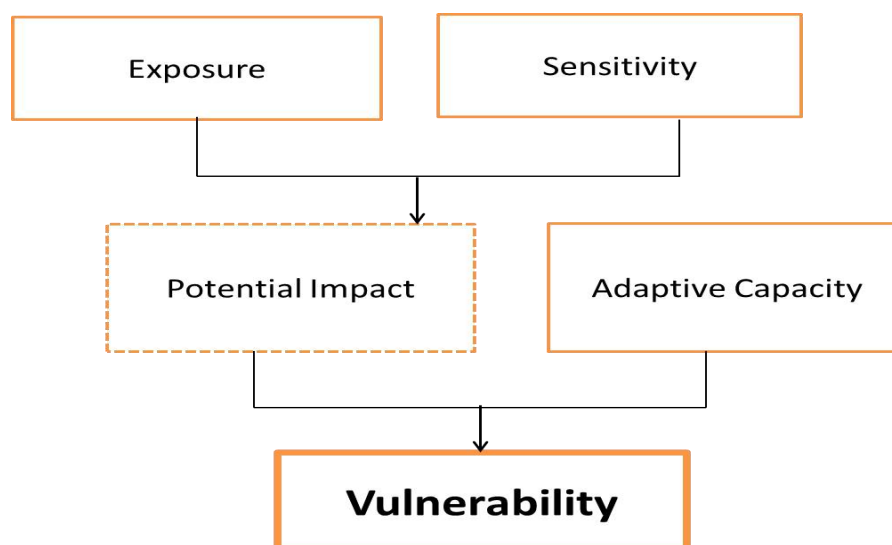
- define the geographical hotspots region and health outcomes prevalent;
- identify the questions to be addressed and steps of assessment;
- identify the policy context;
- establish the involved stakeholders;
- to develop a communication and outreach plan.

2. Vulnerability assessment: Vulnerability is a function of the character, magnitude and rate of climatic risks to which a system is exposed, its sensitivity and adaptive capacity.

The exposure and the sensitivity component together represent the potential impact of the risks involved while the adaptive capacity is the way to avert this impact. Thus, vulnerability assessment is potential impact minus the adaptive capacity.

$$V = f(\text{Exposure, Sensitivity, Adaptive Capacity})$$

- identify the **current risk factors**, including the most vulnerable populations and hotspot regions of climate-sensitive health outcome in terms of exposure and sensitivity
- identify the **climate- related exposures** and **sensitivity** factors
- identify the **current adaptive capacity** of health and other sectors to address these risks

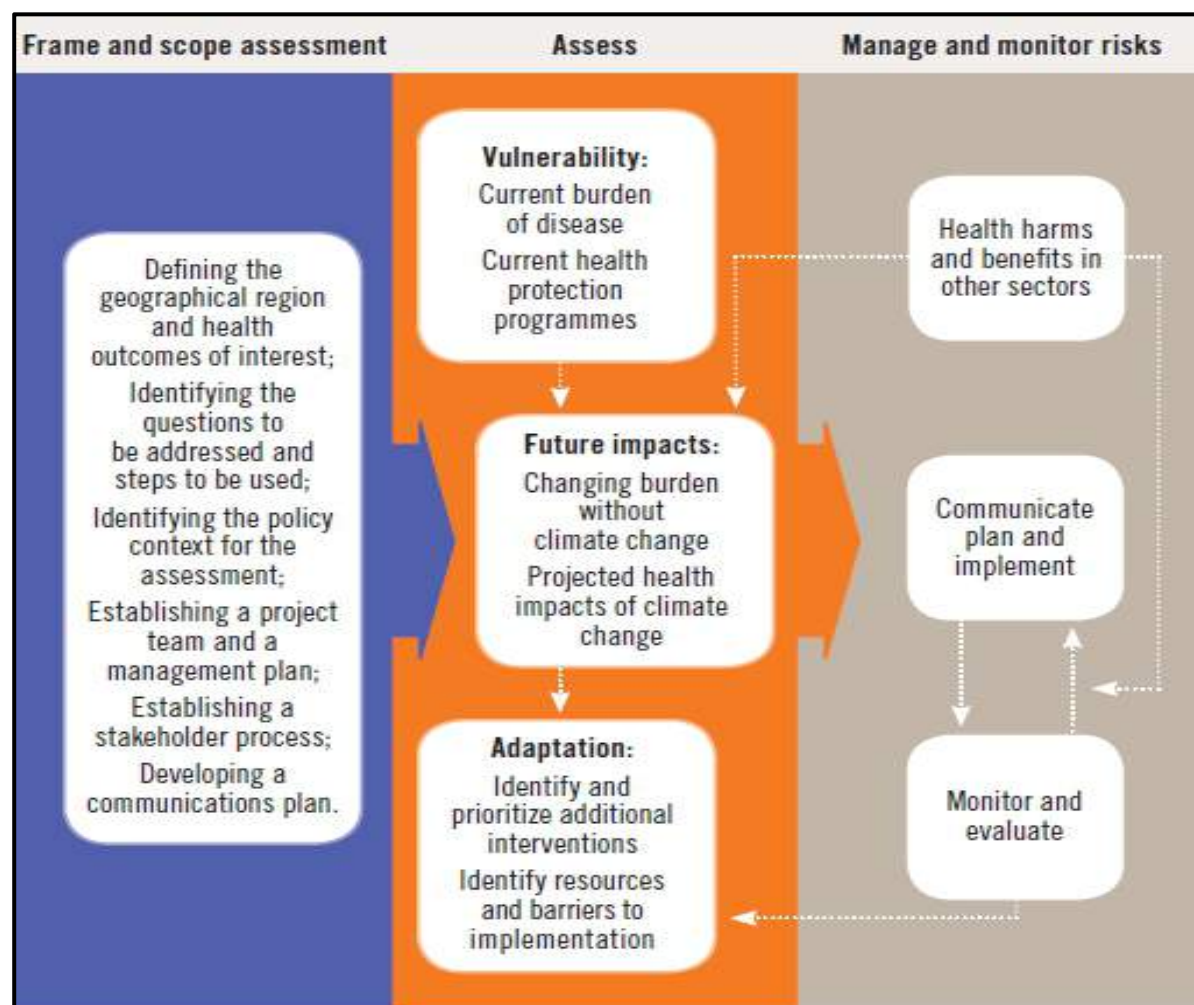


Vulnerability assessment by exposure, sensitivity and adaptive capacity**3. Impact assessment:**

- estimating the possible additional burden of climate- sensitive diseases due to climate change
- describing the risks of health outcomes, including the most vulnerable groups and hotspots regions, may change over coming decades, irrespective of climate change.

4. Adaptation assessment:

- identifying and prioritize policies and programmes to address current and projected health risks
- identify additional public health and health-care policies and programmes to deal with future burden
- identify resources for implementation and potential barriers to be addressed
- estimating the costs of action and of inaction to protect health

5. Establishing monitoring and management plan for the health risks of climate change

Framework of Vulnerability and Adaptation Assessment

Source: Adopted from WHO report (2013). "Protecting health from Climate Change: Vulnerability and Adaptation Assessment"

Measuring vulnerability using indicator-based approach

The most common method of measuring vulnerability is the approach of using indicators which act as proxies for the multi- dimensional impacts associated with vulnerability. Indicators are 'quantitative measures intended to represent a characteristic or a parameter of a system of interest using a single value (Cutter et al., 2006).

A vulnerability indicator can be defined as a representation of a characteristic or quality of a system able to provide information regarding the exposure, susceptibility, coping capacity and resilience of an element at risk to an impact like extreme weather event such as flood, cyclone and drought etc.

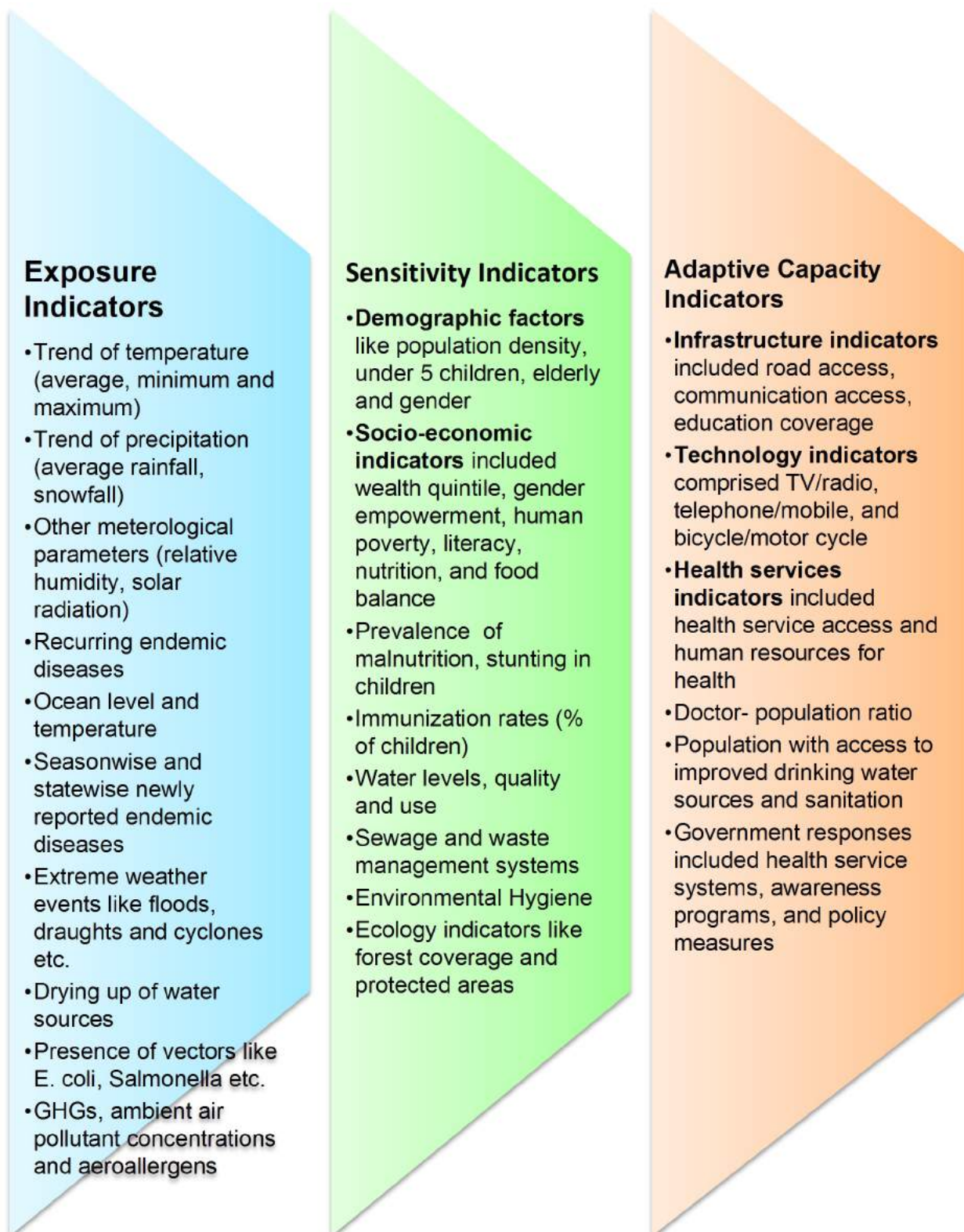
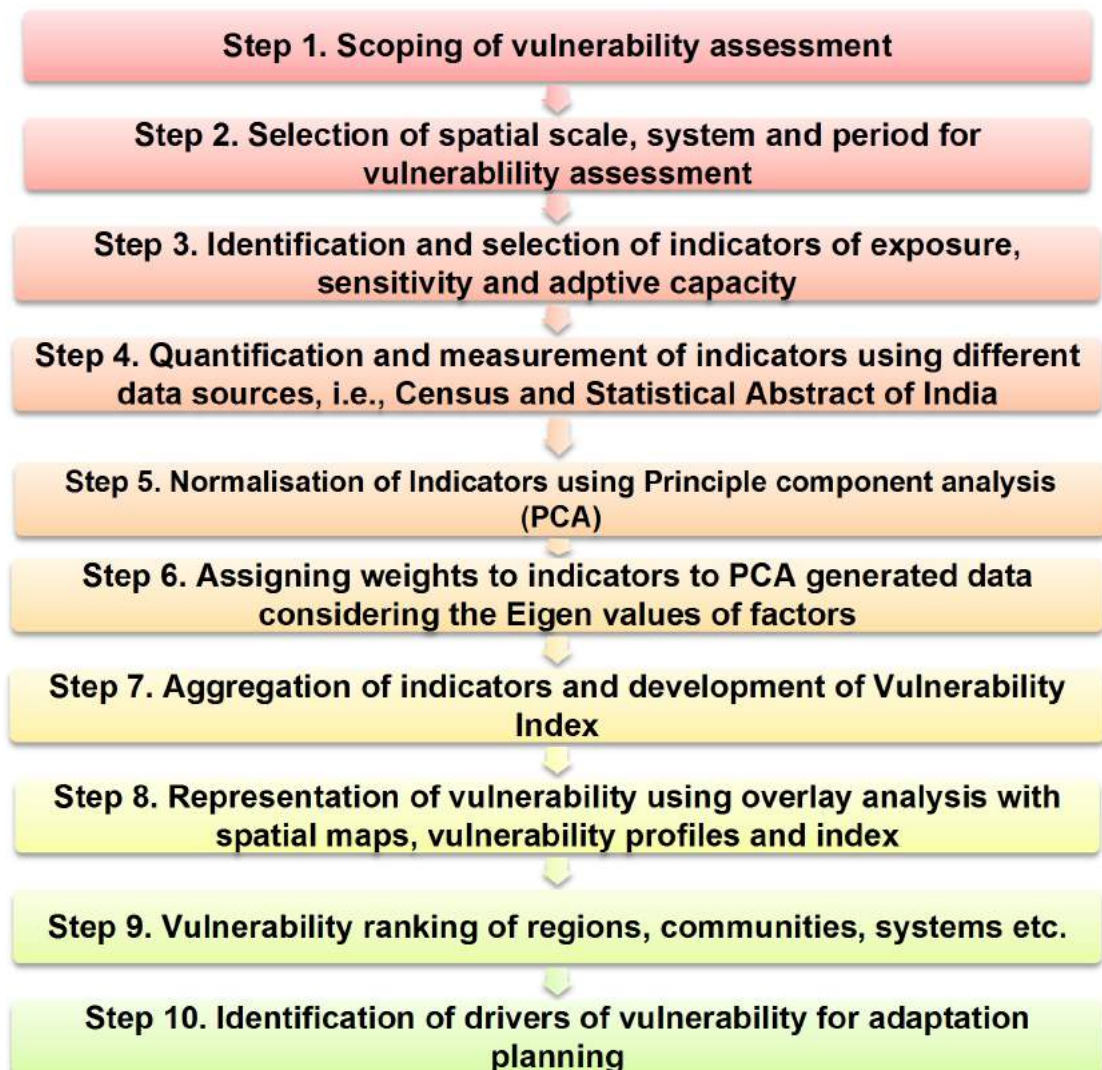


Figure **5**
Indicators comprising the exposure, sensitivity and adaptive capacity functions of vulnerability assessment

Steps for computation of Vulnerability Index (VI)



Why normalisation of indicators?

The process of construction of vulnerability index involves normalisation of all the indicators. Indicators identified for assessment have different units of measurement so they cannot be added or aggregated without normalisation. Normalisation is done based on the functional relationship of an indicator to climate variability. If an indicator has negative functional relationship, then vulnerability increases with decrease in the value of the indicator. Similarly, if an indicator has a positive functional relationship, then vulnerability increases with increase in the value of the indicator.

Three indices for **sensitivity**, **exposure** and **adaptive capacity** were constructed by obtaining a weighted mean of the identified indicators. The three indices were then averaged (with differential weights) to obtain the **vulnerability index**, higher values of the index indicates higher vulnerability and lower values lower vulnerability. This is helpful in targeting and prioritization of regions and groups for adaptation.

Hotspots identification

The health impacts of climate sensitive diseases varies over spatial and temporal scales, and changes further with environmental and socio- economic conditions with possibilities to increase in incidence or their geographical range. This requires capacity building within and outside health sector to identify increased risks and to effectively manage and prepare for the future.

Climate hotspot is an area which is most vulnerable in facing the adverse impacts of global climate change.

Identifying the region most at risk for climate change impact on health

Climate change based health impacts can be traced to certain geographical regions with extreme temperatures which are more prone to the deleterious effects of climate change such as people living on flood plains, small catchments, or on coastlines are at risk from floods and storms.

Hotspots identification helps in reducing the casualties from climate- sensitive diseases and to take steps to adapt to or mitigate climate change impacts on the health of the people. Approaches will need to be tailored as per region- specific circumstances, geography, and preparedness, but the World Bank emphasizes a “climate smart” strategy that aims to improve the health system, as well as those systems that mediate a good part of the health impact of climate change such as access to energy and clean water, and urban development.

Geo- climatic parameters for hotspot identification:

Rainfall, relative humidity, temperature, weather disasters- floods, cyclones, storms, draught, vectors, water availability and air quality.

	DIRECT IMPACTS		ECOSYSTEM-MEDIATED			HUMAN INSTITUTION-MEDIATED
	HEAT AND COLD	FLOODS AND STORMS	VECTOR-BORNE DISEASE	FOOD AND WATERBORNE INFECTION	AIR QUALITY	UNDERNUTRITION
Geographies of greatest impact	Lower latitudes	Low-lying areas/ flood plains	Tropics—variable by disease	Tropics	SE Asia	Sub-Saharan Africa
	Cities	Coasts	Dengue: South American cities	Subtropics	Cities	East Asia and Pacific
	South Asia	Tropics	Leishmaniasis: desert	SE Asia	India	Latin America
	Sub-Saharan Africa	Asia	Encephalitis: Europe, Russia, Mongolia, China	Low-lying areas	China	Sahel
		Africa	Upland mountains with population pressure	Food insecure regions	Pakistan	Conflict zones
		Central/South America		Cholera—SE Asia	Sub-Saharan Africa household pollution	Upland mountains with population pressures
		Atolls				

Figure 6:
Geographic correlations to climate-sensitive health impacts.

Source: Adapted from Geographic Hotspots for World Bank Action on Climate Change and Health

For instance, vulnerability of climate change with child health was studied. We used ranking based on:

a) the vulnerability index of agriculture to climate change, developed by the Government of India's National Initiative on Climate Resilient Agriculture (NICRA) this index is a relative measure of risk between districts and

b) the child health index based on key childhood health outcomes, such as stunting, wasting, underweight, anaemia and diarrhoea in population.

The child health index was created using Principal Component Analysis (PCA) based on district level survey data from National Family Health Survey (NFHS-4) 2015/16 (and on district boundaries of 2011 National census). The index was based on the weighted mean of various factors known to influence child health and the weights were determined using PCA explaining at least 80% of the variations (Under peer review).

The hotspots identified under this are shown in the figure below:

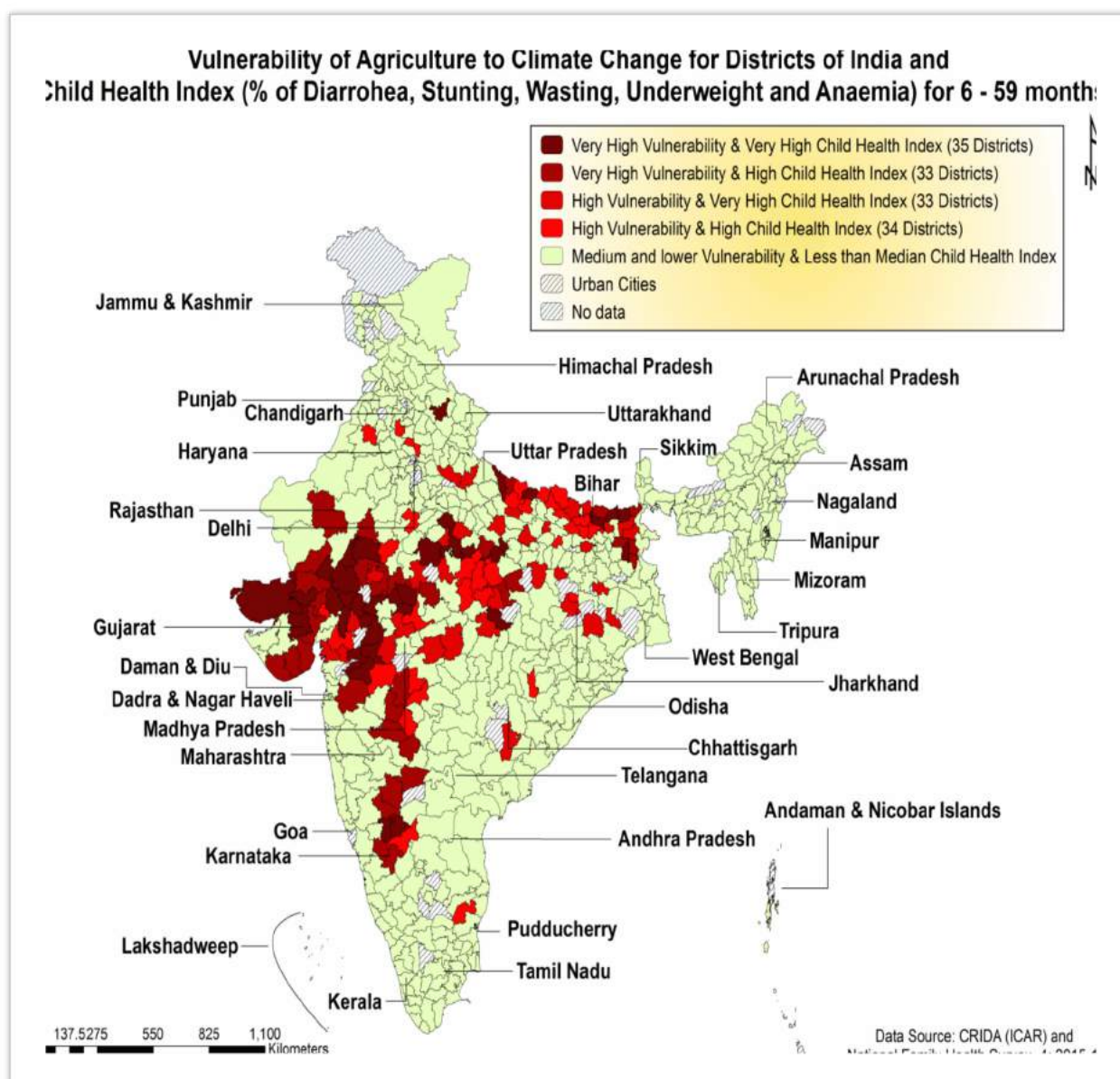


Figure
Hotspots identification of child health outcomes across India

Health Planning and Information System

Health Planning and development of digital information system helps to address environment, climate and health challenges through synchronized planning, managing and designing response.

A spatial plan would address common environment linked features to reduce risks to health, thereby, reducing illness and health cost to individuals and government.

Spatial mapping initiative would help Departments to communicate in real time, build collective action and political coalition.

This spatial plan and digital information system is a proposed action based on the challenges faced today in the environment. It will help health and family welfare officials, municipal departments, representatives of the skill development department and other governments departments to enhance health sector response through knowledge generation and skill development.

Key features critical for health departments in this spatial (digital) dash board are the following:

1. Allow network analysis of breeding sites, water logging areas, flood and cyclone prone area mapping, water pipe lines and location of healthcare facilities
2. Digital Applications for uploading information and interactions with patients, particularly for cold wave and heat stress; vector, water and food- borne disease
3. Messaging/ alert system to relevant health and non- health sectors
4. Generation critical reports for various levels of the government functionaries and decision support tools

Knowledge thus generated would be directed to facilitate development and spatially present a set of health determining infrastructural features. Essentially, would be targeted to facilitate equity in health determining living conditions. The initial phase of the spatial plan would focus on mapping:

- a) Living environment, **particularly housing features** (slum dwellings) and **population characteristics** (migrant population)
- b) Sewage network and **cyclone/ flood prone areas for prompting health protective actions** such as measures against leptospirosis (disease related to rat urine)
- c) Determine **vulnerable population** associated with factors such as low lying (flood prone areas), and breeding sites (example for malaria, rodents)
- d) Spatially locate **prevalence of cases of** – malaria, dengue, leptospirosis etc.
- e) Determine and spatially locate **economic burden of health costs** to government for malaria and leptospirosis to promote engineering solutions
- f) **Social cost** of environment linked illnesses, example of loss of workdays and school days

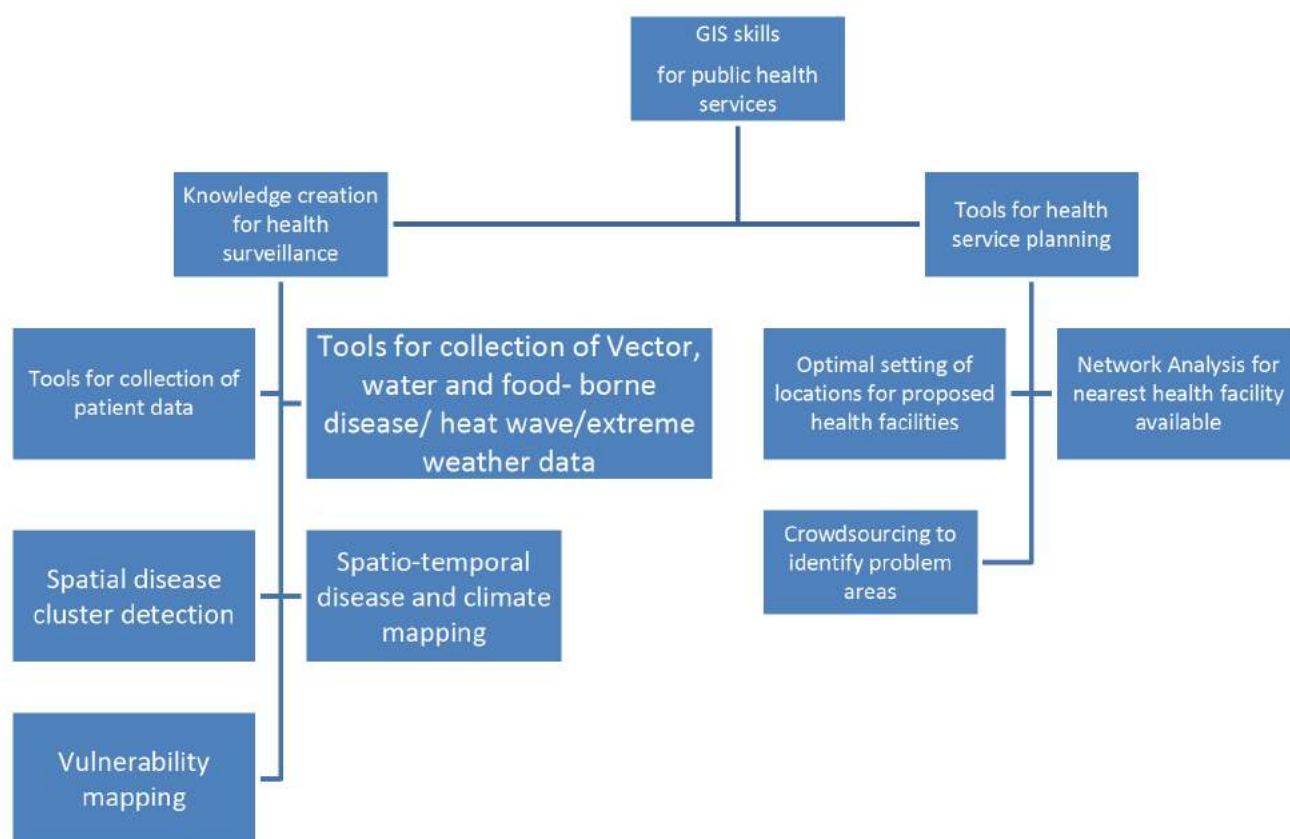


Figure 8:
Framework for health information system integrating health and climate parameters with spatial mapping

The Google based skill enhancing platform with both static and dynamic components for health adaptation to environment challenges can be developed with the following features:

1. Visualizing ward (smallest administrative unit) based patient level spatial information.
2. Location of breeding sites (interactive ward level map)
3. Vulnerability Maps- area elevation, flood risk, ward boundaries, migration etc.
4. Location of existing health facilities (interactive ward level map)
5. Inbuilt spatial features for decision for action to reduce health risk
6. Digital Apps for patient and theme specific data collection
7. Generate reports (graphs pies, etc.) and to generate messages/ reminders for patients, and health departments.
8. Platform for health functionaries to report water-logging sites/ breeding sites via sharing location.

The digital platform could be expanded in the future to enhance safety, and for transforming public space for adding features for sustainable development.

Organizational framework for Stakeholders involvement

The responsibility for implementation of the National Action Plan for Climate Change and Human Health (NAPCCHH) lies with the Ministry of Health and Family Welfare (MoHF&W), which is the main nodal agency.

Ministry of Health and Family Welfare (MoHF&W) plays a vital role :

- reorienting health sector to play a catalytic role in promoting climate and health issues in all sectors ;
- incorporate in Health Policy and strategy ;
- bring related initiatives with MoHF&W under one umbrella
- multi- sectoral action plans for NCD, Nutrition, Malaria, HIV/AIDS, Alcohol, Tobacco use to include climate and health – Health Impact Assessment, Health Lens Assessment, Health Equity Assessment
- technical expertise, evidence & facilitation
- proactively use (i) inter-ministerial (ii) inter-sectoral platforms and mechanisms for collaboration

National level

The overall responsibilities will be with the Secretary (MoHFW), Secretary (DHR) and DG, ICMR and the Director General Health Services (DGHS). The specific responsibility will be with the Environmental Health Division of the MoHFW, a separate and independent cell needs to be created for ensuring implementation, monitoring, supervision & evaluation of the NAPCCH related activities at healthcare settings in the country in coordination with other stake holder government departments of Government of India and states/ UTs. (Draft NAPCCHH report, 2016)

State level

Directorate of Health Services (DHS) of the state will be the implementing agency for state action plans. DHS will create an Environmental Health Cell within directorate and will identify a Public Health Expert of the rank of Deputy Director as the Nodal Officer. The cell will coordinate with the Centre for execution of state action plan.

District level

At District level office of the District Medical/ Health Officer will oversee the implementation in the district. The Medical Officer will be the nodal officer for all the activities.

Health Facility level

At the health facility, the responsibility for implementation will lie with the Medical Officer (Incharge) of the facility. The existing machinery of NHM will be utilised for the related activities. The Rogi Kalyan Samiti (RKS) would be reviewing and monitoring implementation at the health facility level.

Potential Partners

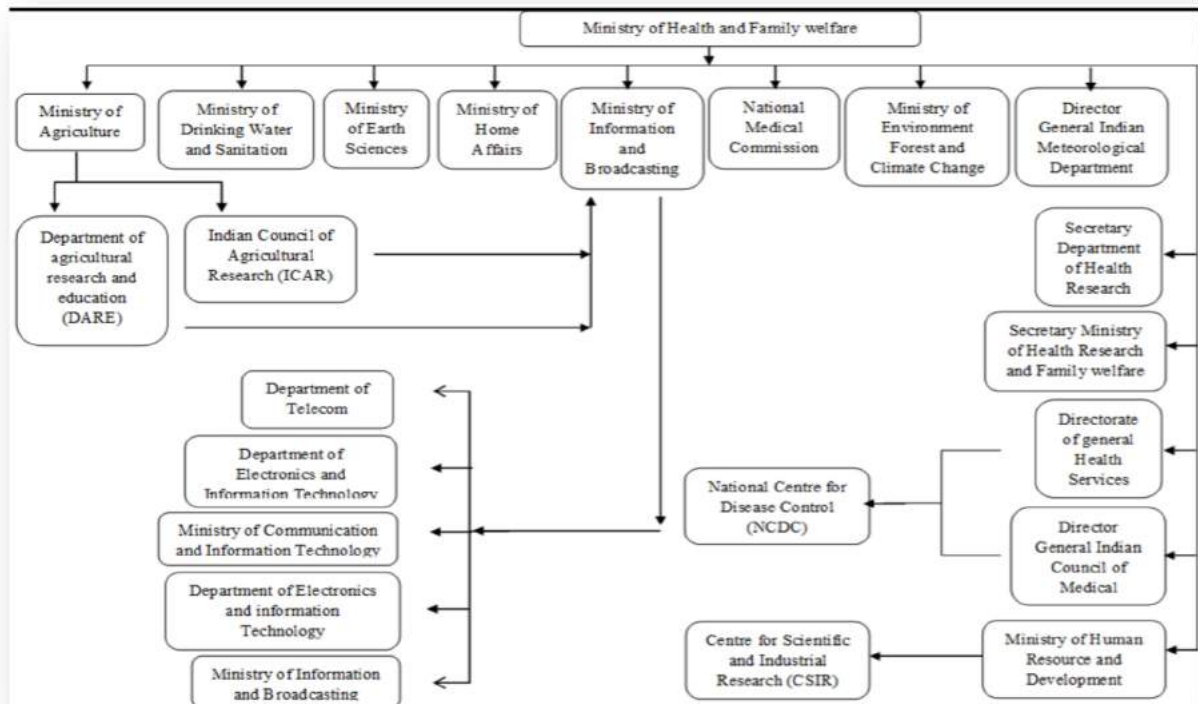
Table 2 List of stakeholders with defined roles and responsibilities

Ministry/Department	Action for health

Ministry/Department	Action for health
Ministry of Women and Child Development	Supplementary nutrition in early stages of life (to vulnerable pregnant, lactating mothers, and infants), vitamin supplement tablets
Ministry of Food Processing Industries	Fortification of processed foods—milk, milk products, flour with Iron, vitamin A and D
Ministry of Agriculture and Farmers Welfare	Access and availability of affordable—grains and greens
Ministry of Drinking Water and Sanitation	Drinking water and sanitation to all households
Ministry of Environment, Forest and Climate Change	Early warning system for high-temperature alerts
Ministry of Earth Sciences	Weather and disaster advisories
Ministry of Petroleum and Natural Gas	Clean affordable cooking fuel and technology
Ministry of Law and Justice	Safety and security to all
Ministry of Health and Family Welfare	24 × 7 connectivity to free or affordable health care

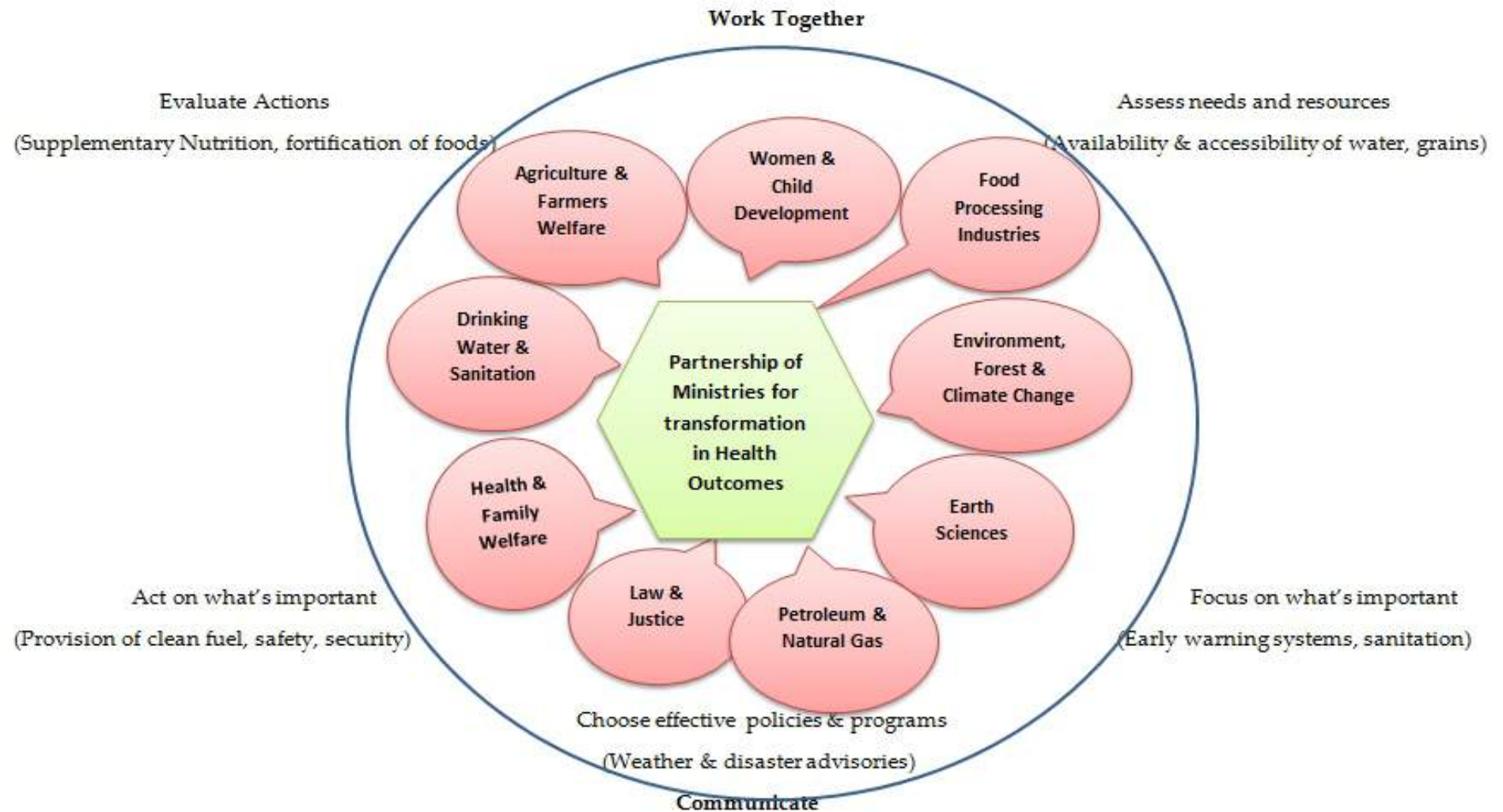
Table 3 List of nodal institutes for different climate- sensitive disease (CSD)

S. No.	Climate Sensitive Disease	Identified Nodal Institute
1	Vector Borne Diseases	National Institute of Malaria Research, New Delhi
2	Water Borne Diseases	National Institute of Cholera and Enteric Diseases, Kolkata
3	Food Borne Diseases	National Institute of Epidemiology, Chennai
4	Heat Stress	National Institute of Occupational Health, Ahmedabad
5	Air Pollution	School of Public Health, PGIMER, Chandigarh
6	Nutrition related problems	National Institute of Nutrition, Hyderabad
7	Zoonotic Diseases	National Centre for Disease Control, Delhi
8	Allergic Diseases	Patel Chest Institute, Delhi
9	Cardio-pulmonary Diseases	AIIMS, New Delhi
10	Mental Health support	National Institute of Mental Health and Neuroscience, Bangalore
11	Sea and coastal area health adaptation and mitigation plan	Jawaharlal Institute of Postgraduate Medical Education & Research (JIPMER), Puducherry
12	Hilly area Health Adaptation and Mitigation Plan	North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences (NEIGRIMS), Shillong.
13	Disasters management	National Institute of Disaster Management (NIDM)



9: Operational Co-ordination of stakeholders

Process cycle showing the partnership and decision-making processes



Adaptation Measures

Climate-sensitive illness can be addressed by establishing early warning systems and management plans for vector-borne disasters. In extreme climatic events, such as cyclones, community relocation in coastal areas with training of community members, improved weather forecasting can be life -saving. City planning to reduce the impact by conserving water bodies, building a green environment, adopting techniques such as passive cooling of a built environment would encompass all the domains.

Strategic actions should focus on:

- Reducing vulnerability via trained workforce, better infrastructure and surveillance systems
- Adaptation to climate change
- Governance and adaptation with policy reforms
- Cross- sectoral collaborations
- Capacity development in documenting trends, interventions, and evaluating effectiveness of interventions
- Climate resilient health programmes
- Emergency preparedness and management

Possible Activities

State level Strategies

- **Health care system strengthening:** Improved access through health care providers (especially in remote and tribal areas), mobile medical units, ratio of morbidity prevalence to care providers; allocation of funds in health care programmes would promote early treatment and timely referral.
- **Digital connectivity:** Digital connectivity and community of recipients with health care providers; particularly to support tracking of new mothers, mothers with children under 5-year of age, families of new born; for strengthening referral transport facility for improved access and availability to ensure better health outcomes.
- **Climate-sensitive disease-related resilience** to reduce health risks through
 - ✓ Development of early warning systems, disease forecasts
 - ✓ City/ community-specific preparedness plans
 - ✓ Adopt measures and methods to reduce effects of climate variability
 - ✓ Short term Development of “Early Warning Systems”

Nutrition security system

- **Access to nutrition dense food**
 - ✓ A ‘PDS-like’ system that includes pulses, millets, and sorghum
 - ✓ A ‘ PDS-extended’ system that ensures consumption of nutrition—dense produce—green leafy vegetables and fruits at subsidized prices
 - ✓ Direct transfer of benefits to the ‘poorest of poor’ families
- **Crop diversification** to fight food insecurity

- ✓ Through provision of high yielding seeds of nutrition dense grains, climate-resilient grains along with market incentives
- ✓ Minimum support price (MSP) for hardy nutritious grains
- ✓ Development of high yielding varieties of such C4 crops—millets and sorghum
- ✓ Government procurement of millets, sorghum, pulses
- **Mandating and expanding fortification** with iron and/or Vitamin A to a range of items
 - ✓ Salt
 - ✓ Packaged milk and milk products
 - ✓ Popularly consumed drinks and snacks, such as beverages, sauces, snacks made of fortified flour
- **Promoting nutritious consumption** through
 - ✓ Home stead gardens, and
 - ✓ Behaviour change education
- **Ensuring nutritious consumption from early years of life**, that is, first 1,000 days of life to have a strong foundation for later years of life.

Community-level strategies

- **Literacy rate women:** Increase in literacy rate, especially among women, is associated with significant drop in prevalence of underweight, stunting, and anaemia.
- **Environment conservation:** Enhancing green area conservation, water harvesting, safety, and security.
- **Sanitation and waste management:** Improved sanitation facility is likely to reduce the prevalence of underweight and anaemia in children.
- **Urban development:** To reduce effect of changing lifestyles through promotion of physical activity in rapidly urbanizing environment, health care access.

Family-level responsible action

- **Behaviour change communication:** For health protective actions, such as increasing awareness of weaning foods, diet diversification, health seeking, and active lifestyle.
- Raise taxes, age limit on alcohol, tobacco and other harmful products with occupational rehabilitation for liquor shopkeepers, drug dealers, cartel workers
- Maintain active suicide hotlines with trained workers
- Open up the public, educate them on common and region- specific mental disorders, learning difficulties remove taboos in urban as well as rural areas emphasizing the importance of early outreach and treatment

Short- term strategies

- Digital platforms for sharing geo- tagged disease prevalence data and information on climate related risks
- Establish early warning systems for vector borne diseases.

- Relocation centre for coastal and flood prone areas
- Launch campaigns timely health protective action for vector control and disease prevention at community level.
- Promoting measures like conserving and developing water bodies, building green space in urban areas.
- Promote risk reduction of population health during disasters through preparedness plans and relocation support.
- Provision of bed nets to reduce the incidences of malaria
- Undertaking measures for management of vector-borne and water-borne diseases
- Improvement in facilities to deal with physical and psychological impacts of post-extreme weather events
- Addressing food security and food-safety issues
- Inclusion of climate-change concerns in health policy
- Enhancing resilience of health institutions" infrastructure to meet demands of CC
- Awareness campaigns, sensitization of the health service providers (ANMs, ASHA, AYUSH, Doctors, AWW)
- Promoting health insurance for vulnerable groups
- Climate variation would lead to increased food shortage, which leads to malnutrition & food security problems
- Awareness of health and hygiene practices

Long- term strategies

- Develop strategies to improve nutritional status of vulnerable population
- Measures to manage water-borne diseases that have worsened due to climate change impacts
- Conduct research on various health indicators to study the pattern of impacts due to climate change
- Undertaking measures for management of vector-borne and water-borne diseases
- Improvement in facilities to deal with physical and psychological impacts of post-extreme weather events
- Awareness and capacity building of women and girl child on health and hygiene related issues
- Target and sensitize parents, teachers, adolescents, senior citizens in urban and rural areas and improve public access to certified scientific literature
- Emphasize community safety and security. Improvement in nutrition, quality of life, freedom of expression often causes significant improvement in mental health, vice-versa.
- Implement digital connectivity with health services and health care providers.

National Health Adaptation Plan For Climate Change Related Disasters

10 December 2019

NATIONAL INSTITUTE OF DISASTER MANAGEMENT
NEW DELHI

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List of Abbreviations

CCD	Climate Change related Disasters
NIDM	National Institute of Disaster Management
IMD	Indian Meteorological Department
IPCC	Intergovernmental Panel on Climate Change
NCDC	National Centre for Disease Control
NHAP	National Health Adaptation Plan
NGO	Non-Governmental Organizations
NDMA	National Disaster Management Authority
CECR	Centre of Excellence on Climate Resilience
PHC	Primary Health Centre
NDRF	National Disaster Response Force
DGHS	Directorate General of Health Services
MoHFW	Ministry of Health and Family Welfare
DHS	Directorate of Health Services
SDMA	State Disaster Management Authority
MoEFCC	Ministry of Environment Forest and Climate Change
DST	Department of Science and Technology
MoNew	Ministry of New and Renewable Resources
BIS	Bureau of Indian Standards
MoUD	Ministry of Urban Development
NIHFW	National Institute of Health and Family Welfare
NHSRC	National Health System Resources Centre
SIHFW	State Institute of Health and Family Welfare
CSO	Central Statistical Office
NIC	National Informatics Centre
ICSSR	Indian Council of Social Science Research
ICMR	Indian Council of Medical Research
CSIR	Council of Scientific and Industrial Research
UGC	University Grants Commission
EMR	Emergency Medical Response
RRT	Rapid Response Team
SDRF	State Disaster Response Force
WHO	World Health Organization
WASH	Water Sanitation and Hygiene
BMW	Bio Medical Waste
IPHS	Indian Public Health Standard
MIS	Management Information System
SOP	Standard Operating Procedures

1. BACKGROUND

The 21st century is witnessing the unprecedented challenges associated with climate change, and equally unprecedented integrated international action is needed to mitigate its effects. The Intergovernmental Panel on Climate Change (IPCC), has reported that anthropogenic activities have caused an increase of approximately 1.0°C in the global average surface temperature above pre-industrial levels, which is expected to increase to 1.5°C between 2030 and 2052, if current trends continue.¹

Along with global warming, rates of sea level rise have accelerated and frequency as well as intensity of tropical cyclones and precipitation have increased. The incidence of natural disasters is increasing, and almost 4.5 billion people have been affected by floods, droughts cyclones and extreme temperature events over the past 20 years.²

The Global Climate Risk Index 2020 places India as the 5th most climate change-affected country in the world, while her contribution to greenhouse gas emissions have been a fraction to that of the United States and China.³

As observed and was predicted by climatologists, the Indian subcontinent has witnessed a unanimous, yet uneven rise in mean surface temperature as well. This has resulted in more energy consumption and generation, and magnified the frequency and severity of climate change disasters. Over the past two decades, the nation has recorded significant anomalies in temperature variabilities, precipitation patterns and lethality of disasters.⁴

More than eighty percent of India's land mass is at multi-hazard risk and is vulnerable to disasters such as cyclones, floods, drought, heat waves and cold waves, as well as other localized hazards. Almost three fourth of the country's population resides in these areas, as a result, over 44 million people every year are affected by natural disasters.⁵ However, this figure is a likely underestimation as it does not take into account areas affected by urban flood, flash floods and the increasing peri-urban challenges emerging due to climate change.

Despite the functioning of national health programs, availability of health manpower and infrastructure to address the existing health problems of the country, India still grapples to cope with

¹ IPCC special report on Global warming of 1.5°C. 2018

² CRED-EMDAT-UNSIDR. Economic Losses, Poverty and Disasters 1998-2017

³Global Climate Risk Index 2020.

⁴Mishra A (2014) An Assessment of Climate Change-Natural Disaster Linkage in Indian Context. J Geol Geosci 3: 167. doi: 10.4172/2329- 6755.1000167

⁵Gupta, Anil K. and Nair, Sreeja S. (2012). Environmental Extremes Disaster Risk Management – Addressing Climate change. National Institute of Disaster Management, New Delhi.

the dual burden of communicable and non-communicable diseases. Climate change is expected to further increase the incidence of natural disasters and its associated diseases.

Identifying this critical gap in the current health scenario, the Centre for Excellence on Climate Resilience at NIDM has prepared the National Health Adaptation Plan (NHAP) for Climate Change related Disasters (CCD) to enable the development of resilient health services, help institutions strengthen their preparedness and capacity to address these issues, and mitigate the effects of climate change related disasters.

APPROACH AND METHODOLOGY

An expert group committee was formed with representation from various stakeholders from the sectors of health, academia, disaster management, environment, climate change, agriculture, water sanitation, rural and urban development, industry, medical institutions, private sector and Non-Governmental Organizations (NGOs). Extensive literature review was done, analyzing existing global adaptation plans and policies. A participatory approach was adopted and a national level consultation was conducted, where key program managers from all the states and Union Territories (UTs), representatives from the World Health Organization (WHO) and other NGOs, public and private sectors were invited for deliberations. Subsequently, four regional consultations were held to capture all region specific issues. The NHAP was thus formulated to serve as a guidepost for policy makers and program managers in addressing and adapting to health problems associated with climate change related disasters.

2. GOALS AND OBJECTIVES

Goal:

Development of resilient health services and systems to mitigate and manage the health effects of climate change related disasters.

Objectives:

1. To identify and assess health hazards and vulnerabilities associated with climate change related disasters.
2. To recommend appropriate measures for prevention, mitigation and preparedness to deal with climate change related health risks.
3. To build human resource capacity through policy planning, advocacy, research, training and education and knowledge management.
4. To provide a roadmap and action points for stakeholders with clearly defined roles, responsibilities and timelines.

3. HAZARD-RISK, VULNERABILITY AND CAPACITY GAPS

A. HAZARD - RISK

A **hazard** is defined as any process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation; while **risk** is a measure of the expected losses (deaths, injuries, property, economic activity etc.) due to a hazard of a particular magnitude occurring in a given area over a specific time period.⁶

Floods, droughts, cyclones, earthquakes and landslides have been recurrent phenomena in the history of the Indian sub-continent. About 60% of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclones and 68% of the area is susceptible to drought.

However whether the hazard constitutes a disaster or not depends on the risk or potential for losses involved in the affected area. According to the Disaster Management Act, 2005, a **disaster** is defined as “a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of property, or damage to, or degradation of environment and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.”⁷

India has been experiencing an increasing number of climate change related natural disasters, resulting in extensive loss of lives, livelihoods, the environment and economy. During Kerala floods of 2018, almost 5.4 million people were affected⁸; while Cyclone Fani in Orissa affected almost 16.5 million people. These two disasters led to a total loss and damages of almost 5 billion USD.⁹

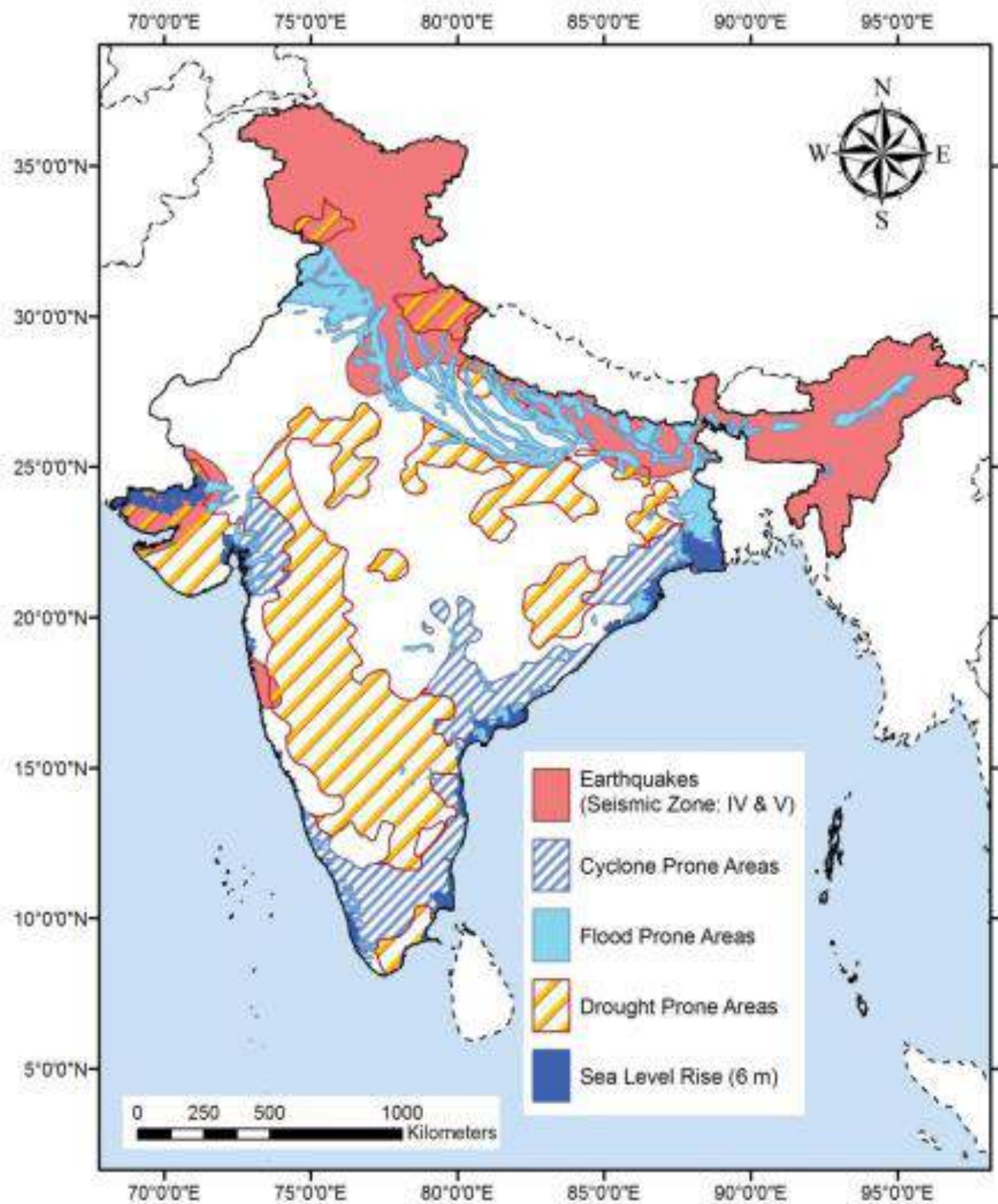
Figure 1 shows the various hazard prone zones of the country.

⁶ NIDM. Handbook for Nodal Officers on Disaster Management.

⁷ Disaster Management Act, Government of India 2005

⁸ Post Disaster Needs Assessment-Kerala. Government of Kerala, 2018

⁹ Cyclone Fani- Damage, Loss and need Assessment, 2019, Government of Orissa



Figures reproduced from (Geomatics, Natural Hazards and Risk, Mapping disaster vulnerability in India using analytical hierarchy process Anusheema Chakrabortya & P.K. Joshi, 2014).

B. VULNERABILITY

The IPCC defines vulnerability as ‘the susceptibility of human and environmental systems that are likely to experience harm or damage from the exposure to stresses and from the absence of capacity to adapt’. It is also understood as “the characteristics of a person or group and their situation that influences their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard.”

Vulnerabilities are independent of exposure and are inherent characteristics of each community. A community can be vulnerable to health effects of climate change and natural disasters owing to its geographic location, socio-demographic composition, economic and environmental resources to name a few. It is therefore imperative to understand and define vulnerability in a local, state and region-specific context, as immense variation in each domain exists between region to region.

i) Environmental Vulnerability: The landscape, natural resources, ecology, geographic location of a community determines its environmental vulnerability. Development at the cost of exploitation and degradation of the environment, and depletion of natural resources renders the community more vulnerable to the effects of climate change. Also, areas where there is existing water scarcity, and depletion of ground water reserves are more vulnerable.

ii) Physical (structural) vulnerability: Remoteness of location, materials used for construction of buildings, faulty site or building designs, population density, connectivity with hospitals with bridges and roadways, etc determine the physical vulnerability of a community.

iii) Socio-economic vulnerability: This is determined by an interplay of social factors such as poverty, overcrowding, illiteracy, lack of access to healthcare, social inequity; as well as cultural and ideological factors such as patriarchy, gender inequity, decision making authorities, and values of basic human rights. The economic status of the country, community and individual also determines the level of vulnerability, as it directly affects their capacity to build sturdy buildings, use technological and engineering advances, or provide for remedial measures following disruption. The poorer the individual, the more exposed and vulnerable they are to their surroundings

iv) Systemic vulnerability: This refers to vulnerabilities that are inherent in social institutions and systems. These vulnerabilities are often linked to existing economic and political structures or systems operating at regional, national or international levels. Poor implementation of policies and programs, lack of intersectoral co-ordination contribute to systemic vulnerabilities.

It is estimated that with her current vulnerabilities, India stands to incur great economic losses as a result of climate change. States like Chhattisgarh, Madhya Pradesh, Rajasthan, Uttar Pradesh and Maharashtra will be amongst the severely affected states, owing to their existing economic vulnerabilities.

CAPACITY GAPS

The **capacity** of any organization, community or society is defined as the combination of all the strengths, attributes and resources available within it, to manage and reduce disaster risks and strengthen resilience.

The presence of functional health infrastructure, trained health manpower, uninterrupted drug and logistic supplies, robust disease surveillance mechanisms, and existence of disaster preparedness plans are all strengths of the community. They constitute critical components of the community's capacity to deal with climate change and related disasters. Any lacunae in the above constitute capacity gaps which increase the risk and vulnerabilities of the community and are avenues that require strengthening while adapting to climate change.

The state of health infrastructure has marked variations in the country, with an unequitable distribution of resources. While two thirds of the Indian population lives in rural areas, health facilities, doctors and infrastructure is concentrated more in the urban areas. The health services available in the rural areas often fail to meet the Indian Public Health Standards and challenges such as unavailability of health manpower, inadequate infrastructure, lack of basic amenities such as water sanitation and hygiene are common woes.

While different states have their own set of challenges and burden of diseases, the states such as Bihar, Uttar Pradesh Jharkhand, Madhya Pradesh, Jharkhand and Odisha, where the burden of diseases such as malnutrition are high, provision of safe Water, Sanitation and Hygiene (WaSH) are a challenge, the quality of health services are poor due to inadequate infrastructure, logistics and scarcity of health manpower, are more vulnerable than others to the impact of climate change.

3. HEALTH IMPLICATIONS OF CLIMATE CHANGE AND RELATED DISASTERS

1. Heat Stress:

The rise in temperatures consequent to climate change has resulted in extreme heat being witnessed in summers, with temperatures reaching higher than 50 degrees C in some parts of India.

This results in heat stress and heat stroke related symptoms such as fatigue, headache, fainting episodes, and dehydration to name a few. Exposure to temperature extremes and heat waves affects the working capacity of people, and can cause kidney failure, liver failure, cardiovascular and respiratory diseases on long-term exposure. The elderly, undernourished and people with underlying organic illnesses are more prone to mortality, which is known to rise during heat waves.

Role and Responsibilities: *As heat waves affect major cities and industrial townships and to some extent rural areas, its prevention and management should be looked after by the directorate of health services of all states and center.*

2. Vector Borne Diseases:

Precipitation that is scattered, intense and untimely provide more favorable conditions for vector breeding than usual. Temperature changes also favor vector longevity and thriving, as well as the multiplication of the microorganisms within their vectors, such as Malaria, Dengue and Chikungunya.

Role and Responsibilities *The prevention and management of vector borne diseases requires integrated approach from various departments. However, the health impacts are handled primarily by Directorate of National Vector borne disease control programme at the central level and at the state level all municipalities play a significant role in its prevention.*

3. Zoonosis

Certain zoonosis that are rodent-borne such as leptospirosis, viral hemorrhagic diseases and tularemia; have an epidemic potential following flooding. Diseases such as Lyme disease, Hantavirus pulmonary syndrome and tick borne encephalitis, which are transmitted through ticks and rodents, are also associated with variations in the climate.

Role and Responsibilities: *The Division of Zoonotic Disease Programmes under National Centre for Disease Control is responsible for management at the centre level. But there is a need for coordination with veterinary and animal husbandry department at all levels.*

4. Water and food-borne diseases:

With the change in mean temperatures, survival time of disease-causing microbes also changes. Change in rainfall patterns, leaching of chemicals and pathogens into ground water following heavy rains, and increased occurrence of natural disasters also result in contamination of water sources. In areas where water supply and sanitation are already compromised, climate change can further affect the availability and quality of water. All these factors could result in an increase in the occurrence of water and food borne illnesses such as Diarrhea, Dysentery, Cholera, etc.

Role and Responsibilities National Water and Sanitation Programme provides adequate and safe water supply in rural and urban development. Management of all diseases is looked after by Directorate of Health Services at state level and Directorate General of Health Services at the Centre level.

5. Respiratory tract and cardiovascular disorders:

The morbidity from chronic respiratory diseases such as Asthma, Chronic Obstructive Pulmonary Disease (COPD) and bronchitis among others, has steadily been rising over the decades, and reflect the state of air pollution in the environment. Chronic respiratory diseases are in-fact, the third largest contributor to mortality, and also becoming some of the costliest illnesses to treat. Temperature extremes and natural disasters are known factors that precipitate cardiovascular diseases like myocardial infarctions and strokes.

Consequent to climate change and increasing temperatures, more and more secondary pollutants are produced such as ozone and particulates. It is predicted that the increased production of these aeroallergens will further precipitate respiratory allergies, increase the episodes of exacerbations of asthma and COPD, as well as result in higher cardio-respiratory mortality.

Role and Responsibilities: Management of all diseases related to respiratory tract and cardiovascular disorders by Directorate of Health Services at state level and Directorate General Health Services at centre level. There is also National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke.

6. Malnutrition:

India is among the largest contributors to global malnutrition. Changes in temperature and precipitation patterns also impact the crop harvest, and can ultimately reduce the world's food production. Crop failure and scarcity of food availability to the poor would aggravate the problem of malnutrition. Several reports have stated that those suffering from malnutrition will be amongst the population most vulnerable to the effects of climate change. Malnourished children and adults have weaker immunity, and simple infections, allergens, trauma or stresses can get complicated and have life-threatening consequences.

Role and Responsibilities: The Department of Women and Child development under Integrated Child Development Services runs the Mid-day meal programme for school going children for prevention and control of malnutrition. Management of the condition is done by DGHS at centre level and DHS at the state level. There also needs to be a synergy with the Department of Food and Public Distribution.

7. Mental disorders:

Emotional stress and impaired mental health consequent to effects of climate change, increased morbidity, physical ill-health, socio-economic and demographic disruptions is a domain that is often underestimated and neglected. The increased frequency and intensity of natural disasters such as floods, cyclones and droughts, along with the scarcity of food and water result in loss of lives,

disruption of families, migration, resettlement, damage to property and loss of livelihood. All these are known precipitating factors for mental illnesses that are predicted to rise with time.

Role and Responsibilities: *The National Mental Health programme run by DGHS at the centre level works towards prevention and management of mental disorders. They should also have action groups to handle mental disorders related to climate change and post disasters.*

8. Injuries:

According to an EM-DAT review, more than 760,000 people have lost their lives, 2 million have been injured and 2 billion have been affected by natural disasters over the past 10 years. While the largest proportion of mortality and injuries post disaster are contributed by earthquakes, it is estimated that climate related disasters such as floods, storms and cyclones have a less than 10% rate of injury. The incidences of animal, insect and snake bites, as well as scorpion stings are reported to increase during disasters like floods which result in disruption of their natural habitat and increased man-animal interaction.

Role and Responsibilities: *The injuries are managed by DHS at state level and Emergency Medical Response division of Ministry of Health and Family Welfare at the Centre level. These are however handled immediately by National Disaster Response Force during and post the disasters.*

9. Occupational health:

Climate change has the potential to impact occupational health of workers both directly and indirectly, resulting in lack of concentration, increased incidence of injuries, stress, heat/ cold exposure, increased workplace violence and reduced productivity. Particularly vulnerable are those workers whose occupations involve exposure to extreme weather conditions and intense physical activities outdoors such as laborers, construction workers, military and para military workers, rickshaw pullers, etc. Post disasters, rescue and relief workers are also at increased risk of occupational injuries and diseases as unprecedented risks may arise due to climate change.

Role and Responsibilities: *The Ministry of Labour & Employment should formulate a plan to handle occupational health problems due to Climate Change and Disasters in collaboration with MoHFW.*

10. Epidemics and Outbreaks

Post disasters, the threat and occurrence of epidemics of water and food borne illnesses, as well as vector borne diseases is known to occur. Common diseases include outbreaks of diarrhoeal diseases, cholera, hepatitis A, food poisoning, malaria, dengue and chikungunya. In the immediate post disaster relief phase, overcrowding in camps and health facilities can precipitate outbreaks of illnesses like acute respiratory infections and measles.

Role and Responsibilities: *These are mainly managed by NCDC at centre level and DHS at state level. In urban areas, it's the municipality which handles the preparedness for epidemics and outbreaks.*

Different disasters can be linked with different health implications, which are summarized in Table 1.

Table 1. Health implications associated with different types of climate change related disasters.

Common Climate / Weather Extremes and Disasters		Health Implications
<u>Primary</u>	<u>Secondary</u>	
Heavy Rainfall	Floods	Injuries, water borne diseases, vector borne diseases, death, drowning, hypothermia, and animal bites
	- Flash floods - Urban floods	Indirect (infected wounds, complications of injury, poisoning, poor mental health, communicable diseases, and starvation)
Dry spells / Low Rainfall	Landslides/slope failures	high mortality and few injuries: trauma and suffocation by entrapment
	- Drought - Desertification	Nutrition-related, Dust-related and airborne, migration-related
	Forest fire	
Oceanic storms	Cyclones	Trauma, Drowning, Injuries, gastroenteritis, vector-borne disease and acute respiratory illness.
Winds	Dust storms / Sand storms	Respiratory problems, eye problems.
	Thunderstorms	Injuries, Thunderstorm asthma.
Temperature extremes	Air Pollution	Respiratory Disorders, Cardiovascular Disorders, Ophthalmic Disorders
	Heat wave	Dehydration, Heat cramps, Heat stroke; accelerated respiratory disease & cardiovascular disease
	Cold wave	Heart attacks, Injuries, frost nip and frost bite, Hypothermia, immersion foot, influenza, Norovirus, Asthma, Sore throats
	Fires (urban, rural, industrial)	Burns, Mortality, wheezing, coughing, sore eyes, respiratory issues, heat induced illnesses, Carbon Monoxide poisoning
Lightening	Lightening disaster	Mortality, Injury, Burn, Disability

5. REGION SPECIFIC ISSUES AND OPPORTUNITIES

NORTH REGION

States Included: Jammu & Kashmir, Himachal Pradesh, Punjab, Uttarakhand, Uttar Pradesh and Haryana

General Climatic Profile:

The North region of the country has a tropical climate with severe summers alternating with cold winters when the temperatures touch freezing points. Due to extreme the heat over summer months, the northern region draws moist winds causing summer or south-west monsoons. These monsoons contribute to 75% of annual rain over a period of four months (June to September), affecting the Indian climate very significantly. Any variability in the rainfall during this period in turn affects the water resources, power generation, agriculture, disease-pattern and ecosystems in the country. Winter season starts early in December and goes on till February for most of the areas in Northern regions, extending even till mid-march for areas at higher altitudes. Maximum temperatures rise sharply exceeding 45 °C by the end of May and early June resulting in harsh summers in the region. Decrease in humidity levels and clear skies over most parts of north India after mid-October are characteristics features of autumn season.

Demography:

- Uttar Pradesh is the most populous state of India with estimated population of 199,812,341 in 2011.
- Followed by Punjab and Haryana in the northern region with population of 27,743,338 and 25,351,462 respectively. Jammu and Kashmir, Uttarakhand and Himachal Pradesh follow further with populations of 12,541,302, 10,086,292 and 6,864,602.
- The National Capital Region of Delhi alone has a population of 16,787,941.
- The state of Himachal Pradesh has the highest share of rural population (89.97%) in India.
- While the NCR Delhi region has the country's most urban population, almost 97.50%.

General Disaster Profile:

- Major part of Jammu and Kashmir and Himachal Pradesh is a cold desert.
- In the states of J & K, Himachal Pradesh, Uttarakhand and Western Uttar Pradesh, most of the area falls in Seismic Zone IV for earthquakes, and some area even in Zone V, while the remaining states fall in Zone III.
- The states of Uttar Pradesh and Punjab are prone to floods.
- There are also drought prone areas in Uttarakhand and western J& K.

Regional Issues:

- Sudden and more frequent extreme hot and cold events.
- It has been observed that the amount of rainfall hasn't significantly increased but the wet days are lesser, with greater intensity of rainfall in a shorter period, creating flood-like situations in the region. The rainy season has even shifted now, starting in mid-July till late September, instead of June till September earlier.
- In the event of displacement after disasters, there are often areas of complete isolation. Sometimes, there is even complete collapse of health services.
- There is lack of co-ordination between departments, in terms of timely information sharing.
- The provisions pertaining to occupational health are limited to certain big industries, while there isn't proper check on small set ups.
- There is limited research available in Indian Context.
- Industrialised areas of Northern India like Delhi, Lucknow, Kanpur, Chandigarh, Baddi and Jammu have seen a rampant urbanisation, increasing the pressure on all sectors.
- There was a history of outbreaks of Japanese Encephalitis in eastern region of the country but in the past few years there have been incidents of disease even in Northern region, taking the health sector by a storm.
- There is also need of vulnerability mapping for diseases, disasters and seasonality of both, for better preparedness of both the system as well the individuals.
- It has also been observed that there is an increase in the deaths due to snake bites after floods, because of closer contact between human and animal population after disasters. Health system is often not prepared for such events with proper inventory.
- The number of vector borne disease cases have risen significantly in the past few years like dengue, chikungunya and malaria.
- The mortality and morbidity data available right now is hospital based, while there is a need to have more population based data for getting an actual picture of the level of disease in the population.
- There are limited facilities available at the primary health care level, increasing the burden over tertiary care facilities.
- The facilities that are already available are not adequately utilised.

SOUTH REGION

States Included:

Telangana, Karnataka, Andhra Pradesh, Tamil Nadu and Kerala

General Climatic Profile:

The Southern region of the country has a tropical climate. In coastal areas there is little difference between the summer and winter temperature. April and May are the hottest months of the year. During the summers temperature shoots up to 40 degrees centigrade and above. Coastal regions too get hot and humid during these months while in the plateau region, summers are cooler though. Nights, however, are cool and sea breeze that sets in during the afternoons bring the much-needed comfort to the people. Winter falls in the month of November and continues till February, although these months are not too cold. June to September is the time of the rainy season brought about by the southwest monsoon that dominates the climate of the region. Humidity, however, increases during the period and rainfalls can continue for a couple of days at a stretch.

Demography:

- Tamil Nadu is the most populated state of southern region with estimated population of 72,147,030 in 2011.
- Followed by Karnataka and Andhra Pradesh with population of 61,095,297 and 49,576,777 respectively. Telangana and Kerala follow further with populations of 35,004,000 and 33,406,061.
- The states of Tamil Nadu and Kerala have almost equal distribution of urban and rural population.
- While the states of Karnataka, Andhra Pradesh and Telangana have almost 60% rural population and 40% urban population.

General Disaster Profile:

- The states of Kerala, Tamil Nadu as well as the coastal regions of Telangana and Andhra Pradesh are prone to cyclones.
- Major region of Karnataka, Andhra Pradesh, Southern Telangana as well as Southern region of Tamil Nadu are severely affected by drought.
- The coastal regions are also prone to coastal flooding. Even some internal areas in Karnataka and Andhra Pradesh are also prone to flooding.
- In the past few years, many incidents of heat waves have been seen in the region.

Regional Issues:

- There has been increase in flood incidents in Kerala and Tamil Nadu. Incidents of cloud burst and heat waves have also been seen in Telangana. Also, drought in south and central Karnataka.
- Prolonged periods of increase in temperature has been seen in many areas.
- Rainfall peak events have increased. Coastline erosion has also been observed but more data is needed in this context.
- Severe cyclones in Andaman & Nicobar Islands have significantly damaged the coral reef cover.
- The temperature and sea level are constantly rising, affecting the ecosystems significantly. This in turn affects the sea catch and thus the nutrition of coastal population.
- Wind speed changes affect the spread of infectious agents causing the diseases.
- Increase in the cases of vector borne diseases in the past few years like malaria, dengue, chikungunya etc.
- Morbidity data for many diseases is missing, while hospital based mortality data is present.
- Even non-communicable diseases incidence and severity is affected in the event of disasters due to hindrances in the supply chain of medicines.
- There is also an increase in injuries and violence against the vulnerable populations' post-disasters.
- Occupational health of industrial workers is affected due to changing temperatures, making them take longer and more frequent breaks during the day and at the same time increasing the hours of late-night shifts.
- Accessibility to health care facilities and health workers is also decreased due to extreme weather events.
- Due to effect of disasters on animals, predators come in close contact with humans, causing loss of life.

EASTERN REGION

States Included:

Bihar, West Bengal, Jharkhand, Odisha and Chhattisgarh.

General Climatic Profile:

The climate of eastern region varies from tropical in Bihar, Jharkhand and Northern West Bengal to sub-tropical in Southern West Bengal, Odisha and Chhattisgarh. Spatial pattern of trends in the mean annual temperature shows significant increasing trends in all states except in Bihar where decreasing trends have been observed. The eastern coastal areas of Odisha and West Bengal are highly vulnerable to tropical cyclones. Rainfall is decreasing over most parts of the country during the pre-monsoon season. However during the post-monsoon season, rainfall is increasing for almost all regions.

Demography:

- Bihar is the most populated state in the region with a population of 104,099,452 in 2011.
- Closely followed by West Bengal with population of 91,276,115 people.
- Odisha, Jharkhand and Chhattisgarh have populations of 41,974,218, 32,988,134 and 25,545,198 respectively.
- Bihar and Odisha are 2 states having significantly large share of rural population i.e., 88.71% and 83.31%.
- Other states in the region too have a rural population of more than 68.13%.

General Disaster Profile:

- Major areas of Bihar and West Bengal are prone to floods.
- The southern West Bengal area and eastern Odisha are prone to Tropical Cyclones.
- There are many drought prone areas in Odisha, West Bengal, Jharkhand and even Bihar.
- Extreme Northern Bihar falls in seismic zone V and West Bengal fall in seismic zone 1V

Regional Issues:

- The region now sees longer summers, more intense heat waves and diminished winters.
- There are floods every year in state of Bihar and West Bengal.
- In the recent years, the number of cyclones in the coastal areas has risen significantly.
- The cases of diseases like Dengue, Malaria and Chikungunya are common in the region.
- Lack of coordination among different disasters.
- During floods and cyclones, there is often close contact with wild animals.
- Now the cases of Scrub Typhus disease are being seen in urban areas in West Bengal as well, which were limited to rural areas earlier.
- Vector borne diseases are spreading to even hilly areas, where these were not found earlier.

WESTERN REGION

States Included: Gujarat, Rajasthan, Madhya Pradesh, Maharashtra and Goa

General Climatic Profile:

The Western region has a predominantly coastal climate because of the Arabian Sea and the Gulf of Kutch. Many areas the west exhibit high day-time and low night-time temperatures during pre-monsoon season. The range of the daytime maximum and night-time minimum temperatures is found more than 15 °C at some places. Maximum temperatures rise sharply exceeding 45 °C by the end of May and early June resulting in harsh summers in the region. The days and night are hot and humid during the summer season. Monsoon strikes in July and lasts till September. The state of Rajasthan has an arid climate due to Thar Desert in the area. In the states of Gujarat and Rajasthan significant decrease in the mean annual temperature trends are observed unlike the rest of the country showing an increasing trend. From October onwards, the climate becomes cool.

Demography:

- Maharashtra is the second most populated state of India with estimated population of 112,374,333 in 2011.
- Followed by Madhya Pradesh, Rajasthan and Gujarat in the western region with population of 72,626,809, 68,548,437 and 60,439,692 respectively.
- Goa is the least populated state in the region with the population of 1,458,545.
- Rajasthan has 75.13% and Madhya Pradesh has 72.37% rural population.
- Gujarat and Maharashtra have 57.40% and 54.78% rural population.
- Goa has more urban population rather than rural of 62.17%.

General Disaster Profile:

- Most of the area in Rajasthan and adjacent area of Gujarat is a hot desert.
- The South-Eastern area of Gujarat and Western Maharashtra and Madhya Pradesh are prone to cyclones, and floods.
- The state of Rajasthan has highest occurrences of drought. The adjoining Gujarat Region which mostly belongs to semi-arid climate also experiences high incidences of drought.
- Cases of droughts have been observed in Maharashtra as well.
- Western most part of Gujarat State is in seismic zone V, followed by Zone IV in adjacent region as well as a small region in western Maharashtra.
- Most of the western region is in seismic zone II with some outlining area of all western states in zone III.

Regional Issues:

- The summers have now become longer with higher temperatures. While the winter season has become shorter.
- There have been incidences of floods and coastal floods in the region, even Rajasthan.
- The heat wave cases in Gujarat, Rajasthan and Madhya Pradesh have become more intense and frequent in the recent years.
- Due to changing climate, there have been rising cases of Crimean-Congo Haemorrhagic Fever, Swine flu, zika virus, malaria, respiratory infections, dengue and leptospirosis.
- The incidence of vector borne diseases has also gone up.
- There are even issues related to shortage of human resources that is properly trained for handling emergency situations.
- Health Infrastructure is not resilient enough to withstand the effect of climate disasters.
- Due to climate change, even food production is going down.

NORTH EASTERN REGION

States Included: Assam, Sikkim, Meghalaya, Tripura, Manipur, Mizoram, Nagaland and Arunachal Pradesh

General Climatic Profile:

Lying very close to the Tropics, North-East India displays, to a large extent, the character of tropical climate, especially in the valleys. The region has a monsoon climate with heavy to very heavy rains, confined within four summer months from June to September. The southwest monsoon is the main source of rain, and June is the rainiest month. There are three seasons in the area, winter, summer and rainy season, though rainy season, as in the rest of India, coincides with summer months. There is a climatic contrast between the valleys and the mountainous region. While the mean January temperature in the valley region of Assam is around 16 °C, the temperatures in the mountainous region of Arunachal Pradesh and Nagaland hover around a maximum of 14 °C and a sub-zero minimum temperature. The summer temperatures in the plains vary between 30 and 33 °C, while the hills have a mean summer temperature of around 20 °C with a mean minimum of 15 °C. No part of North-East India receives rainfall below 1,000 mm. Shillong plateau with its southern limit marked by a 1,200-m-high scarp overlooking the Bangladesh plain receives very heavy rains. Cherrapunji, situated on the top of the scarp, receives a mean annual rainfall of 11,465 mm. About 90 % of the rain is received during the southwest summer monsoon, and June is by far the rainiest month.

Demography:

- Assam is the most populated state of North-eastern with estimated population of 31,205,576 in 2011.
- Followed by Tripura, Meghalaya, Manipur and Nagaland with population of 3,673,917, 2,966,889, 2,855,794 and 1,978,502 respectively.
- The states of Arunachal Pradesh and Mizoram share the least population burden in the region with populations of 1,383,727 and 1,097,206.
- Assam, Meghalaya and Arunachal Pradesh have greater rural population of 85.90%, 79.93% and 77.06%.
- The states of Sikkim, Tripura, Nagaland and Manipur also have above 70% rural population.
- While Mizoram has almost equal rural and urban population, 47.89%: 52.11%.

General Disaster Profile:

- The state of Assam has a large area prone to floods.
- In the states of J & K, Himachal Pradesh, Uttarakhand and Western Uttar Pradesh, most of the area falls in Seismic Zone IV for earthquakes, and some area even in Zone V, while the remaining states fall in Zone III.

- All the states in the region fall in Zone V seismic zone for earthquakes with very high vulnerability, except Sikkim that falls in Zone IV of seismic activity.
- Even hailstorms are frequent in the state of Assam.

Regional Issues:

- The region has warmed significantly over the last decade. Both the minimum temperature and maximum temperature in all states of the region is constantly rising, making the surface air warmer.
- The region has been receiving lesser rainfall since past few years. The number of wet days is decreasing while the intensity of rainfall is increasing.
- Mosquito-borne diseases, including malaria, Japanese encephalitis (JE), lymphatic filariasis and dengue, are major public health concerns in the north-eastern states.
- Since a decade, Chikungunya has been emerging in this region.
- Even Scrub Typhus has re-emerged in hilly areas of the region.
- There is a lack of reliable data available on existing health situation.
- The facilities that are already available are not adequately utilised.

Opportunities: The participatory consultation and analysis of the regional issues has resulted in bringing forth several opportunities for filling the capacity gaps in the health system. These are:

➤ **Policy interventions:**

- Regulations to create a synergy between public and private healthcare sectors are needed.
- Regulations and guidelines for post disaster waste management, including BMW are needed.
- Intersectoral coordination between the environment / climate change department, disaster management department and the health sector institutions should be encouraged.
- Regular meetings should be held, among all stakeholders, to address forthcoming season specific risks.
- A district level health plan for climate change should be made. It may be linked to the mission mode like Swachh-bharat mission, etc.

➤ **Infrastructure- Related:**

- All health care facilities should be made disaster resilient.
- Eco- Friendly infrastructures for all facilities should be encouraged.
- Town planning guidelines should be laid down to ensure provision of green corridors, green health care systems.
- Annual evaluation of health system infrastructure should be done.
- The rural areas need better and more accessible public-healthcare facilities.

➤ **Capacity Building**

- Periodic preparedness drills should be done to make sure all health professionals, support staff and other stake holders know their roles and duties.
- Quality research should be encouraged to better utilise local resources and technologies for every region.
- Persons with high occupational vulnerability to extreme weather conditions should have flexible working hours.
- Awareness workshops and trainings should be arranged regularly for the keeping the health professionals updated with latest knowledge.
- The competence of grassroots workers regarding management of health situations during emergencies should be enhanced.
- There is a need for inclusion of climate change and its health implications in the school and college curriculum for better sensitization of the youth.
- Data consciousness should be inculcated at all levels of the health system and academic programs, so that better data is available for knowledge development.
- There is a need for professionals who can interpret meteorological data and warnings in terms of their health implications.

➤ **Community-centric approaches**

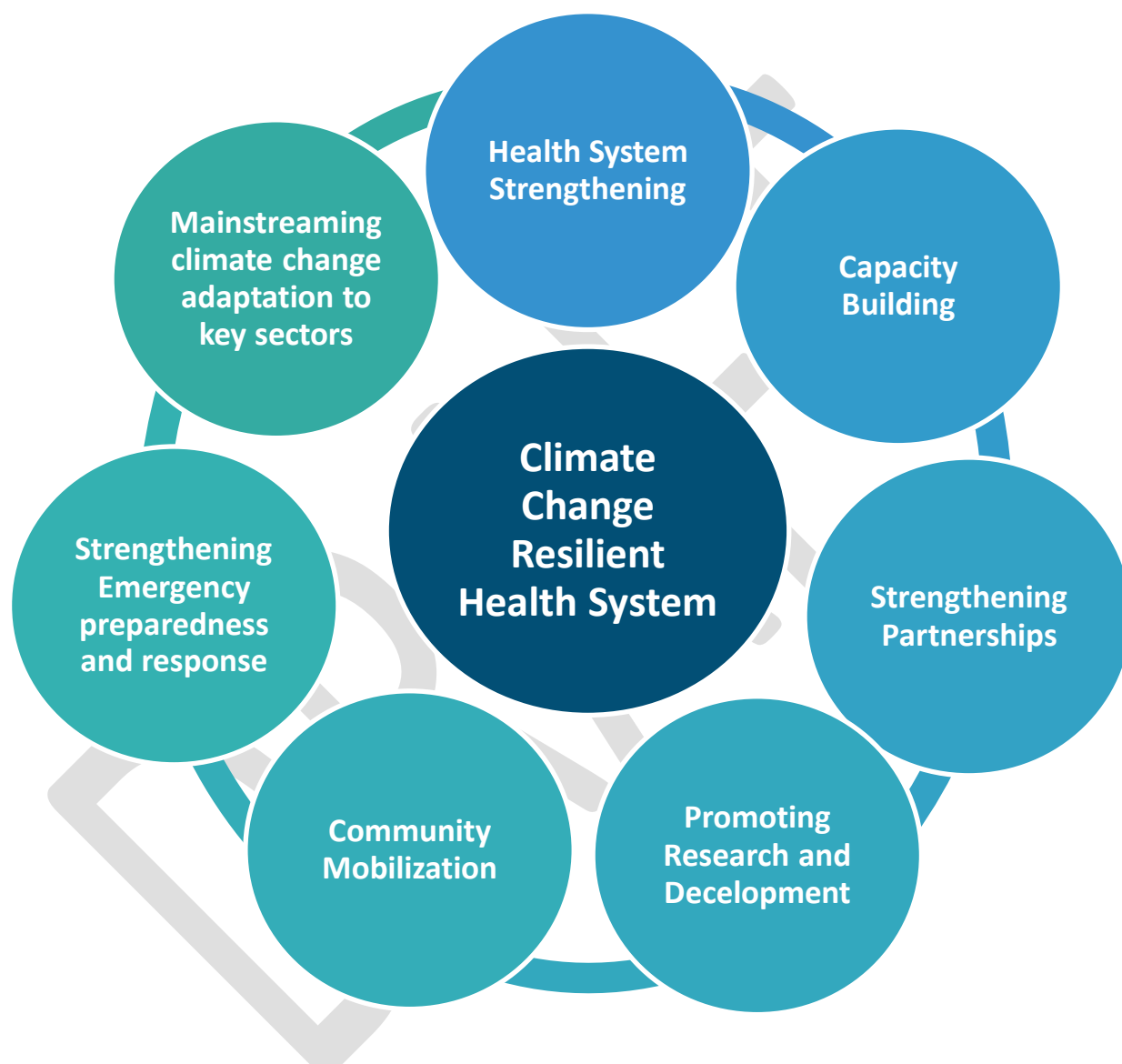
- Community champions can be selected from amongst the community for capacity building to support health response during disasters. Health volunteering among local communities should be encouraged.
- The Tamil Nadu Government offers a scheme where tribals are given incentives to catch and remove venom from snakes before the rainy season so that in case of contact with the animal post disaster, the mortality can be brought down. The venom removed is then sent to different laboratories to make anti venoms. Similar programmes can be adopted by other states to encourage community participation.
- Social media platform can be used for information dissemination related to upcoming disasters and diseases in the region.

➤ **Others**

- Resources that are already available should be used more efficiently.
- The central public procurement system for medical inventory should be strengthened at state, district and even block level in all states for emergency response.
- More human resource engagements can be made at grassroots level to collect and disseminate information better.
- There is a need for better data sharing through official portals for reliability.
- Better investment has to be done in disaster management and healthcare system strengthening.

6. ADAPTATION STRATEGIES

The NHAP proposes a seven-pronged strategic approach to achieve its goal of developing a climate change resilient health system:



In the next section, interventions are proposed that will enable the implementation of these strategies, and these are classified as structural and non-structural health-risk mitigation measures. Further, disaster specific interventions and strategies are presented for enhancing adaptation and preparedness towards heat and cold waves, floods and droughts.

7. MEASURES FOR HEALTH RISK MITIGATION

The implementation of the resilience and adaptation include both structural and non-structural approaches. The structural measures for health risk mitigation include engineering centric approaches that involve improvised construction technology, material design, fitting and fixtures and efficient use of technology. The non-structural measures include improvements in the policy environment, plans and procedures, human resource capacity, effective co-ordination, education, research and development, and inclusiveness.

STRUCTURAL MEASURES FOR HEALTH RISK MITIGATION

1. Safe and resilient health care facilities at all levels

The Pan American Health Organization (PAHO) and the World Health Organisation (WHO) have defined: “a Safe Hospital as one that will not collapse in disasters, killing patients and staff; can continue to function and provide its services as a critical community facility when it is most needed; is organised, with contingency plans in place and health workforce trained to keep the network operational.”¹⁰ The NDMA has developed and released guidelines in 2016 for making health care facilities “safe” and disaster resilient.¹¹ These guidelines need to be disseminated to administrators for retrofitting of the health infrastructure buildings; and for planners and programmers to ensure these guidelines are incorporated in the development of new buildings. Administrators need to ensure that audit of the physical infrastructure of the health facilities is done regularly, and that the building codes, bylaws under municipal acts are not compromised. (Annexure 1)

2. Promoting climate resilient subset facilities

A health care facility is comprised of several subset facilities like Water Sanitation and Hygiene (WaSH), electricity, biomedical waste (BMW) management, transportation and kitchen services are critical to the functioning of the health system.

Health care facilities need to develop resilience to climate sensitive disasters by strengthening all these aspects, specially WaSH standards. In the absence of WaSH, health centres can themselves become source of infections like diarrhoea, cholera, and other food borne and respiratory infections. WaSH facilities need to have a buffer for increased service utilization expected during outbreaks, disasters and other emergencies. (Annexure 2)

¹⁰ Safe Hospitals in Emergencies and Disasters: Structural, Non-structural and Functional Indicators. World Health Organisation (WHO)

¹¹ National Disaster Management Guidelines: Hospital Safety. A publication of the National Disaster Management Authority, Government of India. 2016. ISBN: 978-93-84792-03-9

A disaster it is likely to disrupt the electricity supply for proper functioning of basic facilities like hospitals. Efforts have to be made to use appropriate engineering measures, equipment and materials to build power supply systems that can withstand any disaster and recover within a short time frame.

Adequate BMW management during and post disaster is also critical, however there is a lacunae in the guidelines regarding the same. During a disaster the usual mechanism of biomedical waste handling and management may not function. Ideally, manual collection with the use of appropriate PPE (Personal protective Equipment), segregation, and disposal at properly engineered sanitary landfill under controlled management should continue. However, if controlled disposal or sanitary landfills are compromised, an intermediate, temporary storing site should be pre-identified.

During disasters kitchen services are often most vulnerable and are susceptible to disruption due to shortage of food, water and other essential input supplies. Keeping a minimum few-weeks stockpile of basic food supply and non-perishable food items is an effective way for ensuring functionality of hospital kitchens during emergency.

Effective communication during disasters can help in directing patients to appropriate health facilities, alerting hospitals, other facilities about the inflow of patients or sharing important information. This would require a well-established communication network, connected to regional/state disaster management and public healthcare agencies, and can function despite compromise in power facilities.

NON-STRUCTURAL MEASURES FOR RISK MITIGATION

1. Development of guidelines and SoPS for safe and resilient health care facilities

While the NDMA has released hospital safety standard guidelines, primarily focussing on making health facilities resilient to disasters like earthquakes, due consideration needs to be given to make the facilities resilient even to climate change related disasters, such as heat and cold waves, floods and droughts. The building bylaws proposed by the Indian Public Health System (IPHS) need to be upgraded to adapt to the changing scenario of climate risks and region specific vulnerabilities.¹²

¹² DGHS. MoHFW. Indian Public Health Standards (Iphs) Guidelines for Sub-Centres, PHCs, CHCs and DHs. Revised 2012

2. Capacity building of health personnel and allied sectors

Capacity building and sensitization of medical and para-medical professionals is necessary at all levels- from policy makers and administrators at the top to doctors, nurses and even the grassroots workers like ASHA and anganwadi workers- towards the health implications of climate change and its related disorders.

Medical professionals need to be trained in recognizing and managing climate sensitive diseases, like heat strokes, and adequately notifying them to the concerned authorities.

Medical officers at the district and state level also need to be trained regarding the optimal use of IDSP data for the interpretation of climate sensitive diseases to ensure timely action for their control and prevention.

Sensitization of two other sectors is critical to successfully building the capacity of the health system- these include the private health sector and the AYUSH practitioners. Integrations with the private sector, including private clinics, nursing homes and hospitals; and practitioners of systems of indigenous medicine like AYUSH is important to develop and implement a holistic adaptation plan.

3. Strengthening database and MIS

In the current scenario, there are multiple sources of data regarding various environmental parameters, such as temperature, water, and air; data on the population and demography and also from the health sector. There is a need to integrate the systems to develop a common database that serves as an important policy and decision making tool. The role of the District Information Office (DIO) should be strengthened in context of integrating data from environment, health and disaster sectors.

Monitoring of trends of climate sensitive illnesses can facilitate efficient logistic management by health institutions, as they can budget for and procure drugs, vaccines and other consumables as per the increased requirement.

The IDSP, launched in 2005, has given a boost to the nation's surveillance and monitoring mechanisms. It has facilitated data collection and reporting of diseases of public health importance and increased the sensitivity and response to outbreak-prone communicable diseases. However, challenges of completeness, timeliness and accuracy of reporting still remain. The strengthening of IDSP is critical to adaptation and preparedness towards the health effects of climate change related disasters. As the IDSP already provides data on water and vector borne illnesses, its scope may also be expanded to include diseases prone to heat and cold stresses as well.

The health facilities need to strengthen their surveillance systems to monitor food, air and water quality, vector breeding, malnutrition and other risk factors and behaviors, which make the community more vulnerable to the effects of climate change related disasters.

4. Promoting resource efficiency

Despite the advent of renewable sources of energy, and availability of subsidies, some traditional practices like burning of bio-mass as an energy source, or dependence on coal for power generation are still practiced. For the sake of development and expansion of construction, large areas of the limited forest reserves in urban and peri-urban areas continue to be degraded and uprooted.

The health systems need to transition to more sustainable and environment-friendly alternatives and promote the use of renewable energy, water conservation measures and practices . Better resource consumption patterns need to be adopted as an important measure for adapting to climate change.

5. Encouraging research and development on health and climate change

Since most of the predicted health impact of climate change are forecasted on the basis of modelling techniques from different sources of data, the local effects of climate change are not so well documented or understood. Little information is available on the extent of damage caused by climate change, its associated disasters and quantification of impact at the community level and further research is warranted in the field.

Research will help generate evidence from strategies and interventions that help increase the adaptive capacity at the micro level, and can be replicated as successful models in similar communities.

Further, training and knowledge sharing, dissemination of the research findings, case studies and vulnerability assessments is an important component of developing a resilient health system.

6. Enhancing health emergency response

The focus of current emergency response strategies is either on the normal health challenges or on saving life and property. The effective response for aggravated health challenges and epidemics still remains a gap area. As the frequency and intensity of climate related disasters in increasing, the health emergency response services, and the rapid response teams need to strengthen their capacities for responding to the disasters.

7. Building community resilience

The community is the most important stakeholder facing the impact of climate change, and also has the power to be prepared for and mitigate its effects. One of the most important interventions is to educate the community and generate awareness among the population regarding the basic concepts of climate change related disasters, and its possible impact. They need to be empowered with methods to prepare themselves for disasters associated with climate change, and at the same time adopt measures to decrease their own carbon emissions. Health adaptation is incomplete without adaptation by the community, and therefore mobilization of the community for climate change is of paramount importance.

Few interventions that could help generate awareness among the community include:

- Community mobilization with the help of ASHA workers and ANMs, to impart knowledge about climate change through interpersonal communication with patients.
- Demonstrations on disaster preparedness and mock drills in the community.
- Training of community volunteers in first aid and rescue, as the first responders after a disaster are generally members of the community itself.
- Use of folk tales, street plays and camp approaches, and use of mass communication techniques during VHND.
- Conducting demonstrations during village meets on sustainable practices and alternative lifestyles with lower carbon footprint.
- Promoting health care seeking behaviour, and enhancing awareness about climate sensitive diseases.
- Involving the community in surveillance of diseases and early reporting.
- Promoting the use local and traditional medicine systems
- Promoting measures to safeguard the environment and mitigate the impact of climate change.

8. Sensitization of pharmaceutical and biomedical industry

During epidemics and disasters, the demand for medicines, drugs, vaccines and other logistics increases manifold. In the absence of efficient warning systems, or improper planning, situations can worsen if the health system is under-stocked with essential medications. Not only is the situation of the victims and patients in disasters and epidemics aggravated, but discontinuity of basic essential services such as safe delivery, supply of anti-hypertensives, oral hypo-glycaemic agents, anti-tubercular drugs and other emergency services could worsen the disease outcomes for the community.

During disasters, access to medicine and logistics can be impaired as roadways and other transportation facilities are disrupted. Disruption of power sources could result in break in the cold chain and exposure of large quantities of vaccines and sensitive-drugs to damaging temperatures.

Therefore interventions such as demand forecasting, efficient inventory management, maintenance of buffer stock, and back-up cold chain equipment to mitigate these situations should be in place before hand.

Health facilities should also adopt and promote the use of approved indigenous and locally sourced drugs, medical equipment, products and therapeutic agents, as their cost and supply chain management can be more efficient in times disaster and emergencies.

9. Mainstreaming climate change related health resilience into key sectors

Health is affected by various physical, biological, social and environmental determinants, to name a few, hence the functioning of all sectors of development impacts the functioning of the health system as well. Climate change is a phenomenon that can disrupt the progress and development of all sectors, hence is imperative to integrate actions for mitigating its effects in sectoral development plans and policies. Sectors like water, energy, urban and rural development, all need to collaborate and adopt their roles in the NHAP to support the health sector.

DISASTER- SPECIFIC HEALTH MITIGATION MEASURES

Though many parts of the country are prone to multiple hazards, and mitigation strategies should be implemented in an integrated manner to ensure that the health system is prepared to deal with any type of disaster, in some areas, the health systems have disaster-specific lacunae. For the benefit of such facilities, the following disaster- specific mitigation measures are proposed:

1. HEAT AND COLD WAVES

STRATEGY	INTERVENTIONS
Heat wave vulnerability analysis and mapping	1.1 Data management and processing 1.2 Developing heat impact index 1.3 Developing heat risk maps
Early warning and communications	2.1 Forecast and issuance of heat alert and warning 2.2 Forecast and issuance of cold alert and warning
Developing and implementing mitigation and response plan	3.1 Enhancing mitigation measures in hospitals and health Centres. 3.2 Capturing data on heat and cold related illnesses 3.2 Coordination of mitigation and response Relief and rehabilitation
Enhancing community preparedness	4.1 Timely dissemination of prediction of heat and cold waves. 4.2 Information education communication activities on measures for the prevention of heat and cold related illnesses.
Capacity building of health professionals and health system	5.1 Training of medical and paramedical professionals in identification of heat and cold related illnesses. 5.2 Dissemination of SoPs for management of heat syncope, stroke, etc. 5.3 Emergency expansion plan for Civil Hospitals, Community Health Centres, PHCs, private health providers and schemes for mobile medical teams for post-disaster situation. 5.4 Listing of hospitals of Army, Govt. (both Centre and State) and private hospitals and nursing homes in each district. 5.5 Phone numbers of all these medical facilities should be available at District Control Room as well as in the State Emergency Operations Centre. 5.6 Prior reservation must be done, considering the hazard assessment and medicines like oxygen, saline water, OT and life-saving drugs should be kept ready. 5.7 Vacant post of doctors and Para medical staff should be filled in all the government hospitals in order to make available the required number of medical workers at the time of emergency.

2. FLOODS

STRATEGY	INTERVENTIONS
Forecasting & early warning	1.1 Early Warning and Communications
Flood prevention, preparedness and mitigation	2.1 Structural measures for health care facilities (building infrastructures etc.) 2.2 Non-Structural Measures 2.3 Rehabilitation and Maintenance 2.4 Medical Preparedness
Regulation and enforcement	3.1 Buildings bye laws in Flood Prone Areas 3.2 Survey of Flood Prone Areas 3.3 Coordination and Enforcement
Enhancing community preparedness & response coordination	4.1 Flood Education & Awareness for community preparedness 4.2 Emergency Search and Rescue 4.3 Emergency Relief Services/Camps 4.4 Role of the Corporate/ Public Sector 4.5 Providing Emergency Logistics & emergency Medical Response
Capacity building	5.1 Capacity Building of Professionals 5.2 Providing training & education 5.3 Research and development 5.4 Documentation

3. DROUGHTS

STRATEGY	INTERVENTIONS
Drought vulnerability mapping and assessment	1.1 Drought vulnerability mapping 1.2 Assessment of water storage facilities in drought-prone areas 1.3 Study change in vulnerability and risk under climate change scenarios
Monitoring and early warning	2.1 Preparing detailed advisories 2.2 Developing and monitoring composite index for key drought indices 2.3 Timely dissemination of warnings to all
Regulation and enforcement	3.1 Regular updation existing guidelines, regulation and policies 3.2 Updation of criteria and assessment methods for drought declaration
Enhancing community preparedness and response coordination	4.1 Building community based institutions 4.2 Provision for Financial instruments: crop insurance, relief fund etc 4.3 Encouraging community level drought mitigation plans 4.4 Adoption of water resource management strategies
Training and Capacity building	5.1 Training and capacity building program for drought management 5.2 Ensuring availability of qualified and experienced trainers 5.3 Conducting training programs for officials at various levels 5.4 Documentation of success stories of effective drought management 5.5 Promoting awareness about drought related mitigation measures/policies

4. CYCLONE

STRATEGY	INTERVENTIONS
Forecasting & early warning	1.1 Early Warning and Communications
Cyclone prevention, preparedness and mitigation	2.1 Structural measures for health care facilities (building infrastructures etc.) 2.2 Preventive Health Care in Cyclone Centres 2.3 Non-Structural Measures 2.4 Rehabilitation and Maintenance 2.5 Medical Preparedness
Regulation and enforcement	3.1 Buildings bye laws in Cyclone Prone/Coastal Areas 3.2 Survey of Cyclone Prone Areas 3.3 Health Implications for CRZ Notification 3.4 Coordination and Enforcement
Enhancing community preparedness & response coordination	4.1 Education & Awareness for coastal community preparedness 4.2 Awareness and Preparedness of Fishing Communities 4.3 Emergency Search and Rescue 4.4 Emergency Relief Services/Camps 4.5 Role of the Corporate/ Public Sector 4.6 Providing Emergency Logistics & emergency Medical Response
Capacity building	5.1 Capacity Building of Professionals 5.2 Providing training & education 5.3 Research and development 5.4 Documentation

8. ADAPTATION ROADMAP & IMPLEMENTATION OF NHAP-CCD

S. No.	INTERVENTIONS	INDICATORS	NODAL AGENCY	PARTNERING AGENCIES	STATE/UT Agency
1.	Safe and resilient health care facilities at all levels	1. Proportion of existing health facilities upgraded to “Disaster resilient Safe Health facilities.” (as per NDMA guidelines) 2. Number of new safe and resilient health facilities established. (according to IPHS and NDMA norms)	MoHFW	NDMA NIDM, MoAYUSH Medical institutions	DHS SDMA
2.	Promoting climate resilient subset facilities.	1. Proportion of health facilities equipped with: a) alternative power back up. b) WaSH facilities as per WHO standard. c) capacity to handle BWV during disaster. d) alternative telecommunication systems	MoHFW	MoEFCC, NDMA, NIDM, MoAYUSH	DHS SDMA, local administration
3.	Promoting resource efficiency	1. Proportion of health facilities with solar or other renewable energy source. 2. Proportion of green health facilities 3. Proportion of health facilities with rainwater harvesting.	MoEFCC	MoHFW, NDMA, NIDM, DST, MoAYUSH, MoNew and Renewable energy	DHS SDMA
4.	Development of guidelines and SoPS for safe and resilient health care facilities	1. Upgradation of IPHS guidelines 2. Development of model SoPs for resilient subset facilities	MoHFW	MoUD, BIS, NDMA	DHS
5.	Capacity building of medical and paramedical professionals and allied sectors	1. Proportion of policy makers, administrators, and health managers sensitized to climate change and health adaptation. 2. Proportion of medical and paramedical workers trained in management climate related illnesses.	NIDM	NIHFW NCDC MoAYUSH NHSRC Medical institutions	SIHFW Administrative training institutes, DHS

		3. Proportion of disaster management and environment professionals trained to integrate health adaptation issues of climate change. 4. Number of training programs held for target groups under indicators 1,2,3. 5. Number of training modules developed.			
6.	Strengthening database and MIS	1. Proportion of states and districts with integrated database and MIS. 2. Proportion of state and districts with trained manpower for integrated data management.	NCDC	NIC, NDMA NIDM, DGHS, DST, CSO, MoAYUSH	SDMA, DHS
7.	Encouraging research and development on health and climate change	1. Number of research projects related to climate change and health adaptation. 2. Number of institutions involved with research related to climate change and health. 3. Number of compendiums, case studies developed and research papers published related to climate change and health.	ICMR	DST, NIDM, UGC, CSIR, ICSSR, MoHFW, MoAYUSH, Medical Institutions	Medical Institutions
8.	Building community resilience	1. Proportion of ASHA workers and ANMs sensitized towards climate change and its health effects. 2. Number of community volunteers trained in developing health resilience. 3. Number of CBOs, NGOs and RWAs sensitized towards climate change and health effects.	MOHFW / DGHS	Mo Social justice and empowerment. MRD, MWCD, Dept. of school education	DHS, District administration
9.	Sensitizing pharmaceutical and biomedical industry	1. Number of sensitization sessions conducted for pharmaceutical and industrial organizations.	Dept. of Pharmaceutic als	NDMA, NIDM, DGHS, MoAYUSH	DHS
10.	Enhancing health emergency response	1. Proportion of RRTs at state and district level trained to manage health effects of climate change and related disasters.	MoHFW/ EMR	NDMA, NDRF, DGHS	RRT, DHS, SDMA, SDRF

11.	Mainstreaming climate change related health resilience into key sectors	1. Number of departments and ministries that have incorporated climate change and health related aspects in their program implementation plans.	MoHFW	MoEFCC, NDMA, NIDM, Jal Shakti, Power, MoRD, MoUD, MoAYUSH , Mo Road transport and highways	DHS SDMA

9. ANNEXURES

Annexure 1: Indicators for building safe and disaster-resilient health facilities.⁶

INDICATORS	DESCRIPTION
SITE AND ACCESSIBILITY	• Hazard resilient site • Building codes and hazard specific designs • Well connected through good road networks and transportation facilities • Alternate routes to the health facilities must be there
INTERNAL CIRCULATION AND INTEROPERABILITY	• Well defined zones within an health facilities emergency, ICU, Testing Labs, diagnostic units, OPDs, blood bank and OTs • Well defined zones for regional health hazards : malaria, • Identified areas (vacant or needed to be vacated) to be converted for patients in case of emergency.
EQUIPMENT AND SUPPLIES	• Well maintained inventory of equipment and supplies (medicines)
EMERGENCY SOP	• Emergency exit plans (floor-wise/building-wise) • Emergency plans for dealing with influx of patients/ limited resources.
LOGISTICS SYSTEM AND UTILITIES	• Well placed logistic support systems • Warehouse management • Supply Inventory
TRANSPORTATION AND COMMUNICATION SYSTEMS	• Well-equipped and adequate means of transportation • Back communication and IT systems (databases) • Early warnings including SMS • Coordinated management
HUMAN RESOURCES	• Assessing health risk to staff (doctor, nurses and others) and patients during emergency and ensuring their safety • Groups and committees responsible for responding and executing emergency plans at the health facility at all levels. • Training and capacity building of these groups
MONITORING AND EVALUATION	• Health surveillance facilities (monitoring disease outbreak pre and post disasters) • Post emergency need assessment

Annexure 2: Areas of intervention for climate resilient WaSH facilities. ¹³

INTERVENTIONS	DESCRIPTION
Backup arrangements	Water Power
Protective arrangements	Design and location of WASH facilities/supplies which are resilient to climate risk
WASH stockpiles	Drawing estimates of important WASH supplies and keeping stocks
Preventative maintenance	Well maintained and functional WASH equipment and facilities
Training	On WASH emergency response for all staff
Surge capacity	WASH personnel and team who can be mobilized during emergency
Overflow capacity	Capacity estimation and identification of areas that can be utilized for accommodating patient influx
Infection control readiness	Ensuring that hygiene protocols (hand washing, personal protective equipment, waste management etc.) are followed pre- and post- emergency
Coordination	Team and nodal team within health facility ensuring co-ordination of WASH facilities

¹³ Water, sanitation and hygiene in health care facilities. Status in low- and middle-income countries and way forward. WHO

Health Adaptation Plan for Cyclones

1. Risk Mapping for State or region wise mapping considering factors in epidemiologic triad

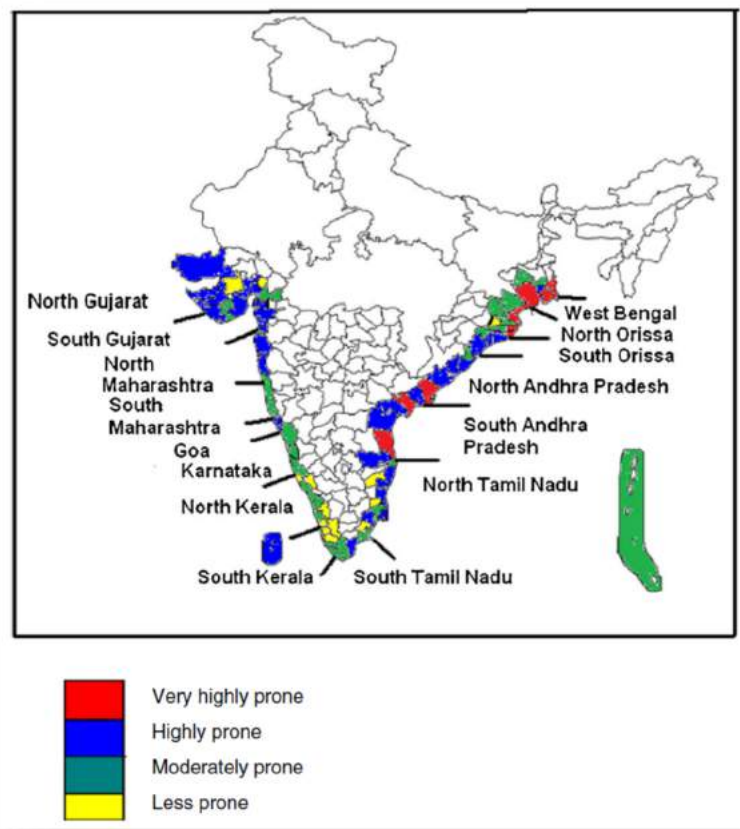
Risk-mapping of cyclone hazard and vulnerability

Indian peninsula has a long coastline measuring about 7,517 km (mainland: 5423 km; islands: 2094 km). The coastline of the mainland is formed by 9 states and 3 union territories, given below.

Coastal States	Coastal Union Territories
1. Gujarat	1. Daman & Diu
2. Maharashtra	2. Dadra & Nagar Haveli
3. Goa	3. Puducherry
4. Karnataka	
5. Kerala	Island Territories
6. Tamil Nadu	1. Andaman & Nicobar Islands (Bay of Bengal)
7. Andhra Pradesh	2. Lakshadweep Islands (Arabian Sea)
8. Odisha	
9. West Bengal	

There are 72 coastal districts in India, and 14.2% of Indian population (171 million) resides in coastal districts. Apart from the 72 coastal districts, another 24 districts within 100 km from the coastline, not touching the coast, are also at risk of cyclone-related damage and health effects. Indian coastline is prone to cyclonic storms forming in the Bay of Bengal and the Arabian sea. The three major factors contributing to cyclone-related damage are — strong winds, heavy rains, and combined effect of storm surges and astronomical tides.

Cyclone hazard proneness of districts has been classified based on frequency and intensity of cyclones, wind strength, probable maximum precipitation, and probable maximum storm surge. Out of 96 districts (72 districts touching the coast and 24 districts not touching the coast, but within 100 km from the coastline), 12 are very highly prone, 41 are highly prone, 30 are moderately prone, and the remaining 13 districts are less prone, as presented in the Figure and Table below.



Source: Mohapatra M. Cyclone hazard proneness of districts of India. J Earth SystSci2015;124:515–26. ©Indian Academy of Sciences

Cyclone-prone districts of India (For 69 + 24* districts)

Very Highly Prone		Highly Prone		Moderately Prone		Less Prone	
State/UT	District	State/UT	District	State/UT	District	State/UT	District
AP	Nellore	AP	Visakhapatnam	A&N Island	A & N islands	Gujarat	Sunder Nagar*
AP	East Godavari	AP	Krishna	Dadra & Nagar Haveli	Dadra & Nagar Haveli	Gujarat	Kheda*
AP	Srikakulam	AP	West Godavari			Gujarat	Vadodara*
AP	Guntur	AP	Prakasam	Gujarat	Ahmedabad	Kerala	Wayanad*
Orissa	Balasore	AP	Vizianagaram	Gujarat	Anand	Kerala	Palakkad*
Orissa	Kendrapara	Daman & Diu	Daman	Gujarat	Surat	Kerala	Kottayam*
Orissa	Bhadrak	Daman & Diu	Diu	Gujarat	Navsari	Kerala	Idukki*
Orissa	Jagatsinghpur	Gujarat	Junagadh	Gujarat	Valsad	Kerala	Pathanamthita*
Orissa	Ganjam	Gujarat	Kachchh	Gujarat	Bharuch		
Tamilnadu	Kanchipuram	Gujarat	Bhavnagar	Goa	North Goa		
West Bengal	South 24-pargana	Gujarat	Jamnagar	Goa	South Goa		
West Bengal	Medinipur	Gujarat	Porbandar	Karnataka	Udupi		
West	North 24	Gujarat	Amreli	Karnataka	Uttar Kannada		

Bengal	Pargana*				
West Bengal	Howrah*	Orissa	Puri	Karnataka	Dakshin Kannada
West Bengal	Kolkata*	Orissa	Khordha	Kerala	Kozhikode
		Puducherry	Puducherry	Kerala	Malappuram
		Puducherry	Karaikal	Kerala	Thrissur
		Tamil Nadu	Pudukkottai	Kerala	Kasargod
		Tamilnadu	Cuddalore	Kerala	Kannur
		Tamilnadu	Tiruvarur	Kerala	Ernakulam
		Tamilnadu	Nagappattinam	Kerala	Alappuzha
		Tamilnadu	Chennai	Kerala	Kollam
		Tamilnadu	Viluppuram	Kerala	Thiruvananthapuram
		Tamilnadu	Ramanathapuram	Lakshadweep	Lakshadweep
		Tamilnadu	Toothukudi	Maharastra	Thane
		Tamilnadu	Tirunelveli	Maharastra	Mumbai suburban
		Tamilnadu	Thanjavur	Maharastra	Ratnagiri
		Tamilnadu	Tiruvalur	Maharastra	Raigarh
		Tamilnadu	Kanyakumari	Maharastra	Sindhudurg
		Orissa	Mayurbhanj*	Gujarat	Rajkot*
		Orissa	Cuttack*	Orissa	Jajpur*
		Orissa	Nayagarh*	Orissa	Dhenkanal*
		Orissa	Keonjhar*	Orissa	Gajapati*
		West Bengal	Hoogli*	Tamilnadu	Tiruvannamalai*
				Tamilnadu	Ariyalur*
				Tamilnadu	Sivaganga*
				West Bengal	Bardhaman*

* = districts within 100 km from the coast, but not touching the coast.

Source: National Disaster Management Authority, Govt. of India.

<https://ndma.gov.in/images/cyclones/cyclonepronedistrict.pdf>

In the above risk assessment, vulnerability of the districts has not been taken into consideration. The vulnerability of districts to cyclones needs to be assessed locally in each setting.

Vulnerability is an aggregate function of exposure, sensitivity, and adaptive capacity. Input parameter for exposure is the cyclone hazard ratings derived by the IMD/NDMA. Potential parameters of sensitivity are population density, population size below 5 years and >65 years, and percentage of kutchha houses. Potential parameters of adaptive capacity are indicators of economic wellbeing, level of cyclone preparedness, or composite index available from the District Level Household and Facility Surveys or district-level human development index, as proxy measures of adaptive capacity. A prototype of such a cyclone vulnerability index for the health sector is outlined in “Shukla RS, Dogra N. Vulnerability and adaptation. In: Dogra N, Srivastava S. Climate Change and Disease Dynamics in India. TERI, New Delhi; p. 357-382.”

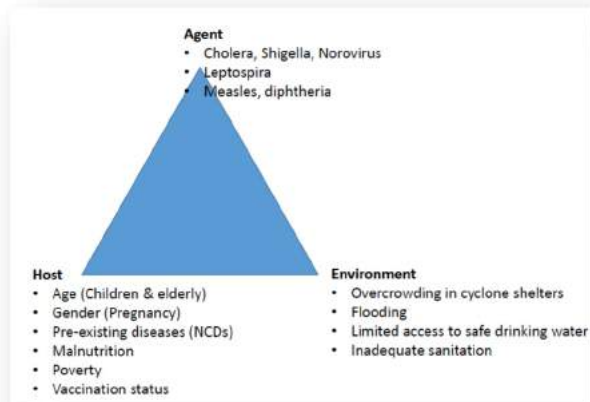
Refer to: Disaster Management Guidelines: Management of Cyclones

<https://ndma.gov.in/images/guidelines/cyclones.pdf>

2. Epidemiologic triads to understand cyclone-related health problems

Causation of various health problems in the post-cyclone settings and conditions which favor disease initiation and propagation could be explained and understood using the epidemiologic triangles presented below.

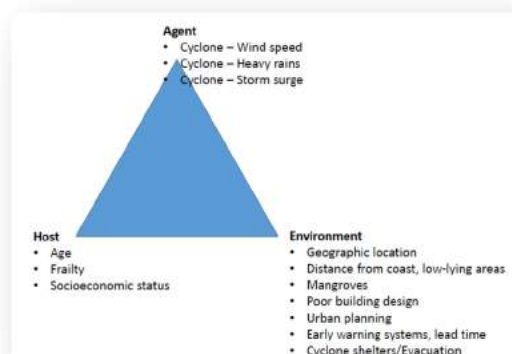
Epidemiologic triad for cyclone-related infectious diseases



Epidemiologic triad for cyclone-related mental health problems



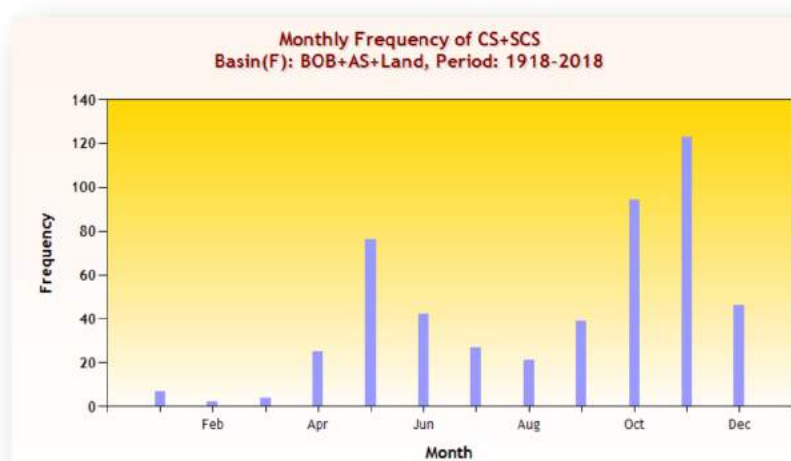
Epidemiologic triad for cyclone-related injuries



3. Seasonal and long-term trends in cyclone hazard

The average annual frequency of cyclones in the Bay of Bengal and Arabian sea is about 5, with a ratio of 4:1. Month-wise frequency of cyclonic storms affecting Indian coastline exhibit a bimodal distribution with a primary peak during September to December and a secondary peak during April to July. Cyclones are infrequent during the months of January to March.

Month-wise cumulative frequency of cyclones (cyclonic storms and severe cyclonic storms) during the period 1918—2018

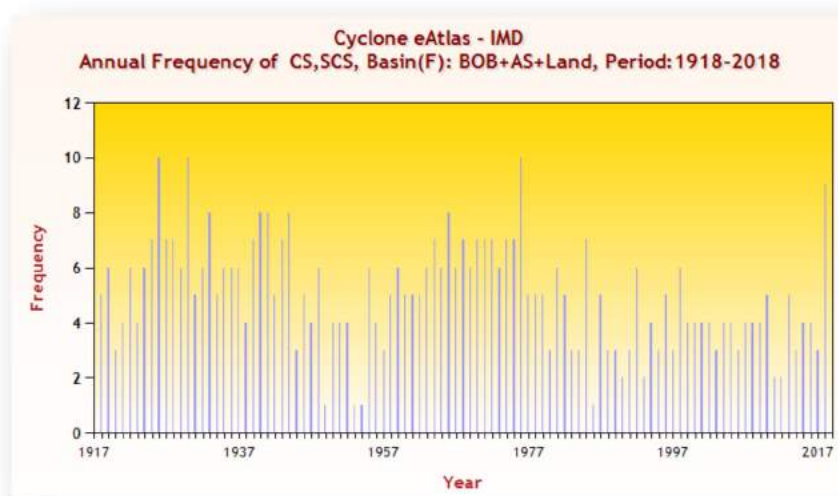


Source: Cyclone eAtlas – IMD, ©India Meteorological Department

<http://www.rmchennaieatlas.tn.nic.in/>

Overall, the annual frequency of cyclones affecting the Indian coast is variable, ranging from 1 to 10 cyclones per year. Over the period 1918—2018, long-term multiyear cycles in the annual frequency of cyclones have been observed. Moreover, a significant increase in the frequency and intensification rate of cyclones during the month of November and to some extent in the month of May has been observed. However, frequency of cyclones during the months of June and September has decreased.

Annual frequency of cyclones (cyclonic storms and severe cyclonic storms) during the period 1918—2018



Source: Cyclone eAtlas – IMD, ©India Meteorological Department

<http://www.rmccchennaieatlas.tn.nic.in/>

4. Pattern and timing of illnesses encountered in post-cyclone settings

Several health problems — infectious diseases, non-communicable diseases (NCDs) and injuries — have been documented to be increased in post-cyclone settings. Majority of the increase in these health problems is seen in the first 4 weeks following a cyclone. Common health problems encountered in post-cyclone settings during 1985—2014 are summarized below in the order of priority.

Health Problems	Remarks
Water-borne infections – infectious diarrhea, shigellosis, cholera, norovirus, leptospirosis	Peaks at Day 5 post-cyclone; comes down by Week 5; however, outbreaks have occurred up to 3—8 months after cyclones.
Acute respiratory diseases	Increase, especially in children. Overcrowding in the evacuation camps favours increase in respiratory infection
Undifferentiated febrile illness	Up to 4 weeks after storms
Skin and soft tissue infections	Up to 4 weeks after storms

Vector-borne diseases	Increase in the vector population will happen gradually as flood waters recede and leave pools of stagnant water. It also takes some time for other vectors and rodents to multiply to nuisance or hazardous levels.
Exacerbation of NCDs/chronic illnesses	Modest increase in incidence of myocardial infarction, stroke, diabetic foot, worsening control of chronic illnesses like asthma, chronic kidney disease
Injuries – contusions, lacerations, puncture wounds, corneal abrasions, infected wounds, major traumatic injuries	Less data on orthopedic injuries; increase in injuries seen up to 4 weeks after storms. Possible sources of major injuries are: house collapse, uprooted trees, and electrocution.
Bites and stings – insects, scorpion, snakes, animals	Up to 4 weeks after storms
Acute mental health problems such as acute stress reaction, adjustment disorder, depression, attempted suicide	Begin within 1 week and may persist up to 3 months
Post-traumatic stress disorder and other chronic mental health issues	Persist in the long-term 1—5 years after the cyclone
Outbreak of vaccine-preventable diseases in congregate settings	No empirical evidence of increased risk in cyclone settings. However, there is a potential risk of VPD outbreaks if prior vaccine coverage is poor.

Although cyclonic storms are primarily characterized by strong winds, majority of the damage to lives and property is caused by associated events such as storm surges and flooding, not by the wind. Thus, people residing in poorly built constructions located in low-lying areas close to the coastline are the most vulnerable, especially if the lead time for warning and evacuation is insufficient.

When a cyclone is making landfall, traumatic injuries and asphyxiation due to entrapment could occur due to collapse of poorly built residential structures, uprooted trees, and wind-strewn debris. Electrocution or drowning could occur when victims attempt to secure property such as television antennas or boats.

Although the impact of cyclones on infectious diseases is limited, outbreaks of infectious diseases such as cholera and leptospirosis are well known in the aftermath of cyclones. Such outbreaks are attributable to flooding and lack of access to safe drinking water and sanitation

facilities in post-cyclone settings. Moreover, in congregate settings such as cyclone shelters, outbreaks of droplet/airborne infections such as influenza, measles, and diphtheria is possible, especially if the prior childhood vaccine coverage in the cyclone affected population is poor.

Although sending in medical and paramedical personnel and teams to deliver healthcare in cyclone-affected areas is a potential option, it is considered as an inappropriate response. Rather, the local and neighboring health facilities would be best placed to handle emergency medical care to cyclone victims. However, damage to healthcare facilities, roads, and electrical power distribution could adversely affect the access and delivery of health services.

5. Stakeholders' Roles and Responsibilities, Timing, Operational Coordination

S.No	Stakeholder(s)	Task/activities	Probable time/ duration for initiate actions	Responsibilities
1.	India Metrological Department, Regional Metrological Centers	Issuing cyclone alerts	Before the cyclonewith sufficient lead time	Issuing cyclone alerts to State Govt./UT administration
2.	State Govt./UT Administration	Issuing Cyclone Alerts to health services to be on standby	Before the cyclone with sufficient lead time	All alerts to SDMA to be accompanied by simultaneous alerts to the State health department.
3.	State Govt./UT Health Services	Create and maintain a repository of health facilities	Preparedness phase	Creation and maintenance of a district level repository of public and private hospitals and other health facilities with details of staff, beds, equipment, and services available.
3.	State Govt./UT Health Services	Creation of buffer capacity among HCWs within the state	Preparedness phase	Identify, train, and assign HCWs posted in adjoining districts to offer medical assistance, when required, to cyclone-prone districts.
4.	State Public Health Department	Training HCWs	Preparedness phase	Training HCWs working in cyclone-prone districts on management of cyclone-related health problems

4.	State Public Health Department&StateGovt./UT Administration	Operational coordination with non-health sectors	Response phase; Recovery phase	Coordinating various non-health sector agencies delivering health-related activities in cyclone settings.
4.	State Public Health Department	Surveillance and outbreak investigation	Response phase; Recovery phase	Surveillance activities for disease outbreaks in the community and cyclone shelters; investigation and control of outbreaks
5.	District Health Services	Making hospitals structurally safe and functional in the face of cyclones, to ensure uninterrupted care delivery	Preparedness phase	Contingency planning to ensure adequate HCWs, consumables, electricity, oxygen, water, food availability at healthcare facilities in the post-cyclone period.
6.	Govt. Hospitals, CHCs, PHCs	Making healthcare facilities and hospitals structurally safe and functional in the face of cyclones, to ensure uninterrupted care delivery	Preparedness phase	Contingency planning to ensure adequate HCWs, consumables, electricity, oxygen, water, food availability at healthcare facilities in the post-cyclone period.
6.	Govt. Hospitals, CHCs, PHCs	Healthcare delivery	Response phase; Recovery phase	Care delivery in post-cyclone period.
7.	Private Hospitals	Healthcare delivery	Response phase	Care delivery in post-cyclone period.
8.	District Hospitals	Mental health services	Recovery phase	To deliver mental health services to cyclone victims.
9.	108 Ambulance Services	Field deployment of 108 ambulance services to deliver medical assistance	Response phase	Training 108 ambulance service personnel in cyclone-prone districts to attend to minor ailments in post-cyclone settings.
10.	NGOs working in cyclone-prone districts	Community linkage for mental health	Recovery phase	Identify and assist persons with mental health needs to avail

		services		medical care in post-cyclone settings.
11.	NDMA	Risk assessment and mapping	Preparedness phase	Cyclone hazard assessment of districts of India; web-based Composite Risk Atlas for Hazard Risk & Vulnerability Assessment
11.	NDMA	Cyclone resilience of healthcare facilities for uninterrupted service provision	Preparedness phase	Preparation of guidelines for safe hospitals (completed)
12.	SDMA& DDMA's	Combining cyclone hazard proneness with local data on vulnerability	Preparedness phase	District-level vulnerability assessment and identification of hotspots
13.	MoH&FW, GoI	Mobilizing medical assistance	Response phase	Mobilization of external medical assistance when requested by states
14.	Non-health sectors	Cyclone risk reduction measures	Preparedness phase	Implementation of cyclone disaster risk reduction measures as outlined in the National Disaster Management Plan (NDMP) 2016 under "Cyclone and Wind Risk Mitigation (Section 3.2)"
15.	Community	Strengthening the ability of communities to manage and cope with cyclones	Preparedness phase	Trainings for panchayats, SHG, NCC, NSS, Youth, local community organizations, volunteers

6. Identify and list the resources (Health & Non-health) required: Listed below

- Region specific resources' list may be suggested as checklist: No region-specific resources. These resource requirements are for cyclone-prone districts only.

7. Identify actions for risk reduction that are acceptable in various parts of the country or if possible region wise

Cyclone disaster risk reduction measures as outlined in the National Disaster Management Plan (NDMP) 2016 under “Cyclone and Wind Risk Mitigation (Section 3.2)” are to be followed to reduce the risk of cyclone-related damage. Action points have been enlisted therein.

8. Action points for SNO-CC which can be undertaken within limited resources for measures to control or prevent illnesses.

Disaster preparation phase

1. Formulate district specific guidelines with action points and contact name and number of key stakeholders based on previous experience
2. Link with IMD and NDMA for information on disaster impact
3. Assign roles and responsibility of each stakeholder during disaster impact and flow of action
4. Co-ordinate the activities of the stakeholders
5. Train the manpower
6. Supervise and monitor the availability of infrastructure
7. Ensure good information flow between the stakeholders
8. Set up and strength the surveillance system through the IHIP portal
9. Identify the trigger levels during disaster situation for each disease for each PHC and to be incorporated into IHIP portal
10. IEC materials needed during disaster kept ready in collaboration with State IEC department

Response phase

1. Initiate the activities by the health team
2. Co-ordinate the activities of different stakeholders
3. Regulate volunteer action related to health

Recovery phase

1. Strengthen the surveillance to pick up any health event/outbreak
2. Alert and initiate outbreak response based on the reporting through IHIP portal
3. Outbreak investigation in case of outbreak (most outbreak happen at a the recovery phase)
4. Report on the activities done by the health team during disaster and lessons learnt

9. Logistics required at the health care facilities for ready ref by SNO-CC (refer respective programme)

List of equipments- essential & Desirable kits, Reagents, drugs etc

Health Problems	Consumables
Water-borne infections	ORS, Zinc tablets, iv fluids Chlorine tablets for water disinfection Hand sanitizers and soaps for hand washing
Acute respiratory diseases	Antipyretics, antihistamines, antibiotics, bronchodilator, nebulisation equipments Masks for health care personal Hand sanitizers IEC on cough etiquette in the evacuation camps
Undifferentiated febrile illness	Antipyretics IEC on the danger signs, guidelines on treatment Point of care diagnostics
Skin and soft tissue infections	Local antibiotic creams Dressing materials
Vector borne disease	RDK for malaria, antimalarial Doxycycline for scrub typhus Immediate: personal protective measures and adulticide. Adulticide should be based on the vector density and should not be driven by pressure from population. Intermediate and long term: larvicidal and adulticide Caution on indiscriminate spraying of insecticide and insecticide resistance
Exacerbation of NCDs/chronic illnesses	Osteoarthritis may exacerbate for elderly – analgesic ointments, analgesics Hypertensive and anti-diabetic medications, BP apparatus and blood glucose estimation
Injuries – contusions, lacerations, puncture wounds, corneal abrasions, infected wounds, major traumatic injuries	Dressing materials, TT injections (beware of giving multiple doses),
Bites and stings – insects, scorpion, snakes, animals	Anti-snake venom, prazosin for scorpion sting, anti-histamines and steroid to manage anaphylaxis due to insect bite

	Anti-rabies vaccine for dog bites
Acute mental health problems such as acute stress reaction, adjustment disorder, depression, attempted suicide	Mild sedative for managing anxiety and depression
Post-traumatic stress disorder and other chronic mental health issues	Long term action using psychotherapy
Outbreak of vaccine-preventable diseases in congregate settings	Cold chain equipments Generator for maintaining cold chain Routine immunisation to be started as early as possible. Cold chain check and cold chain to be maintained. Drugs to manage AEFI to be handy

10. Preparedness of health system and personnel

Enlist action points for SNO-CC for preparedness related activities in reference to manage illnesses.

Type of training required at various levels of healthcare providers

Inter-professional training has to be done as teams, so that each one is aware of their responsibility and aids better co-ordination of activities

State team

District team

Sub-district team

PHC team

The adjacent district and PHC should be trained together as in case of disaster the adjacent districts members would be great use and familiarity with the area will enhance better co-ordination.

Parameters to assess Training Need Assessment

1. Percentage of medical officers trained in Standard treatment guidelines prepared by DHR
2. Percentage of staff of PHC and sub-center trained in disaster preparedness and management
3. Percentage of staff trained in IHIP
4. Percentage of health facility reporting through IHIP portal

List activities for prevention of illnesses (IEC, pamphlets, advisories, training, workshop etc)

Training workshops

On the Standard Treatment Workflows (STWs) for relevant diseases developed by DHR (ICMR)

Febrile illness management including vector-borne diseases

Snakebite and scorpion stings

Psychological first aid

Disaster management: This will enhance collaboration of work between the health and other departments

IEC material

1. Cough etiquette
2. Vector control especially personal protective measures for mosquito/mite/tick bites
3. Water safety
4. Pamphlets on psychological first aid
5. Warning symptoms, when to seek care in case of febrile illness
6. Sanitation and hygiene in evacuation camps
7. Cyclone preparedness kits

Based on your widespread research, suggest the following

Content for IEC, pamphlets, advisories (suggest template, guide States for development)

Key message:

Do's and don't

With a pictorial illustration

Time to release such awareness material (Hand holding of state to list activities in their calendar of activities.

District level activities

Each district based on the data from the meteorological department should identify the months when disaster impacts. Disaster preparedness should for health should start 6 months prior to anticipated disaster. From the cyclone eAtlas it is noted that January, February, March have fewer number of cyclones, so preparedness activities should be done during these months.

PHC

PHC should start its preparation activities – such as maintaining stock of the logistics and training of health workers at least 2 months prior to the cyclone/storms/floods season in that district

IEC activities

A month prior to the cyclone/storms/floods season in that district, the village health and nutrition days should include aspect of health protection during cyclone

Development of training module for Health Officers as well as Paramedical workers

Standard Treatment Workflows developed by the DHR, ICMR can be used for training.

Disaster management training as per NDMA.

Indicators related to Input, Process, Output and Outcome for the Climate sensitive illnesses that can be periodically monitored. Suggest indicators for monitoring.

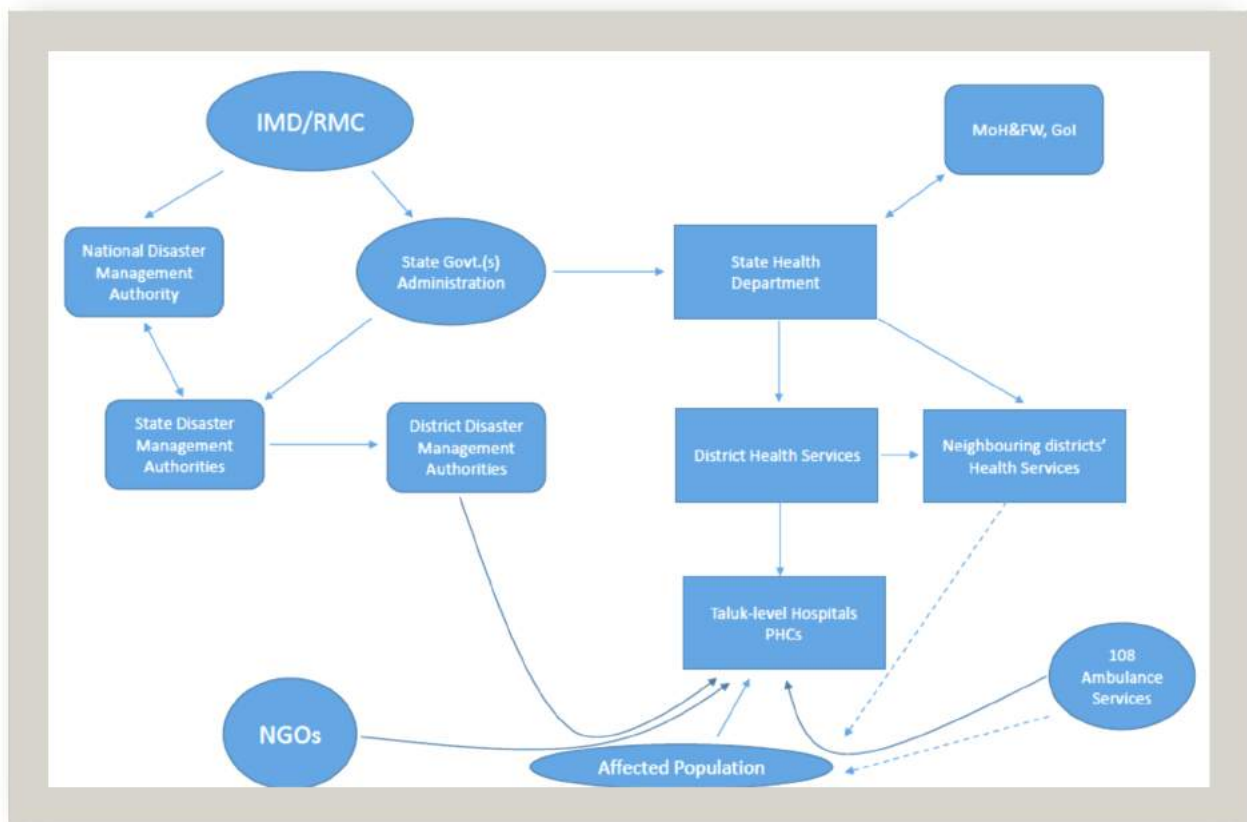
List of Indicators:

1. Percentage of districts with district specific guidelines with action points and contact name and number of key stakeholders
2. Percentage of districts that completed district-level vulnerability assessment and hotspot mapping
3. Number of cyclone resilient healthcare facilities for uninterrupted service provision in coastal districts
4. Number of health facilities with health manpower trained for providing mental health services to cyclone victims
5. Percentage of district with contingent plan to ensure adequate HCWs, consumables, electricity, oxygen, water, food availability at healthcare facilities
6. Number of meetings held in each district with non-health stake holders related to disaster preparedness
7. Number of cyclone shelters in each district
8. Number HCWs posted in adjoining districts identified, trained and assigned to offer medical assistance
9. Percentage of districts with district level repository of public and private hospitals and other health facilities with details of staff, beds, equipment, and services available
10. Percentage of medical officers trained in Standard treatment guidelines prepared by DHR
11. Percentage of staff of PHC and sub-centre trained in disaster preparedness and management
12. Percentage of staff trained in IHIP
13. Percentage of health facility reporting through IHIP portal

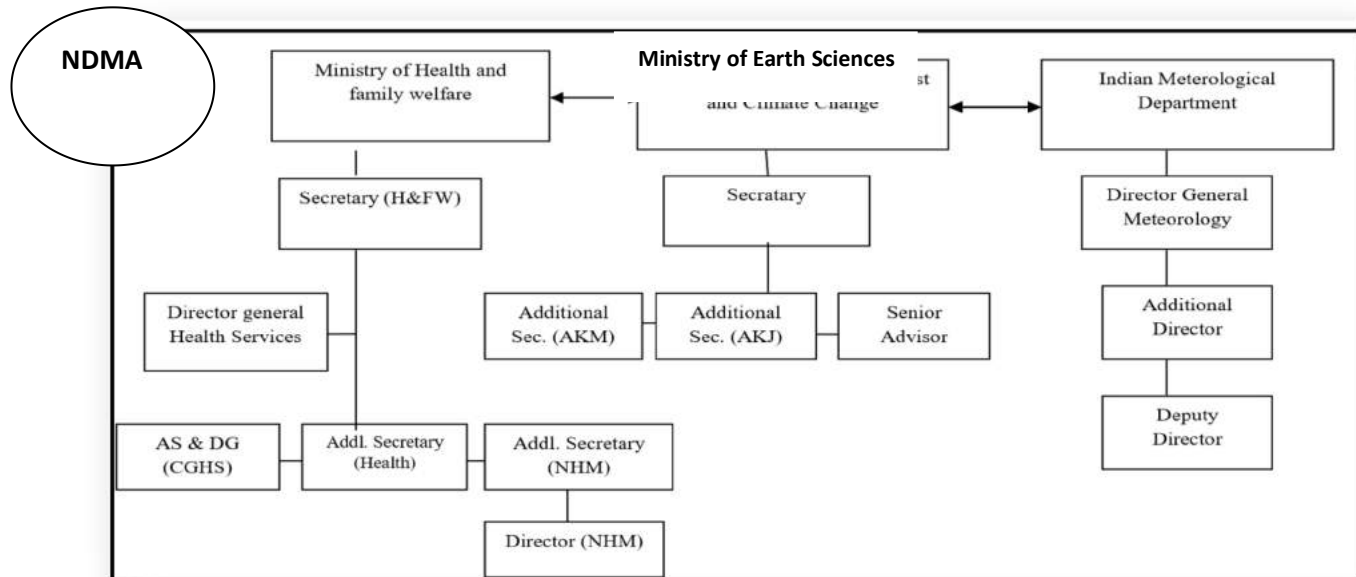
14. Number of awareness generation campaigns for risk groups conducted in each of the district
 15. Number of advocacy meetings held between the vulnerable groups and health personnel
 16. Number of health system research/epidemiological studies done related to cyclone related health problems
 17. Number of diarrheal outbreaks reported after cyclones in these districts
 18. Number of febrile illness outbreaks reported after cyclone
 19. Number of snake bites/scorpion stings reported after cyclone
 20. Number of injuries reported after cyclone
 21. Number of deaths during cyclone and within 4 weeks
 22. Number of VPD outbreaks reported after cyclone
- Suggest the type of surveillance and parameters for consideration Integrated Health Information Portal (S, P and L forms) from all health facilities

Each PHC should have identify the trigger levels for outbreak alert during cyclones

Operational Coordination:



Operational Communication Channel: (Subject to corrections)



Health Adaptation on Green and Climate Resilient Healthcare Facilities

Executive Summary

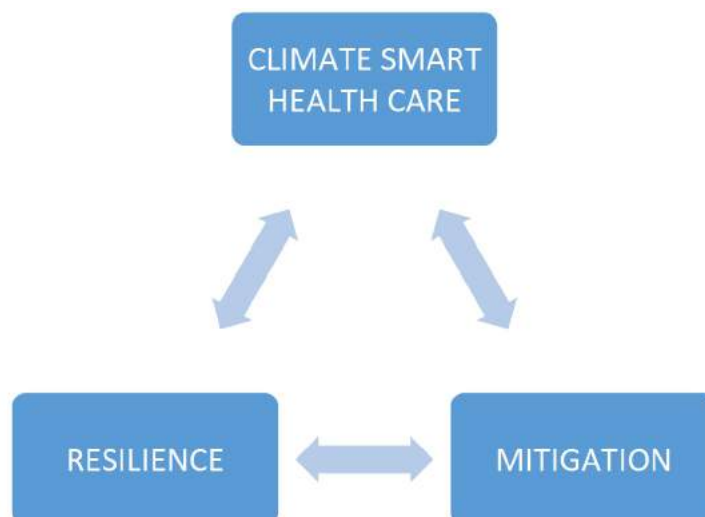
Climate change and Healthcare

Healthcare services encompassing physicians, nurses, hospital administrators, allied healthcare professionals, laboratory operations and related services for healthcare delivery including transport, communications, food services, water and waste management must be well-prepared and adapted to deliver healthcare services in the event of acute or persisting impacts of climate change.

As “**first responders**” to health effects of acute climatic events, healthcare facilities are expected to be the “last building standing” thereby delivering uninterrupted care. They need not only **robust infrastructure** but also **need to become adept to tackle the greater burden of diseases** resulting from the aftermath of floods, droughts, heatwaves, air pollution, vector-borne disease transmission and post-traumatic disorders, besides malnutrition.

Often, this is challenged when health care is not adequately prepared. Some examples have been documented in the recent past of several actors and stakeholders convening together to handle climate emergencies. Such reactive measures have been successful in care delivery, but **a more planned, structured climate –preparedness and health adaptation plan** will certainly augment and facilitate our work in India and elsewhere to face the consequences of climate change.

This Centre of Excellence, under the National Program for Climate Change and Human Health (NPCCHH) is dedicated to developing **an implementation framework and action plan for transformative action** in two dimensions of healthcare – **resilience** and **mitigation (greening)**, together enshrining the principles of a **Climate-Smart health care system for India**.



Defining the concepts of resilience and mitigation

Resilience -Health system resilience can be defined as the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learned during the crisis, reorganise if conditions require it. Response to a crisis, be it a disease outbreak or other disruption resulting in a surge of demand for health care (eg, a natural disaster or a mass casualty event) needs both a vigorous public health response and a highly proactive and functioning health-care delivery system. (Ref: Lancet-What is a resilient health system-lessons from Ebola). A climate resilient healthcare system is one that ensures an **adaptive framework** that helps it **respond adequately and appropriately** in the event of an acute climatic event. There should be **an efficient and trained pool of healthcare and allied professionals who are able to identify and deal with the additional disease burden associated with climate change and its impacts on health.**

Mitigation – Health care including hospitals, health systems and the health products supply chain can **paradoxically contribute to emissions** from the entire lifecycle of their operations, estimated to be 2.6 gigatons of CO₂a year or about 4.6% of total greenhouse gas emissions. Healthcare systems hence have a **responsibility to adopt sustainable, low-carbon solutions to mitigate and reduce their own climate footprint.**

*Together, **resilience and mitigation**, with often an overlap in measures taken, **combine to build a Climate-smart health system that can adapt to deliver critical healthcare services in the face of climate change.***

This encompasses good location of the healthcare facility, appropriate building standards, efficient access and utilization of energy, water, food, transport, communications as well as correct waste management practices. A critical link to such an adaptation plan will include access to climate information services that provide weather forecasting, vulnerability assessments, risk predictions, and disease surveillance systems that can ensure an adequate, integrated and coherent response.

Challenges and Opportunities

Indian Healthcare System: The Indian healthcare system is a diverse, multi-tiered one with several players and governance structures. An implementation framework for climate preparedness and action will therefore vary with the tier of the system and the various actors and stakeholders involved. Of note, the concepts of green and climate resilient healthcare have been incorporated within the Indian Public Health Standards and can soon be established as the norm for the public health care system.

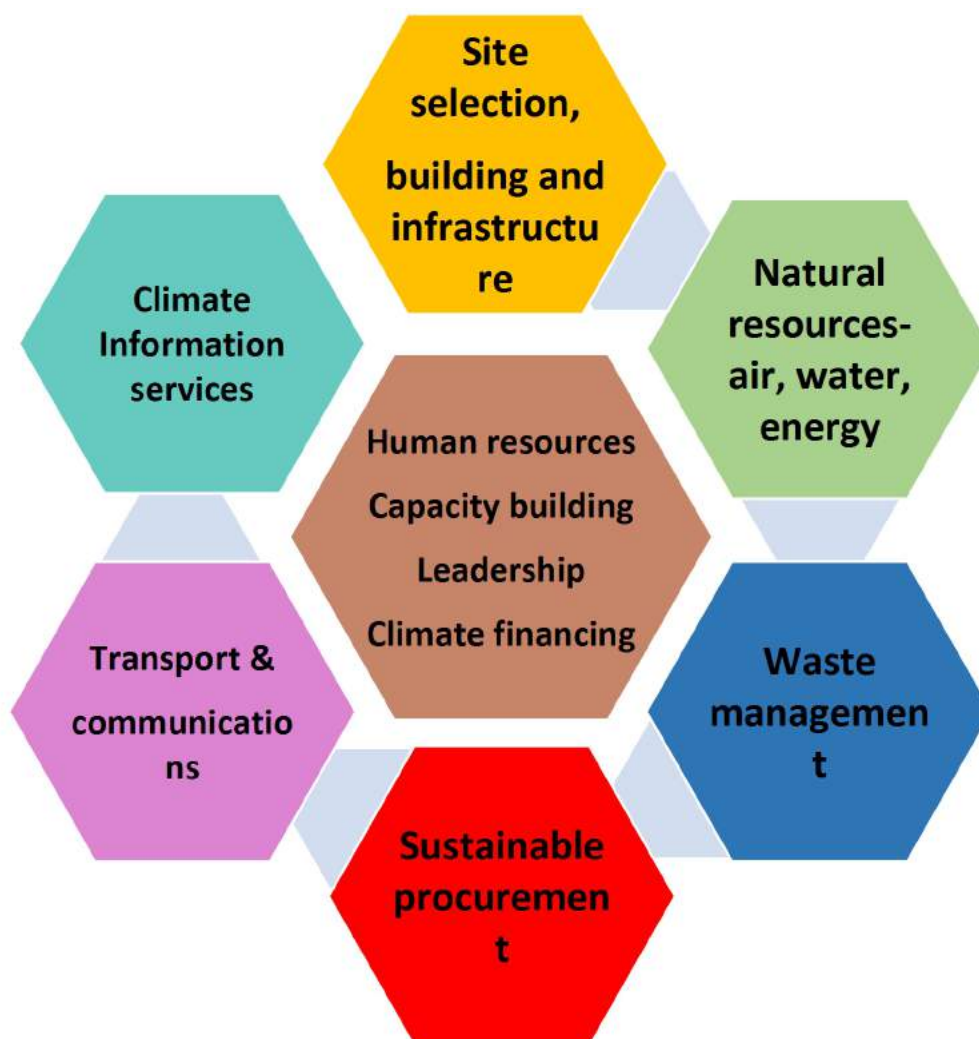
The concept has also been recognized and adopted by leading heads and administrators of private healthcare facilities and organisations representing healthcare professionals in India. This can be leveraged to bring in the framework in practice through these networks.

The Centre of Excellence for Green and Climate Resilient Healthcare facilities is located at the Centre for Environmental Health at the Public Health Foundation of India. The technical support team here will be available to handhold state nodal officers through the steps to establish climate resilient and green healthcare facilities at every level of the health system with coordinated action through the National Centre for Disease Control and other Centers of Excellence in the National Action Plan for Climate Change and Human Health (NAPCCHH)

FRAMEWORK FOR CLIMATE RESILIENCE AND MITIGATION

An overarching framework will be provided that covers action, timing and resources (human resources and tools involved) for a healthcare facility to be resilient and green. Actual ground implementation in the states will then be customized and prepared for every level of health care in the state plans, in co-ordination with the State Nodal Officers.

FRAMEWORK FOR CLIMATE- SMART HEALTH SYSTEMS



Core domains for action for Implementation of Climate-smart healthcare

I. Health professionals' capacity-building – Climate preparedness and adaptation

i. The impacts of climate change on human health range from acute respiratory illnesses due to poor air quality, increase in incidence and exacerbation of current cardio-respiratory conditions due to air pollution and worsening heatwave/coldwave conditions, increase in water-borne and vector-borne diseases, worsening of nutrition-related disorders and an alarming increase in mental health disorders.

Every region/state may have different vulnerabilities and this disease vulnerability assessment will form the fundamental block of health sector preparedness of each region.

ii. Health and allied professionals must be adequately sensitized to recognize this growing disease burden and be well-trained to provide both preventive and curative care to their patients and communities. **Capacity –building of the healthcare professionals lies at the core of climate preparedness and can be achieved through a structured training program through virtual or in-person teaching modules.**

iii. A list of resources can be built that include **freely available virtual trainings** by WHO and other organisations, with self-paced training on climate change and health impacts. Additionally, virtual or **in-person trainings** can be organized through the NAPCCHH for State Nodal Officers, district medical officers, and health professionals in allied disciplines like nursing, pharmacy, laboratory services, health administration and public health specialists at state and district level.

iv. **Information-education-communication (IEC) materials** on climate change and human health impacts in English and local languages can be widely disseminated and displayed at strategic locations in healthcare facilities and communities. Short videos and educational material can be made available to enhance awareness through television or print media.

v. Finally, a **mobile-based app linked to tele-medicine services** must be made available for use in the event of acute climatic events.

vi. Training in climate change and health impacts must become an **integral part of medical and allied professionals' curriculum**. This policy change must be collectively driven by NAPCCHH and allied national programs related to environmental pollution.

II. Health infrastructure strengthening for resilience and mitigation

Indian Healthcare System: The Indian healthcare system is a diverse, multi-tiered one with several players and governance structures. An implementation framework for climate preparedness and action will therefore vary with the tier of the system and the various actors and stakeholders involved.

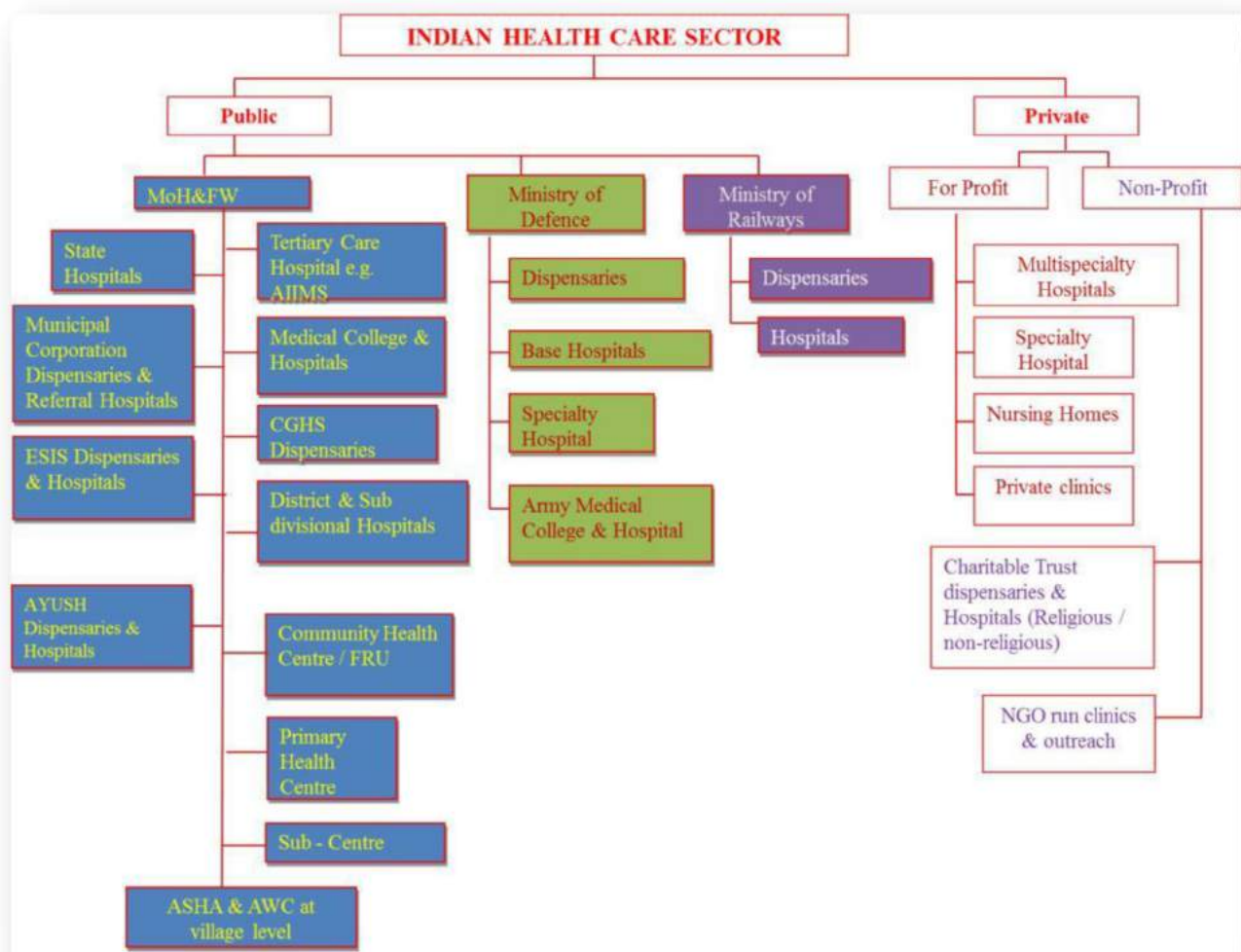


Figure 1: India's healthcare system is characterised by multiple systems of medicine, mixed ownership patterns and different kinds of delivery structures

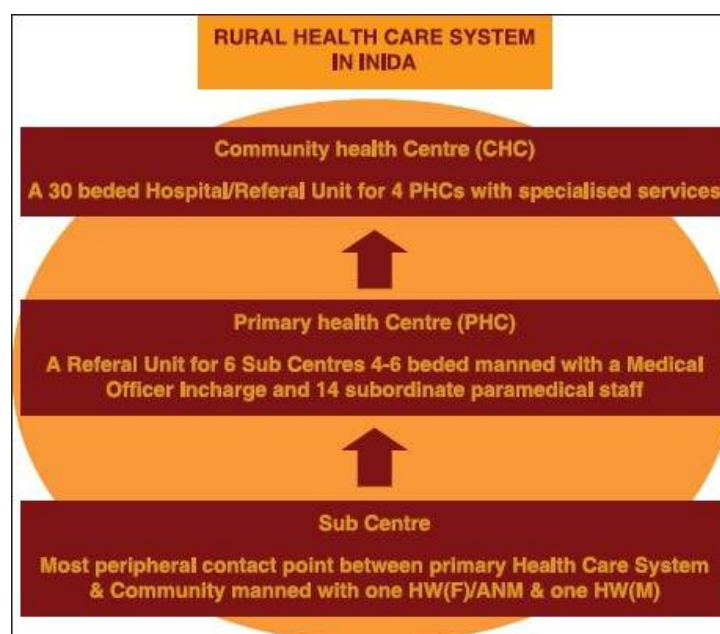


Chart 1: Primary Healthcare System in India

The resilience of healthcare facilities includes both **retro-fitting existing facilities and incorporating principles of resilience and “greening” in new establishments.**

An important component will be an immediate focus on the refurbishing of 1,50,000 Sub-centers and primary health centers as Health and Wellness centers in the Ayushman Bharat program aiming at Universal health coverage through Comprehensive Primary Health Care (CPHC). Wider health system strengthening through co-ordinated action via both National and State Health Systems Resource Centre and established private hospital networks can move the Indian healthcare system on a steady path towards decarbonisation and climate –smart healthcare.

FRAMEWORK FOR HEALTH FACILITY INFRASTRUCTURE RESILIENCE AND MITIGATION

I. SITE SELECTION

ACTION

A pre-site assessment or a climate vulnerability assessment for the siting of healthcare facility needs to be conducted to explore current and future climate risks associated with the facility.

RESOURCE

Vulnerability assessments (VA) can be conducted using the tool developed by the Centre of Excellence for vulnerability assessments under NAPCCHH.

IMPLEMENTATION

Based on the assessment, the relevant Centre for Excellence needs to be consulted for proactive action. For instance, if the facility is vulnerable to vector-borne diseases or heat related issues, the related experts or the health adaptation plan for those climate risks needs to be followed. If the facility is situated in a flood or drought prone area, relevant risk protocols and plans should be in place to mitigate impacts of these extreme events.

- i. Based on VA, appropriate siting of the health care facility must be planned for new facilities. For existing facilities, protective measures must be implemented based on the VA to protect the facility from impacts of acute climatic events.
- ii. Emergency or disaster preparedness at health facility level must be contextualized based on previous patterns of climate events in the region.

Action Plan	Stakeholders	Activities	Available Toolkits
1. Vulnerability Assessments for siting healthcare facility Conduct a pre-site assessment to explore site sustainability measures for new facilities Evaluate Climate change and future extreme weather risks with respect to existing facility infrastructure 2. Access issues Evaluate access plan of action for extreme events	- State nodal officer for climate change - State Program Officers - Urban planners - Public health engineers - Environmental consultants - Hospital administrators	Plan location of HCF to ensure that it is ✓ easily accessible entry and exit paths ✓ away from flood-prone area ✓ accessible from main roadways ✓ near public transport hubs ✓ appropriate building materials for disaster resilience	- World Bank, 2017 report on Climate-smart healthcare - Resilient cities framework - NRDC - IIPHS guidelines - Ahmedabad Heat Action Plan - UNFCC action plan - WHO framework for green and climate resilient healthcare

The infrastructural assessments include an assessment of the building materials, climatic durability of the hospital structure, efficient lighting and ventilation and an adequate focus on development of greenery within and surrounding the facility. A pre-site assessment or a climate vulnerability assessment for the building structure and design needs to be conducted to explore current and future climate risks associated with the facility.

RESOURCE

Vulnerability assessments can be conducted by the public health engineers in public health facilities and administrators in private hospitals using standard resources including Green Rating for Integrated Habitat Assessment (GRIHA), Indian Green Building Council (IGBC), Green hospital standards and Retrofit guidelines for existing facilities. (Annexures)

IMPLEMENTATION

Based on the assessment, the appropriate infrastructural changes can be implemented keeping in mind timing. Some of the changes that may be proposed include:

- i. Prepare for installation of cool roofs well ahead of the anticipated heat wave season
- ii. Ensure flood marks are adhered to and access and exit points are assessed
- iii. Propose refurbishing of the building beginning with critical service areas such as the emergency room, labor rooms, intensive care areas, operation theatres, essential services like laundry, catering or operational facilities controlling water, and power supply, laboratory facilities and in-patient areas.

A draft action plan for stage-wise refurbishing without severe disruption to service delivery must be prepared and implemented within reasonable timelines.

Action Plan	Stakeholders	Activities	Available Toolkits
Appropriate building design Construction of infrastructure using appropriate design, materials and access to withstand acute climatic events and low-carbon solutions	- State nodal officer for climate change - State Program Officers - Urban planners - Public health engineers - Civil engineers - Environmental consultants	✓ Building materials sourced from sturdy, low-carbon sources ✓ Insulation of walls to retain heat ✓ Cool roof technology ✓ Natural and mixed mode ventilation model for healthcare centres to ensure adequate air flow and indoor air quality ✓ Appropriate options for lighting – LED bulbs, natural light ✓ Access to appropriate power sources ✓ Appropriate siting of different patient care areas - OPD, IPD, waiting and treatment areas ✓ Plant vegetation in and around HCF to provide shade and act as a carbon sink	- Green Rating for Integrated Habitat Assessment (GRIHA) - Indian Green Building Council (IGBC) for green building standards based on LEED – Leadership in Energy and Environmental Design (USGBC for reference) - Bureau of Energy Efficiency (BEE)- 1-5 stars for rating - IIPHS guidelines - Green Hospital Standards (CCDC)

The energy utilization pattern of the healthcare facility must be assessed at the baseline to understand the demand across the facility, energy load and supply matrix, source of energy supply, patterns of disruption in the past and a critical services prioritization list must be developed.

ACTION

- i. A baseline assessment of the energy utilization of the healthcare facility for maintenance of heating, lighting, operation of equipment, essential services like water in all areas, functional services in critical areas like the labour room, operation theatres, intensive care units besides the overall facility must be mapped out.
- ii. An audit of the energy sources of the entire facility, grid mix, existing use of alternate sources of energy like renewable energy must be conducted.
- iii. A risk mapping of the energy demand and supply outlining patterns of disruption in the past should be conducted.
- iv. A clear analyses of the patient footfall through the year, linked to factors like seasonal disease burden, climatic information services with forecasts, for example, of floods or heatwaves and peripheral services dependent on energy supply like outreach clinics and immunization drives requiring efficient functioning of vaccine supply cold chain must be completed.
- v. For both retrofitting existing buildings and in new health facilities, a framework for establishing a team of energy managers trained to work in tandem with public health officers, hospital administrators, public health engineers and operations and maintenance personnel for ensuring a continuous supply of energy to maintain functional services at all times.

RESOURCE

Baseline energy audits can be conducted using our energy and health audit checklist by the team of energy manager, public health officer and hospital administrators.

IMPLEMENTATION

Based on the assessment, the appropriate infrastructural changes can be implemented keeping in mind timing. Some of the changes that may be proposed include:

- i. Develop a plan for provision of clean and efficient energy supply from appropriate sources –grid and renewable energy based on the facility requirement
- ii. Ensure 24/7 supply for critical areas with a thermostat or other mechanism to switch off lights and other appliances where not in use.
- iii. Installation of LED lighting in all areas with adequate attention during new constructions to maximize natural lighting and ventilation.
- iv. Replacement of diesel gensets with solar or wind powered alternatives.
- v. Inclusion of energy efficiency as a criterion in procurement of medical equipment.

A draft action plan for stage-wise refurbishing without severe disruption to service delivery must be prepared and implemented within reasonable timelines.

Action Plan	Stakeholders	Activities	Available Toolkits
Energy mapping Assessment of energy requirements for the level of healthcare in the facility • Evaluation of the energy supply and distribution efficiency, including grid interactive supply and storage of excess energy • Assessment of energy efficiency for last mile delivery in health systems • New constructions- choice of energy mix to be pre-determined • Existing HCF- Based on demand and supply, plan for change in energy mix, adopting renewable energy sources in greater proportion • Maximise use of natural lighting	• State nodal officer for climate change • State Program Officers • Urban planners • Public health engineers • Energy consultants • Environmental consultants	✓ Solar or wind energy investments in urban and rural care to reduce carbon footprint from conventional sources ✓ Decentralized battery powered solar rooftops for PHC, CHCs and small rural centers for energy efficiency ✓ Installation of low-energy LED lighting ✓ Divest from diesel generators or retrofit existing ones to reduce emissions	• BEE • IGBC • NRDC • World Bank, 2017 • Healthcare Climate Challenge Hippocrates tool • Green Hospital Standards(CCDC) • IIPHS guidelines

IV. Water management in the healthcare facility

An assessment of the water demand, utilization across different sections of the facility and the supply matrix must be assessed at the baseline. A critical facilities prioritization list for water supply must be prepared.

ACTION

- A baseline assessment of the water utilization of the healthcare facility for maintenance of essential functional services in critical areas like the labour room, operation theatres, intensive care units besides the overall facility must be mapped out.
- An audit of the water sources of the entire facility must be conducted by the public health engineers and hospital administrators, options available for additional supply and conservation strategies including rainwater harvesting measures must be assessed.
- A risk mapping of the water demand and supply outlining patterns of disruption in the past should be conducted.
- A thorough assessment of wastewater management is also mandated with documentation of successful existing measures and options for new strategies for wastewater treatment, recycling and disposal.

RESOURCE

Baseline water management audits can be conducted using our green hospital standards and master checklist for environment-friendly sustainable health facilities.

IMPLEMENTATION

Based on the assessment, the appropriate infrastructural changes can be implemented keeping in mind timing. Some of the changes that may be proposed include:

- Develop a plan for provision of clean and efficient water supply from appropriate sources based on the facility requirement

- ii. Ensure 24/7 supply for critical areas with a plan for storage of water for functional healthcare delivery during critical periods.
- iii. Installation of rainwater harvesting infrastructure with a system for quick transition to this source when appropriate.
- iv. Establishment of waste water treatment and recycling facility with a mapped facility plan for reuse in the toilets, garden, etc
- v. Regular monitoring of all plumbing fixtures to manage leaks etc and securing of overhead tanks and other water storage facilities
- vi. Adequate planning with water board engineers for storm water management and facility-level management of stagnant water

A draft action plan for stage-wise refurbishing without severe disruption to service delivery must be prepared and implemented within reasonable timelines.

Action Plan	Stakeholders	Activities	Available Toolkits
Vulnerability assessments for water availability and efficiency - HCF audits on water requirements, supply and waste water management to understand the vulnerabilities - Sub-metering to understand and evaluate water consumption	- State nodal officer for climate change - State Program Officers - Urban planners - Public health engineers - Water board engineers - Environmental consultants	✓ Assess plumbing fixtures and fix leakages ✓ Installation of on-site rainwater harvesting and storm water management strategies that capture rainwater and recharge groundwater supplies ✓ Secure the overhead tanks to withstand any cyclones or strong winds ✓ Sub-metering reports to be submitted every quarter to the State officers ✓ Bi-annual checks to be conducted to ensure all activities are conducted as per the action plan	- NRDC - IGBC - World Bank, 2017 - Green Hospital Standards (CCDC) - IIPHS guidelines
Risk assessments - Conserve and maintain existing water resources - Ensure supplementary water source is available during climatic events. - Efficient waste water treatment strategy			

A thorough baseline assessment of management of general(solid) waste, biomedical waste, food waste, plastic waste, e-waste and end-of-cycle management of equipment, including medical devices must be conducted.

ACTION

- i. A baseline assessment of the waste generation and management strategy for all categories of waste must be conducted by a waste management team.
- ii. An audit of the quantum of waste, segregation at source, storage and disposal channels must be mapped with identification of gaps throughout the lifecycle of waste management.
- iii. A risk mapping of the biomedical waste management practices accounting for health worker and waste handler safety must be conducted.
- iv. A thorough assessment of established channels for efficient waste disposal and linking with new resources where required should be completed.

RESOURCE

Baseline waste management audits can be conducted using our green hospital standards and master checklist for environment-friendly sustainable health facilities.

IMPLEMENTATION

Based on the assessment, the appropriate infrastructural and functional changes can be implemented keeping in mind timing. Some of the changes that may be proposed include:

- i. Develop an operational plan for all categories of waste management under the health facility waste manager and team, with compliance to existing rules and policies
- ii. Ensure channels of waste disposal even during critical periods when functional capacities exceed normal demand.
- iii. Ensure protection of healthcare workers and waste handlers at all levels.
- iv. Regular monitoring and evaluation of waste handling steps for all categories of with course correction where appropriate.
- v. Options for waste recycling, composting of dry and wet waste and reuse within the health facility must be explored.

A draft action plan for stage-wise refurbishing of waste management systems with adequate reinforcement of management methods through training and provision of operation manuals and resources must be prepared and implemented within reasonable timelines.

Action Plan	Stakeholders	Activities	Available Toolkits
Assessment of HCF waste management infrastructure - Committee to be formed for Waste Management in each hospital. - Determine gaps in implementation of Biomedical waste management rules - Look for segregation at source and safe handling of bio-medical waste post leaving the facility - Setting up in-house waste management system in hospitals for manual composting of wet and or dry waste. - Assessment of management practice for solid waste, food waste, plastic and end-of lifecycle equipment, including e-waste	- State nodal officer for climate change - State Program Officers - Urban planners - Public health engineers - Environmental consultants - Environmental Engineers - Hospital Managers/Medical Superintendents	✓ Training programs for State coordinators ✓ Implementation of Bio-medical waste management rules, 2016 ✓ Tie-up with designated collectors and recyclers for other waste categories	- BMWM rule, 2016(revised) - Health-care waste management in a hospital, WHO - Green Hospital Standards (CCDC) - IIPHS guidelines

VI. Sustainable procurement for healthcare

The incorporation of sustainable procurement practices and solutions in health care service delivery and manufacture and purchase of goods , including medical equipment, pharmaceuticals and overall supplies forms a critical component of green and environmentally-friendly health care facilities.

ACTION

- i. The establishment of a sustainability or green committee within the healthcare facility can help to incorporate the practices of sustainable healthcare delivery and transition to sustainable alternatives for procurement of goods and services
- ii. Creating a demand for sustainable alternatives must become a practice and could range from incorporating energy efficiency criteria in technical specifications for procurement of medical equipment to transition to non-PVC gloves.
- iii. Awareness building and provision of sustainable alternatives within procurement portals of general procurement must be promoted.

RESOURCE

A sustainable procurement in healthcare guide is available to guide the transition to sustainable practices. Wide dissemination and training is critical to facilitate adoption of these strategies.

IMPLEMENTATION

- i. A baseline assessment of potential opportunities for replacement of some categories of products and services with sustainable alternatives can be conducted.
- ii. The sustainability committee can engage with manufacturers and suppliers to stimulate production of sustainable alternatives by creating demand from health facilities for “green” products.
- iii. The committee can assess the high impact products and prioritise these categories in routine procurement. Examples include high-volume products such as PVC gloves and disinfectants which have both environmental and health impacts.

A sustainability action plan for the healthcare facility can be developed with scope for iterations and timeline for implementation as new sustainable solutions become available.

Action Plan	Stakeholders	Activities	Available Toolkits
Assessment of procurement practices in HCF • Establishment of Sustainability Committee/Green team in the healthcare facility for procurement policies • Creating the demand for sustainable substitution products and alternatives • Stimulating the policy and framework for sustainable manufacturing and consumption in alignment with SDG 12 • Quality control and incentivizing sustainable healthcare services	• State nodal officer for climate change • State Program Officers • Hospital Administrators • Medical Superintendents • Procurement Officers • Environmental Engineers	✓ Training programs on sustainable procurement ✓ Contextualize and develop Sustainable Procurement manuals for healthcare facilities	• Environmental Management System Certification ISO 14001:2015 • Green Hospital Standard's Manual • UNDP manual on Procurement • WHO manual on procurement • Green Hospital Standards (CCDC) • IIPHS guidelines • Sustainable procurement in healthcare guide(Health Care Without Harm)

- i. Mapping of the transport requirements for all components of healthcare delivery can help to prioritise development of a framework for an efficient transport system to ensure functional and sustainable services at all times and particularly during crises.
- ii. Assessment of the requirement for community outreach for healthcare services including home visits for antenatal care, immunization etc including frequency and distance must be conducted
- iii. An evaluation of access to sustainable travel options for patients and providers through provision of access to public transport services, pooled services where appropriate and emergency access to transport for remotely located patient populations must be conducted.
- iv. A baseline evaluation of the communication channels for internal functioning and linkages to essential services must be conducted to assess the gaps in delivery
- v. A robust system of linkages to disease surveillance, disaster response and emergency preparedness must be established.
- vi. A scoping of the communication services for provision of telehealth services and incorporation of digital health strategies for efficient healthcare delivery, especially last-mile connectivity, must be carried out with external consultants where appropriate.

RESOURCE – A guide and manual of operations for Hospital Climate Action Plan will be made available. This must be contextualized to the particular facility and linked to disaster response measures as outlined for overall emergency preparedness.

IMPLEMENTATION

- i. Establishment of pooled transport service strategies for patients and providers
- ii. Facilitation of sustainable supply chain choices for goods and services through linking public and private transport operations
- iii. Establishment of functional communication channels for delivery of essential services
- iv. Promoting incorporation of telehealth services to close the gaps in access to health care services

IX Climate Information services

The health facility must be linked to efficient climate information services that provide forecasting and warnings of acute changes in weather conditions and onset of acute climatic events like storms, floods, heatwaves, coldwaves and drought conditions.

ACTION

- i. Establish linkages to meteorological services for timely climate information to the healthcare facilities
- ii. Establish a plan for emergency response with regular mock drills organized by designated administrative personnel
- iii. Develop and prepare an emergency hospital action plan for movement and evacuation of patients, personnel and facility assets in the event of an acute event with functional services for acute illness and injury management

RESOURCE

Websites of state meteorological services and Ministry of Earth Sciences

IMPLEMENTATION

- i. The healthcare facility communication system must be linked to the state meteorological websites and helplines for receiving timely information and forecasting messages and alerts.
- ii. A disaster response team must be constituted under the control of the hospital administrator and public health officer for coordinated action when required.
- iii. Regular mock drills must be conducted after allocation of roles and responsibilities across different hospital personnel involved with both patient care and support services.
- iv. A plan for establishment of temporary or mobile shelters must be in place.
- v. Evacuation plans and provision for skeletal functioning of essential services in the event of an acute event must be established.

Action Plan	Stakeholders	Activities	Available Toolkits
Establishment of links to climate information services at every HCF level - Link to meteorological information services, including weather forecasting information - Access to linked disease surveillance systems - Linkage to disaster response teams - Evacuation plans and emergency preparedness strategy	- State nodal officer for climate change - State Program Officers - Hospital Administrators - Medical Superintendents - Procurement Officers - Environmental Engineers - Transport department officials in emergency response	Hospital communications and information system equipped with linkages to ✓ Early warning system for all acute climatic events including floods, droughts, heatwaves, poor air quality ✓ Weather forecasting units at city or district level ✓ Hospital emergency preparedness team on standby at all times ✓ Plan for moving patients and assets ✓ Plan for evacuation shelters and temporary and mobile structures ✓ Regular mock drills	- NDMA, 2008, "National Disaster Management Guidelines for Floods" - HCF action plans

X. Capacity building and Leadership

The entire organizational structure for efficient and coordinated climate response requires capacity building at all levels. The State Nodal Agency and the State Nodal Officer for Climate Change and his/her team must be equipped and aware of the requisite skillsets for climate adaptation of the healthcare facilities.

ACTION

- i. Awareness and sensitization of healthcare professionals and facility staff regarding acute climate events and related disease burden
- ii. Skill-building programs for all personnel involved in different components of health care delivery from patient care to allied and support services

RESOURCE

Training modules and training of the trainers courses will be available for capacity-building at state and district level.

IMPLEMENTATION

- i. Established short –term trainings for State Nodal Officers and health facility –level officers in public health and public works department to ensure essential services in a coordinated manner
- ii. Specific courses for waste management, sustainable procurement etc for designated officials involved in the management of these verticals.

Action Plan	Stakeholders	Activities	Available Toolkits
Capacity building plan for Climate preparedness and decarbonisation of HCF - Awareness and sensitization on Climate Change events on Heat wave, flooding, air pollution events, waste management. - Healthcare professionals awareness on climate –related disease burden. - Sensitization workshop on Bio-medical waste management handling - Sensitization workshop on Sustainable Procurement - Develop State-run flood forecasting and warning system	- State Program Officers - Environmental Engineers - Climate scientists - Public health professionals	✓ Flood forecasting, warning system, moving belongings and assets ✓ Evacuation shelters and temporary and mobile structures ✓ Training of healthcare and allied professionals in emerging disease burden due to climate change- CMEs, meetings, conferences ✓ Regular mock drills	- N A Yusoff et al 2017 - UNFCCC action plan - NDMA,2008, “ National Disaster Management Guidelines for Floods” - White Paper on Climate change and health: Role of the health sector

CONCLUSION

Overall an action plan with efficient inter-sectoral coordination and capacity-building at all levels will be necessary to help the healthcare facilities in the public and private systems to prepare for climate change. This health adaptation plan is proposed as a guide for action in all states and can be further contextualized for state and facility-level action.

ANNEXURES

- i. **All listed resource documents**
- ii. **Master checklist for implementation framework of WHO for green and climate-resilient healthcare facilities**
- iii. **Master checklist for implementation framework of CoE for green and climate resilient healthcare facilities.**

Health Adaptation Plan for Hilly and Mountainous area

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1. INTRODUCTION:

The Earth's climate has changed throughout history. Most of the climate changes are attributed to very small variations in Earth's orbit that change the amount of solar energy our planet receives.¹ The current climate change is however attributed much to the human activities. The planet's average surface temperature has risen about 1.62 degrees Fahrenheit (0.9 degrees Celsius) since the late 19th century, a change driven largely by increased carbon dioxide and other human-made emissions into the atmosphere.^{1,2} Most of the warming occurred in the past 35 years, with the five warmest years on record taking place since 2010. Not only was 2016 the warmest year on record, but eight of the 12 months that make up the year — from January through September, with the exception of June — were the warmest on record for those respective months.^{1,3} The recorded annual mean temperature in India since 1901 also suggests an increasing trend of temperature in the country. The overall difference of mean temperature between 1901 and 2014 is 0.4° C.⁴ The IPCC's third assessment report projected that, as we continue to change atmospheric composition, global average surface temperature will rise by 1.4 °C to 5.8°C in this century, along with changes in precipitation and other climatic variables.⁵

India is a vast country covering a total area of about 32.78 lakh sq km out of which hilly districts constitute a total of 7.08 lakh sqkm area which is about 21% of total land mass. There are 16 states which have hilly terrains in India (**Fig1**). It is observed from the list of the states that 10 states are fully hilly states. Those states are Arunachal Pradesh, Himachal Pradesh, J&K, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura and Uttarakhand. All the north-eastern states except Assam are totally under hilly terrain.

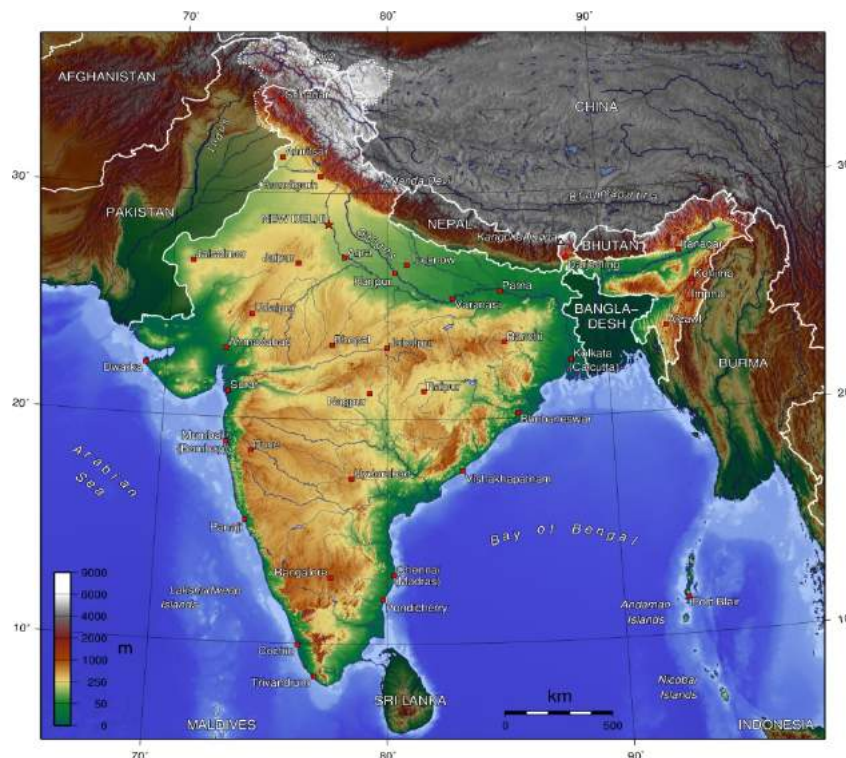


Fig. 1 Showing Topography of India
GOAL AND OBJECTIVES OF THE MODULE

GOAL:

To develop a holistic framework in order to increase the resilience to the adverse effects of climate change including prevention and control of climate sensitive diseases and its impact in mountainous and hilly regions of India.

OBJECTIVES:

1. To review the current trend of climate sensitive diseases and link the climate change parameters to the climate sensitive diseases to generate evidence on the health effects of climate change.
2. To develop an adaptation strategy through multi sectoral co-ordination to protect the population from the adverse consequences of the climate sensitive diseases.
3. To develop an action plan to protect the vulnerable population from extreme climatic conditions.
4. To facilitate exchange of knowledge and communication across different public health sectors for expansion of the adaptation framework.

DISTRIBUTION OF HILLY TERRAINS (STATE WISE) IN INDIA

An estimated 70 million people live in hilly and mountainous terrains in our country. A total of 16 states and 124 districts are categorized as hilly districts covering an estimated 7lakh sqkm.

Table 1: Showing the states with the number of hilly districts and the area under hilly terrain

Sl No	Name of State or <i>Union Territory (Italicized)</i>	Number of Districts	No. of Hilly district	Area under hilly terrain (sq km)
1	Andhra Pradesh	13	0	0
2	Arunachal Pradesh	24	13	83743
3	Assam	33	3	19153
4	Bihar	38	0	0
5	Chhattisgarh	27	0	0
6	Goa	2	0	0
7	Gujarat	33	0	0
8	Haryana	22	0	0
9	Himachal Pradesh	12	12	55673
10	Jammu and Kashmir	22	14	222236
11	Jharkhand	24	0	0
12	Karnataka	30	6	48046
13	Kerala	14	10	29572
14	Madhya Pradesh	52	0	0
15	Maharashtra	36	7	69905
16	Manipur	16	9	22327
17	Meghalaya	11	7	22429
18	Mizoram	8	8	21081
19	Nagaland	12	8	16579
20	Odisha	30	0	0
21	Punjab	22	0	0
22	Rajasthan	33	0	0
23	Sikkim	4	4	7096
24	Tamil Nadu	33	5	22789
25	Telangana	33	0	0
26	Tripura	8	4	10486
27	Uttar Pradesh	75	0	0
28	Uttarakhand	13	13	53483
29	West Bengal	23	1	3149
	TOTAL	703	124	7,07,747

2. CLIMATE CHANGE AND ITS IMPACT IN HILLY TERRAINS

Mountains are early indicators of climate change. Mountain systems are particularly sensitive to even small climatic changes having the potential to produce significant effects, particularly in marginal environments that are currently under stress.

Climate change due to increase of human activities is leading to several direct and indirect impacts on health and wellbeing of people living in the mountainous region in India.^{6,7}

The impact of climatic change on health condition can be broken down into three main categories:

1. Direct Impact (in the form of natural disasters)
2. Indirect effect (due to climate induced economic dislocation, crop failure and associated malnutrition and hunger)
3. Indirect Effect (due to spread and aggravated intensity of infectious diseases due to changing environmental condition).

Climatic changes may exacerbate the various types of flooding that are already common in mountain areas, such as riverine floods, flash floods, glacial lake outburst floods, and breached landslide dams.⁶

Some of the important potential health risks due to climate variations are:-

1. There is increased evidences of incidence of vector-borne diseases such malaria, dengue, chikungunya, JE etc in previously unreported mountainous areas. Vector borne diseases are moving beyond historical ranges.
2. The incidence of waterborne diseases such as diarrhoea are likely to increase due to contamination from flooding, increased human movement, drying up of water reserves.
3. Climatic changes may exacerbate the various types of flooding that are already common in mountain areas, such as riverine floods, flash floods, glacial lake outburst floods, and breached landslide dams
4. The risk of flash floods and landslides during the monsoon period causing injuries and loss of human life.

POTENTIAL DISEASES RELATED TO CLIMATE CHANGE IN HILLY TERRAINS

Table 2: Potential list of water borne climate sensitive diseases

Climate sensitive diseases	Epidemic potential	Environmental changes	Non- Climatic factors
Cholera	High	• Rise of Temperature • Bacterial survival & proliferation time • Precipitation • Extreme weather • Variations in weather • Glacier melting • Flooding • Drought	• Poor SEC • Poor sanitations • Lack of awareness • Contamination of water, food with human & livestock faeces • Livestock farming • Flooding break down sanitation systems • Lack of potable water • Faeco-oral transmission • Outbreak/Epidemic • Poor public health preparedness & response
Acute Diarrhoeal Diseases (dysentery & Diarrhoea)	High		
Enteric Fever	High		
Viral Hepatitis	High		

Table 3: Potential list of Vector borne climate sensitive diseases

Climate sensitive diseases	Epidemic potential	Environmental changes	Non- Climatic factors
Malaria	High	• Temperature • Precipitation • Humidity • VBD move to higher altitude • Accelerate pathogen developments • Increase of breeding site • Length of transmission season may increase • Change in vector life span • Increase vector density	• Expansion of agriculture • Irrigation, cropping practices • Insecticide use • Live stock farming • Deforestations • Urbanization • Population migration • Awareness level • SEC • Public health preparedness & response
JE	High		
Dengue	High		
Chikungunya	High		

Climate change and water borne diseases:

In South Asia, scientists predict an increased frequency of floods due to greater intensity of rainfall events and to glacier lake outburst floods (GLOFs) in mountainous regions. These trends are already being seen. In 2007, floods resulting from monsoon rains killed more than 2,000 persons and displaced more than 20 million persons in Bangladesh, India and in Nepal.^{8,9} In 2010, at least 255 people are reported to have died after a cloudburst in Ladakh and heavy overnight rains triggered flash floods, mudflows and debris flows. Floods create conducive environments for numerous health consequences resulting from disease transmission. For example, if floodwaters become contaminated with human or animal waste, the rate of faecal-oral disease transmission might increase, allowing diarrheal disease and other bacterial and viral illnesses to flourish. Faeco-oral transmission of diseases is of particular concern in regions with limited access to clean water and sanitation.¹⁰ A warmer climate could cause water-borne diseases to become more frequent, including cholera and diarrhoeal diseases.¹¹ As rising ambient temperatures increase, bacterial survival time and proliferation also increases and thus the incidence of diarrhoeal diseases might further increase.¹² Human exposure to waterborne infections occurs by contact with contaminated drinking water or food, which may result from human actions, such as improper disposal of sewage wastes, or be due to weather events like floods. Rainfall can influence the transport and dissemination of infectious agents.

The burden of waterborne disease in India is enormous (Figure 2). Diarrhea is the third leading cause of death in under-5 children in India.¹³ Diarrheal diseases are largely attributable to unsafe drinking water and lack of basic sanitation; thus, reductions in the availability of freshwater are likely to increase the incidence of such diseases.¹⁴ Rapid urbanization and industrialization, population growth, and inefficient water use are already causing water shortages.⁹ Climate change will exacerbate the lack of available fresh water as annual mean rainfall decreases in many areas.

A relationship has been observed between increase in sea-surface temperature and the onset of cholera epidemics, with the cholera outbreaks following the seasonal rise and fall in sea-surface height and temperature.¹⁵ According to WHO's journal of public health, "Bulletin of the WHO", an approximate of 24% rise in the number of cholera cases identified from 2000 to 2008 in India.¹⁶ Cases of cholera has been reported in the past few years in hilly states like Arunachal Pradesh, Mizoram and Nagaland.¹⁷

Table 3: Table showing the year wise trend of water borne diseases in hilly states

States	Cholera				Acute Diarrhoea				Enteric Fever			
	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017
Arunachal Pradesh	0	0	9	0	12675	10834	11715	4826	4512	4476	4574	551
Himachal Pradesh	0	0	0	0	350459	334168	310789	247993	48786	40639	38093	31925
Manipur	0	0	0	0	29954	29159	33193	23942	10636	5422	4942	2539
Meghalaya	1	0	0	0	197024	167691	165404	83466	10395	13459	14128	4010
Mizoram	0	26	17	5	14201	14215	13602	9414	2758	2804	3085	1818
Nagaland	0	0	6	0	22301	15511	15062	9573	11604	7977	8267	5759
J&K	0	0	0	0	515013	472843	534341	410190	57537	52359	46904	34971
Sikkim	0	0	0	0	3983	53295	46289	28115	716	453	474	65
Tripura	0	0	0	0	80388	88064	95278	59852	10553	4596	5398	1856
Uttarakhand	0	0	0	0	90428	108974	110942	73055	28939	34120	33904	21237

Climate change and Vector borne diseases:

The occurrence of vector-borne diseases is widespread, ranging from the tropics and subtropics to the temperate climate zones. With few exceptions, they do not occur in the cold climates of the world, and are absent above certain altitudes even in mountain regions of the tropical and equatorial belt.^{6,9} However, Vectors are moving beyond their historic ranges to higher elevations.¹⁸ Vector for transmitting Falciparum malaria is reported to be spreading to higher altitudes in the Himalaya.¹⁹ There has been report of possible upward transmission of the leishmaniasis vector beyond 600 m in Garhwal and Himachal Pradesh in India, where it was previously not endemic.²⁰ Shuklaa et al (1999) reported clinical cases of dengue, as well as larvae of its principal vector, Aedes aegypti from the Kumaon hills at elevations higher than previously reported.²¹ Similarly, there have been several first time recent reports of vector borne diseases such as chikungunya virus (CHIKV), Dengue as well as their vectors in the hilly regions of Northeastern Region of India by Indian Council of Medical Research.²²⁻²⁵

Though vector borne diseases like malaria are endemic in many districts, it is legitimate to worry about malaria in few new pockets due to lack of complete awareness in these areas, which to date have not grappled with such problems. There is an urgent need to educate health workers in hilly areas who may not have seen malaria in the past but could now confront the disease due to climatic changes. Inaccessible terrain in hilly remote areas, lack of adherence to medication and incomplete treatment, advocacy in a language and idiom not understood by communities are some of the factors which act as roadblocks in the field.²⁶

Vulnerability in context of climate change:

Generally the vulnerability of a population to a health risk depends on local environment, availability of local health infrastructure, access to information on extreme weather threats, thus vulnerability of different regions will vary accordingly. Vulnerability to various diseases may be related to weather conditions such as temperature, precipitation, ecological changes including deforestation, altitude, latitude, topography, soil pattern, man-environment interfaces etc. Vulnerability risk assessments can provide information for decision-makers on the extent and magnitude of likely health risks attributable to climate change, as well as suggest priority policies and programmes that can prevent or reduce the severity of future impacts.²⁷ For assessment of vulnerability the data collected need to be

robust and the data need to be viewed in the context of local communities and environments. Integrating local and scientific knowledge is necessary to make informed decisions.

Table 4: Table showing the year wise trend of vector borne diseases in hilly states (2014-2017)

<i>States</i>	Dengue				Malaria				Chikungunya				JE			
	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017
Arunachal Pradesh	27	1933	13	15	6082	5088	3128	1538	0	35	239	15	32	32	0	5
Himachal Pradesh	2	19	322	453	102	60	106	95	0	0	0	0	0	0	0	0
Manipur	0	52	51	187	145	216	122	80	0	0	0	0	1	6	47	186
Meghalaya	0	13	172	42	3916 8	48603	3514 7	1643 3	0	78	360	200	72	41	47	48
Mizoram	19	43	580	107	2314 5	28593	7583	5710	0	0	0	0	0	0	0	0
Nagaland	0	21	142	357	1936	1527	828	394	0	0	0	0	6	0	0	0
J&K	1	153	79	485	291	216	242	226	0	0	1	0	0	0	0	0
Sikkim	5	21	82	659	35	27	15	12	0	0	30	83	0	0	0	0
Tripura	6	40	102	123	5124 0	32525	1054 6	7040	34	180	311	468	14	28	98	90
Uttarakhand	106	1655	2146	971	1171	1466	961	532	0	0	35	0	2	2	0	0

3. ADAPTATION STRATEGY:

Adaptation to climate change is both related to vulnerability which can be defined as “degree to which individuals and systems are susceptible to or unable to cope with the adverse effect of climate change” and to future potential impacts either avoidable or unavoidable. The following key adaptation strategies have been identified in the table as given below.

S.No	Key strategy	Task/activities
1.	Vulnerability Assessment/Mapping of vulnerable structures/population	- Analyze the pattern and magnitude of climate sensitive diseases in the hilly areas - Analysis of the meteorological data, geological data (help to be taken from Indian Meteorological Dept. and Geological Society of India) - Identifying & Mapping vulnerable hilly areas prone to climate sensitive diseases (Use of GIS & remote sensing) - Identifying different communities where vulnerabilities (migrant population, slums, construction sites, isolated hamlets in hazardous terrains etc) are highest and where the need for safety and resilience is greatest
2.	Identification of stakeholders	- Representatives from the Respective State Health services - Representatives from Vulnerable districts: <i>Block Medical Officers, Program Officers.</i> - State Program managers: <i>NVBDCP, IDSP.</i> - State level Representatives from International Organizations: <i>WHO, UNICEF</i> - Local NGO Representatives - Representatives /Experts from Medical Colleges. - Representatives from State/District Disaster Management Authority. - Representatives from Public Health Engineering department. - State Representative from Public Health Laboratory - State Disaster Response Team
3.	Orientation/Capacity building/training of stakeholders and involved personnel	- Training/Orientation of medical and paramedical staff to climate sensitive diseases and its early detection. - Capacity building of grass root level workers to report cases of vector borne diseases, water borne diseases, unusual syndromes to health centres with early conformation of diagnosis and complete treatment of all cases. - Capacity building of State Disaster Response Team & Epidemic Preparedness Team - Prioritize the strengthening of existing capacities (man power, logistics) among local authorities, civil society organizations, and the private sector

4.	Development of zone specific action plan, generation of resources and man power	• Each State may develop Zone specific action plan after risk assessment • Separate allocation of funds from the state health budget for execution of action plan • Documentation of roles & responsibilities of stakeholders • Health system preparedness for extreme weather events/ natural calamities/epidemics
5.	Awareness generation/developing tools for IEC/plan for delivery of IEC	• To raise public awareness about climate change and its effects on health • Awareness of disasters specific to hilly and mountainous regions like landslides, earthquakes, flash floods with the use of mass media and social media. • Vector borne diseases, methods of prevention, early detection of symptoms, recognition of warning signs and prompt reporting. • Periodic mock evacuation drills at community level to be carried out by rescue teams
6.	Monitoring/Surveillance/Research	• Strengthening the existing disease surveillance system for early detection of outbreaks of vector borne /water borne diseases • Monitoring of implementation plans on climate sensitive diseases. • Conducting operations/ translational research • Include climate sensitive diseases management in planning, implementation and follow up activities

Table 4: Highlighting the strategies with specific roles and responsibilities

Key strategy	AGENCY RESPONSIBLE	RESPONSIBILITIES
VILNERABILITY ASSESSMENT	Indian Meteorological Department (IMD), Geological Society of India (GSI), Regional level space application centres	• FORECASTING EXTREME WEATHER EVENTS, Monitoring the temperature, Atmospheric pressure, Precipitation levels and providing data, • MAPPING OF AREAS,
BASELINE SURVEY	State Health Department (DMO rep hilly districts, BMO rep hilly districts)	• Robust monitoring and reporting of climate sensitive diseases and linking it to data provided by IMD & GSI • Estimate a baseline for commonly prevalent diseases
IDENTIFICATION OF STAKEHOLDERS	MoHFW with State health department	• Identification of all stakeholders responsible for execution of action plan with appropriate communication
CAPACITY BUILDING OF STAKEHOLDERS	MoHFW with State health department	• Orientation of all the stakeholders on climate change and its impact, delegation of roles and responsibilities
DEVELOPMENT OF ZONE	Stakeholders	• Formulation of preparedness action plan

SPECIFIC ACTION PLAN, GENERATION OF RESOURCES AND MAN POWER		by respective stakeholders (District disaster management authority, District health department, Local NGOs, International Organizations, District IDSP Cell, District public health laboratories, Public health engineering Deptt, State pollution control board)
AWARENESS GENERATION/DEVELOPING TOOLS FOR IEC/PLAN FOR DELIVERY OF IEC	State & District health society in collaboration <i>NVBDCP, IDSP etc</i>	• Preparation of IEC materials relevant to climate sensitive disease • Orientation of grassroot level workers for delivery of IEC
MONITORING/SURVEILLANCE	Collaborative inter & intra sectorial efforts (State & District health society, Medical colleges, Public health engineering Dept. Meteorological Dept. SAC, IDSP	• Ongoing process, state and district health society with existing IDSP framework will continue robust monitoring of relevant diseases • PHED will monitor water supply systems, sanitation, water quality

Strategies specific for Water Borne Diseases:

Actions	Strategies	Responsible institutions	Monitoring and evaluation (Indicators)
1. Data gathering	1.1 Collection of data on climate change parameters 1.2 Preparation of data recording and reporting format 1.3 Training on efficient and timely data capture 1.4 Collection of data on trend of water borne diseases 1.5 Sharing and Linkage of health and environment data with the use of software's	IMD, Geological Society of India. IDSP cell of State. State Health Dept in collaboration with IMD. IT Dept. HMIS unit of State Health Dept.	• Regular(monthly) reporting of data on 1. Annual mean Maximum temperature trends 2. Annual mean Minimum temperature trends 3. Annual average rainfall trends 4. Annual mean DTR trends • Monthly Updated Data base of climate sensitive parameters • Timely and complete uploading of forms in the Institute web site (IDSP, IMD) • Usage of software for linking the climate and health related data. Yes/No
2. Response to impending outbreaks	1.1 Utilizing the data for early detection of water borne epidemics	IDSP cell	• No of warning signals generated and communicated in a year(from district to state)

	1.2 Early response to outbreaks of water borne diseases 1.3 Timely preventive actions taken for prevention and control of spread	DHS + IDSP cell DHS + IDSP cell	• No of epidemics predicted at an early stage annually at State level. • No of visits conducted by RRT teams to investigation sites. • No of outbreaks of water borne disease controlled with timely intervention in the State (district wise break up)
3. Developing co-ordination and communication systems	1.1 Mapping of key institutions involved in this activity and identification of nodal person from each institution. 1.2 Regular sharing and dissemination of data among the nodal persons. 1.3 Conducting research on climate sensitive diseases to generate a pool of evidence.	State Health Dept (IDSP cell, HMIS cell, IEC cell , District Medical officers, State Program Manager) in collaboration with IMD, Agriculture Dept, Water Resources and Soil Conservation Dept, IDSP cell, Directorate of Information and Public Relations.	• Database availability of key institutions • Updated list of nodal persons with contact numbers • No of meetings conducted yearly among stakeholders • Data base of research Research surveys conducted annually • No of research studies /articles published on climate change and health.

Water Conservation and Management:

In India, regardless of improvements to drinking water, many other water sources are contaminated with both bio and chemical pollutants, and over 21% of the country's diseases are water-related. Furthermore, only 33% of the country has access to traditional sanitation. One concern is that India may lack overall long-term availability of replenishable water resources. Water scarcity in India is expected to worsen as the overall population is expected to increase to 1.6 billion by year 2050. This problem is more serious for people residing in hilly terrains of India. <https://thewaterproject.org/water-crisis/water-in-crisis-india>

A water safety and conservation plan should be prepared by the **Department of water Resources** to ensure supply of safe drinking water to the public. The core areas that should be highlighted are:

- Strengthening surveillance of water quality, monitoring safety of available water bodies.

- Raising awareness among the public on water conservation and minimizing wastage of water.
- Concrete plan on water harvesting and water shed management for both rural and urban areas. This may be implemented in some core areas as a pilot project and may later on be expanded based on the initial results.
- Waste water management and recycling strategies to be chalked out and implemented in some areas as a start up project.
- Cost effective and appropriate water conservation techniques for household purposes.

Strategies Specific for Vector borne diseases:

Actions	Strategies	Responsible institutions	Monitoring and evaluation (Indicators)
1. Data gathering	1.1 Collection of data on climate change parameters	IMD, Geological Society of India.	• Regular(monthly) reporting of data on 1. Annual mean Maximum temperature trends 2. Annual mean Minimum temperature trends 3. Annual average rainfall trends 4. Annual mean DTR trends
	1.2 Collection of data on entomological parameters	Regional ICMR Institutes: Entomology Units	• Regular (monthly) reporting of data on Entomological parameters : - For Malaria: Mosquito Species, Resting collections, Indoor resting density, Human biting rate, human blood index, Sporozoite rate, Insecticide susceptibility, larval density, pupal density. - For Dengue: House Index, Container Index, Breteau Index, pupal index. <i>Sentinel sites which are endemic may be selected for surveillance.</i>
	1.4 Collection of data on trend of vector borne diseases	IDSP cell of State. State Health Dept in collaboration with IMD:	• Monthly Updated Data base of climate sensitive parameters, Entomological parameters, disease outbreaks.

	1.5 Sharing and Linkage of health, entomological and environment data with the use of software's	IT Dept: technical help from IT experts. HMIS unit of State Health Dept.	• Timely and complete uploading of forms in the Institute web site (IDSP, IMD, ICMR) • Usage of software for linking the climate, entomology and health related data. Yes/No
2. Response to impending outbreaks	1.1 Utilizing the data for early detection of vector borne epidemics 1.2 Early response to outbreaks of vector borne diseases 1.3 Timely preventive actions taken for prevention and control of spread	IDSP cell DHS + IDSP cell DHS +NVBDCP Unit	• No of warning signals generated and communicated in a year(from district to state) • No of epidemics predicted at an early stage annually at State level. • No of visits conducted by RRT teams to epidemic sites • Regular updating of data from field teams on the epidemic Yes/No • No of villages covered for Indoor Residual spraying after reporting of cases • No of Awareness campaigns conducted in epidemic sites after reporting. • Bed nets distributed in epidemic sites after reporting. Yes/No • Action taken (on epidemic) report submitted and communicated at all levels Yes/No

Vector Control strategies: To be implemented by the NVDBCP cell in each district

Integrated Vector Control which includes a justified combination of all known strategies of vector control: Environmental, Chemical control through use of larvicides and adulticides, biological control and personal protection measures.

Environmental control: The Municipal Corporation in urban areas and the Village panchayat in rural areas to be involved. The Public Health Engineering Department to be the key department to co-ordinate such activities.

- Mosquito-proofing of overhead tanks/ cisterns/ underground reservoir/wells. It is, also essential that potable water supplies be delivered in sufficient quantity, quality and consistency to reduce the necessity and use of water storage containers that serve as the most productive larval habitat.

- Water coolers, and air conditioners should be regularly inspected, drained and cleaned.

- There is a need for periodic inspection of areas during the rainy season to locate potential breeding sites.

Proper solid waste disposal: Solid wastes, namely tins, bottles, buckets or any other waste material scattered around houses, should be removed and buried in landfills.

Chemical control: The details regarding chemical control of vectors is already described in detail under the NVBDCP program. Link <https://www.nvbdc.gov.in/>

Insecticidal Residual Spray is one of the most cost-effective control measures for Malaria and Kala-azar in India. To maximize the impact of IRS, it should be synchronized with case detection. The success of the effectiveness of house spraying for malaria control depends on adherence to the specified criteria of the insecticide and application procedure, public acceptance of spraying, the availability of well maintained equipment, adequately trained spraying personnel, efficient supervision and strong financial support.

(IEC): Specific IEC will be prepared based on the illness.

For Diarrhoeal diseases: Mothers in each household may be sensitized on prevention of diarrhoeal diseases during Village Health Days, Observance of Diarrheal Control Fortnight. The School Health program can be used for education of children on safe water and diarrhea prevention.

For Vector Borne Diseases: Health education materials should be developed and widely disseminated in the form of posters, pamphlets, handbills, hoardings. Inter-personal communication through group meetings, traditional / folk media particularly must be optimally utilized. These activities may be carried out in close liaison with the NVBDCP program.

4. FORMULATION OF ACTION PLAN:

1. **Logistics required at health care facility:** Supply of consumables including drugs for the common communicable diseases in the area. Also every district should be equipped with a trauma centre for the management of disaster like landslide, earthquake or road traffic accidents . State of the art laboratory services for diagnosis of common vector borne diseases and also for zoonotic diseases.

Resources	
Infrastructure	1. Disaster resilient health care structures. 2. Emergency/ Trauma centre for management of disasters. (at least 1 in every district) at least one trained orthopaedic surgeon, General Surgery and Anesthetist along with support staff. 3. Isolation wards in district hospitals. Refer to document: <i>Guidelines for screening centres and isolation facilities in hospitals.</i> https://mohfw.gov.in/sites/default/files/7784416446.pdf 4. Laboratory infrastructure with State of the Art diagnostic facilities.(at least 1 in every district)
Human Resources (At district level)	1. Epidemic preparedness (Rapid response team) 2. Search and Rescue team 3. Doctors trained in Emergency Medicine (two in each district HQ) 4. Infectious disease specialist. 5. Microbiologist 6. Epidemiologist/ Public Health Specialist 5. Laboratory Technicians 7. Personnel from Public Works/Public Health engineering department. 8. Experts from Agriculture, Forests and Water Department. 9. Entomologists 10. Technological experts for mapping of areas and projection. 11. Public Health experts.
Drugs, testing kits, reagents	1. Rapid diagnostic kits for Malaria. 2. Specimen collection tools 3. Diagnostic facilities for JE, Dengue,

	Chikungunya. 4. Water testing kits. 5. Drugs for malaria 6. IV fluids /drugs for management of VBD's. 7. Antibiotics 8. ORS solutions 9. Vaccines 10. Cold chain equipments (ILR, Deep freezers) 11. Decontamination solutions

2. Preparedness of health system and personnel: Coordinate the surveillance activities under Vector Borne Diseases Control Program (NVBDCP) & Integrated Diseases Surveillance Program (IDSP) with the state health department. Also there should be coordination with State/District Disaster Management for emergencies due to natural disaster like landslide, earthquake and flood.

a. *Epidemic Preparedness Teams should be constituted at State and District Level for Epidemic Preparedness.* The framework under IDSP for epidemic preparedness (Rapid Response Teams) may be adapted as such in the action plan with some modifications as per local contexts.

The Roles of the State Epidemic preparedness team will be:

- Surveillance of infectious diseases and risk analysis in the state.
- Chalking out action plans with clear lines of responsibility when an outbreak occurs.
- Identification of teams' leaders and members (e.g. Rapid Assessment Team (RAT), Investigation Teams, Control Teams etc).
- Conducting regular meetings to review data and evaluate the effectiveness of the implemented measures in the state.
- Making recommendations for improvements of outbreak preparedness plan

The roles of the District epidemic preparedness team will be:

- Surveillance and monitoring of climate sensitive diseases at district level.
- Promptly investigate any outbreaks of diseases within the district.
- Prepare an action plan for epidemics with specification of man power and other logistics.
- Report regularly to the State Health authorities on infectious disease outbreaks and unusual syndromes reported within the district.

b. *Search and Rescue team:* The main objective of the Search and Rescue team is to rescue trapped survivors in a disaster and provision of aid to people who are in imminent danger. Search and rescue teams specific for mountainous regions may be recruited by the State Authorities (help to be taken from NRDA & SRDA) who will work in close liaison with the

State and District authorities. Outsourcing from external agencies may be considered if required.

c. *Public Health laboratories:* A list of all public health laboratories to be maintained at State Level. Regular monitoring of the laboratories, capacity building of the labs in terms of equipment, man power and reagents need to be ensured at every district to tackle any kind of public health emergencies. It should be ensured that at least one public health laboratory having comprehensive testing services (clinical, environmental, food and water quality testing) should be there at each district. Local PHLs play an important role in the public health system as the only laboratories that exist solely with the incentive, mission, and community ownership to address laboratory services for local public health and safety.

3. Operational communication channel. Nodal centre at state level will be established for coordination of the activity. Alert from the surveillance data/any other sources will be received by the nodal center. The data/information will be analyzed and interpreted followed by on spot visit of the area by rapid assessment team along with management facilities including laboratory services by a Rapid Response Team (epidemiologist, microbiologist, physician and support staff) from IDSP. The same may be communicated to the national nodal center if any'

4. Mechanism to ensure data surveillance, alert generation, timely sharing with concern departments & stakeholders: The tools of epidemiological surveillance for early detection in conjunction with direct and remote sensing technologies for surveillance of the environmental determinants of health (e.g. water and air quality, variability in ambient temperature and humidity or incidence of extreme weather events) should be used for surveillance and alert generation. The overarching aim of this component is to use integrated disease surveillance and monitoring of a broad range of signals around a health risk and early warning systems to identify changing conditions more quickly to anticipate outbreaks and emergencies related to weather and climate. Coordinate the surveillance activities under Vector Borne Diseases Control Program (NVBDCP) & Integrated Diseases Surveillance Program (IDSP) with the state health department. Also state referral Laboratory services will be required for testing of samples for confirmation of diagnosis.

5. ESTABLISHING AN INTEGRATED SURVEILLANCE SYSTEM

Strengthening the existing disease surveillance system for early detection of outbreaks related to climate sensitive diseases. Disease specific operational guidelines are already available in IDSP can be used. The baseline data on health outcome and climatic and other environmental factors to be determined to understand the subsequent changes in those health outcomes. **Establishing an integrated surveillance system will be key for understanding the correlation between health outcome and climatic parameters.** It should also include development of models and early warning systems (EWS) and establishment of An Early Warning, Alert and Response Network (EWARN) at district level

Annexure1 : Actions for risk reduction & management

Strategies	Actions
A. Risk Assessment	• Hazard identification through existing surveillance data • Prioritization of public health threats
B. Risk Communication	• Conveying or transmitting information between parties about impending public health risk related to climate change.²⁹ • Communicating about the risks during any outbreaks • Should not be restricted to negative messages and warnings but should include positive 'educational messages' & protective behaviours that populations and individuals can adopt²⁹
C. Situation Management	• A comprehensive coordinating outbreak response team • Rapid case detection and response • Managing negative feedback and outrage • Priority setting for diseases & disaster • Anticipating concerns • Develop strategic plan of action

The following framework can be used to assess the level of risk and resources at hand for effective management of climate sensitive diseases and disasters. Each state/ district can prepare its own framework.

PRIORITY SETTING FOR DISEASES-

CLIMATE SENSITIVE DISEASES	RISK	IMPACT	CONTROL MEASURES	RESOURCES AVAILABLE
MALARIA				
JE				
CHIKUNGUNYA				
Acute Gastro Enteritis				
CHOLERA				
DENGUE				

PRIORITY SETTING FOR DISASTERS:

NATURAL DISASTERS	RISK/VULNERABILITY	IMPACT	CONTROL MEASURES	RESOURCES
LAND SLIDE				
FLASH FLOODS				
THUNDER STORMS				

Annexure 2: Case definitions and Triggers from IDSP framework maybe used:

MALARIA-Any patient with fever with any of the following: *Chills, sweating, jaundice or splenomegaly, Convulsions, coma, shock, pulmonary edema and death may be associated in severe cases.*

Malaria: Outbreak definition:

Trigger 1

- Single case of smear positive in an area where malaria was not present for a minimum of three months
- Slide positivity rate doubling over last three months
- Single death from clinically /microscopically proven malaria
- Single *falciparum* case of indigenous origin in a free region

Trigger 2:

- Two fold rise in malaria in the region over last 3 months
- More than five cases of *falciparum* of indigenous origin

JAPANESE ENCEPHALITIS:

- Febrile illness of variable severity associated with neurological symptoms ranging from headache to meningitis or encephalitis
- Symptoms can include: Headache, fever, meningeal signs, stupor, disorientation, coma, tremors, paresis (generalized), hypertonia, loss of coordination
- The encephalitis cannot be distinguished clinically from other central nervous system infections

Trigger 1

- Clustering of two or more similar case from a locality in one week

Trigger 2

- More than four cases from a PHC (30,000 population) in one week

DENGUE FEVER:

An acute febrile illness of 2-7 days duration with 2 or more of the following:

- Headache, Retro-orbital pain, Myalgia, Arthralgia, Rash, Hemorrhagic manifestations, Leucopenia

Trigger 1

- Clustering of two similar case of probable Dengue fever in a village
- Single case of Dengue hemorrhagic fever

Trigger 2

- More than four cases of Dengue fever in a village with population of about 1000

SOURCES OF INFORMATION TO DETECT OUTBREAKS

- Rumour register
 - To be kept in standardized format in each institution
 - Rumours need to be investigated
- Community informants
 - Private and public sector
- Media
 - Important source of information, not to neglect
- Review of routine data
 - Triggers

EARLY WARNING SIGNALS FOR AN OUTBREAK

- Clustering of cases or deaths
- Increases in cases or deaths
- Single case of disease of epidemic potential
- Acute febrile illness of an unknown aetiology
- Two or more linked cases of meningitis
- Unusual isolate
- Shifting in age distribution of cases
- High vector density
- Natural disasters Eg: Floods

LEVELS OF RESPONSE TO DIFFERENT TRIGGERS

Trigger	Significance	Levels of response
1	Suspected /limited outbreak	Local response by health worker and medical officer
2	Outbreak	Local and district response by district surveillance officer and rapid response team
3	Confirmed outbreak	Local, district and state
4	Wide spread epidemic	State level response
5	Disaster response	Local, district, state and centre

Annexure 3: Sample Checklist for Baseline Survey

A. Demographic and Socio-economic profile overview of State & District

1. Geographical Data-

Latitude, Longitude & Area (Sq. Km) /Terrain

% area under slope: >30 degree (+)

Areas with elevation: >500 ft.

Number of hilly district:

% area under forest cover (-)

2. Meteorological Data-

(1) List of Meteorological stations-

(2) Climate- tropical/dry/ temperate/ cold/polar.

(3) Temperature (in °C): Summer: March – June

Monsoon: July – September

Winter: October – February

(4) Precipitations-

a. Average rainfall (mm):

b. Average snowfall (mm):

c. Sunshine hours:

d. Relative humidity:

e. Atmospheric pressure:

f. Wind speed:

3. (Non-climatic/Geographic indicators)

a. Demographic- (State & District)

i. Total Population:

ii. Census:

iii. Caste Distribution,

iv. Economic distribution:

v. Education status:

vi. Livelihood profile:

b. Other Indicators-

i. Industries:

ii. Tourism (Tourist Places):

iii. Food supply (supply and demand, availability) :

iv. Water supply services:

v. Waste water management:

vi. Solid waste management :

vii. Transportation (e.g. public transport, number of private vehicles etc.)

viii. Access to Health Care Services (public health and health services)

ix. Energy (electricity, fossil fuels, cooking fuels etc.

x. Building (design, energy use)

B. Disease Profile

- Diseases Prevalent (Estimate a baseline for commonly prevalent climatic sensitive diseases)

Diseases	Prevalence rate	Outbreaks in last 3 years
Water borne diseases • Cholera • Acute Diarrhoeal Diseases (dysentery & Diarrhoea) • Enteric Fever • Viral Hepatitis		
Vector borne diseases • Malaria • JE • Dengue • Chikungunya		
Others		

Annexure 4: Sample Check-list for Vulnerability Assessment of Climatic Sensitivity Diseases (Describe current health risks & public health capacity to manage risk)

A. Identification of hilly areas, population & regions Vulnerable to Climatic Sensitivity Diseases

1. Describing current risks of climate-sensitive health outcomes, Including the most vulnerable populations and regions

Indicators	Unit	Source of Data	Vulnerable Areas
Geographic hilly area considered most vulnerable to climate change	Mapping GIS		1. 2. 3. 4.
Identifying different communities where vulnerabilities are highest (migrant population, slums, construction sites, isolated hamlets in hazardous terrains etc.)			1. 2. 3. 4.

2. The relationship between climate conditions (current and past weather) and health outcomes in vulnerable areas & communities

- a. Identified vulnerable areas:

Indicators	STATUS(Yes/No)	Outcome (Trend of Climatic sensitive Diseases in relation to documented indicators of climate changes)		
		Diseases	Magnitude	No. of Epidemic/Outbreak
a. Temperature change				
b. Precipitation change				
c. Extreme weather events				

(The table to be used separately for each vulnerable areas)

B. Identification of associated sector on vulnerable to climatic changes

Are each of the sectors below being affected by these changes and events? If so, what plans or actions are already in place to respond

Identified Sector	Status (Yes/No)	Outcome	Responses
1. Industries			
2. Tourism			
3. Food supply (supply and demand, availability)			
4. Water supply services			
5. Waste water management			
6. Solid waste management f.			
7. Transportation (e.g. public transport, number of private vehicles etc)			
8. Health (public health and health services			
9. Energy (electricity, fossil fuels, cooking fuels etc			
10. Building			

(design, energy use)			

3. Sample Checklist for IDENTIFICATION OF STAKEHOLDERS & CAPACITY BUILDING OF STAKEHOLDERS

Stakeholders	National/State/Local (Govt. / NGO)	Roles and Responsibility	Orientation Training on Climate Change Received (Yes/No)

Annexure 4: Sample Checklist for Awareness Generation/Developing tools for IEC/Plan for delivery of IEC

IEC planning	
What are the modes of IEC/ Awareness planned?	☐ District level launch ☐ Miking ☐ Drum beating ☐ HH Stickers ☐ My Village My Home ☐ TV ☐ Radio/ Community Radio ☐ Public Announcement/ Announcement in religious places ☐ Community meetings/ Mothers' meetings ☐ Rallies ☐ Newspaper ☐ Pamphlets/ Leaflets ☐ Street Banner/ Hoarding ☐ Session Banner ☐ Media orientation ☐ Meeting with Key influencers/ community leaders ☐ Others, Specify _____
Have you received any funds for IEC for? *	☐ Yes, State funds for SID ☒ No ☐ Not aware ☐ other (specify) _____
Has the state/district received any prototypes for IEC planning?	☐ Yes ☐ No ☐ Not aware
Have you printed IEC materials for your district/block?	☐ Yes ☐ No ☐ Not aware

4. Sample Checklist for monitoring & surveillance Use of IDSP checklist

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COVID 19

Experiences and Climate Change

COVID experiences and Climate Change

COVID-19 Scenario

Global Scenario

The COVID-19 pandemic has been a very challenging public health crisis globally particularly due to its highly infectious nature, large scale involvement of the populations and places all across the globe. The unprecedented health crises in the pandemic times were having observations of a rapidly spreading of the new viral infections among the people and rising number of newly and severely affected areas across the world. There was a continuous worldwide reporting of increasing acute and severe health problems, loss of human lives, extreme hardships to health care facilities, crisis in availability of required healthcare facilities infrastructures and logistics in the form of hospital beds, masks, gloves, PPEs, ventilators, testings, reagents, skills and informations for specific management of the infected cases, awareness and skills of the healthcare professionals and workers across the countries. This health crisis was following a report of a cluster of atypical pneumonia cases from Wuhan, China, in December 2019 but was later designated as Coronavirus disease 2019 (COVID-19) on 11th February 2020. Finally, on 11th March 2020, the World Health Organization (WHO) had declared COVID-19 as a Global Pandemic. The causative virus is known as SARS-CoV-2, a novel strain of coronaviruses having 79% genetic similarity with SARS-CoV from the 2003 Severe Acute Respiratory Syndrome (SARS) outbreak.

Indian Scenario

In spite of the early precautions and preventive health advisory measures undertaken by the Government of India in the early 2020, the COVID-19 infections started to spread rapidly across different parts of the country after the first case was reported on January 30th, 2020. Keeping public health as the utmost priority, our country eventually declared a nationwide lockdown on 24th March 2020 to control and manage the highly infectious disease among the population. The nationwide

lockdown in the country was meant to control its rapid transmission and adverse health impacts among the population and gave opportunity in strengthening several public health measures to combat the pandemic crisis in the country. However, it did bring extreme hardships in all dimensions including medically, socially, economically and psychologically to all people particularly to the elderly and those with the underlying medical ailments. COVID-19 pandemic highlighted the unimaginable vulnerability of health sector across the world including our country. The acutely increasing and widespread demand for healthcare services including availability of required infrastructures and logistics for managing the affected populations from across different places in the country was a huge burden for the country. The country responded wholly mobilizing the available resources prioritizing COVID-19 as the utmost agenda to protect, prevent and control the disease for the people across the country. The latest information pertaining to the number of COVID-19 active cases, cured discharged statistics, and other public health-related information is reported on the Ministry of Health and Family Welfare, Government of India website (<https://www.mohfw.gov.in/>).

COVID-19 and Climate Change

Several studies, experiences and expert opinions on covid-19 infections were reported and shared globally to help combat the new pandemic of gigantic proportion. The COVID-19 infection is considered as a disease of zoonotic origin and at the same time, climate change is also known to have its indirect health impacts in the form various climate sensitive diseases like vector borne and zoonotic disease etc. Though there are no conclusive evidences to establish the COVID-19 outbreak as a direct impact of climate change, however, it is considered that there is an indirect relationship between climate change and covid-19 pandemic. Climate change is also manifested as global warming and changes in hydrometeorological conditions including rainfall, temperature, humidity etc. which can impact climate sensitive diseases of potential outbreaks. Increasing deforestation across the world is an example of major cause of climate change and can be one of the largest causes of habitat loss worldwide. This can force animals to migrate and eventually come in closer contact with humans, creating an opportunity for pathogens to get into new hosts. Livestock farms in large numbers can also serve as sources for spillover of

infections from animals to people enabling both emerging and re-emerging diseases to occur and affect the populations. Various other anthropogenic activities are increasingly projected as continuously disturbing the natural cycles of many phenomenon occurring in the environment and the planet. As the world adapts to a new normal, it is crucial to address the issues holistically and primarily the public health concerns including negative impacts of climate change making integral to the COVID-19 recovery action programmes.

There were many reports and incidences when the widespread lockdown undertaken during the pandemic times which brought a halt in the human activities including vehicular traffics, limited industrial activities etc. impacted the environment and the planetary health. This led to reports of a substantial decrease in pollution levels in the world and the country including air and water quality. In the midst of the pandemic sufferings, people in many Indian cities had the chance to breathe cleaner air again and could regain to see clear and blue skies. However, these gains in the environmental conditions were short-lived as pollution levels increase once again as life started to return to normalcy with increasing human activities.

There are enough experiences and lessons learnt during the global health crisis of COVID-19 pandemic and strengthening the public health concerns both globally and nationally in our country can be considered among the priorities. As the country moves ahead in the new decade, it must strengthen public healthcare facilities and infrastructures, early warning systems and disease surveillance systems etc. Various environmental factors related to climate change like air pollution, water contamination, vector-borne diseases, and natural calamities are presently emerging as threats to India's public health. All populations are affected by climate change though some are more vulnerable like elderly population, those with chronic health conditions, lower-income communities, etc. These groups of vulnerable population are also disproportionately impacted by COVID-19 infections. Strengthening public health facilities and infrastructures will require considerations of building resilient healthcare systems to help protect health and cope adverse negative health effects from both climate change and emerging and re-emerging outbreaks like COVID-19.

Air pollution and COVID-19 infection

Climate change impact air pollution and conversely air pollution also impacts climate change and both can impact immensely the health of the people across the places.

One of the major environmental factors prominently seen to be reported having associated with covid-19 infections is about air pollution which itself is recognized as the identified as a major environmental risk to human health. Studies were reported that both COVID-19 infection and air pollution can have potential synergistic effect which can affect the respiratory system of our body. It has been observed that long-term exposure to air pollution is associated with an increased prevalence of health problems particularly respiratory diseases and deaths. As the pandemic spreaded and affected various populations from a large number of cities and areas across the world, many researchers were increasingly reporting on the association between air pollution and COVID-19 infections. Global and Indian studies by leading academic and medical institutions have reported that people living in poor air quality areas are more likely to get affected from COVID-19. These studies have accounted for other factors that may influence death risks, such as pre-existing medical conditions, socioeconomic status, and access to healthcare services.

Some of the significant findings on the association between air pollution and COVID-19 infections are reported from studies across the world particularly from China, Italy, England, France, Spain, Germany, USA including India etc. These were the major countries where COVID-19 infections were reported large in number and severe among the affected populations. A compilation of these related studies on COVID-19 and air pollution is briefly described in the annexure

1. Air Pollution and Transmission of and infection by COVID-19

- Air pollution has exerted a positive impact on the transmission of and infection by COVID-19
- Ambient NO₂ in polluted air may contribute to the spread ability of COVID-19

- COVID-19 infections are positively correlated with ground-level ozone.
- Outdoor airborne aerosols might be possible carriers of COVID-19
- Some meteorological conditions like Dry air, low winds and precipitation rates support COVID-19 virus diffusion.
- Warm-season will not stop COVID-19 from spreading.

2. Air Pollution and Hospital admissions of COVID-19 cases

- A positive relationship between air pollution and particularly PM2.5 concentrations, and Covid-19 cases, **hospital admissions** and deaths

3. Air Pollution and Mortality in COVID-19 patients

- Severe air pollution is reported to have a link to higher mortality in COVID-19 patients. This result is based on the “double-hit” hypothesis, which states that chronic exposure to PM2.5 causes alveolar ACE-2 receptor overexpression. This may increase viral load in patients exposed to pollutants, depleting ACE-2 receptors and impairing host defenses. High atmospheric NO₂ may provide a second hit causing a severe form of SARS-CoV-2 in ACE-2 depleted lungs resulting in a worse
- An association is found between increases in PM concentrations and mortality rates due to COVID-19 observed in Northern Italy and the peaks of particulate matter concentrations, frequently exceeding the legal limit of 50 µg/m³ as PM₁₀ daily average
- A positive correlation between the level of air pollution of a region and the lethality related to COVID-19

4. Long term exposure to air pollution and morbidity & mortality of COVID-19 cases

- Long-term exposure to NO₂, which primarily arises from urban combustion sources such as traffic, may enhance susceptibility to severe COVID-19 outcomes, independent of long-term PM2.5 and O₃ exposure.
- Long-term exposure to air pollution, especially PM2.5, has also been found to be associated with COVID-19 mortality

Some of the major health action points which may be considered in the health sector-

1. Strengthening public health facilities and infrastructures considering also climate sensitive disease or problems which can be an emerging and re-emerging health problems
2. Strengthening surveillance system for infectious and communicable diseases (ARI, febrile illness etc.) using information technology
2. Capacity building of State level programme officer/ nodal person in health responses in emergency situations
3. Identifying/ designating District level nodal person for implementation of actions mentioned in State Climate health action plan
4. Multi-stakeholder based behaviour change communication Outreached activities for reduction of emissions, climate appropriate behaviour

References studies (2020) from which inferences taken of the linkage between Air Pollution and COVID-19 infection(Inference, Source)

1. Assessing nitrogen dioxide (NO₂) levels as a contributing factor to corona virus (COVID-19) fatality regional scale and combined with the number of death cases taken from 66 administrative regions in Italy, Spain, France and Germany by YaronOgen

- *Highest NO₂ concentrations combined with downwards airflow prevent an efficient dispersion of air pollution. These results indicate that the long-term exposure to this pollutant may be one of the most important contributors to fatality caused by the COVID-19 virus in these regions and maybe across the whole world*
- . <https://doi.org/10.1016/j.scitotenv.2020.138605>

2. Ambient nitrogen dioxide pollution and spread ability of COVID-19 in Chinese cities by Ye Yao, Jinhua Pan, Zhixi Liu Weidong Wang, HaidongKan, Weibing Wang

- *A significant association between NO₂exposure and R₀, suggesting that ambient NO₂ may contribute to the spread ability of COVID-19*
- *Effects of NO₂ on host defenses that prevent the spread of the virus.*
- <https://doi.org/10.1101/2020.03.31.20048595>.

- 3.Two mechanisms for accelerated diffusion of covid-19 outbreaks in regions with high intensity of population and polluting industrialization: the air pollution-to-human and human-to-human transmission dynamics Mario CocciaCnr -- national research council of Italy

- *The results reveal that accelerated transmission dynamics of COVID-19 in specific environments is due to two mechanisms given by air pollution-to-human transmission and human-to-human transmission; in particular, the*

means of air pollution-to-human transmission play a critical role rather than human-to-human transmission.

- <https://doi.org/10.1101/2020.04.06.20055657>

4.The Potential Role of Particulate Matter in the Spreading of COVID-19 in Northern Italy: First Evidence-based Research Hypotheses by Leonardo Setti¹, Fabrizio Passarini, Gianluigi De Gennaro, Pierluigi Barbieri, Maria Grazia Perrone, Andrea Piazzalunga ⁶, Massimo Borelli, Jolanda Palmisani³, Alessia Di Gilio, PriscPiscitelli, Alessandro Miani ⁸

- *Association between higher mortalityrates due to COVID-19 observed in Northern Italy and the peaks of particulate matter concentrations,frequently exceeding the legal limit of 50 µg/m³ as PM₁₀ daily average*
- <https://doi.org/10.1101/2020.04.11.20061713>.

5.SARS-Cov-2 RNA found on Particulate Matter of Bergamo in Northern Italy: First Preliminary Evidence

- *An association is found between increases in PMconcentrations and mortality rates due to COVID-19.*
- <https://doi.org/10.1101/2020.04.15.20065995>

6. Risk of COVID-19 and long-term exposure to air pollution: evidence from the first wave in China

- *Long-term exposure to air pollution,especially PM_{2.5}, has also been associated with COVID-19 mortality.*
- <https://doi.org/10.1101/2020.04.21.20073700>

7. Urban Air Pollution May Enhance COVID-19 Case-Fatality and Mortality Rates in the United States

- *Long-term exposure to NO₂, which largely arises from urban combustion sources such as traffic, may enhance susceptibility to severe COVID-19 outcomes, independent of long-term PM_{2.5} and O₃ exposure.*

- <https://doi.org/10.1101/2020.05.04.20090746>

8. Effects of meteorological conditions and air pollution on COVID-19 transmission: Evidence from 219 Chinese cities

- *Air pollution has exerted a positive impact on the transmission of and infection by COVID-19*
- <https://doi.org/10.1016/j.scitotenv.2020.140244>

9. Assessing the relationship between ground levels of Ozone (O₃) and nitrogen dioxide (NO₂) with coronavirus (COVID-19) in Milan, Italy

- *COVID-19 viral infections are positively correlated with ground-level ozone.*
- *Ground level nitrogen dioxide is inversely correlated with COVID-19 infections.*
- *Dry air, low winds, and precipitation rates support COVID-19 virus diffusion.*
- *Warm-season will not stop COVID-19 from spreading.*
- *Outdoor airborne aerosols might be possible carriers of COVID-19.*
- <https://doi.org/10.1016/j.scitotenv.2020.140005>

10. Air Pollution Exposure and Covid-19 in Dutch Municipalities Matthew A. Cole, Ceren Ozgen, Eric Strob

- *A positive relationship between air pollution, and particularly PM_{2.5} concentrations, and Covid-19 cases, hospital admissions, and deaths*
- <https://doi.org/10.1007/s10640-020-00491-4>

11. Exposure to air pollution and COVID-19 mortality in the United States: A nationwide cross-sectional study Xiao Wu, Rachel C Nethery, M Benjamin Sabath, Danielle Braun, Francesca Dominici

- *A small increase in long-term exposure to PM2.5 leads to a large increase in the COVID-19 death rate*
- <https://doi.org/10.1101/2020.04.05.20054502>

12. Coronavirus (COVID-19) related mortality rates and the effects of air pollution in England. The research report examines the potential relationship between long-term air pollution exposure and coronavirus (COVID-19) mortality rates.

Possibility of a correlation between PM2.5 exposure and coronavirus (COVID- 19) related mortality of a similar scale to that found by Wu et al. (2020)

13. Air pollution aggravating COVID- 19 lethality? Exploration in Asian cities using statistical models Ankit Gupta, Hemant Bherwani, Sneha Gautam, Saima Anjum, Kavya Musugu, Narendra Kumar, Avneesh Anshul

- *A positive correlation between the level of air pollution of a region and the lethality related to COVID-19*
- <https://doi.org/10.1007/s10668-020-00878-9>

14. Severe air pollution links to higher mortality in COVID-19 patients: The “double-hit” hypothesis. Antonio Frontera, Lorenzo Cianfanelli, Konstantinos Vlachos, Giovanni Landoni

- *“double-hit hypothesis”: chronic exposure to PM2.5 causes alveolar ACE-2 receptor overexpression. This may increase viral load in patients exposed to pollutants, depleting ACE-2 receptors and impairing host defenses. High atmospheric NO2 may provide a second hit causing a severe form of SARS-CoV-2 in ACE-2 depleted lungs resulting in a worse*
- www.elsevier.com/locate/jjinf

Summary of some the study findings related to air pollution effects on COVID-19 from across the world (China, Italy, US, France, India, Iran, Spain, Germany, England)

References	Study region	Study design	Period of study	Outcome
Zhang et al.	219 prefecture cities in China	Retrospective	January 24 to February 29, 2020	A positive correlation was observed between air pollution indicators and new COVID-19 confirmed cases. The SARS-CoV-2 spreading was between 5 and 7% when the air quality index (AQI) was increased by 10 units.
Zhu et al.	120 cities in China	Retrospective	January 23 to February 29, 2020	A significant positive association was found for PM _{2.5} , PM ₁₀ , NO ₂ , and O ₃ with newly COVID-19 confirmed cases. A 10- $\mu\text{g}/\text{m}^3$ increase (lag0–14) in PM _{2.5} , PM ₁₀ , NO ₂ , and O ₃ was associated with a 2.24, 1.76, 6.94, and 4.76% increase in the daily counts of COVID-19 cases, respectively.
Li et al.	Wuhan and XiaoGan in China	Retrospective	January 26 to February 29,	A significant correlation was observed between COVID-19 incidence and AQI in both cities

References	Study region	Study design	Period of study	Outcome
			2020.	($p < 0.01$). The incidence of COVID-19 was highly correlated with PM _{2.5} and NO ₂ in both cities.
Lin et al.	29 Provinces in China	Retrospective	January 21 to April 3, 2020	Higher ambient CO concentration was a risk factor for the increased spreading of SARS-CoV-2, while higher temperatures, efficient ventilation and air pressure reduced its transmissibility.
Yao et al.	Whuan in China	Retrospective	January 19 to March 15, 2020	After adjusting to temperature and relative humidity, SO ₂ , NO ₂ , CO, and O ₃ , the case fatality rate (CFR) was positively associated with PM _{2.5} and PM ₁₀ .
Jiang and Xu	Wuhan in China	Retrospective	January 25 to April 7, 2020	A significant positive correlation ($p < 0.01$) was observed between AQI especially PM _{2.5} and the daily COVID-19 deaths.

References	Study region	Study design	Period of study	Outcome
Pansini And Fornnaca	China,France, Germany, Iran,Italy, Spain,UK and the USA	Retrospective	NA	Increased SARS-CoV-2 infections were observed in the regions where high levels of PM _{2.5} and NO ₂ were present. A significant correlation was found between the levels of air quality with COVID-19 spread and mortality in six countries except for Spain and Germany.
Travaglio et al.	England	Retrospective	As of April 10, 2020	The markers of poor air quality, such as NO and SO ₂ were associated with an increased rate of COVID-19 related deaths across England, after adjustment of population density.
Konstantinoudis et al.	England	Retrospective	As of June 30, 2020	An increase of 0.5% and 1.4% in COVID-19 mortality rate was observed for every 1 µg/m ³ increase in NO ₂ and PM _{2.5} ,

References	Study region	Study design	Period of study	Outcome
				respectively.
Magazzino al.	et 3 cities in France	Retrospective	NA	This study showed a direct relationship between air pollutants (PM _{2.5} and PM ₁₀) and COVID-19 fatality.
Ogen	France, Germany, Italy, Spain	Retrospective	January to February 2020	About 78% of deaths occurred in just five regions of northern Italy and central Spain, where NO ₂ were present at the highest concentrations combined with downward air pressure.
Mele and Magazzino	25 cities in India	Retrospective	January 29 to May 18, 2020	In machine learning (ML) analysis with Causal Direction from Dependency (D2C) algorithm, a direct relationship was found between the concentration of PM _{2.5} and COVID-19 mortality.
Zoran et al.	Milan, Italy	Retrospective	January 1 to April	COVID-19 infections showed a positive

References	Study region	Study design	Period of study	Outcome
			30, 2020	correlation with ground level O ₃ . However, ground level NO ₂ was inversely correlated with COVID-19 infections. Outdoor airborne aerosols might be the possible carriers of COVID-19 transmission.
Zoran et al.	Milan, Italy	Retrospective	January 1 to April 30, 2020	Daily new cases of COVID-19 were positively related to PM and AQI. Dry air supports SARS-CoV-2 transmission. Warm-season may not have a role in spreading viral infection.
Fattorini and Regoli	Italy	Retrospective	As of April 27, 2020	Long-term air-quality data showed a significant correlation with COVID-19 cases in 71 provinces in Italy, provided further evidence that chronic exposure to air pollution may influence the viral spreads.

References	Study region	Study design	Period of study	Outcome
Setti et al.	110 Provinces in Italy	Retrospective	February 24 to March 13, 2020	A significant association has been observed between the geographical distribution of daily PM ₁₀ exceedances and the initial spreading of COVID-19 in the Italian provinces.
Coker et al.	Northern Italy	Retrospective	January 1 to April 30, 2020	A positive association was observed between ambient PM _{2.5} concentration and excess COVID-19 related mortality. A one-unit increase in PM _{2.5} concentration (µg/m ³) was associated with a 9% increase in the COVID-19 related fatality.
Frontera et al.	Italy	Retrospective	As of March 31, 2020	A high number of COVID-19 cases were found in the most polluted regions and the affected patients required ICU admission. The mortality was two-fold

References	Study region	Study design	Period of study	Outcome
				higher in these polluted regions than the other regions.
Coccia	Northern Italy	Retrospective	As of March 17, to April 2020	An association was observed between accelerating and vast diffusion of COVID-19 and air pollution. This study demonstrated that contaminated air accelerates the transmission of the SARS-CoV-2 to humans other than the transmission from human to human.
Vasquez-Apestegui et al.	20 districts in Lima (Peru)	Retrospective	As of June 12, 2020	The higher rates of spread of COVID-19 in Lima were associated with the previous long-term PM _{2.5} exposure.
Andree BPJ	355 municipalities in the Netherlands	Retrospective	As of March 31, 2020	PM _{2.5} was a highly significant predictor of COVID-19 cases and the related hospital admissions. It was also observed that COVID-19 cases were increased by almost

References	Study region	Study design	Period of study	Outcome
				100% when pollutant concentrations were increased by 20%.
Hendryx and Luo	USA	Retrospective	As of May 31, 2020	In regression analyses, COVID-19 prevalence and mortality rates were significantly associated with greater diesel particulate matter (DPM).
Wu et al.	3000 counties in the U.S.A.	Cross-sectional	As of April 04, 2020	An increase of only 1 $\mu\text{g}/\text{m}^3$ in long-term $\text{PM}_{2.5}$ exposure is associated with an 8% increase in the COVID-19 fatality rate.
Adhikari and Yin	New York, USA	Retrospective	March 1 to April 20, 2020	Short-term exposures to ozone and other meteorological factors could be associated with COVID-19 transmission and initiation of the disease, but disease aggravation and fatality depend on other factors.
Bashir et al.	California,	Retrospective	March 4	Air pollutants such as

References	Study region	Study design	Period of study	Outcome
	USA		to April 24, 2020	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , and CO showed a significant correlation with the COVID-19 epidemic.