Government of Karnataka
Department of Health & Family Welfare

DRAFT OF KARNATAKA STATE ACTION PLAN FOR CLIMATE CHANGE & HUMAN HEALTH (KSAPCCHH)

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Karnataka State Health System Resource Center
&
Department of Health & Family Welfare

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ABBREVIATIONS

ANM	Auxiliary Nurse Mid-wife
ASHA	Accredited Social Health Activist
ARS	Arogya Raksha Samithi
BAAQMP	Board's Ambient Air Quality Monitoring Programme
BBMP	Bruhat Bengaluru Mahanagara Palike
BMI	Body mass index
CAAQMS	Continuous Ambient Air Quality Monitoring Stations
CBO	Community Based Organisation
CHC	Community Health Centres
CPCB	Central Pollution Control Board
CRS	Central Railway Station
DGHS	Director General of Health Services
DHR	Department of Health Research
DHS	District Health Society
DoHF&W	Department of Health & Family Welfare
DST	Department of Science & Technology
EMPRI	Environmental Management & Policy Research Institute
EWS	Early Warning System
FSSAI	Food Safety and Standards Authority of India
GIS	Geospatial Information System
GOI	Government of India
HMIS	Health Management Information System
ICDS	Integrated Child Development Scheme
ICMR	Indian Council of Medical Research
IDSP	Integrated Disease Surveillance Project
IEC (ICT)	Information Education Communication (Information and communications technology)
IISc	Indian Institute of Science
IITM	Indian Institute of Tropical Meteorology
IMD	India Meteorological Department
IPCC	Intergovernmental Panel on Climate Change
IPCC SREX	Intergovernmental Panel on Climate Change -Special Report on Extreme Events
KSAPCCHH	Karnataka State Action Plan for Climate Change and Human Health
KSDMA	Karnataka State Disaster Management Authority
KSNDMC	Karnataka State Natural Disaster Monitoring Center
KSPCB	Karnataka State Pollution Control Board
MHRD	Ministry of Human Resource Development

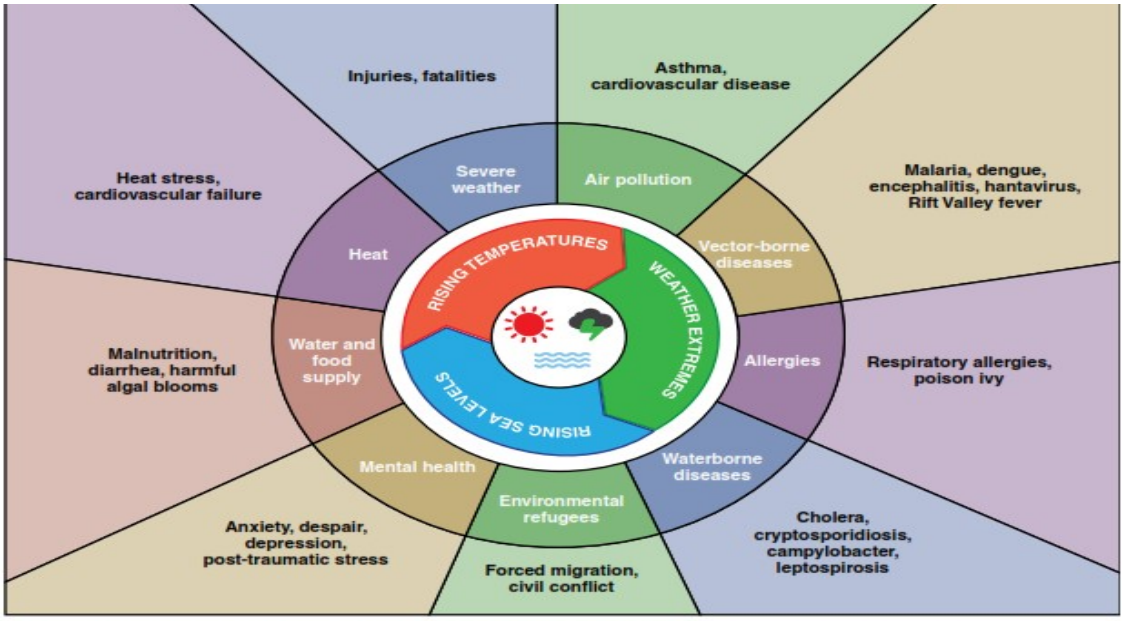
Ministry of I&B	Ministry of Information & Broadcasting
MOEF&CC	Ministry of Environment, Forest and Climate Change
MOHFW	Ministry of Health & Family Welfare
NAMP	National Air Quality Monitoring Programme
NAPCCH	National Action Plan on Climate Change & Health
NCD	Non Communicable Diseases
NCDC	National Centre for Diseases Control
NDMA	National Disaster Management Authority
NEERI	National Environmental Engineering Research Institute
NFHS	National Family health survey
NGO	Non-Governmental Organisation
NHM	National Health Mission
NIC	National Informatics Centre
NIMR	National Institute of Malaria Research
NITM	National Institute of Traditional Medicine
NIV	National Institute of Virology
NVBDCP	National vector Borne Disease Control Programme
PHC	Primary Health Care
PHFI	Public Health Foundation of India
PIP	Programme Implementation Plan
RDPR	Rural Development & Panchayat Raj
SIHFW	State Institute of Health & Family Welfare
SSU	State Surveillance Unit
STG	Standard Treatment Guidelines
TERI	The Energy and Resources Institute
UNICEF	United Nations International Children's Emergency Fund
UV	Ultraviolet
V&A	Vulnerability and Adaptation Assessments for Climate Change assessments
WHO	World Health Organisation

INTRODUCTION

The "Climate change is the biggest global health threat of the 21st century." This statement opens and sums up the final report of a year-long Commission held jointly between The Lancet and University College London (UCL) Institute for Global Health. Climate change will have its greatest effect on those who have the least access to the world's resources and who have contributed least to its cause. Without mitigation and adaptation, it will increase health inequity especially through negative effects on the social determinants of health in the poorest communities. 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 periods*." The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes.

Given the complexity of social and environmental factors that influence disease and health outcomes, the precise extent of this impact is difficult to establish. The World Health Organization (WHO), for example, estimated in the early 2000s that climate change was already accounting for an additional 150,000 annual deaths (WHO, 2004). Forecasts suggest that by 2030 an additional 250,000 deaths per year will occur from heat exposure, undernutrition, malaria, and diarrheal disease due to climate change.

(Climate change, together with other natural and human-made health stressors, influences human health and disease in numerous ways Figure: 1).



Source: Adapted from J. Patz. National Oceanic and Atmospheric Administration. (https://toolkit.climate.gov/image/505).

Figure1: Impact of Climate change on human health

Direct Impacts of Change in Climate 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) has mentioned 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, If the body temperature rises above 38°C (heat exhaustion), physical and cognitive functions are impaired; above 40.6°C (heat stroke), risks of organ damage, loss of consciousness, and death increase sharply. The factors which interplay in occurrence of these morbidity and mortality majorly are vulnerable population and vulnerable regions.

The *vulnerable population* implies the demography (extremes of age, sex, population density, and pregnant women), Health Status (proportion of malnourished, population with infectious and chronic diseases, mentally or physically disabled people), socio-economic status (poor/ marginalised- 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.

Karnataka though reported less mortality due to heat wave, certain parts of North Interior Karnataka remains vulnerable to heat wave as many of these are bordering districts of Telangana and Andhra Pradesh.

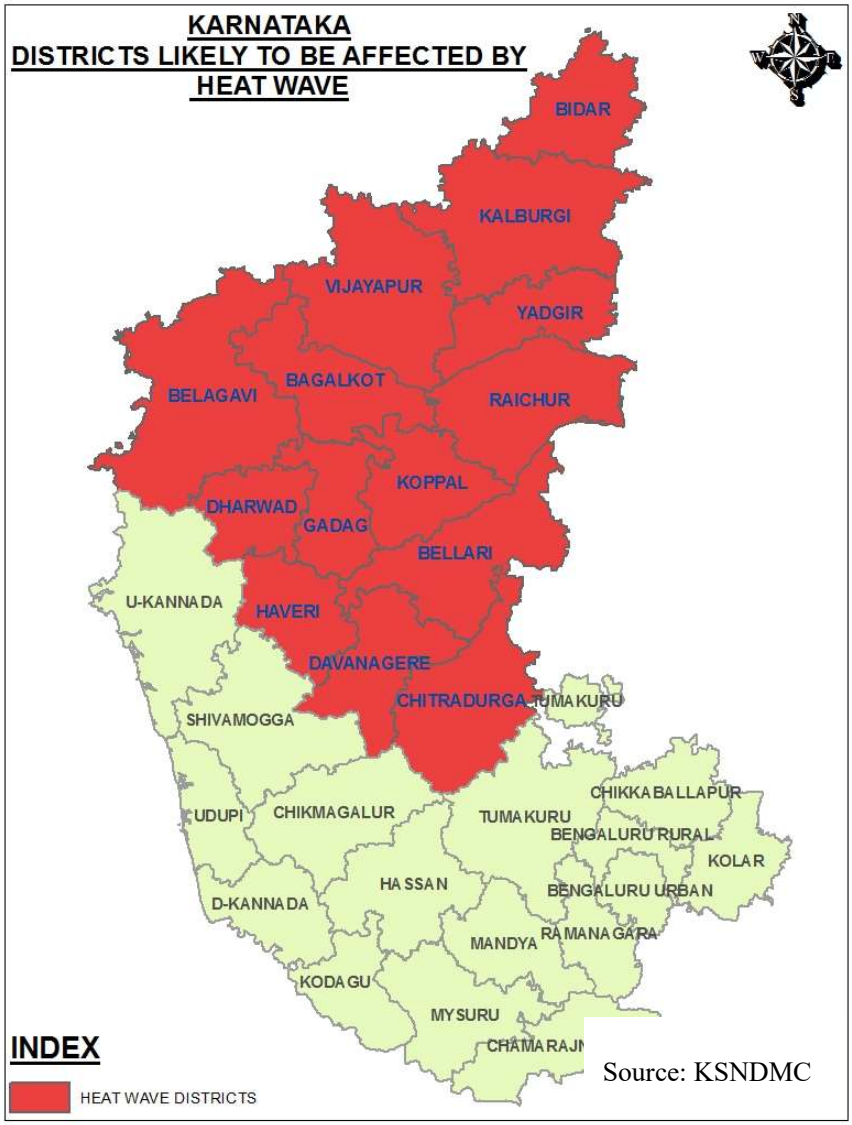


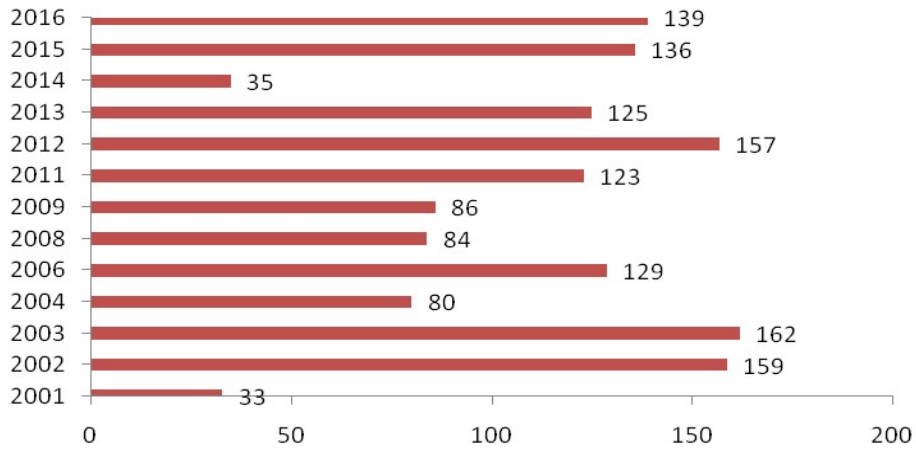
Figure 2: Karnataka districts likely to be affected by heat wave

2. Drought, Storms and Floods

Climate change can result in more hot days, more periods of drought and dust storms, more periods of heavy rains (precipitation), and consequent flooding. These may adversely affect health directly through drowning, injuries, hypothermia, hyperthermia, 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. The reason primarily is due to contamination of water, disruption of water purification and sewage disposal.

Health Impacts of floods are immediate deaths and injuries, Non-specific increases in mortality. It contributes infectious diseases such as leptospirosis, hepatitis, diarrhoeal, respiratory, and vector-borne diseases. Floods are exposure to toxic substances, mental health effects and indirect effects of increased demands on health systems. In the data obtained from Karnataka State Natural Disaster Monitoring centre, in the past 15 years, 13 years have been drought year of varied intensity in Karnataka as shown in the table below:



Source :KSNDMC

Figure 3: Number of Taluks declared drought (2001-2016)

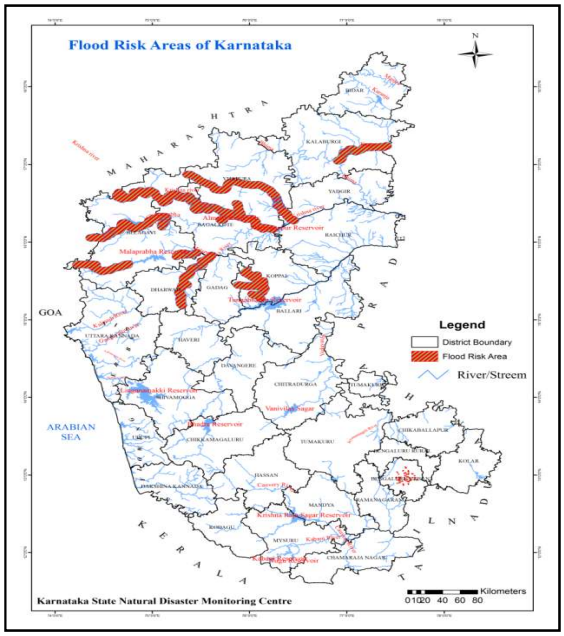


Figure 4: Flood risk area of Karnataka

As per "Cyclone Hazard Prone Districts of India: A report" prepared by NDMA and IMD, the coastal district of Karnataka are in Moderate proneness category. Data regarding to the same is as follows:

Table 1: List of vulnerable districts of Karnataka for Cyclone wind & coastal/inland flooding

District	Wind & Cyclone	Coastal/Inland Flooding
Udupi	M	-
Uttara Kannada	M	-
Dakshina Kannada	M	-

M: Moderate

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, pneumonia, COPD, allergic rhinitis, 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 attacks. 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. 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.

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 pollution.

In Karnataka, during the period 2006-2010, the average concentration of SPM (suspended particulate matter) and RSPM (respirable suspended particulate matter) were 220 & 225µg/m^3 in Bangalore. The levels were found to be very high in Gulbarga (177 & 68 µg/m^3), Hubli (222 & 103µg/m^3), and Dharwad (241 and 115µg/m^3) respectively. (SoER 2015)

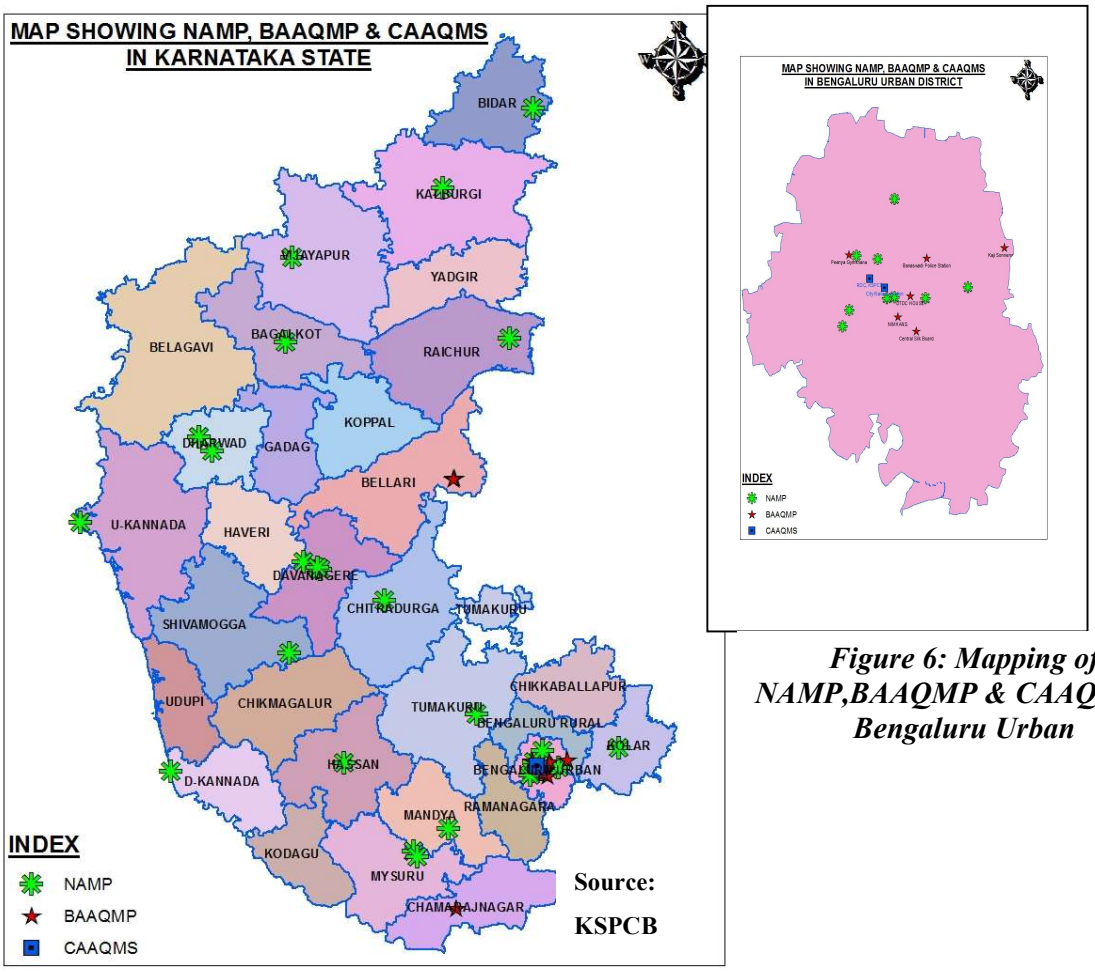
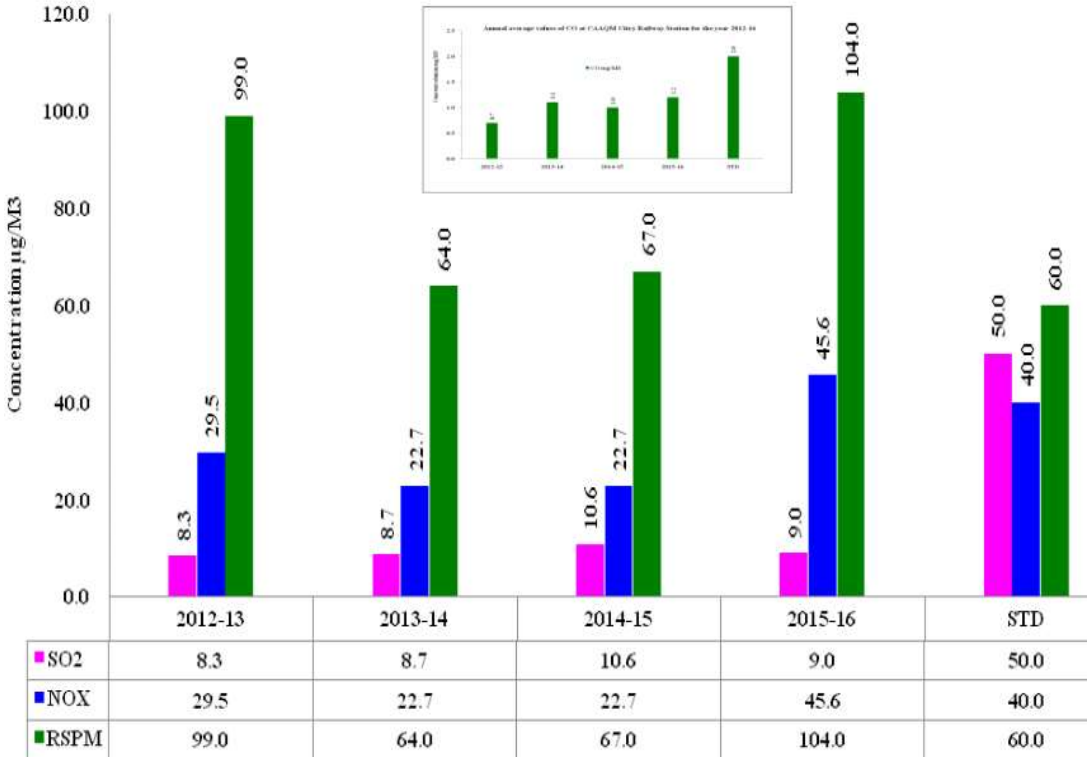


Figure 5: Mapping of NAMP, BAAQMP and CAAQMS in Karnataka

Figure 6: Mapping of NAMP,BAAQMP & CAAQMS in Bengaluru Urban



Source: KSPCB

Figure 7: Annual average values of air pollutants at CAAQM CRS (2012-2016)

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 temperatures. 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)* including within the ambient environmental range, results in sunburn, photo-ageing, cataracts, immune-suppression and skin melanomas. 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 emphasised, 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.

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 dependant diseases particularly affecting the vulnerable populations include the following:

1. Air Borne and Cardio-Respiratory Illnesses: Climate change influences various illnesses caused by pathogens and transmitted through the air 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. Environmental factors influence the efficacy of airborne disease transmission; the most evident environmental conditions are temperature and relative humidity. 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 people.

The data obtained from department of Health and Family Welfare, the number of H1N1 positive cases detected from 2009-2017 were 12697 and the deaths reported were 481.In the Year 2015 and 2017 the H1N1 positive cases detected were 3565 and 3260 respectively.

From the data obtained from RNTCP, the total number of diagnosed TB cases were 235848 out of which 221953 are undergoing treatment and a total of 6% deaths and an average of 84% success rate from 2013-2017.

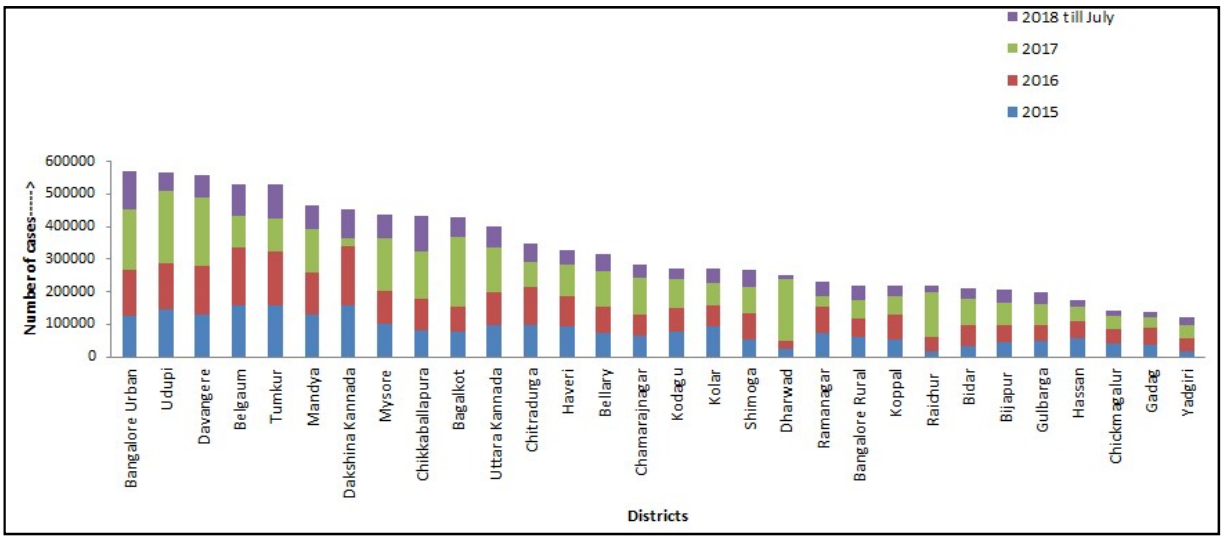


Figure 8: District wise distribution of acute respiratory infections (ARI) cases from 2015-2018 (July)

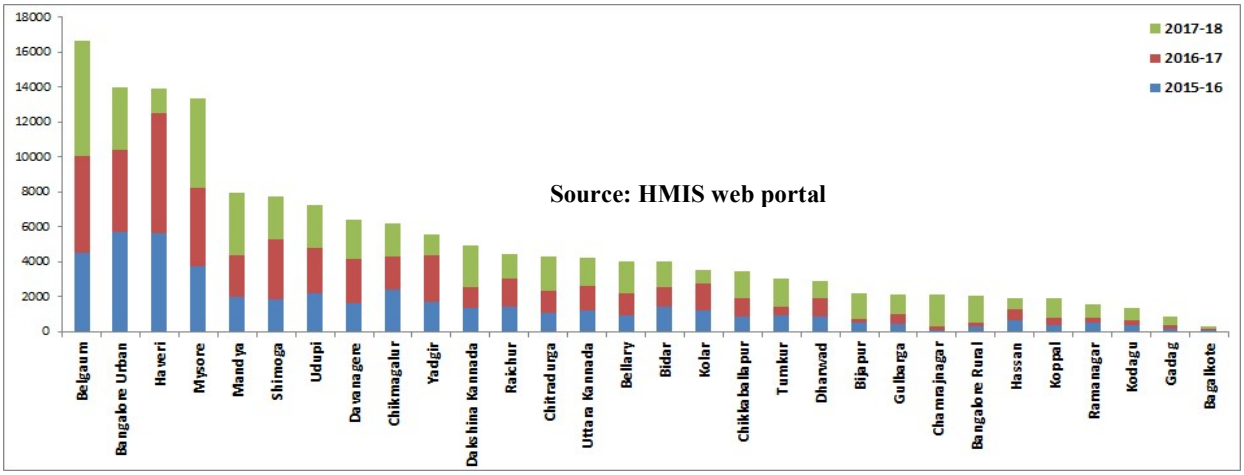


Figure 9: District-wise number of children below 5 years of age admitted with Respiratory infections

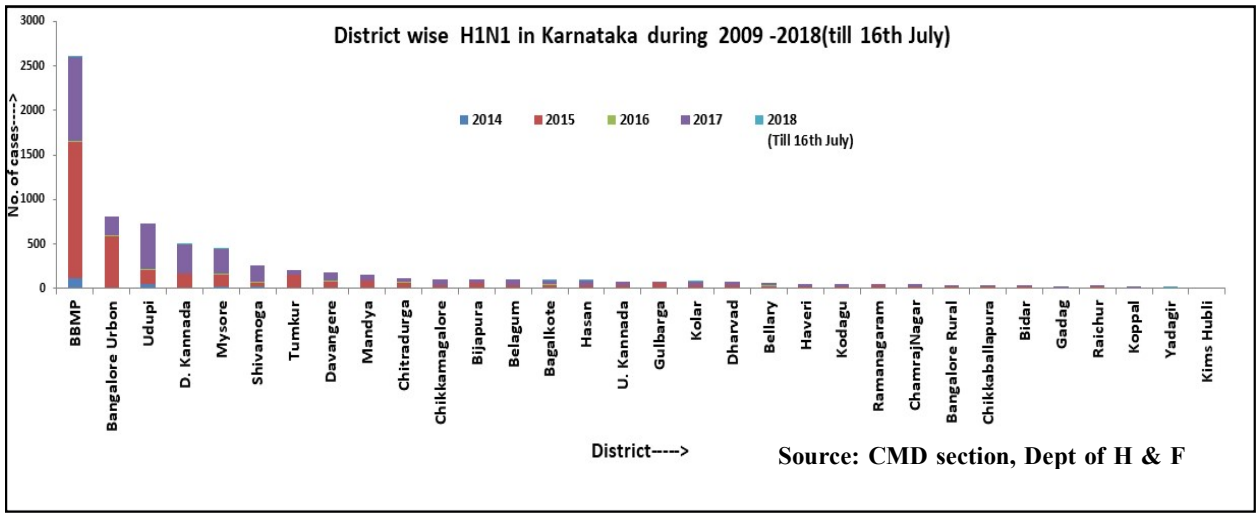


Figure 10: District wise distribution of H1N1 cases during 2009- 2018(till 16th July)

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 population.

✓ Ongoing global changes such as climate change, large scale land use transformations, increasing global travel and political instability in various regions of the world, contribute to variations in the patterns and occurrence of a number of infectious diseases, notably vector-borne diseases, which are known to be sensitive to weather and climate. Changes in terms of the season of occurrence and the geographical distribution of these diseases are anticipated to increase as weather and climate are known to be drivers of the transmission and distribution of vector-borne diseases.

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.

The data obtained from National Vector Borne Disease Control Programme (Karnataka) showed that during 2013-2017, the number of Malaria positive cases detected were 58558, Dengue positive cases detected were 38652, Filariasis, Chikungunya and JE positive cases detected were 11339, 8880 and 126 cases respectively.

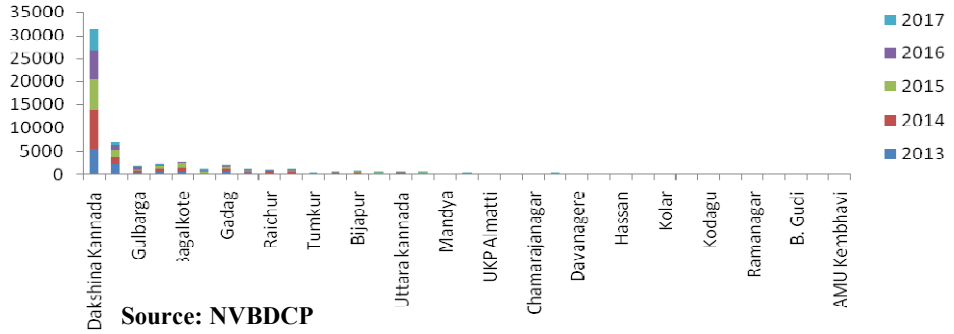


Figure 11: District wise Distribution of Malaria positive cases (2013-2017)

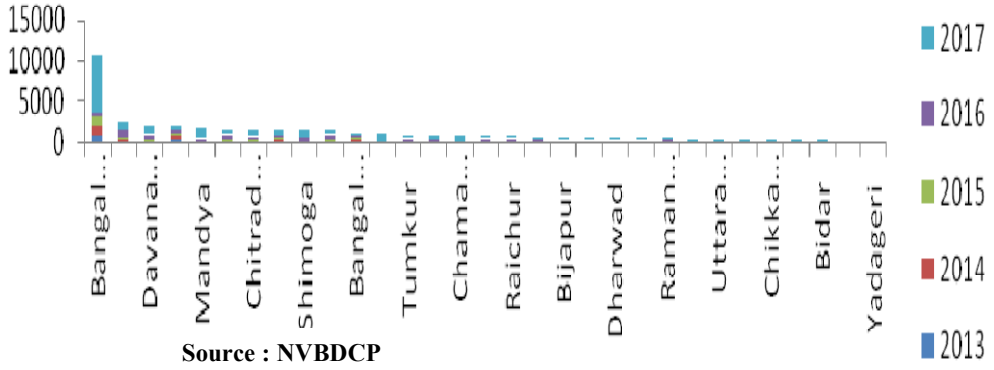


Figure 12: District wise Distribution of Dengue positive cases (2013-2017)

3. **Waterborne & Foodborne diseases**: Caused by the ingestion of water contaminated by human or animal faeces or urine containing pathogenic bacteria or viruses; includes cholera, 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-dependant infectious diseases. The increase in temperature is seen

to be associated with increased survival and abundance of micro-organisms. 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.

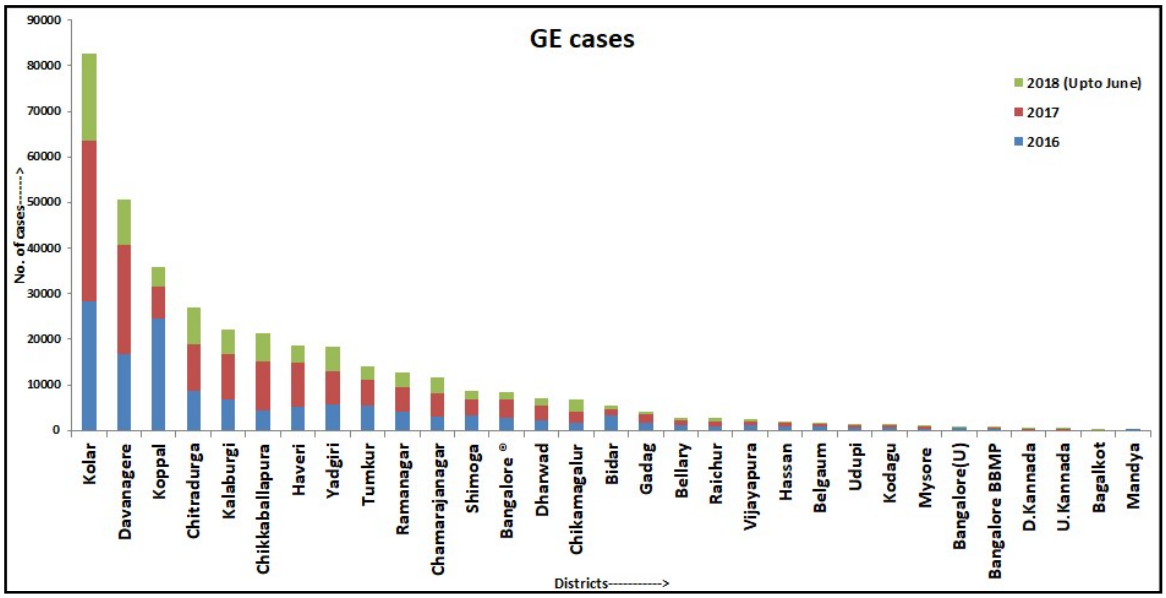


Table 2: District wise distribution of Water Borne Disease (Total positive cases), 2017 & 2018

Sl. No	DISTRICT	2017					2018				
		Typhoid Fever	Cholera	Shigella Dysentery	Viral Hepatitis A	Viral Hepatitis E	Typhoid Fever	Cholera	Shigella Dysentery	Viral Hepatitis A	Viral Hepatitis E
1	Bengaluru Urban	2002	0	0	39	3	29	1	0	3	1
2	Bidar	334	0	0	4	0	13	0	0	0	0
3	Belagavi	5101	1	4	0	0	12	0	0	1	0
4	Ballari	7913	0	0	0	0	0	0	0	0	0
5	Bagalkote	5661	5	0	151	8	117	0	0	14	1
6	Bengaluru (R)	224	0	0	0	0	0	0	0	0	0
7	Vijayapura	1093	0	2	3	0	548	1	7	0	0
8	Chitradurga	934	0	0	9	1	0	0	0	0	0

Sl. No	DISTRICT	2017					2018				
		Typhoid Fever	Cholera	Shigella Dysentery	Viral Hepatitis A	Viral Hepatitis E	Typhoid Fever	Cholera	Shigella Dysentery	Viral Hepatitis A	Viral Hepatitis E
9	Chikkamagaluru	81	0	0	2	0	0	0	0	0	0
10	Chikkaballapur	365	0	0	1	0	4	0	0	0	0
11	Chamarajanagara	4716	0	0	6	0	11	0	0	0	0
12	Dharwad	1929	3	7	14	17	26	0	0	10	0
13	Dakshin Kannada	222	0	0	2	0	18	0	3	11	0
14	Davanagere	392	0	0	0	0	0	0	0	0	0
15	Gadag	2975	0	0	10	2	47	0	0	0	0
16	Kalburgi	4840	0	0	2	0	53	0	0	0	0
17	Hassan	2005	0	1	6	1	0	0	0	0	1
18	Haveri	5190	0	21	1	1	989	0	1	1	0
19	Kodagu	1237	0	0	3	0	129	0	0	0	0
20	Kolar	5332	0	4	2	3	424	0	1	0	0
21	Koppal	3249	1	3	4	21	413	0	4	0	2
22	Uttara Kannada	1757	0	0	0	0	0	0	0	0	0
23	Mandya	1402	0	0	0	0	0	0	0	0	0
24	Mysuru	3048	0	0	20	7	2	0	2	0	0
25	Raichur	1076	0	0	36	11	13	0	0	0	0
26	Ramanagara	1798	0	0	0	0	3	0	0	0	0
27	Shivamogga	1983	0	0	3	0	1	8	0	1	0
28	Tumakuru	749	0	7	1	0	4	0	4	0	0
29	Udupi	420	0	0	87	103	42	0	1	36	14
30	Yadgiri	1379	0	0	0	0	3	0	0	0	0
TOTAL		69407	10	49	406	178	2901	10	23	77	19
Source: IDSP, Dept of H & F W											

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.

   The serious effects of climate due to floods or droughts on anthropometric indices are proved in many studies. According to NFHS - 4 (2015-16) Karnataka report , the total % of the population whose BMI<18.5kg/m^2 was 37.2% and children under-weight were 35.2%.The

percentage of children and Adults who were anaemic was found to be 60.9% and 63% respectively.

Table 3: District wise distribution of Malnutrition status (2015-16)

Sl.No	Indicators	Women whose BMI is below normal (BMI < 18.5 kg/m2)14(%)	Men whose BMI is below normal (BMI < 18.5 kg/m2) (%)	Children age 6-59 months who are anaemic (<11.0 g/dl) (%)	All women age 15-49 years who are anaemic (%)	Men age 15-49 years who are anaemic (<13.0 g/dl) (%)
1	Bagalkote	21.3	19.3	62.6	40.8	13.5
2	Bangalore Rural	21.3	16.7	48.8	46.2	22.9
3	Bangalore(U)	14	8.7	51.7	39.6	20.5
4	Belgaum	20.6	17.5	66.3	41.2	17.3
5	Bellary	23.6	18.4	72.3	49.9	20
6	Bidar	26	24.8	69.1	44.3	19.2
7	Bijapur	19.5	11.4	68	41.9	20.5
8	Chamrajnagar	26.1	18	53.2	44.5	23.1
9	Chikkaballapur	24.8	24.7	62.9	54	22.8
10	Chikmagalur	24.9	20.5	57.9	42.2	12.7
11	Chitradurga	22.7	17.6	64.4	43.7	24.5
12	Dakshina Kannada	25.6	21.8	54.3	45.4	15.7
13	Davanagere	22.7	18.5	65.9	46.9	18.9
14	Dharwad	16	13.2	50.7	45.9	18.3
15	Gadag	21.1	15	70.7	41.1	19.4
16	Gulbarga	22.5	20.5	72.4	43.1	14.9
17	Hassan	18.4	18.3	53.1	47	24.5
18	Haveri	21.5	19.6	63.9	52.7	15.3
19	Kodagu	19.6	23.1	46.6	37.2	10.6
20	Kolar	23.5	26.1	57.3	44.9	15.7
21	Koppal	26.9	21.4	68.1	45.8	16.2
22	Mandya	18.2	13.8	55.2	46.2	13.9
23	Mysore	19.1	10.2	60.1	45.6	9.1
24	Raichur	20.8	9.3	70.6	58.7	24.1
25	Ramanagar	22.4	14.8	53.9	47.5	20.6
26	Shimoga	22.7	31.1	53.8	48.6	21.8
27	Tumkur	20.3	17.3	53.8	52.7	19.6
28	Udupi	27.6	18.4	56.2	44.7	13.2
29	Uttara Kannada	31.7	29.9	47.7	41.9	12.4
30	Yadgir	27.4	17.5	74	47.7	13.8
Source: NFHS-4 (2015-16)						

There are certain **positive effects of climate change** like modest reductions in cold-related morbidity and mortality in some areas due to fewer cold extremes, 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.

1. STEPS TO REDUCE IMPACTS OF CLIMATE CHANGE

The *United Nations Framework Convention on Climate Change (UNFCCC)* came into force on 21st March 1994. It is the "Rio Convention", one of three adopted at the "Rio Earth Summit" in 1992. Today this convention has 197 countries and is known as "Convention of Parties". 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.

The *Kyoto protocol* was adopted in Kyoto, Japan, on 11 December 1997. It **commits** its Parties by setting internationally binding emission reduction targets. 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 Parties 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 UNFCC 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 has released a National Action Plan on Climate Change in June 2008. The National Action Plan Climate Change addresses the urgent and critical concerns of the country through enhancement of the current and planned programmes presented in the Technology Document. The National Action Plan on Climate Change identifies measures that promote our development objectives while also 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 plan identified eight national missions:

1. National Mission on Sustainable habitat.
2. National Mission for Sustaining the Himalayan Ecosystem-centre for climate change
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".

Executive Committee on Climate Change convened its first meeting on 1^{4th} November 2014. The Committee reviewed the progress of eight national missions on Climate Change and suggested formulation of four new missions viz.

1. National Mission on "Waste to Energy Generation".
2. National Mission on India's Coastal areas-
3. National Wind Mission
4. Health Mission

In this background, the proposed 'Mission on Health' was undertaken by Ministry of Health & Family Welfare under the 'National Action Plan on Climate Change'. As a follow-up action, MoHFW constituted a National Expert Group on Climate Change & Health (NEGCCH) 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.

For the expert group, the *National Centre for Diseases Control (NCDC*) was the nodal agency with members' representation from DteGHS, MoHFW, MoEFCC, ICMR, DST, NDMA, CGWB, Min of Agriculture, CPCB, Ministry of Earth Sciences, TERI, NEERI etc to draft the strategies for Mission on Health under the National Action Plan on Climate Change.
Consequent to the formation of National Action Plan on Climate Change and Human Health (NAPCCHH) the State Government of Karnataka has mandated to prepare Karnataka State action plan on Climate Change and Human Health (KSAPCCHH).

The plan has identified 7 Departments /Organizations for the implementation and review of activities under KSAPCCHH.

1. Urban development department of Karnataka- *Ministry of urban development*
2. State agriculture department- *Ministry of Agriculture*
3. Karnataka Renewable Energy Development Limited- *Ministry of New & Renewable Energy*
4. Water Resources Department, Govt. of Karnataka- *Ministry of Water Resources*
5. Centre for climate change unit Environmental Management & Policy Research Institute (EMPRI) - *Ministry of Environment, forest & Climate Change*
6. State forest development agency- *Ministry of Environment, forest & Climate Change* (MOEFCC).
7. Karnataka State Coastal Zone Management Authority- *Ministry of Environment, forest & Climate Change* (MOEFCC).

Karnataka's ground realities

Geographically Karnataka is situated on a tableland where the Western and Eastern Ghat ranges converge into the Nilgiri hill complex, the State of Karnataka is confined roughly within 11.5 degree North and 18.5 degree North latitudes and 74 degree East and 78.5 degree East longitude. The neighbouring state bounded with Karnataka includes Maharashtra and Goa in the North and North-West; by the Arabian Sea in the West; by Tamil Nadu in South-east and Kerala in the South-West and Andhra Pradesh in the East. The State extends to about 750 km from North to South and about 400 km from East to West and covers an area of about 1,91,796 sq. km being the

8th largest state holding 5.83% of the total geographical area of India. There are three distinct geographical regions in Karnataka: the Coastal Plains, the Western Ghats and the Deccan Plateau. The coastline of Karnataka stretches for about 320 km. The major rivers flowing through Karnataka are Cauvery, Kabini, Krishna and Tungabhadra.

The statistical figures/salient features mentioned in Karnataka State Action Plan on Climate Change (KSAPCC 2015) are listed below, should lead to the critical elements of a credible Action Plan on Climate Change and Human Health:

- About 77% of the total geographical area of the state is arid or semi-arid; drought is a threat to consider as two thirds of the state receives less than 750 mm rainfall per annum. Karnataka ranks second in India, next only to Rajasthan, in terms of total geographical area prone to drought. 54% of total geographical area of the state is drought prone, affecting 88 of 176 taluks and 18 of the 33 districts.
- The state is endowed with limited water resources that are already stressed and fast depleting. The sectoral demands for water are growing rapidly on account of increase in population, urbanization, rapid industrialization and rising incomes.
- Karnataka has seven river basins and receives a total of 236 billion m^3 of water every year, 92% of it through rainfall. Around 47% are 'lost' through evapo-transpiration and another 46 % flow into the Arabian Sea, into Andhra Pradesh and Tamil Nadu. The state meets its requirement from the remainder of about 7.5% paired with ground water. There are nearly 37,000 tanks and lakes with a water spread area of 6.9 lakh hectare and more than 20,000 irrigation tanks.
- Ground water provides for 45% of irrigation in the state
- 64.6% of the total geographical area of the state is said to be under cultivation; farmers and agricultural labourers account to 56.5% of the total workforce of Karnataka. The state experiences rich and diverse agriculture practices which contribute 28.61% to the Gross State Domestic Product (GSDP).
- The state of Karnataka, with its urban population at about 34% of total population, is currently ranked as the fifth most urbanized state in the country. The absence of basic amenities and the lack of employment opportunities in rural areas act as push factors driving away the population from rural areas.
- The vehicular population in the state has increased by almost 70% between 2003 and 2009 and is continually increasing.

- With less than 20% forest and tree cover and with Western Ghats as one of the Global bio-diversity hotspots, the state has an important role to play as a Carbon sink at the global level.
- Karnataka ranks seventh in the production of cement in the country. Karnataka is also the third largest steel producer in India. These two industries account for over 20% of the overall emissions of the state and over 40% of the emissions due from industrial sector.
- Electricity (35.9%); industry (22.5%); agriculture (20.2%); and transport (10.4%) are the major contributors of GHG emissions in the state. According to the Annual Reports of Karnataka Power Transmission Corporation Ltd (KPTCL) the percentage of the total coal power capacity comes to about 40.6%.
- Karnataka has no known reserves of coal or petroleum products. Hence this prominence of fossil fuels in its energy mix, which also lead to high GHG emissions.

Climatic features of Karnataka

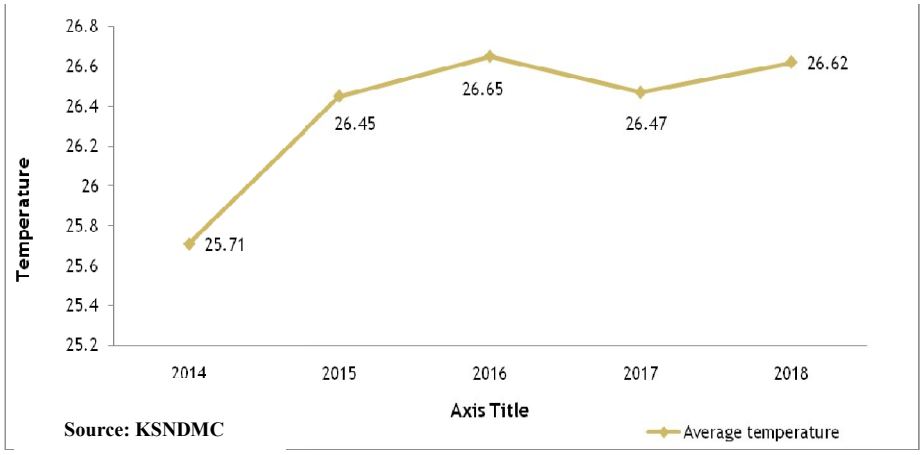


Figure 14: Trend of annual average temperature of Karnataka from 2014-18

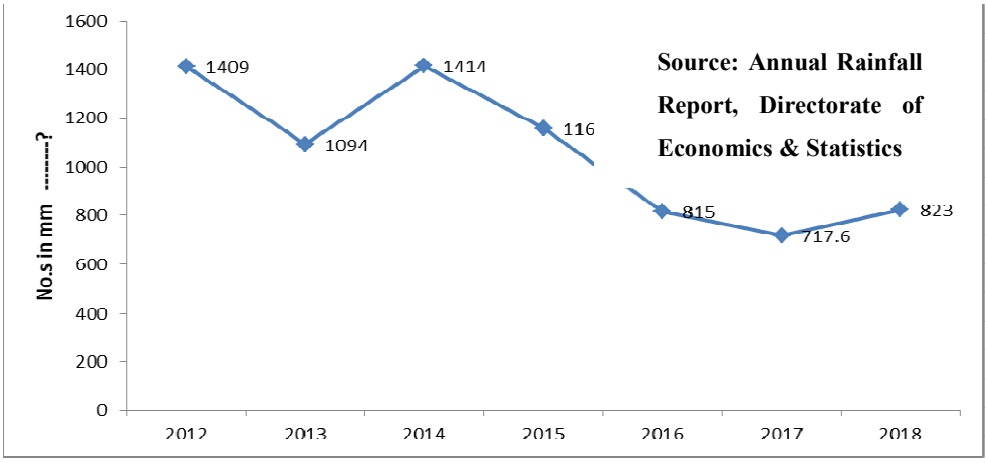


Figure 15: Trend of annual rainfall in Karnataka (in mm)- 2012 to 2018

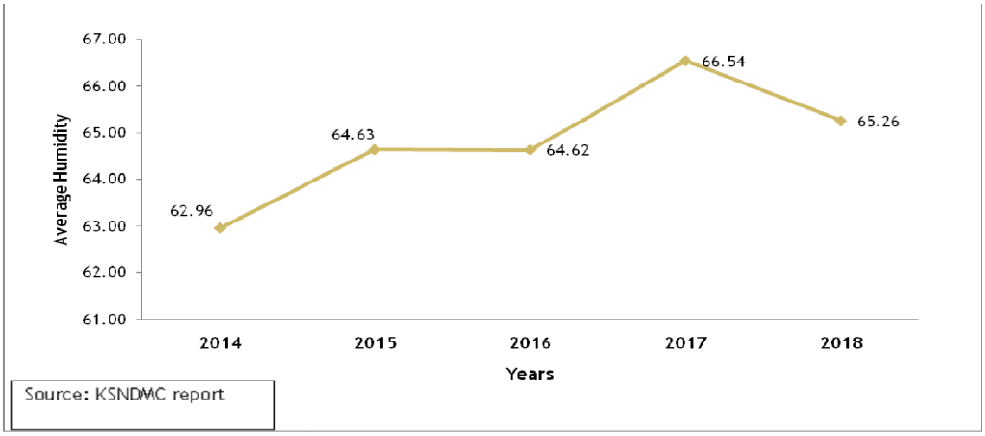


Figure 16: Trend of annual average humidity (%) in Karnataka from 2014 to 2018

2. KARNATAKA's STRATEGIC FRAMEWORK FOR ADAPTATION OF HUMAN HEALTH AGAINST CLIMATE CHANGE

The State Health and Family Welfare System derives strength from several institutes and infrastructures of the GOI, multi-lateral institutes, and NGOs including ICMR, PHFI, WHO, UNICEF, IISc, EMPRI and many others.

Measures that would help address the imminent challenges would include *development of an integrated early health warning system*, *district 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 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 has been noted in the Joint Indo–U.S. Workshop on Climate Change and Health.

The linkage of health with environmental and climate change determinants is well recognized. 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/ development and coordination of early warning and surveillance systems in specific areas (e.g. heat waves, health effects of flooding, air pollutants, ultraviolet radiation, vector 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 like Chikungunya, Dengue, Malaria, Typhoid, leptospirosis etc.
4. Strengthening and enthusing action through innovative strategies/ new technological approaches to bring equity/ improve access in health across income groups. (Pilot test innovative approaches to increase access through internet based technologies to provide early health care advice/ referral ; Online system to help-identify availability of care

provider, register patients in Government hospitals; introduce long term health tracking system incorporating *Aadhaar* card number to assist surveillance and generate trends).

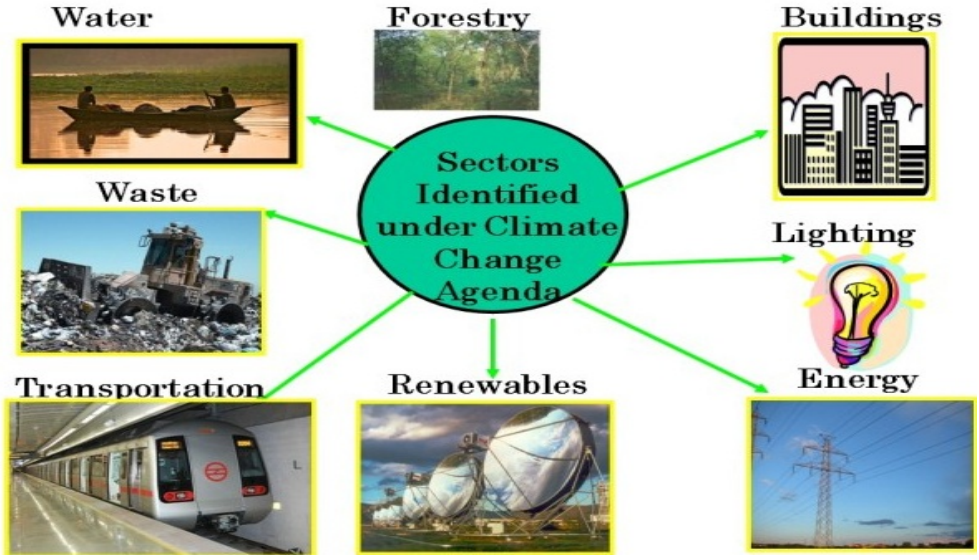
5. Undertake case studies in climatically sensitive locations to pilot test new approaches aimed at building resilience.

3. INTEGRATION OF HEALTH MISSION WITH OTHER MINISTRIES AND DEPARTMENTS ON CLIMATE CHANGE

The frequency and magnitude of occurrence of "morbidity and mortality", "acute and chronic" or "communicable" and "Non-Communicable" illnesses depends on factors like socioeconomic status, place of residence, occupation, level of nourishment, underlying illness, supply of safe drinking water, sanitation facilities, deforestation, air pollution, extreme weather, governance (local, state and national level), unplanned urbanization, chemical exposures, agricultural practices (use of insecticides/ pesticides), availability of health facilities, trained/ skilled manpower at health facilities, laboratory support, customs and religious practices etc .

To reduce these illnesses, various national programmes/ schemes have already been started by various ministries which aim to mitigate, adapt and develop required infrastructure. To name a few national programmes/ schemes are: *Midday Meal Scheme*, *Integrated Child Development Scheme*, *National Vector Borne Disease Control Programme (NVBDCP*), *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 Tobacco Control Programme*, *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*, *Universal Immunization Programme* etc.

Karnataka State Action Plan on Climate Change (KSAPCC) was being prepared on the lines of National Action Plan on Climate Change (NAPCC) further extension to the Climate Change Agenda, as per the framework of Ministry of Environment and Forests, Govt. of India. The sectors identified under Climate Change Agenda mainly include Water Resources, Forest, Biodiversity & Horticulture, Transportation, Health, Energy & Power, Urban Planning and Vulnerability assessment.



hange.

The State Ministry of Health & Family Welfare (MoHFW) seeks to coordinate & collaborate with other Ministries, Departments & NGOs/CBOs to implement KSAPCCHH.

National Level departments	State level department	Government Organizations	Missions /Schemes
Ministry of Environment, forest & Climate Change (MOEFCC)	Department of Forest, Ecology & Environment	Karnataka Forest Department Karnataka State Forest Industries Corporation Limited Karnataka State Pollution Control Board Lake Development Authority Environmental Management & Policy Research Institute (EMPRI) Karnataka Biodiversity Board Karnataka State Coastal Zone Management Authority	National Mission for "Green India". National Mission on India's Coastal areas.
Ministry of Health and Family welfare	Department of H&FW	Directorate of H&FW, Directorate of Medical education, AYUSH Department, SIHFW KSHSRC	National Health Mission
Ministry of Drinking Water and Sanitation	Urban development department, RDPR , in Rural Areas	Urban Local Bodies City corporations, Town municipals. RDPR, for Rural Areas	National Mission on Sustainable habitat. SWACHH BHARAT mission
Ministry of Agriculture (MoA)	Department of Agriculture,	Agriculture Watershed development	National Mission for Sustainable Agriculture.
Ministry of New & Renewable Energy	Energy Department	Karnataka Renewable Energy Development Ltd.	National Solar Mission. National Wind Mission. National Mission for Enhanced Energy Efficiency. National Mission on "Waste to Energy Generation".

National Level departments	State level department	Government Organizations	Missions /Schemes
National Disaster Management Authority	Department of Science & Technology,GoK	Karnataka State Disaster Management Center(KSNDMC)	
Department of Science & Technology (DST)	Department of Science & Technology,GoK	Karnataka State Council for Science and Technology (KSCST)	National Mission on Strategic Knowledge for Climate Change.
Ministry of Women and Child Development	Department of women and Child development, GoK		National Nutrition Mission (NNM)
Ministry of Information & Broadcasting (MI &B)	Department of Information and Public Relations,GOK		
Ministry of Human resource Development	Department of public instructions, GOK		
Indian Council of Medical Research (ICMR)	NITM, Belagavi		

The State *Ministry of Health and Family Welfare* is the nodal ministry for implementation of Karnataka State Action Plan for Climate Change and Human Health (KSAPCCHH).

The strengthening of the National and State Programmes under various ministries will raise the level of health of people through direct or indirect impacts. The possible health impacts of other departments are foreseen as follows:

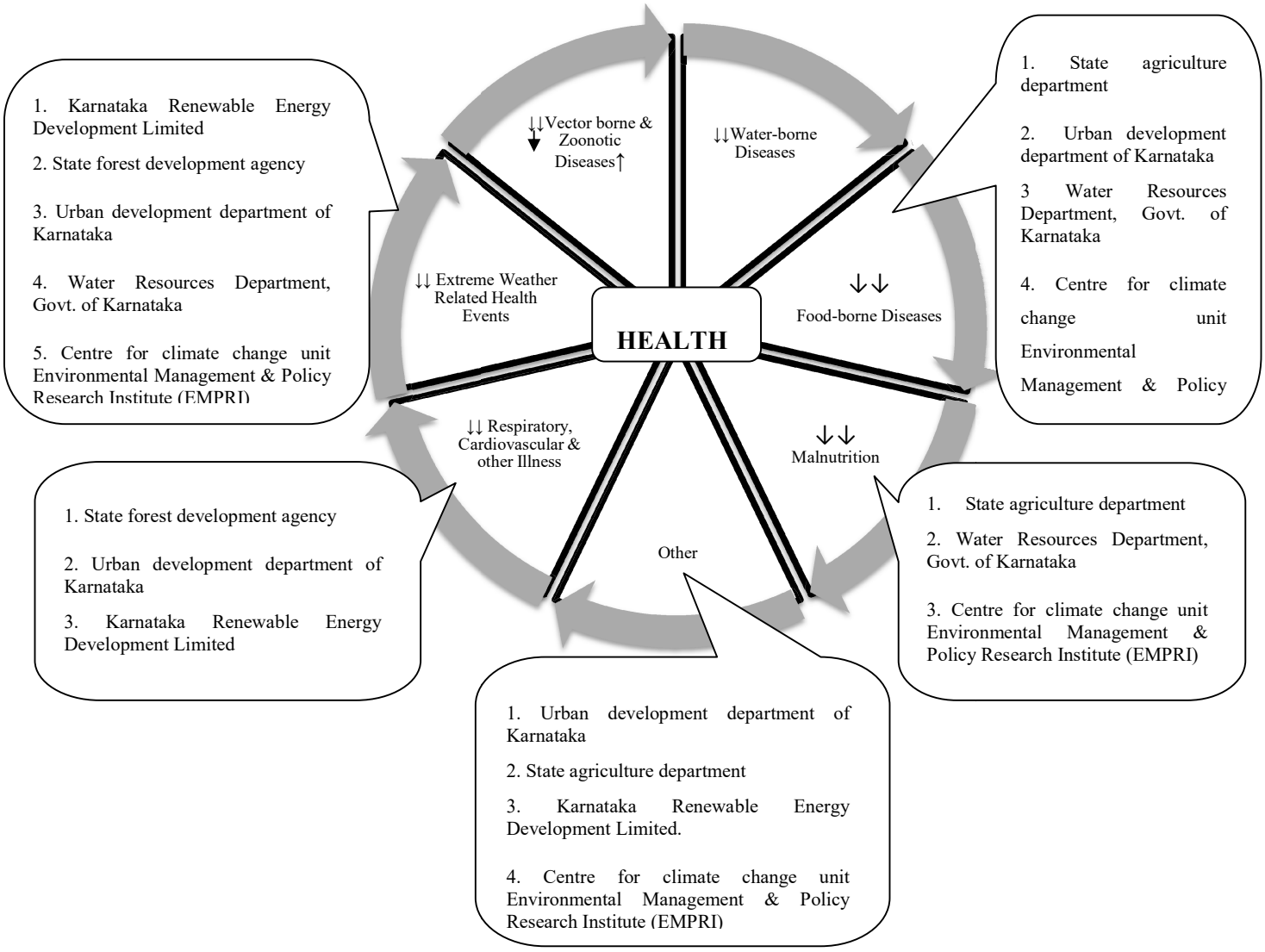


Figure 18: Health impacts of other departments

4. KSAPCCHH: VISION, GOAL AND OBJECTIVES

Vision

To strengthen health of citizens of Karnataka against climate sensitive illness, especially among the vulnerable like children, women and marginalized population.

Goal

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

Objective

To build capacity of health care services against adverse impact of climate change on human health.

Specific Objectives

Objective 1:

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

Objective 2:

- To strengthen capacity of health system (infrastructure, training, development of resource material and HMIS) to respond to climate sensitive illness/ diseases.

Objective 3:

- To perform situational analysis to strengthen preparedness and response at state/ district/ below district levels to cope with adverse health impacts of climate change related disasters.

Objective 4:

- To assist districts to assess their health vulnerabilities in the context of climate change and accordingly build capacities to adapt and mitigate the vulnerabilities.

Objective 5:

- To develop partnerships with stakeholders in the private sector, the civil society and other stakeholder government departments, and creating synchrony/ synergy with other missions on climate change and ensure that health is properly represented in the climate change agenda in the state**.**

Objective 6:

- To strengthen monitoring, surveillance and research capacity about impact of climate change on human health, and develop a mechanism to fill the gap in the evidence based health policy.

5. KSAPCCHH: ACTIVITY MATRIX

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
1.	To create awareness on the impacts of climate change on human health among general population (vulnerable community), health-care providers and Policy makers.	Development of IEC& BCC material	-Identify the nodal agency/ Organisation to undertake communication needs assessment for the target groups - Development of Communication Plan involving mass media and inter-personal communication (audio visual, print, outdoor outreach IEC materials both in Hindi, English and other	-Develop an integrated IEC strategy -Monitor the dissemination and utilization of IEC material upto village level -Explore inter-sectoral / inter-ministerial / voluntary groups from civil society / NGOs for collaboration on awareness activities -Explore additional sources of funding	-Commissioning of impact studies and follow up Evaluation: To determine whether the target population is covered/ informed timely -Actively pursue partnerships with other agencies	Department of H&FW State Surveillance Unit	JD-IEC Karnataka State Agriculture Department Department of Information & Public Relations, GoK Dept. of Forest, Ecology, Environment, GoK ICMR-National Institute of Traditional Medicine(NITM), Belagavi Regional office of Health and Family Welfare, Bangalore Karnataka State Higher Education Council

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
			vernacular languages). - Development of Communication Tools for effective & efficient communication activities -Training & Sensitization of Health Care Providers and Field Functionaries on use of communication materials	-Integrate climate change with nutritional status and health into school and College curricula - Periodic Impact assessment of communication activities			Department of Public Instruction Department of Urban development Department of Rural Development & Panchayat Raj, GoK Commissioner of Food Safety, GoK Karnataka Pollution Control Board
		Advocacy	- Creation of a State forum of Elected Representatives for advocacy among public for demand generation and	Provide evidence to the decision-makers to change policies, practices, and systems. Involve community-based organizations	Community capacity building: encourage and support communities' involvement with institutional and	Department of H&FW State Surveillance Unit	Regional office of Health and Family Welfare, Bangalore Dept. of Forest, Ecology, Environment, GoK Dept. of Urban

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
			allocation of adequate resources -Advocacy with Partners across multiple sectors /organizations to provide technical & financial support National and regional level consultations to influence and Inform legislators and decision makers in government and other institutions to address the complex systems and interrelated issues of climate change and health	(CBOs) for Community engagement processes to address issues of concern to them, with the goal of increasing community decision-making and control.	political processes and decision-making — especially for the vulnerable groups and disadvantaged communities most at risk of climate-related health impacts. Expand the span of coalitions to strengthen support for favorable legislatures/ policies		Development, GoK Department of Rural Development & Panchayat Raj, GoK Department of Women and Child Development, GoK ICMR-National Institute of Traditional Medicine, Belagavi Karnataka State Department of Agriculture Karnataka State Disaster Management Authority Karnataka Pollution Control Board Karnataka Renewable Energy Development Ltd. Department of Water Resources, GoK Environmental

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
							Management and Research Institute
2.	To strengthen capacity of health system to respond to climate sensitive illness/ diseases	Enrich Indian Public Health Standards (infrastructure, development of resource material etc) in context of climate change	-Constitute the *Task Group* to review the existing Indian Public Health Standards in context of climate sensitive diseases as well as extreme weather events. -Consolidate the state and area specific recommendations of Task Group and get concurrence of the NHM for the same -Identify the mechanism for implementation of these	Phased Implementation of the recommendations of the Task Group at District Hospital, Community Health Centre and Primary Health Centre level	Continue the implementation process and accomplish it.	Department of H&FW State Surveillance Unit	Regional office of Health and Family Welfare, Bangalore JD-Planning ICMR-National Institute of Traditional Medicine, Belagavi

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
			recommendations				
		Capacity building (training) of health care professionals) in context of climate change	Establishment of an Environment Health & Climate Change Cell at State / District Level with (i) Human Resource & focal points, (ii) terms of reference, (iii) technical committees/ working groups to support the focal point, (iv) skilled staff, (v) logistics, and (vi) funds (customized as per the vulnerabilities of the states) Identify the pool of master trainers and organize training of master trainers	Training of state and district level health care professionals who will then train the below district officials. Sensitization and orientation of private health care providers.	Continue and Complete the trainings of health care staff till village level. Update the training modules In light of new evidences and requirements.	Department of H&FW State Surveillance Unit	Regional office of Health and Family Welfare, Bangalore SIHFW Dept. of Forest, Ecology, Environment, GoK ICMR-National Institute of Traditional Medicine, Belagavi EMPRI IISc KSHSRC

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
			Printing of training modules				
3.	To perform situational analysis to strengthen preparedness and response at state / district/ below district levels to cope with adverse health impacts of climate change related disasters.	To develop/ strengthen the monitoring and surveillance systems for climate sensitive diseases	Develop / strengthen existing surveillance systems to capture data on climate sensitive diseases (prioritise) Initiate development mechanism and indicators to monitor diseases trend and integrate them on one platform.	Build an interdisciplinary platform through data sharing and data linkages Incorporate other climate sensitive diseases in the monitoring system Conduction of Joint Review Missions / Central Internal Evaluations and feedback mechanisms.	Update monitoring and surveillance system as per new evidences Evaluate system and Upgrade the platform as per evolving technologies. Identify areas for future research based-on-needs.	Department of H&FW State Surveillance Unit	KSHSRC Regional office of Health and Family Welfare, Bangalore ICMR-National Institute of Traditional Medicine, Belagavi EMPRI PHFI IPH PHI NIMHANS(Public Health Department)
		To establish an institutional mechanisms for policy and	-Identification of Organizations & Institutions of International / National / Regional repute for	State Nodal Agency to coordinate with other agencies at sub district level such as municipalities, local urban bodies, PRIs	Synergize with other non health sectors to have collaborative and multi-sectoral approach.	KSHSRC ICMR-National Institute of Traditional Medicine,	JD-planning EMPRI State Council of Scientific & Industrial Research IISc

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
		planning at national, state, district and local level	partnering as Centers of Excellence (CoE) Collaborate with CoE in development of guidelines, capacity building of States, supporting implementation, periodic monitoring,supervision, mentoring and hand holding of States -Identify the state nodal agency/ institute	etc for efficient and effective implementation of Health action plan under NAPCCHH Involve other stakeholders, such as private, nongovernmental organizations, international cooperation agencies, universities and research institutes.		Belagavi	
		Develop mechanisms for EWS/ alerts and	Constitution of a multi-stakeholder working group for development of	Review of data from monitoring and surveillance and develop thresholds/	Evaluation and modifications for the	Karnataka State Disaster Managemen	Karnataka State Natural Disaster Monitoring Centre Dept. H&FW(JD-

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
		responses at state, district and below district level	early warning system for health events due to extreme weather conditions - Design EWS in collaboration with Meteorology Dept, NDMA etc. -Design and integrate an effective national public health response plan taking support of technical & financial resources from Emergency Medical & Relief Services (EMR). - Integrate SHOC Response system under IDSP and	prediction models for health events other than those due to extreme weather. States to prepare the public health response plans as per specific vulnerabilities. Develop communication and dissemination systems to ensure people and communities are warned in advance	appropriateness of the plans' components including thresholds of action and the interventions enacted to maximize response effectiveness for the relevant community or region.	t Authority	medical) ICMR-National Institute of Traditional Medicine, Belagavi Dept. of Forest, Ecology, Environment, Meteorological Centre, Bengaluru SSU Department of Agriculture Department of Rural Development & Panchayat Raj Department of Urban Development Karnataka Pollution Control Board EMPRI

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
			EMR				
4.	To provide support to districts to assess their health vulnerabilities in the context of climate change and accordingly build capacities to adapt and mitigate the vulnerabilities	Establishment of an Environmental cell in the Health department at State and District Level	States to form expert groups to enlist and prioritize the diseases/ health emergencies according to area and type of population occurring due to climate variability/ extremes. -. Enlistment of the areas where the health sector can employ greening efforts,	Expert group to collect / collate/ draft diseases specific treatment guideline / action plan as per state's priority list and upload the same on State website for ready reference. - Effective and efficient transfer of technology including measurement of the carbon footprint of health facilities	Disseminate reports and good practices; Provide technical support, financial assistance to regional level health functionaries.	Department of H&FW State Surveillance Unit	Regional office of Health and Family Welfare, Bangalore Dept. of Forest, Ecology, Environment. Karnataka Pollution Control Board DSU KSHSRC EMPRI
		Capacity building for vulnerability assessment at various	Identify Nodal Agency at State level for capacity building of health personnel for vulnerability	Multi disciplinary experts to conduct meetings/ Workshops/ Training etc of trainers at state level for	For climate sensitive illnesses Conductworkshops /follow-on training/ structured training in new treatment/	Department of H&FW / SIHFW / KSHSRC	Regional office of Health and Family Welfare, Bangalore Dept. of Forest, Ecology, Environment Karnataka State Disaster

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
		levels and liaison with centre	assessment.	dissemination of diseases specific health action plan	management technologies at regional or local level		Management Authority SSU EMPRI
		State specific implementation framework	State to form climate sensitive health Programme Implementation Plan (PIP)	Implement/ adapt/ modify Monitoring, Supervision and Evaluation tool for climate sensitive diseases.	Strengthen/ modify Monitoring, Supervision and Evaluation tool for climate sensitive illnesses, based on feedback or identified lacunae/s ,	Department of H&FW State Surveillance Unit	KSHSRC Regional office of Health and Family Welfare, Bangalore JD Planning Dept. of Forest, Ecology, Environment Dept. of Urban Development RDPR Karnataka Pollution Control Board Karnataka State Disaster Management Authority Department opf Water Resources, GoK EMPRI

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
		State to work in collaboration with stakeholders to identify the gaps and to develop district specific action plans	Nodal agency/ State health ministry to establish/ strengthen linkages with other agencies like IMD, SPCB, NDMA etc to identify the gaps in practical application and possible remedial measures.	Develop/ adapt/ update- diseases specific action plan based on identified gaps in practical application of state health action plan.	Climate resilient health Policy analysis by Nodal agency/ State health ministry under legislative purview to develop climate proof communities and infrastructure	Department of H&FW State Surveillance Unit	JD Planning KSHSRC Regional office of Health and Family Welfare, Bangalore Dept. of Forest, Ecology, Environment Dept. of Urban Development RDPR ICMR-National Institute of Traditional Medicine, Belagavi Karnataka Disaster Management Authority Karnataka State Department of Agriculture Department of Women and Child Development Karnataka Pollution Control Board EMPRI

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
							Karnataka Renewable Energy Development Ltd. Department of Water Resources, GoK Karnataka State Coastal Zone Management Authority Meteorological Centre, Bengaluru
5.	To Promote partnerships with stakeholders in the private/informal sector, civil society and government departments, to create synergy with the programmes of	Identify and enlist departments / institutions/ organisations (Govt. Non-Govt.) working in the area of climate change	Stakeholder's mapping and analysis of their services to identify the aspects/areas underserved in management of climate sensitive diseases and limiting duplication.	Stakeholders to identify, prioritize and coordinate the service areas to be served for risk reduction and Environmental Impact assessment by partnership.	Develop risk reduction and Environmental Impact assessment tool and best management practices which are affordable and acceptable in social/ traditional context locally.	Department of H&FW State Surveillance Unit KSHSRC	State Demography section Regional office of Health and Family Welfare, Bangalore JD Planning Dept. of Forest, Ecology, Environment Dept. of Urban Development RDPR ICMR-National Institute of Traditional Medicine,

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
	those involved in other missions on climate change and ensure that health is properly represented in the climate change agenda in the country						Belagavi Karnataka Disaster Management Authority Department of Agriculture Department of Women and Child Development Karnataka Pollution Control Board EMPRI Karnataka Renewable Energy Development Ltd. Department of Water Resources, GoK Karnataka State Coastal Zone Management Authority Meteorological Centre, Bengaluru

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
		To develop joint action plan with other deptt./ organizations In view of their capabilities and complementarities	Explore and Identify strategies, policies and measures: - to establish Corporate Social responsibility / accountability in terms of finances and adaptation measures to prevent/reduce/ treat climate sensitive diseases .	Evaluate Corporate Social Responsibility (CSR) under laws for Health strategies, Policies and measures for promotion of health and environmental and social protection.	Assist decision makers by providing alternative services and by helping in Identification of gaps in services so as to reduce the potential adverse effects of climate variability on health	Department of H&FW JD Planning SSU	KSHSRC Regional office of Health and Family Welfare, Bangalore Dept. of Forest, Ecology, Environment Dept. of Urban Development RDPR ICMR-National Institute of Traditional Medicine, Belagavi Karnataka Disaster Management Authority Karnataka State Department of Agriculture Department of Women and Child Development Karnataka Pollution Control Board EMPRI Karnataka Renewable

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
							Energy Development Ltd. Department of Water Resources, GoK Karnataka State Coastal Zone Management Authority Meteorological Centre, Bengaluru NGOs Community Based Organisations

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
6.	To strengthen monitoring, surveillance and research capacity about impact of climate change on human health, and develop a mechanism to fill the gap in the evidence based health policy.	Create database of professional , researchers and institutions engaged in studies of impact of weather and climate	"Standardization of information" after Collection, collation, triangulation and interpretation of the available data from various sources to more accurately measure morbidity and mortality due to climate variability and develop / adapt monitoring tool for them.	Using standardized monitoring tool, conduct Continuous monitoring and annual evaluation of health events due to extreme climate variability.	Enhance existing infrastructure of health monitoring and surveillance and integrate it with risk assessments, mitigation and adaptation strategies.	Department of H&FW State Surveillance Unit	Regional office of Health and Family Welfare, Bangalore State Demography section, KSHSRC ICMR-National Institute of Traditional Medicine, Belagavi EMPRI
		Create mechanism for data capture, collation, analysis and interpretatio n	Coordinate with stakeholders to develop mechanism or update existing surveillance system to detect, quantify, characterize, and monitor health	Link health databases with real-time monitoring of weather, climate, geospatial, and exposure data so as to accurately forecast health illness/ event	Evaluate databases and its integration with other surveillance system to identify the gaps and for adoption of newer technologies to	Department of H&FW State Surveillance Unit	State Demography section KSHSRC Regional office of Health and Family Welfare, Bangalore ICMR-National Institute of Traditional Medicine,

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
			events regionally.		develop user friendly and easily interpreted information.		Belagavi
		To develop centre of excellence on different aspect of climate change and health at state level.	Identify health/ research facilities which are actively contributing in researches related to prevention and preparedness for extreme weather events such as emergency care, maintain relevant data and medical records.	For assessment of risk, vulnerability and adaptability -Conduct epidemiological researches/ baseline surveys -Develop tools for assessment of vulnerabilities -Develop Hazard Map by type, magnitude, location and population characteristics.	Develop and validate models, enhance research on the effectiveness of diseases' management (chemoprophylaxis/ vaccine/other preventive measures), and evaluation of mitigation strategies.	State Surveillance Unit JD-Demography	Meteorological centre, Bengaluru ICMR-National Institute of Traditional Medicine, Belagavi KSHSRC Regional office of Health and Family Welfare, Bangalore EMPRI Karnataka State Disaster Management Authority NGOs
		Identify best	Collect and Share	Conduct seminars, workshops, conferences		Department	State Demography

S. No.	Objective	Key Actions	Activity			Roles and Responsibilities of Department / Ministry	
			Short term (First two years)	**Medium Term** (More than two years to five years)	**Long Term** (More than five years to fifteen years)	**Nodal**	**Supportive**
		practices in implementation of measures to combat the effect of climate change	reports, publication etc regarding successful measures undertaken at other places to combat the effect of climate change	focusing on effects of climate change and the measures to combat and mitigate the effect of climate change.		of H&FW State Surveillance Unit	section KSHSRC Regional office of Health and Family Welfare, Bangalore EMPRI IISc ICMR-National Institute of Traditional Medicine, Belagavi NGOs

6. FRAMEWORK FOR KSAPCCHH

Input (first 2 years)			
5 Climate sensitive illness	**Priority District**	**Exaggerating/contributing factors**	**Department/ institute/ organization / health care facilities/other stakeholders**
1)Malaria	1) Dakshina Kannada 2) Udupi 3) Yadgir 4) Raichur 5) Gulbarga	High temperature High attitude Low altitude Moderate rainfall Extreme weather and climate events– like droughts and floods Change in demography, migration , land usage practices, water projects, agricultural practices etc.	NVBDCP SSU National Institute of Malaria Research Woman and child development department
2)Dengue	1)Bangalore Mahanagara Palike (BBMP) 2)Dakshina Kannada 3)Udupi 4)Yadgir 5)Raichur	Increase temperature (5-35^{0}c) Increase humidity Increase precipitation Socioeconomic factors	NVBDCP SSU Woman and child development department BBMP
3)Acute Respiratory Infections	1) Bangalore (U) 2) Bangalore (R) 3) Davanagere 4) Chitradurga 5) Hassan	Increase humidity Low temperature Outdoor and indoor air pollution, Environmental tobacco smoke Housing conditions Socio-economic status Nutritional status	SSU HMIS Department of forest ecology and environment Department of public instruction Agriculture department Rural development and Panchayat raj department Urban development department Karnataka renewable energy development limited Karnataka state

			industrial and infrastructure development corporation limited Karnataka state road transport corporation Department of information and public relations Department of information technology, biotechnology, and science and technology Department of labour Karnataka pollution control board Woman and child development department
4) Acute Gastroenteritis	1) Bangalore (U) 2) Bangalore (R) 3) Davanagere 4) Chitradurga 5) Hassan	↑Temperature above baseline, high humidity and possibly by rainfall. ↓Temperature + lower levels of humidity. Availability of safe water supply Socioeconomic status Sanitation facilities Personal hygiene	SSU HMIS Department of rural development and panchayat Raj Urban development department
5) Malnutrition	1) Yadgir 2) Raichur 3) Gulbarga 4) Bagalkote 5) Koppal	Extreme weather and climate events– like droughts and floods Food availability Food accessibility Food utilization Household food insecurity, Inadequate care and Unhealthy household environment	Woman and child development department HMIS Integrated Child Development Scheme (ICDS) Public distribution system

The data obtained from IDSP, CMD , NVBDCP, NCD, HMIS and Nutrition departments, among 30 districts 13 Priority districts were identified :1) Dakshina Kannada 2) Udupi 3) Yadgir 4)Raichur 5) Bangalore Mahanagara Palike (BBMP) 6) Bangalore (U) 7) Bangalore (R) 8) Davanagere 9)Chitradurga 10) Hassan 11) Gulbarga 12) Bagalkote 13) Koppal

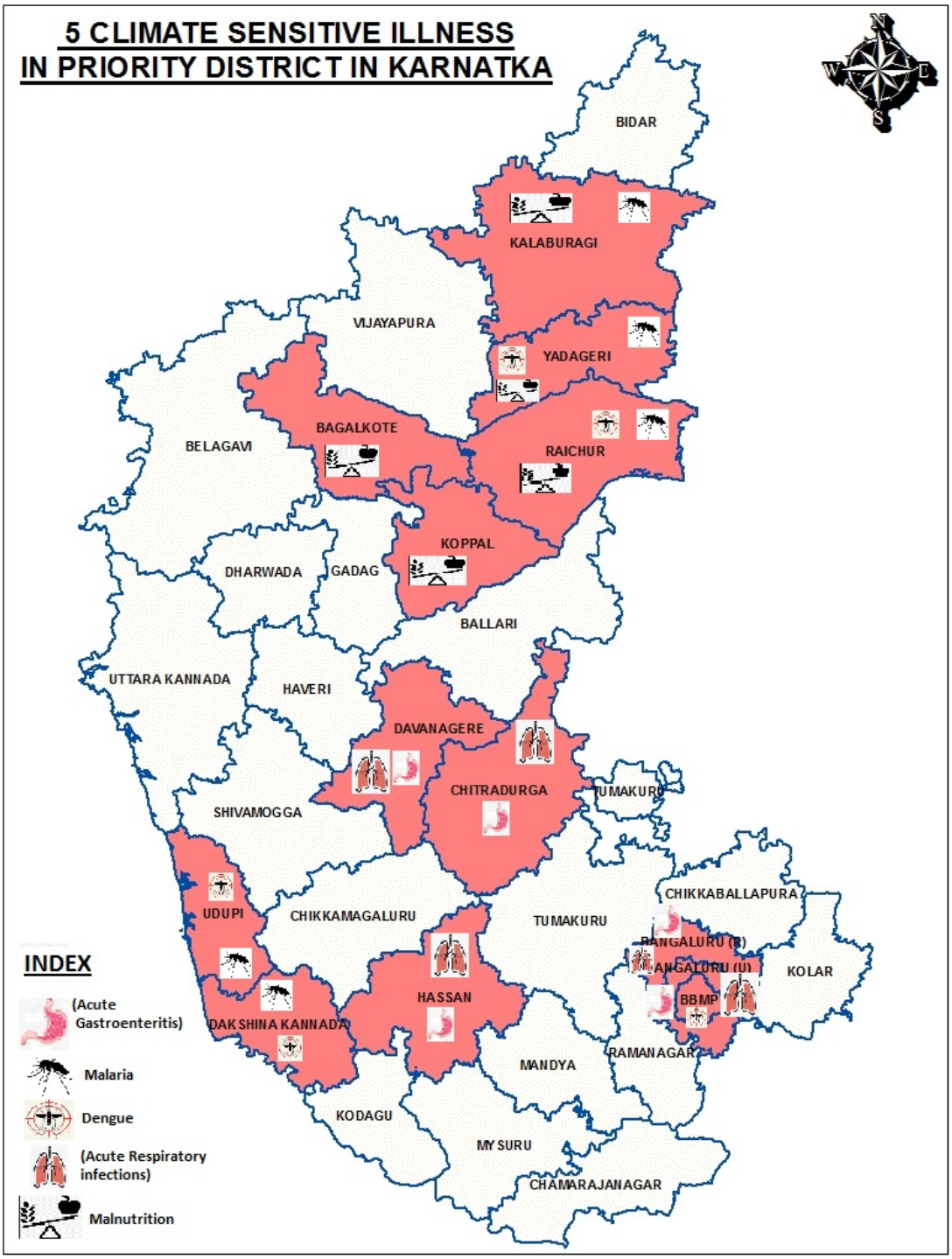


Figure 19: Map showing 5 climate sensitive illnesses in priority districts of Karnataka

Process: 2 to 5 years

1. *Training of health care personnel* on guidelines and treatment modalities against climate sensitive illnesses at district level. (STG attached as Annexure I)
2. *Awareness generation campaign* for general as well as vulnerable population through health talks, specific day celebration, health melas etc.
3. Yearly "*Advocacy network meeting*", for vulnerable communities & health personnel.
4. *Capacity building* at state and district level to assess vulnerability against climate sensitive illnesses.
5. State to formulate *specific implementation framework* for climate sensitive diseases.
6. Formulation of specific action plan for efficient and appropriate resource allocation and mobilization to cope with climate sensitive illnesses.
7. Establishment of network of department/institute/organization/ health care facilities for implementation of diseases' specific implementation plan.
8. Establishment of harmonized disaster risk management database at district level .
9. To conduct health system research and epidemiological studies / surveys on vulnerable population for climate sensitive illnesses.
10. Development of mathematical /prediction models for state specific climate illnesses to issue notification or EWS for preparedness of health care system.

Output:

1. Awareness & Behaviour modification among general population including children and youth for impact, illnesses, prevention and adaptive measures for climate sensitive illnesses.
2. Increase in trained personnel and equipped organization to implement the KSAPCCHH guideline at district level.
3. Increase in resilient health services, infrastructure, and capacities for health emergency / disaster due to climate sensitive illnesses.
4. Increase in timely, valid, comprehensive and reliable data for climate sensitive illnesses/ events from both government and non-government health sector.
5. Implementation of guidelines/action plan in each district to mitigate and adapt for climate sensitive illnesses.
6. Reduction in factors contributing/ exaggerating the climate sensitive illnesses.
7. Develop mechanism for Early warning system/ alerts at district and below level.

7. KSAPCCHH: CLIMATE RESILIENT INTERVENTION

In addition to collaboration with other sectors, the health sector is also directly responsible for programmes that address climate-sensitive health risks, such as vector-borne and water-borne disease, and the health response during extreme weather events, and nutritional crises.

Health programmes should become climate-resilient through assessment, programming and implementation which considers climate risks and vulnerability and should be redesigned and implemented taking into account both current climate variability, and projected future climate change.

Existing efforts in disaster risk reduction, public health preparedness, and many vertical programs for communicable and non-communicable diseases may not be adequate, may be rendered ineffective or unsustainable, or may not be needed.

Specific health programmes can use information gathered through the implementation of the component related to "information and early warning systems" (e.g. V&A assessments, research, Integrated Risk Monitoring and EWS) to improve their decision-making, and adjust the scale of intervention accordingly. For example, health programming informed by early warnings about a potential outbreak or heat wave, can use time wisely to prepare operations for increased patient loads and special needs. Climate-informed programming should continuously review and adjust service delivery according to new information from time to time.

Climate-related health risks	**Vulnerability**	**Interventions**
Water borne & Food borne diseases	-Availability of safe water supply to all -Sanitation facilities in urban slums and remote rural areas -Personal Hygiene -Political willingness -Socio-economic status -Natural disasters -Demographic	**Public Health Intervention** 1. Strengthen the existing surveillance system for water and food borne illnesses, enhance this surveillance during high risk period 2. Capacity building of health care personnel 3. Up-gradation and strengthening of laboratories for case diagnosis. 4. Study the regional pattern of water borne diseases to analyze trends in incidence and prevalence 5. Provide logistic support and adequate supplies to the affected region 6. Improve access to health care facilities by vulnerable population, especially those in remote areas. 7. Strengthen surveillance on food handling units, local vendors. 8. Incorporation of real-time surveillance, evaluation and monitoring in the planning process. 9. Assess regional vulnerability (spatially and temporally) with respect to changes in the climate to identify areas, population groups and diseases that may be impacted more significantly. 10. Prioritise water scarce regions to ensure supply of potable drinking water and adequate sanitation facilities in both rural and urban areas as envisaged by the State Water Policy

Climate-related health risks	Vulnerability	Interventions
	changes -Accessibility to health care	11. Preventive medical care - One of the most important public health interventions available to society is the provision of adequate medical care, Rapid diagnosis & treatment and vaccination have had a significant impact on the global risk of waterborne diseases. 12. Health education and behavioural modification - educating people to routinely chlorinate drinking water or to boil it during outbreaks of cholera, encouraging the use of narrow neck vessels in which to store water, and other changes in water handling. 13. Control of the environment - For waterborne diseases, concerned with ensuring that drinking and recreational water is free from potentially infectious agents, and that human sewage and other wastes are dealt with in as safe a manner as possible. 14. Cultivating political will - The cost of many possible interventions for reducing waterborne disease can be enormous. For example, a large-scale water treatment works can cost several tens of millions of pounds. Getting the support to spend such large sums requires considerable political persuasion skills. **Other sector's Intervention** 1. Department of Rural Development and Panchayat Raj , GoK and Urban development department of Karnataka -ensure minimum household safe water requirement -reuse of treated waste-water -encourage water saving technologies like low-flow toilets & Showers etc 2. Karnataka State Agriculture Department -develop/ encourage programs for efficient use of irrigation water. -promotion of climate resilient crops among farmers 3.Karnataka State pollution control board (KSPCB) -Central Pollution Control Board in collaboration with Karnataka State Pollution Control Board is executing National Water Quality Monitoring Programme (NWMP) comprising **63 stations in the State.** The monitoring is done on monthly basis in selected stretches of rivers. - The Central Pollution Control Board (CPCB) has developed a Comprehensive Environmental Pollution Index (CEPI) scores of the critically polluted industrial clusters/areas to consider the projects for environmental clearance and to improve the quality of environment in these areas.
Adaptation measures for Water borne & Food	***-*** *Strengthen surveillance program for various water & food borne diseases.* *- Ensure adequate supplies (vaccines and medications) for cases management.* *- Sanitation improvement and supply of safe drinking water* *- Establishment of intersectoral coordination mechanisms and Early warning system* *- Undertake epidemiological studies to detect further risk factors and vulnerable*	

Climate-related health risks	Vulnerability	Interventions
borne diseases	*populations.* *- Education programs for general population on efficient use of water, appropriate food handling, hygiene practices and climate change sensitive diseases and preventable measures* *-To promote environment awareness and carry out action based programme for protection and improvement of environment in schools through NGC (National Green Corps).* *-Increase in the awareness activities such as organizing seminars, workshops, campaigns, street plays, tree plantations, debate, painting, drawing competitions and other environment related activities to school children and general public are usually carried out by KSPCB in collaboration with NGO's/ Trusts/ Eco-clubs and other organizations through the year.*	
Air Borne, Cardio-pulmonary & Respiratory Allergic Diseases	- Change in timing, survival, transmission & duration of certain microbes (like Influenza virus) - Interaction of air pollution, pollen and weather -Proportion of population malnourished, with extremes of age, underlying illnesses, pregnant females. - Commonest type of occupation - urban slums and remote rural areas -Socio-economic status -Accessibility to health care	**Public Health Intervention** 1. Strengthen surveillance and monitor programme for Hospital admission as well as Outpatient for respiratory illnesses, influenza and allergic cases 2. Enhance vaccination programs and 'Vaccination Campaign' for vaccine-preventable air borne and respiratory diseases 3. Ensure availability of logistics, equipments and other treatment modalities including drugs at all level of health care 4. Ensure & provide logistic support and adequate 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 outbreak. 5. Monitor health outcomes with early warning system related to extreme weather events/ high risk seasons with other organisation/ stakeholders. 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. **Other sector's Intervention** 1. Department of Forest, Ecology and Environment Department, GoK - Ensure that State and District Pollution Control bodies set standards for industry-specific emission and effluent, monitor levels of pollutants and enforce penalties. - Enforce stricter 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 -To promote environment awareness and carry out action based programme for protection and improvement of environment in schools through NGC (National Green Corps). -Increase in the awareness activities such as organizing seminars, workshops, campaigns, street plays, tree plantations, debate, painting, drawing competitions and other environment related activities to school children and general public are usually carried out

Climate-related health risks	Vulnerability	Interventions
		by KSPCB in collaboration with NGO's/ Trusts/ Eco-clubs and other organizations through the year. -The Central Pollution Control Board (CPCB) has developed a Comprehensive Environmental Pollution Index (CEPI) scores of the critically polluted industrial clusters/areas to consider the projects for environmental clearance and to improve the quality of environment in these areas. 2. Department of Public Instruction - Regular screening of school children for early detection diseases, which can be attributed to the existing air pollution -Inclusion of harmful health effects of environmental pollution (Ambient Air Pollution AAP and Household Air Pollution HAP) in the school curriculum, including current policies and mitigation practices that are designed to reduce air pollution. -Improving 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 3. Agriculture Department, GoK -Policy in place to promote multiple uses of crop residues and prevent their on-farm burning. 4. Rural Development and Panchayat Raj Department -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.) 5. Urban Development Department, GoK and Karnataka Pollution Control Board -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 KSPCB continuous air monitoring data 6. Karnataka Renewable Energy Development Ltd -Develop policies for truly clean chulhas (cook stoves) and to support further research and development. -Research and development of other non-conventional/renewable

Climate-related health risks	Vulnerability	Interventions
		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 State Policy on clean Biofuels (biogas, ethanol, etc) and set up State Biofuels Development Board for strengthening the existing institutional mechanism and overall coordination. Strengthening the existing institutional mechanism and overall coordination of State Biofuels Development Board. -Create a state consensus action plan for replacing biomass fuels with alternative clean fuels 7. Karnataka State Industrial and infrastructure development corporation limited (KSIIDC) and Food, Civil Supplies and Consumer Affairs Department -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 8. Energy Department, GoK -Promote the development of more efficient cooking devices -Evaluate the potential for electric cooking appliances to substitute for biomass and LPG 9. Karnataka State Road Transport Corporation -Ensure effective implementation of New Motor Vehicles Act (once approved -Ensure proper engine checks for vehicles to assess pollution levels 10. Department of Information and Public Relations -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 11.Department of Information technology, Biotechnology and Science and technology ,GoK) -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 12. Department of Labour, GoK -Ensure regular health check- ups for early screening of pollution related diseases. -Frame guidelines and conduct workshops for health promoting workplaces, (like guidelines on indoor air quality),

Climate-related health risks	Vulnerability	Interventions
		-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 (ex. Metro) or non-motorised transport. 13. Women and Child Development Department, GoK -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 14. Finance Department, GoK -Analysis of the economic and financial implications of the health and other impacts of air pollution 15. Department of Law, GoK -Support enforcement on bans of burning trash for heating or as a way of disposal
Adaptation Measures for Air Borne, Cardio-pulmonary & Respiratory Allergic Diseases	***-*** *Strengthen surveillance system for respiratory diseases and develop health forecasting for acute and chronic respiratory diseases* *- Mapping and assessment of areas, which have potential effect on respiratory diseases through production of pollen or other allergens.* *- Set guideline to improve management of bronchial asthma, COPD and other related respiratory illnesses.* *- Establish an integrated, efficient, and effective early warning system.* *- Establishment of air pollutants monitoring system focusing on ground level Ozone* *- Develop public health preparedness and intervention plan for the health impacts due to climate change* *- Raising awareness on climate change and its effect on respiratory diseases*	
Vector-borne diseases	-Weather variables: temperature, rainfall, humidity, floods, drought, wind, daylight duration etc. -Change in Vector population due to change in growth, survival, feeding habits, seasonality, breeding sites, resistance etc -Change in interaction of vector& pathogen due to change in susceptibility, Incubation period,	**Public Health Intervention** 1. Strengthen active and passive surveillance in priority districts. 2. Strengthen sentinel hospitals for management of malaria and dengue. 3. Identify programmatic gaps and filling them. 4. Develop a model for forecasting of disease trend. 5. Inter-sectoral collaboration for vector control 6. Providing equipment and other related logistics for entomological surveillance 7. Elimination and reduction of vector breeding sites. 8. Encourage research on new safe and effective control measures 9. Intersectoral collaboration strengthening 10. To include for new treatments and diagnostic methods to education 11. Outreach interventions as well as field interventions such as vector control 12. Modifications to the built environment to help reduce the human health impact of infectious diseases. **Intervention by Community & Individual** 1. Eliminate/ control small and manmade vector breeding sites

Climate-related health risks	Vulnerability	Interventions
	or transmission - Change in demography, migration, land - usage practices, water projects, agricultural practices etc. Public health infrastructure and access to it.	2. Enhance community participation 3. House protection by using screening windows, doors and fencing the garden etc. 4. Use self protection measures like protective clothing etc,
Adaptation measures for malaria and dengue	***-*** *Strengthen National Programs for control of vector borne diseases (NVBDCP)* ***-*** *Strengthen surveillance for* ***malaria and dengue****.* *- Raise awareness among general population by mass media and campaign mode* *- Ensure 'Environmental Health Impact Assessment' of new development projects.* *- Early warning system for* ***malaria and dengue****.* *- Enforce legislation and regulations of* ***malaria and dengue****.*	
Nutrition	Changes in food - availability - accessibility -utilization -system stability crop failure/ yield decline Indirect effects -reduction in animal/ aquatic population, yield.	1. Seasonal nutritional screening (Vit A, Anaemia) in children, pregnant & lactating females high risk communities 2. Scale up integrated food security, nutrition and health programmes in vulnerable zones for at risk populations 3. Strengthen maternal & child health services and promote implementation of IMNCI programme. 4. Expand & promote fortified food consumption in the vulnerable population 5. Strengthening surveillance & control programs for diseases like malaria, schistosomiasis, parasitic infections 6. Establish a communication and mass media strategy for behaviour change.
Adaptation measures for Nutritional diseases	*- Strengthening surveillance and establishment of highly sensitive alert system by developing health forecast system for acute malnutrition and any other climate sensitive diseases.* *- Prevention and control of emerging and re-emerging food insecurity and acute malnutrition (hidden hunger).* *- Supporting and strengthening preventative health nutrition programs (fortification and supplementation) and projects within public health divisions, with emphasis on community involvement projects.* *- Capacity building and increasing awareness of the population through regular training workshops on health and nutrition education.* *- Undertaking research on population and on individual level to provide a solid basis for formulation of adaptation strategies and sewerage system.* *- Improving monitoring systems such as continuous monitoring of drinking water quality, water supply and sewerage system* *- Strengthening the existing emergency preparedness and disaster management by implementing recognized surveillance monitoring system*	

8. KSAPCCHH: ORGANIZATIONAL FRAMEWORK FOR IMPLEMENTATION

Operational framework for implementation of State Action Plan for Climate Change and Human Health (KSAPCCHH) at State, District and Taluk level is as follows:

8.1 State Level:

8.1.1 State Level Governing Body

The state level governing body shall be comprised of following:

1	***Honourable State Health Minister***	**Chai*rmen***
2	**Principal Secretary, H&FWS**	***Vice Chairman***
3	**Director, H&FWS**	**Member Secretary**
4	Commissioner, H&FWS	Member
5	Mission Director-National Health Mission	Member
6	Regional Director -Health & Family Welfare	Member
7	Director, SIHFW	Member
8	Project Director, IDS	Member
9	Executive Director, KSHSRC	Member
10	State Programme Manager, NHM	Member
11	Chairman, KSDMA	Member
12	Director General EMPRI	Member
13	Chairman, Karnataka Pollution Control Board	Member

8.1.2 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 Karnataka State Action Plan for Climate Change and Human Health (KSAPCCHH). It shall be working through Directorate of Health Services (DHS) of the state, which will be the implementing agency for KSAPCCHH.

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:

1	Executive Director, KSHSRC	Nodal Officer
2	Director I/c, State ICMR	Member
3	Director, Meteorological department of State	Member
4	Chairman, Karnataka Pollution Control Board	Member
5	Chairman, Karnataka State Disaster Management Authority	Member
6	State Surveillance Officer	Member
7	Environmental Engineer/ Scientist from Department of Forest Ecology and Environment	Member
8	Director , Department of Agriculture	Member

The Task force of the State Environmental Health Cell will coordinate with the Centre for execution of KSAPCCHH. The proposed State Level Structure of Environmental Health Cell is as follows:

8.1.3 Structure at State Environment Health Cell:

1. Consultant-Capacity building/ Training/ HR Management — 1 post
2. Consultant-Environmental Health — 1 post
3. Epidemiologist — 1 post
4. Data Manager & Analyst — 1 posts
5. Secretarial Assistants cum Data entry Operator — 1 post

8.1.3.1 Roles and Responsibilities of State 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.
- Assessment of needs for health care professionals (like training, capacity building) and organise training, workshop and meetings.
- Ensure appointment of contractual staff sanctioned under the KSAPCCHH.
- Maintain State and District level data on physical, financial, epidemiological profile for these illnesses.
- Ensure Convergence with NHM activities and other related departments in the State / District
- Monitoring of the programme through HMIS, 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.

8.1.3.2 Roles and Responsibilities of State Environmental Health Cell Staff:

1) Consultant-Capacity building/ Training/ HR Management

Qualification: MBA (HR) or MSW (HR) (Full time)

Age: 45 years or below

Experience: 3+ years' experience in Human Resource Management preferably in Health Department.

Remuneration: Rs.50,000/- to Rs.55,000/-

Roles and responsibilities:

- Assessment of needs for health care professionals at the district level (like training, capacity building) and organise training, workshop and meetings.
- Ensure appointment of contractual staff sanctioned under SAPCCHH at district level.
- Social mobilization against preventive measures through involvement of women's self-help groups, community leaders, NGOs etc.
- Monitoring, capacity building/ training activities of district level.
- Providing assistance and support to the district training consultant in planning and execution of training activities.
- To assist the Officer in carrying out the activities.

2) Consultant-Environmental Health

Qualification: BE or B.Tech in Environmental Engineering, M.Tech in Environmental Engineering, M.Tech or MSc in Environmental Science (Full time)

Age: 45 years or below

Experience: 2+ year's experience preferably in Health Department. (M.Tech in Environmental Engineering, M.Tech or MSc in Environmental Science)

4+ year's experience preferably in Health Department. (BE or B.Tech in Environmental Engineering)

Remuneration: Rs.50,000/- to Rs.55,000/

Roles and responsibilities:

- 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.
- Communicate and coordinate with all the stakeholders (as per GoK)
- Interpretation of district data to detect "Early Warning Signals" of climate change.
- Administer the collection, compilation and analysis of data.
- Support District Training Consultant in capacity building by organizing training for health care professionals at various facility levels.
- Monthly reviews and compilation of periodic reports and plans.

- Assistance and support to district Environmental Health Consultant.
- Supervise Data Manager and Data Entry Operator to ensure timely collection of data from stakeholders and submission of reports to higher authority.
- To assist the Officer in carrying out the activities.

3) Epidemiologist

Qualification: In order of preference either of the below:

i. Medical Graduate with Post Graduate Degree/Diploma in Preventive and Social Medicine / Public Health or Epidemiology (such as MD, MPH, DPH, MAE etc).

ii. Any Medical Graduate with 3 years experience in Epidemiology /Public Health

Age: 45 years or below

Experience: Minimum 2 years experience in issues related to Public Health Programmes or Epidemiology.

Remuneration: Rs.50,000/- to Rs.55,000/

Roles and responsibilities:

- Assist Consultant-EH in the preparation and implementation of State Action Plan for Climate Change and Human Health.
- Assist Consultant-EH in Vulnerability assessment and risk mapping for commonly occurring climate sensitive illnesses in the state.
- Communicate and coordinate with all the stakeholders (as per GoK)
- Interpretation of district data to detect "Early Warning Signals" of climate change.
- Identify the disease trends across the state using IDSP data.
- Collect monthly summaries of the disease situation from the district surveillance units.
- Coordinate movement of Rapid Response Team & participate in all outbreak investigations
- Ensure timely submission of annual project report to the higher authority.
- Coordinate regular meetings of State Level Task Force and assist in inter-sectoral coordination.
- Organize regular meetings of stakeholders.
- Make supervisory visits to DSUs to monitor implementation of project activity

- Support state surveillance officer in carrying out other works related to effective implementation of IDSP

4) Data Manager & Analyst

Qualification: Master's or Bachelor's degree in Computer Science, Information Science, Statistics. (Full time)

Age: 45 years or below

Remuneration: Rs.35,000/

Experience: 1+ years' experience in health or social sector.(Master's degree in Computer Science, Information Science, Statistics)

2+ years' experience in health or social sector.(Bachelor's degree in Computer Science, Information Science, Statistics)

Roles and responsibilities:

- Ability to work with large data sets.
- Excellent data management or analysis skills.
- Communicate and coordinate with all the stakeholders (as per GoK).
- Compilation of data/information from various departments relevant to climate change (IMD, District Disaster Management Authority, Pollution Control Board etc.,) of district level.
- Coordinate with state Consultant-Environmental Health in the analysis of district data and detect "Early Warning Signals" of climate change.
- Preparation of periodic reports and analysis alerts under the programme.
- To assist the Officer in carrying out the activities.
- Maintain and update state database of illnesses identified in the district.
- Maintain state level data on physical, financial, epidemiological profile for these illnesses.

5) Secretarial Assistants cum Data Entry Operator

Qualification: Any graduate with good computer knowledge

Age: 45 years or below

Experience: 3+ years' experience in health department is preferable.

Remuneration: Rs.18,000/

Roles and responsibilities:

- Ability to work with large data sets.
- Experience in MS office tools.
- Good typing knowledge of English and Kannada languages.
- Coordinate with all the stakeholders (as per GoK) and compilation of reports.
- In time submission of report to higher authority.
- Assisting Officer, Epidemiologist, Consultant-HR and Consultant-Environmental Health in execution of various activities.
- Familiarity with administrative duties.
- To work in good coordination with rest of the staff.

8.2 District Level:

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

8.2.1 District task force shall be comprised of following:

1	District Magistrate/ District Commissioner	Chairman
2	DHO	Member Secretary
3	CEO –ZP	Member
4	DS	Member
5	District Surveillance Officer	Member
6	DHEO	Member
7	District Informatics officer, National Informatics Center	Member
8	Commissioner , Municipal Administration	Member
9	JD, Department of Agriculture	Member
10	DDPI, Education Department	Member
11	DD, Information and Public Relations	Member

8.2.2 Structure at District Environment Health Cell:

	District Surveillance Officer	Nodal officer
1	Consultant-Environmental Health	1 post
2	Data Manager & Analyst	1 post

8.2.2.1 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.

8.2.2.2 Roles and Responsibilities of District Environmental Health Cell Staff:

1) Consultant-Environmental Health

Qualification: BE or B.Tech in Environmental Engineering, M.Tech in Environmental Engineering, M.Tech or MSc in Environmental Science (Full time)

Age: 45 years or below

Experience: 2+ year's experience preferably in Health Department. (M.Tech in Environmental Engineering, M.Tech or MSc in Environmental Science)

4+ year's experience preferably in Health Department. (BE or B.Tech in Environmental Engineering)

Remuneration: Rs.35,000/

Age: 45 years or below

Roles and responsibilities:

- 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.
- Communicate and coordinate with all the stakeholders (as per GoK)
- Interpretation of collected data to detect "Early Warning Signals" of climate change.
- Administer the collection, compilation and analysis of data.
- Support capacity building by organizing training for health care professionals at various facility levels.
- Monthly reviews and compilation of periodifc reports and plans.
- Supervise Data Manager and Data Entry Operator to ensure timely collection of data from stakeholders and submission of reports to higher authority.
- To assist the Officer in carrying out the activities.

2) Data Manager & Analyst

Qualification: Master's or Bachelor's degree in Computer Science, Information Science, Statistics (Full time)

Age: 45 years or below

Experience: 1+ year's experience in health or social sector (Masters degree in Computer Science, Information Science, Statistics)

2+ year's experience in health or social sector (Bachelor's degree in Computer Science, Information Science, Statistics)

Remuneration: Rs.30,000/

Job Responsibility:

- Ability to work with large data sets.
- Excellent data management or analysis skills.
- Communicate and coordinate with all the stakeholders (as per GoK).
- Collection of data/information from various departments relevant to climate change (IMD, District Disaster Management Authority, Pollution Control Board etc.,)

- Coordinate with Consultant-Environmental Health in the analysis of collected data and to detect "Early Warning Signals" of climate change.
- Preparation of reports under the programme.
- To assist the Officer in carrying out the activities.
- Maintain and update district database of illnesses identified in the district.
- Maintain District level data on physical, financial, epidemiological profile for these illnesses.

8.3 Community Health Centre Level (Taluk Level)

The proposed Taluk Level Structure is as under:

1	THO	Member Secretary
2	Block Health Education Officer	Member
3	Executive Officer (TP)	Chairman
4	Sr. Health Inspector	Member
5	Executive officer (Town Municipal Authority)	Member

8.4 Primary Health centre 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 utilised for the related activities. The Arogya Raksha Samithi (ARS) would be reviewing and monitoring implementation at the Primary Health centre level. The ANM, ASHA and Anganwadi worker will assist in activities related to implementation of action plan at local level.

9. KSAPCCHH: CAPACITY BUILDING AND AWARENESS

Capacity building will be based on the baseline and follow-up situation which, has been stated earlier and should be assessed periodically. Communication and training are crucial in mitigating emission, and in adapting to changes in the climate.

- ✓ Education programs for general population on efficient use of water, appropriate food handling, hygiene practices and climate change sensitive diseases and preventable measures.
- ✓ To promote environment awareness and carry out action based programme for protection and improvement of schools through NGC (National Green Corps).
- ✓ Increase in the awareness activities such as organizing seminars, workshops, campaigns, street plays, tree plantations, debate, painting, drawing, competitions and other environment related activities to school children and general public will be carried out in collaboration with NGO's/Trusts/Eco-clubs and other organizations throughout the year.
- ✓ The communication activities will be specifically aimed to enable and empower the 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. The communication tools will also be appropriately designed to these population.
- ✓ For effective advocacy, opinion makers / stakeholders including celebrities, will be sensitised, oriented and will involve them for communication and public awareness activities.
- ✓ Involvement of the private sector in preparedness and vulnerability reduction by forming public private partnerships.
- ✓ A thorough need assessment will be done in order to develop better State & district Communication strategies and plans to combat the adverse effect of climate on health.
- ✓ Training of health care personnel on guidelines and treatment modalities against climate sensitive illnesses at district level will be given.
- ✓ State will conduct seminars, workshops, conferences focusing on effects of climate change and the measures to combat and mitigate the effect of climate change.

- ✓ Identification of Master trainers and then the training of Master trainers, state, district and below district level health care professionals.
- ✓ Printing and up-gradation of Training Modules.
- ✓ Sensitization and orientation of private health care providers.

- ✓ Primary health-care systems will be strengthened to withstand the onslaught of climate change.
- ✓ Strengthening of hospital services to attend emergency and referral cases adequately and efficiently.
- ✓ Specific strategies and standard operating procedures for managing climate sensitive diseases will be developed in light of the future impacts of climate change with prevention in mind.
- ✓ State and district level capacity building institutions will be identified with skilled technical resource persons for building the capacity of the public health force.

10.ESTABLISHMENT OF A PCR LABORATORY

- ✓ At present in the entire state PCR laboratory is located only in Shivamogga, making it inaccessible for many regions and the delayed diagnosis of the diseases.To improve the diagnostic profile a PCR diagnostic facility can be established in Gulbarga division.

- ✓ PCR is the abbreviation for "polymerase chain reaction". PCR is a method used for amplifying DNA.

- ✓ The use of PCR in molecular diagnostics has increased to the point where it is now accepted as the gold standard for detecting nucleic acids from a number of origins and it has become an essential tool in the research laboratory.

- ✓ The laboratory must develop its own standard operating procedures (SOPs) depending on the diagnostic tests they can offer. The choice of molecular diagnostic tests such as PCR depends on the endemic diseases/objective of the laboratory and type of patients that the hospital/laboratory caters to (e.g. primary health care and specialized healthcare facilities for particular disorders/diseases/priority areas of national laboratories structure, etc.), the purpose of testing (screening, diagnosis, therapeutic response/ drug resistance, epidemiological surveillance, etc.), prevalence of the disease/virus sought, cost effectiveness, as well as the availability of infrastructure, clinicians and technically skilled laboratory staff/staff expertise in the laboratory.

- ✓ Applications of PCR in clinical microbiology

- ✓ The PCR is currently being employed in the detection and quantification of a number of DNA and RNA viruses, including Hepatitis C virus, HIV, Japanese encephalitis virus, human papillomaviruses, chikungunya virus, influenza viruses, rabies virus, cytomegalovirus and JC virus and Ebola.

- ✓ Protocols have been developed for PCR diagnosis of protozoal pathogens of humans and animals, including pathogenic Plasmodium spp., pathogenic amoebae, Giardia spp., Cryptosporidium spp., Microsporidia filarial parasites, etc.

- ✓ The detailed infrastructure, equipments and consumables required for establishment of PCR laboratory (is attached as Annexure Chapter 5 of WHO guidelines)

- ✓ Biosafety in PCR laboratories

- ✓ Biosafety Level 3 is applicable to clinical, diagnostic, teaching, research, or production facilities where work is performed with indigenous or exotic agents that may cause serious or potentially lethal disease through the inhalation route of exposure. Laboratory personnel must receive specific training in handling pathogenic and potentially lethal agents, and must be supervised by scientists competent in handling infectious agents and associated procedures. All procedures involving the manipulation of infectious materials must be conducted within BSCs or other physical containment devices.

- ✓ A BSL-3 laboratory has special engineering and design features. The standard and special safety practices, equipment, and facility requirements apply to BSL-3.(is attached as Annexure)

11.KSAPCCHH: REPORTING, MONITORING AND EVALUATION

10.1 Reporting: The existing reporting formats will continue for the reporting of 5 climate sensitive illness. KSHSRC in coordination with SSU will prepare the state reports and every district should submit the climate related illness data to the KSHSRC each quarter.

10.2 Monitoring: KSHSRC in coordination with SSU will monitor these 5 climate sensitive illnesses. The monitoring indicators of these 5 climate sensitive illness are given below:

10.2.1 Malaria indicators

1) - Monthly Blood Examination Rate (ABER)
2) - Annual Blood Examination Rate (ABER)
3) - No of Fever cases
4) - No of Malaria cases
5) - No of Pf cases
6) - No of deaths due to Malaria
7) - Annual Parasite Incidence (API)
8) - Annual Falciparum Incidence (AFI)
9) - Test Positivity rate (TPR)
10) - Test falciparum Rate (TfR)
11) - Pf Percentage (Pf %)
12) - % of fever cases who were tested for malaria by microscopy/ RDT with a positive test result for RDT and were started on treatment no later than the next day with ACT

Details of these parameters are given below:

Annual Blood smear Examination Rate (ABER)

$$\text{ABER} = \frac{\text{Number of blood smears examined + RDTs positive in a year} * 100}{\text{Total population}}$$

Monthly Blood smear Examination Rate (MBER)

$$\text{MBER} = \frac{\text{Number of blood smears examined in a month + RDTs positivein a month}}{\text{Total population}} \times 100$$

Annual Parasite Index (API):

$$\text{API} = \frac{\text{Total No. of positives for malaria parasite in a year + RDTs positive}}{} \times 1000$$

Total population

Annual falciparum Index (AfI)

AfI = Total number of positives for *P.falciparum* in a year x1000

Total population

Test Positivity Rate (TfR) (similar to earlier SPR)

TPR = Total No. of blood smears found positive for malaria parasite + RDTs positive x 100

Total no. of blood smears examined +RDTs conducted

Test falciparum Rate (TfR)

TfR = Total No. ofpositives for *P.falciparum* x 100

Total no. of blood smears examined

P.*falciparum*percentage *(Pf %)*

Pf% = Total no. of positives for *P.falciparum* x 100

Total no. of positives for malaria parasite

Surveillance Quality indicators

In addition to the ones mentioned above, the quality of surveillance can be gauged by generating value of following indicators and analysis:

1) Number of subcentres having ABER more than 10.
2) Number of subcentres having both ANM and MPW (M) conducting surveillance.
3) Number of PHCs, General Hospitals, Community Health Centers, private hospitals out of total in the district having:
    a) Sanctioned post of lab technicians
    b) Having microscopy facility
4) Number of PHCs, General Hospitals, Community Health Centers, private hospitals out of total in the district where passive surveillance is more than 15% of new OPD.
5) Range / Average time lag between collection and examination of blood smears in different PHCs.
6) Range / Average time lagbetween date of examination and radical treatment of positive cases.
7) Proportion of blood smears examined within 24/48/72 hours of blood smear collection.
8) Number and name of PHCs who have not sent the negative blood smears for cross checking to ROHFW / CML.

    Number and name of PHCs binocular microscope

9) c) Having malaria from which negative blood smears have been selected randomly and brought by DVBDCO to the district lab for cross checking and number of missed positives.
10) Ratio of passive blood smears to active blood smears.
11) Ratio of blood smears collected by male MPW to those collected by ANM of different PHCs.
12) Slide positivity rate among blood smears collected by passive, active, mass, contact & ASHAs
13) Number of positive cases PV and Pf and number of follow up smears collected for each and result.
14) Number of suspected malaria cases reported under form-P of IDSP by each PHC / district total.
15) Number of fever cases reported under form-S of IDSP by each PHC / district total.
16) Number of General Hospitals / CHC / other hospitals having stock of chloroquine, primaquine & ACT.
17) Slide positivity rate of RDTs.
18) Number of RDT positive but slide negative cases.
19) Number of lab technicians requiring training.

Monitoring indicators used in Integrated Vector Management:

The following is the list of indicators, their definitions and and the source record.

1) % of spray equipment in working condition
2) % of spray workers trained
3) Insecticide use
4) No of ITNs/ LLINs distributed
5) IRS Coverage (Eligible) – Population (%)

=(Population covered with IRS ÷ Total Eligible population) X 100

6) IRS Coverage (Targeted) – Population (%)

=(Population covered with IRS ÷ Total Eligible population) X 100

7) IRS Coverage – Rooms (%)

=(Rooms sprayed completely in houses Covered÷ Total no of Rooms Targeted) X 100

8) % of Eligible population Covered by ITN

=(Number of households with at least 2 effective bed nets ÷ Eligible households) X 100

9) % of Targeted population Covered by ITN

=(Number of households with at least 2 effective bed nets ÷ Targeted households) X 100

10) % of Eligible villages with more than 80 % population Coverage with ITNs- Bednets Treated

=(Number of eligible villages with more than 80% coverage with ITNs ÷ No of Eligible villages) X 100

11) % of house holds in which beneficiaries reported having slept under ITNs/ LLINs previous night

12) % of PHC sampled in which utilization of ITNs/ LLINs was more than 80%

In addition, some quality indicators are as follows:

1) Pre and post spray vector density.
2) Per Man Hour Density of Anopheline vectors.
3) Resistance status of Anopheline vectors.
4) Number of hatcheries established in the district.
5) Number of villages where larvivorous fishes have been released in all locations of Anopheline breeding places.
6) Number of irrigation / open wells where larvivorous fishes have been released out of total wells in district.
7) Outcome of longitudinal entomological studies.
8) Number of houses where bed nets / LLIN have been distributed out of total houses in the village.
9) Number of households having the LLIN out of total distributed.
10) Proportion of people who have slept under bed nets /LLIN previous night of the survey out of given.
11) Number of houses cross checked for quality of spray.

10.2.2 Dengue indicators

Dengue case surveillance:

1) Area affected: Rural /Urban, Villages /ward
2) Population affected

3) Number of suspected cases
4) Number of samples tested
5) No. of confirmed cases
6) No. of deaths

Entomological indicators:

House Index (HI): percentage of houses infested with larvae and/or pupae.

$$HI = \frac{\text{Number of houses infested}}{\text{Number of houses inspected}} X100$$

Container Index (CI): percentage of water-holding containers infested with larvae or pupae.

$$CI = \frac{\text{Number of positive containers}}{\text{Number of containers inspected}} X100$$

Breteau Index (BI): number of positive containers per 100 houses inspected.

$$BI = \frac{\text{Number of positive containers}}{\text{Number of houses inspected}} X100$$

Pupal Index (PI): Number of pupae per house

$$PI = \frac{\text{Number of Pupae}}{\text{Number of houses inspected.}} X100$$

10.2.3 Malnutrition Indicators

Impact indicators Impact indicators are linked to objectives

1	Percentage of stunted children under three years (or under five years)-height-for-age
2	Percentage of wasted children under three years (or under five years). (weight-for-height)
3	Percentage of under-weight under three years (or under five years)- (weight-for-age)
4	Percentage of low birth weight infants (<2500 g)
5	Number of births during a given reference period to women aged 15-19 years /1000 females aged 15-19 years
6	Women whose Body Mass Index (BMI) is below normal (age 15-49 years) -BMI < 18.5 kg/m2 (%)
7	Women who are overweight or obese (age 15-49 years)-BMI ≥ 25.0 kg/m2)14 (%)
8	Men whose Body Mass Index (BMI) is below normal-age 15-49 years (BMI < 18.5 kg/m2) (%)

9	Men who are overweight or obese- age 15-49 years -BMI ≥ 25.0 kg/m2 (%)
10	Proportion of overweight in school-age children and adolescents 5-18 years (BMI-for-age >+1 SD)
11	Incidence of diseases that have an impact on nutrition (Malaria, diarrhoea, ARI, and HIV/AIDS).
12	Prevalence of haemoglobin <11 g/dL in pregnant women
13	Prevalence of haemoglobin <12 g/dL in non-pregnant women
14	Percentage of micronutrient deficiency disorders - Vitamin A Deficiency and Iron Deficiency Anaemia in pre-school and school children and pregnant women, median urinary iodine level in school children and goitre prevalence
15	Prevalence of diarrhoea in children under 5 years of age

Output indicators complement impact indicators and are linked to results

16	Percentage of children 0-6 months exclusively breastfed.
17	Percentage of infants that were breastfed within one hour after delivery.
18	Percentage of children 6-24 months still breastfeeding.
19	Percentage of children 6-24 months receiving appropriate complementary feeding as defined by FADUA criteria: Frequency, Amount, Density (energy), Use of food (variety) and Active feeding.
20	Percentage of sick children 6-24 months receiving appropriate complementary feeding as defined by "continuation" during and "increasing" after illnesses
21	Percentage of children (6-34 months or 6-59 months) receiving Vitamin A Supplementation every six months (100,000 IU for children 6-12 months and 200,000 IU for children > 12 months).
22	Percentage of postnatal women receiving Vitamin A supplementation (200,000 IU) within 8 weeks after delivery.
23	Percentage of children (6-24 months) receiving daily Iron supplementation (12.5 mg iron + 50 µg folic acid daily) from 6 to12 months (prevalence of anaemia less than 40%) or from 6 to 24 months (prevalence of anaemia more than 40%).
24	Percentage of children with Low-Birth-Weight (<2500 g) receiving daily Iron supplementation (12.5 mg iron + 50 µg folic acid daily) from 2 up to 24 months.

25 Percentage of children (12-34 months or 12-59 months) receiving de-worming (Albendazole 1 to < 2 years 200 mg and > 2 years 400 mg or Mebendazole 1 to < 2 years 250 mg and > 2 years 500 mg) every six months.

26 Use of iodised salt.

27 Percentage of pregnant women receiving Iron supplementation (60 mg iron + 400 µg folic acid daily) for six months (and continuing for three months after delivery).

28 Percentage of pregnant and lactating women receiving adequate nutrition as defined by frequency and variety.

29 Proportion of population using a safely managed drinking service

30 Proportion of mothers of children 0-23 months who have received counselling, support or messages on optimal breastfeeding at least once in the last year

31 Percentage of 1-year-olds who have received the appropriate doses of the recommended vaccines in the national schedule by recommended age

Performance indicators for preventive nutrition

32 Number of trained nutrition professionals /100,000 population

33 Percentage of community service providers with knowledge of key nutrition messages and actions at critical stages in the life cycle of women and children.

34 Percentage of community and facility-based service providers with skills on Behavioural Change Communication (BCC).

35 Percentage of children under 3 years (or under 5 years) being weighed monthly and with their growth plotted in the card.

36 Percentage of caregivers with knowledge of key nutrition behaviours and practices at critical stages in the life cycle of women and children.

37 Percentage of caregivers with knowledge of local recipes to support home-based recovery of sick children during and after illness.

38 Percentage of health facilities with no stock of Iron-Folic Acid (IFA) and Vitamin A.

39 Percentage of pregnant women receiving the recommended IFA supplementation (quantity and duration) based on recorded data.

40 Type and coverage of community-based BCC initiatives (e.g. drama, school events, care-groups, cooking sessions, radio programs, etc.).

41 Type and coverage of community-based initiatives to promote food diversification looking

at production, processing, preparation and preservation of available resources.

42 Proportion of children with severe acute malnutrition having access to appropriate treatment including therapeutic foods and nutrition counselling

Management of acute malnutrition (performance indicators)

- Recovery rate
- Death rate
- Defaulter rate
- Weight gain
- Length of stay
- Coverage

10.2.4 Acute respiratory infections (ARIs) indicators

1. Total number of Acute respiratory infection cases reported
2. Number of patients hospitalized with acute respiratory infections syndrome.
3. Total number of LRIs in children under five years (<5years)
4. Total number of Vaccines given to children against influenza.

Quality indicators focusing on the diagnostic process

1. Total Patients treated for acute sinusitis
2. Total Patients treated for acute otitis media
3. Total Patients treated for acute tonsillitis/pharyngitis
4. Total Patients treated for acute lower respiratory tract infections
5. Total Patients treated for pneumonia
6. Total Patients treated for acute exacerbation of chronic obstructive pulmonary (COPD)
7. Total Patients treated for acute lower respiratory tract infection (LRTI)

Quality indicators focusing on the case management

1. Health facilities able to give standard ARI case management
2. Pneumonia cases at health facilities who receive standard case management

3. Health facility staff trained in standard ARI case management
4. ARI cases at health facilities whom antibiotics are given though they are subjects that should not receive them
5. Health personnel supervised by health authorities
6. Health workers having good knowledge of standard ARI case management
7. Health facilities equipped with ARI case management guidelines.

10.2.5 Acute Gastroenteritis indicators

1. Number of diarrhoea/dysentry cases as mentioned in S-form
2. Suspected cholera cases as reported in the P-form.
3. Number of lab confirmed cases of Cholera or other ADD causative agents as reported in the L-form.
4. Number of outbreaks occurred
5. Quality parameters of potable drinking water (at least once in 3 months).

10.3 Evaluation:

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

10.3.1 Internal: As part of the NHM, monthly / quarterly progress monitoring is 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 KSAPCCHH implementation should be merged with the overall HMIS that has been established under the NHM.

10.3.2 External: Karnataka will commission an independent evaluation every 2 years. External evaluation will be done by an independent agencies like Public Health

Institutes, and other public health agencies and NGOs who has an experience in health evaluation activities. The state will choose an agency by forming a committee involving the experts from the other departments in co-ordination with the national level experts. At the minimum, the audit should cover one well performing district and one slack performing district. The recommendations of the audit should be developed into an action plan to strengthen the existing system.

11.Gantt chart showing the activities for 15 years

Objectives	Activities	Duration in Years		
		0-2	2-5	5-15
1) To create awareness on the impacts of climate change on human health among general population (vulnerable community), health-care providers and Policy makers.	Identification of nodal agency to undertake communication needs	■		
	Development of communication tools and plans and their periodic impact assessment	■	■	
	Training and sensitization of health care providers	■		
	Creation of a State forum for advocacy	■		
	Monitor, dissemination and utilization of IEC		■	
	Commission of impact studies and follow up evaluation			■
2) To strengthen capacity of health system to respond to climate sensitive illness/ diseases	Constitute the task group	■		
	Establishment of an Environment health and climate change cell at state/District level	■		
	Training (Master trainers/ state/district /village level heath staff)	■	■	■
	Printing of training modules	■		
3) To perform situational analysis to strengthen preparedness and response at state / district/ below district levels to cope with adverse health impacts of climate change related disasters.	Strengthen existing surveillance system & Develop prediction models	■	■	
	Identification and collaboration with COE to develop guidelines , Capacity building, monitoring etc.	■		
	Identification of state nodal agency & to co-ordinate with other agencies at sub-district level	■	■	
	Design and integrate EWS, National Public health response team and SHOC response system under IDSP & EMR	■		
	Conduction of Joint review missions/central internal evaluations & feedback mechanisms		■	
	Review of data from monitoring and surveillance and Develop prediction models		■	
	Evaluation and modifications for the appropriateness of the plan components			■
4) To provide support to districts to assess their health vulnerabilities in the context of climate change and	Form Expert Group	■		
	Identify nodal agency at state level for capacity building and vulnerability assessment and to strengthen linkages	■		

accordingly build capacities to adapt and mitigate the vulnerabilities	with other agencies			
	Form climate sensitive health programme implementation plan (PIP)			
	Develop/adapt/update Disease specific action plan			
	Climate resilient health policy analysis by nodal agency			
5)To Promote partnerships with stakeholders in the private/informal sector, civil society and government departments, to create synergy with the programmes of those involved in other missions on climate change and ensure that health is properly represented in the climate change agenda in the state	Stake holders Mapping and analysis of their services and to identify , prioritize and coordinate the service areas			
	Explore ,Identify and Evaluate CSR			
	Develop risk reduction and environmental impact assessment tool			
6) To strengthen monitoring, surveillance and research capacity about impact of climate change on human health, and develop a mechanism to fill the gap in the evidence based health policy.	Standardization of information and development of monitoring tool			
	Identify health/ research facilities , Collect and share reports/publications and Conduct epidemiological researches/ baseline surveys			
	Conduct continuous monitoring and evaluation of health events &databases and its integration with other surveillance system			
	Link health databases with real time monitoring of climate, weather etc			
	Develop tools for vulnerability assessment and Hazard map			
	Conduct workshops/seminars/conferences focussing on climate change			

12. KSAPCCHH: BUDGET

KSAPCCH implementation requires funds for activities such as human resource, programme activities, training, documentation, communication, awareness, research, monitoring & evaluation, health system strengthening, etc. at the National, State / District and below levels.

As part of the State Programme Implementation Plan (PIP) that is prepared annually, a separate budget item for the KSAPCCH implementation has to be included. States will ensure that the budgeting exercise is done prior to the budget finalization.

11.1 Budget for State Action Plan on Climate Change and Human Health

(1&5 years)

Non Recurring		
Particulars	**Amount in Rs**	**Remarks**
Setting up of office	7815000	One time activity which includes laptops, desktops, printer/scanner/ Xerox machine, tables chairs etc (Attached annexure)
PCR Lab	3308000	As per WHO guide lines PCR Lab instruments and equipments proposed.
Recurring (1 year)		
Setting up of office	10230000	Includes internet, telephone, miscellaneous
HR	26280000	Includes 7 positions @ state level and 2 positions @ district level
Capacity Building	721200	Includes state level workshop, TOT @state level & district level orientation training
IEC	300000	Includes Radio bytes, Jingles,Televiision ads, flipcharts etc
Monitoring & Evaluation	800000	Includes one baseline internal evaluation
Total(Recurring cost for 1 year)	**38331200**	
Total Estimated Budget (1 year) (Recurring+ Non recurring)	**49454200**	
Recurring (4 year)		
Setting up of office	44328000	Includes AMC for equipments ,internet, telephone, miscellaneous
HR	105120000	Includes 7 positions @ state level and 2 positions @ district level
Capacity Building	847950	Includes district level reorientation training and PHC level training
IEC	1200000	Includes Radio bytes, Jingles,Televiision ads, flipcharts etc
Monitoring & Evaluation	2000000	Includes two external evaluation
Total Recurring cost for 4 yrs)	**153495950**	
Total Estimated budget for 5 years(Recurring + Nonrecurring)	**202950150**	**Rs. 20.295 crores** (Annexures attached at the end)

11.1.1 Detailed budget for State Action Plan on Climate Change and Human Health (one year)

Sl. No.	Item/Activity	No of units	Cost per unit (Rs)	No. of Months	Total(Rs)	Remarks
I	**Setting up of Office (Non-Recurring)**					
1	Computers	1	55000	1	55000	1 computer for state level (Secretarial assistance cum Data Entry Operator)
2	Laptops	4	60000	1	240000	For 2 consultants (Training Consultant+ Consultant-Environmental Health) at state level and one epidemiologist and Data Manager & Analyst
3	Laptops for districts	60	60000	1	3600000	2 laptops for 2 consultants in each of 30 districts (Dist. Level-Consultant- Environmental Health+ Data Manager & Analyst)
4	Printer/Xerox/scanner	31	25000	1	775000	one printer each for state and 30 districts
5	chairs	310	2500	1	775000	10 chairs for state and 10 each for 30 districts
6	Tables (State)	6	15000	1	90000	6 tables for state
7	Tables (Districts)	90	15000	1	1350000	3 tables for each of 30 districts
8	Cupboards/Almairahs	62	15000	1	930000	2 cupboards for state and 2 each for 30 districts
	TOTAL I				7815000	
II	**Setting up of Office (Recurring)**					
1	Internet facility	31	1500	12	558000	Internet facility each for state and 30 districts
2	Telephone	31	1000	12	372000	Telephone facility each for state and 30 districts
3	Stationery	31	15000	12	5580000	Stationery each for state and 30 districts
4	Miscellaneous	31	10000	12	3720000	Miscellaneous expenses each for state and 30 districts
	TOTAL II				10230000	
Sl. No.	Item/Activity	No of units	Cost per unit	No. of Months	Total	Remarks
III	**Human Resource for Setting up State and District Environment Cell**					
1	State Level Environmental cell Nodal officer	1	0	12	0	This position will be a Regular Government Doctor from the Dept. of H&FW
2	State Level Epidemiologist	1	75000	12	900000	Salary for Epidemiologist State level@75000*12 months = 900000
3	Training Consultant	1	50000	12	600000	Salary for Training consultant State level@50000*12 months = 600000
4	Consultant-Evironmental Health	1	50000	12	600000	Salary for Environmental health consultant @50000*12 months = 600000

Sl. No.	Item/Activity	No of units	Cost per unit (Rs)	No. of Months	Total(Rs)	Remarks
5	Data Manager & Analyst	1	35000	12	420000	Salary for Data Manager State level @35000*12 months = 420000
6	Secretarial assistance cum Data Entry Operator	1	18000	12	216000	Salary for Data Entry Operator State level @18000*12 months = 216000
7	Group D	1	12000	12	144000	Salary for Group D State level @12000*12 months = 144000
8	Consultant-Evironmental Health	30	35000	12	12600000	Salary for Environmental health consultant at Districts@35000*12 months* 30 dist= 7140000
9	Data Manager & Analyst	30	30000	12	10800000	Salary for Data Manager @30000*12 months*30 dist = 10800000
	TOTAL III				26280000	
Sl. No.	**Item/Activity**	**No of units**	**Cost per unit**	**No. of Months**	**Total**	**Remarks**
IV	**Capacity Building**					
1	State Level Workshop (Action plan dissemination)	230	1800	1	414000	30 DHO/30 DSO/30 state program officers/30 DDPI/30 DDICDS/3 from each of 15 departments /5 Regional H&FW office/3from each of 5 NGO's /8 from KSHSRC
2	TOT State Level	60	800	2	96000	2 days TOT for 30 DSO and 30 Epidemiologists
3	District level Orientation training	528	400	1	211200	One day orientation for THOs/BHEOs/senior LHV of selected 30 districts (62 Talukas)/ 176*3=528
	Total IV				721200	
V	**IEC**					
1	Radio bytes and Jingles	1	50000	1	50000	One time state level activity
2	Television Ads	1	100000	1	100000	One time state level activity
3	Posters/banners/Flip Charts	1	150000	1	150000	One time state level activity
	Total V				300000	
VI	**Monitoring and Evaluation**					
1	Baseline Internal Evaluation	1			800000	Lump sum Rs 5 lakhs which includes travel, accommodation, report writing, TA/DA, Printing (questionnaires and final evaluation report) and meetings.
	Grand Total I+II+III+IV+V+VI				**46146200**	

11.1.2 Detailed budget for State Action Plan on Climate Change and Human Health (four years)

Item/Activity	No of units	Cost per unit	No. of Months	Total	Remarks
Setting up of Office (Recurring)					
AMC for equipments	96	5000	4	1920000	1 Desktop/ 64 Laptops/31Printer/Xerox/scanner @ Rs.5000/per device-4years
Internet facility	31	1500	48	2232000	Internet facility each for state and 30 districts
Telephone	31	1000	48	1488000	Telephone facility each for state and 30 districts
Stationery	31	15000	48	22320000	Stationery each for state and 30 districts
Miscellaneous	31	11000	48	16368000	Miscellaneous expenses each for state and 30 districts
TOTAL I				**44328000**	
Human Resource for Setting up State and District Environment Cell					
State Level Environmental cell Nodal officer	1	0	48	0	This position will be a Regular Government Doctor from the Dept. of H&FW
State Level Epidemiologist	1	75000	48	3600000	Salary for Epidemiologist State level@75000/month
Training Consultant	1	50000	48	2400000	Salary for Training consultant State level@50000/ month
Consultant-Evironmental Health	1	50000	48	2400000	Salary forEnvironmental health consultant @50000/month
Data Manager & Analyst	1	35000	48	1680000	Salary for Data Manager State level @35000/month
Secretarial assistance cum Data Entry Operator	1	18000	48	864000	Salary for Data Entry Operator State level @18000/month
Group D	1	12000	48	576000	Salary for Group D State level @12000/month
Consultant-Evironmental Health	30	35000	48	50400000	Salary for Environmental health consultant at 30 Districts@35000/month
Data Manager & Analyst	30	30000	48	43200000	Salary for Data Manager at 30 districts @30000/ month
TOTAL II				**105120000**	
Capacity Building/meetings					

Item/Activity	No of units	Cost per unit	No. of Months	Total	Remarks
PHC level Orientation Training	2547	250	1	636750	PHC level Medical Officers of 30 districts(2547 PHCs)/Rs. 250/Mo which includes TA/DA/Food
District level re-orientation training	528	400	1	211200	One day reorientation for THOs/BHEOs/senior LHV of selected 30 districts (176 Talukas)/ 176*3=528
Total III				**847950**	
IEC					
Radio bytes and Jingles	1	50000	4	200000	One time state level activity per year
Television Ads	1	100000	4	400000	One time state level activity per year
Posters/banners/Flip Charts	1	150000	4	600000	One time state level activity per year
Total IV				**1200000**	
Monitoring and Evaluation					
Evaluation through external agency	**2**	**1000000**		**2000000**	Lumpsum Rs 10 lakhs which includes travel, accomodation,report writing, TA/DA,Printing (questionnaires and final evaluation report) dissemination and meetings.(Mid-term and 5th year)
Total V				**2000000**	
Grand Total I+II+III+IV+V				**15349595 0**	

11.1.3 Proposed budget for instruments and equipments required for PCR Lab

Sr. No.	Item	Nos.	Price	Approx. Amt.	Technical Specification
1	Adjustable Volume Single Channel Pippettes 0.5 to 10 µL,10-20 µL, 5 to 100 µL, 100 to 200 µL,50 to 1200 µl	2	30000	60000	As in soft copy attached with this doc .ONE SET FOR EACH ROOM(4)
2	BP apparatus	1	1000	1000	
3	Centrifuge 10000 RPM	1	12000	12000	
4	Cryobox	4	8000	32000	Hold 100 tubes .ONE SET FOR EACH ROOM(4)
5	Cryovial(sterile)	2	5000	10000	Autoclavable 2.0ml this is the specification
6	Cyclomixer	1	50000	50000	
7	Dark Field Microscope	1	180000	180000	
8	Digital Microscope with High power Camera and dedicated PC	1	120000	120000	
9	Digital Weighing machine	1	84000	84000	As in soft copy attached with this doc
10	Dry bath	1	25000	25000	COPY ATTCH
11	Electronic Multichannel Pipette(8 channel 100 to 300 µl)	1	50000	50000	As in soft copy attached with this doc
12	Horizontal Autoclave	1	225000	225000	18 KV IS THE SPECIFICATION
13	Ice flake making machine	1	48000	48000	photo attached
14	LCD projector	1	100000	100000	
15	loop streilizer	2	20000	40000	
16	Microtube Box	2	2000	4000	COPY attachedONE SET FOR EACH ROOM(4)
17	Mili Q water plant	1	180000	180000	As in soft copy attached with this doc
18	Mini cooler 0^0 c 1.5ML capacity	1	15000	15000	Tarsons
19	Nano drop machine	1	100000	100000	

20	Needle crusher Chair with hand rest bed-folding	1	5000	5000	SAMPLE COLLECTION
21	Non Refrigerated Micro Centrifuge	1	50000	50000	As in soft copy attached with this doc
22	PCR Rack with Cover	2	3000	6000	Tarsons ONE SET FOR EACH ROOM(4)
23	Pipette set single channel	2	150000	300000	As in soft copy attached with this doc ONE SET FOR EACH ROOM(4)
24	Quick Spin(microcentrifuge)	1	60000	60000	As in soft copy attached with this doc ONE SET FOR EACH ROOM(4)
25	Non Refrigerated table top Centrifuge	1	70000	70000	5000RPm IS THE SPECIFICATION
26	Section 2 : Laminar flow-small	1	100000	100000	photo attached
27	Sterile serological pipette with auto pipetter	1	25000	25000	
28	Ultrafreezer (Vertical) -80 degree	1	600000	600000	As in soft copy attached with this doc
29	UV Cabinet	1	30000	30000	As in soft copy attached with this doc
30	Vertical Surgical Autoclave	1	125000	125000	
31	VORTEX SHAKER	3	25000	75000	TARSONS OR REMI
32	WATER BATH (56 C)	1	150000	150000	
33	Thermocyclers and real-time PCR machines	1	215000	215000	As per WHO guideline - Establishment of PCR laboratory in developing countries
34	Gel electrophoresis chambers	1	60000	60000	
35	Automatic Pipettes	1	1000	1000	
36	Positive-displacement pipettes	1	25000	25000	
37	Refrigerator (2 Nos)	2	25000	50000	
38	Freezer	1	25000	25000	
	Total (Non –recurring cost)			**3308000**	

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3. State of environment report Karnataka-2015

4. Karnataka State Pollution Control Board, Annual Report -2015-16

5. National Family Health Survey- 3 & 4

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ANNEXURE

STANDARD TREATMENT GUIDELINES

1. MANAGEMENT OF MALARIA

INTRODUCTION	Parasitic infection due to four plasmodia species: P. falciparum, P. vivax,P. malariae, and P.ovaletransmitted by the female Anopheles mosquito.
CLINICAL FEATURES	➢ Malaria - paroxysms of fever, chills, sweats, fatigue, anaemia and splenomegaly. ➢ Falciparum malaria (severe and complicated malaria) - Mental clouding, coma, convulsions, delirium and occasionally localizing signs. Hyperpyrexia (>40.5ºC), haemolysis, haematocrit <15% or Hb <5 g/dl, hypoglycaemia, oliguria, anuria, pulmonaryoedema, macroscopic haemoglobinuria and jaundice.
DIAGNOSIS	➢ Thick and thin blood smear showing presence of protozoa. (Note that blood films may be negative even in a severe attack because of sequestration of parasites in the deep capillaries.) ➢ Rapid diagnostic kits (RDK) can be used for detection of P. falciparum where microscopy results are not obtainable within 24 hours of sample collection
TREATMENT	1.All fever cases suspected to be malaria should be investigated by microscopy or RDT. 2.Patients of uncomplicated malaria can be managed at primary level but patients with severe malaria with complications should be admitted and managed in a hospital where facilities for detailed investigations and blood transfusion exist. 3.P. vivax cases should be treated with chloroquine for three days and Primaquine for 14days. Primaquine is used to prevent relapse but is contraindicated in pregnant women, infants and individuals with G6PD deficiency. Note: Patients should be instructed to report back in case of haematuria or high-coloured urine/cyanosis or blue coloration of lips and Primaquine should be stopped in such cases. Care should be taken in patients with anaemia. 4.P. falciparum cases should be treated with ACT (Artesunate 3 days + Sulphadoxine- Pyrimethamine 1 day). This is to be accompanied by single dose primaquine on day 2. 5. Pregnant women with uncomplicated P. falciparum should be treated as follows:

	1st trimester: Quinine 2nd & 3rd trimester: ACT Note: Primaquine is contraindicated in pregnant woman. 6. In cases where parasitological diagnosis is not possible due to non-availability of either timely microscopy or RDT, suspected malaria cases should be treated with full course of chloroquine, till the results of microscopy are received. Once the parasitological diagnosis is available, appropriate treatment as per the species, is to be administered. 7. Presumptive treatment with chloroquine is no more recommended. 8. Resistance should be suspected, if despite full treatment (with no history of vomiting, diarrhoea,) patient does not respond within 72 hours, clinically and parasitologically. Suchcases not responding to ACT, should be treated with oral Quinine with Tetracycline/Doxycycline. These instances should be reported to concerned District Malaria/State Malaria Officer/ROHFW for initiation of therapeutic efficacy studies.
Treatment of P. vivax cases (Table 1.12)	1.Chloroquine: 25 mg/kg body weight divided over three days, i.e. 10 mg/kg on day 1, 10mg/kg on day 2 and 5 mg/kg on day. 2. Primaquine: 0.25 mg/kg body weight daily for 14 days.

Table 1.12. Age-wise dosage schedule for treatment of P. vivax cases

Age (in years)	Tab Chloroquine (150 mg base)			Tab Primaquine (2.5 mg base) Day – 1 to Day – 14
	Day – 1	Day – 2	Day – 3	
<1	½	½	¼	0
1-4	1	1	½	1
5-8	2	2	1	2
9-14	3	3	½	4
15 & Above	4	4	2	6

Primaquine is contraindicated in infants, pregnant women and individuals with G6PD deficiency. 14 days regimen of Primaquine should be given under supervision

Treatment of uncomplicated P. falciparum cases (Table 1.13)	1.Artemisinin based combination therapy (ACT): Artesunate 4 mg/kg body weight daily for 3 days plus Sulfadoxine (25mg/kg body weight) - Pyrimethamine (1.25 mg/kg body weight) on first day. (Caution: ACT is not to be given in 1st trimester of pregnancy). 2. Primaquine: 0.75 mg/kg body weight on day 2: 0.75 mg/kg body weight on day

Table 1.13. Age-wise dosage schedule for treatment ofP. Falciparumcases

Age (in years)	Day – 1	Day – 2		Day – 3

	Artesunate (50 mg)	*SP**	*Artesunate (50 mg)*	*Primaquine (7.5 mg Base)*	*Artesunate (50 mg)*
<1	¼	¼	½	0	½
1-4	1	1	1	1	1
5-8	2	½	2	2	2
9-14	3	2	3	4	3
15 & Above	4	3	4	6	4

TREATMENT OF UNCOMPLICATED P. FALCIPARUM CASES IN PREGNANCY	➢ 1st trimester: Quinine salt 10 mg/kg 3 times daily for 7 days (Caution: Quinine may induce Hypoglycaemia ; pregnant women should not start taking quinine on an empty stomach and should eat regularly, while on quinine treatment). ➢ 2nd and 3rd trimesters: ACT as per dosage given above.
TREATMENT OF MIXED INFECTIONS (P. VIVAX + P. FALCIPARUM) CASE	All mixed infections should be treated with full course of ACT and **Primaquine 0.25 mg** per kg daily for 14 days.
TREATMENT OF SEVERE MALARIA CASES	**Inj. Artesunate 2.4 mg/kg IV or IM** given on admission (time = 0h); then at 12 h and 24 h and then once a day. (Caution: Care should be taken to dilute artesunate powder in 5% sodium bicarbonate provided inthe pack only) Or **Inj. Artemether 3.2 mg/kg IM** given on admission and then 1.6 mg/kg per day. Or **Inj. Arteether 150 mg IM** daily for 3 days in adults only (not recommended for children). Or **Inj. Quinine: 20 mg/kg** on admission (IV infusion or divided IM injection) followed bymaintenance dose of 10 mg/kg 8 hourly. The infusion rate should not exceed 5 mg salt/kg per hour. Loading dose of Quinine, i.e. 20 mg/kg on admission may not be given, if the patient has alreadyreceived quinine or if the clinician feels inappropriate). **NEVER GIVE BOLUS INJECTION OF QUININE.** If parenteral quinine therapy needs to be continued beyond 48 hours, reduce dose to 7 mg/kg 8 hourly. **Note:** The parenteral treatment in severe malaria cases should be given for minimumof 24 hoursonce started (irrespective of the patient's ability to tolerate oral medication earlier than 24 hours)followed by a full course of ACT for 3 days. **Those patients who received parenteral Quinine therapy and can take orally should receive:**Oral Quinine 10 mg/kg three times a day for

	7 days (including thedays, when parenteral Quinine wasadministered) plus Doxycycline 3 mg/kg once a day or Clindamycin 10 mg/kg 12-hourly for 7 days (Doxycycline is contraindicated in pregnant women and children under 8 years of age; instead, giveclindamycin 10 mg/ kg 12 hourly for 7 days).
MONITORING	Monitor core temperature (preferably rectal), respiratory rate and depth, pulse, blood pressure and level of consciousness every 4 hours; Record urine output, and look for the appearance of brown or blackurine (haemoglobinuria) or oliguria; Monitor therapeutic response, both clinical and parasitological, byregular observation and blood films; Carry out regular laboratory evaluation of haematocrit or haemoglobin, glucose, urea or creatinine and electrolytes; Avoid drugs that increase the risk for gastrointestinal bleeding (aspirin, corticosteroids).
SUPPORTIVE TREATMENT	Treat fever, hypoglycaemia, electrolyte imbalance, hypotension, renal failure, anaemia, convulsions appropriately.
CHEMOPROPHYLAXIS	Chemoprophylaxis should be administered only in selective groups in high P. falciparum endemic areas. **Short-term chemoprophylaxis (up to 6 weeks)** **Tab. Doxycycline** 100 mg once daily for adults and 1.5 mg/kg once daily for children (contraindicated in children below 8 years). The drug should be started 2 days beforetravel and continuedfor 4 weeks after leaving the malaria endemic area. Note: It is not recommended for pregnant women andchildren less than 8 years. **Chemoprophylaxis for longer stay (more than 6 weeks)** **Tab. Mefloquine** 250 mg weekly for adults and should be administered two weeks before, duringand four weeks after exposure. **Note:** Mefloquine is contraindicated in individuals with history of convulsions, neuropsychiatricproblems and cardiac conditions. Therefore, necessary precautions should be taken and all shouldundergo screening before prescription of the drug.
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2. MANAGEMENT OF DENGUE FEVER

INTRODUCTION	Dengue is tropical viral disease transmitted byAedes aegyptimosquito. **CLINICAL FEATURES** • **Dengue fever**-fever of 2-7 days duration with two or more of the following manifestations: Headache, retro-orbital pain, myalgia/arthralgia, rash, haemorrhagic manifestation (petechiae and positive tourniquet test) and leucopenia. • **Dengue haemorrhagic fever (DHF)**, if one or more of the following are present: Positivetourniquet test, petechiae, ecchymosis or purpura, bleeding from mucosa, injection or othersites, haematemesis or melaena, thrombocytopenia (platelets 100,000/mm3 or less) andevidence of plasma leakage. • **Dengue shock syndrome (DSS).** All the above criteria of DHF plus signs of circulatoryfailure.
DIAGNOSIS	➢ Demonstration of IgM antibody specific for dengue virus. ➢ CBP - Total leucocytes count is either normal or decreased. Platelet count is less thannormal. ➢ Tourniquet test - 10 or more petechiae per 2.5 cm2 (In DHFmore definite result i.e.>20 petechiae). The test may be negative or mildly positive during the phase of profound shock.
TREATMENT	
	DHF is classified into four grades of severity, where grades III and IV are considered to be DSS. **Grade I:** Fever accompanied by non-specific constitutional symptoms; the only haemorrhagic manifestation is a positive tourniquet test and/or easy bruising. **Grade II:** Spontaneous bleeding in addition to the manifestations of grade I patients, usually in the form of skin or other hemorrhages. **Grade III:** Circulatory failure manifested by a rapid, weak pulse and narrowing of pulse pressure or hypotension, with the presence of cold, clammy skin and restlessness. **Grade IV:** Profound shock with undetectable blood pressure or pulse. **DF and DHF during febrile phase** Instruct to reportimmediately if patient develops any of the following danger signals: Severe abdominal pain, passage of black stools, bleeding into the skin or from the nose or gums, sweating and cold skin.
NON PHARMACOLOGICAL	➢ Bed rest and plenty of oral fluids or ORS. ➢ Use of cold/tepid sponging to keep temperature below 38.5°C.

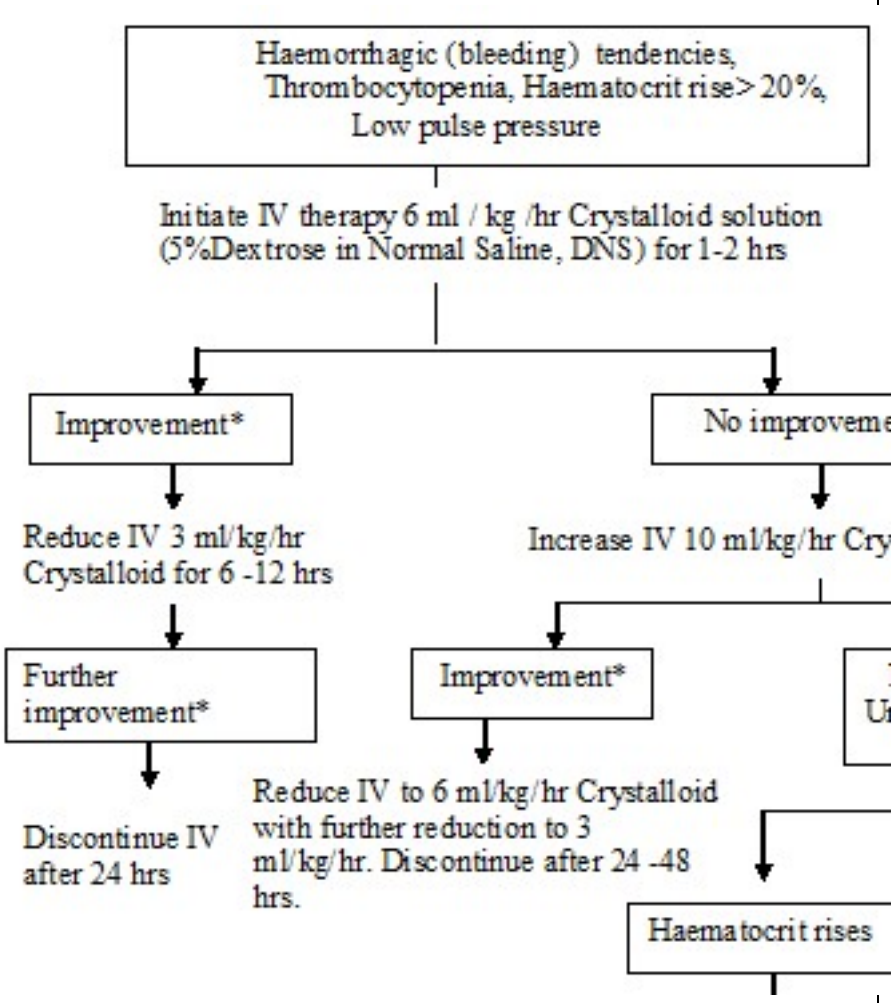
PHARMACOLOGICAL	1. **Tab. Paracetamol 500 mg 6 hourly** (not more than 4 times in 24 hours). (Caution: No role of antibiotics, steroids; do not give aspirin or ibuprofen as these medicines may aggravate bleeding). 2. **ORS** in patients with dehydration. ➢ Follow-up daily until temperature is normal. ➢ Check haematocrit daily where possible. ➢ Check for signs of severe illness.
INDICATIONS FOR HOSPITALIZATION	Tachycardia, increased capillary refill time (>2 seconds), cool, mottled or pale skin, diminishedperipheral pulses, changes in mental status, oliguria, sudden rise in haematocrit or continuously elevated haematocrit despite administration of fluids, narrowing of pulse pressure (<20 mm Hg), hypotension (A late finding representing uncorrected shock).
FLUID MANAGEMENT	Cases without shock (pulse pressure >20 mm Hg) **(Fig. 1.8)** 

Fig. 1.8. Volume replacement flowchart for patients with DHF Grades I & II.

DHF grade III (with circulatory failure) and grade IV (profound shock with undetectable blood pressure and pulse).
Immediately admit the patient to a hospital where trained personnel can manage shock and where blood transfusion facilities are available **(Fig. 1.9).**
Refer patients with refractory shock and with major bleeding to specialized care unit.

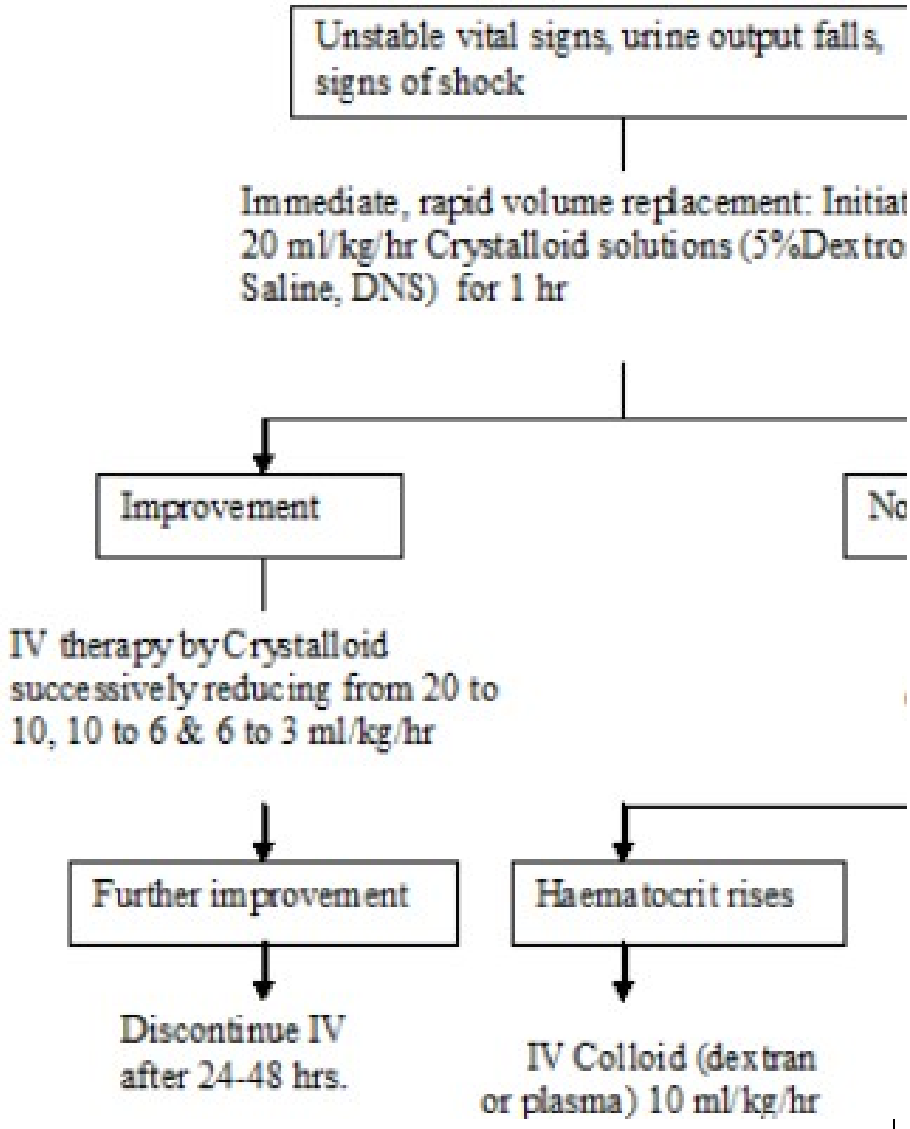


Fig. 1.9. Volume replacement flowchart for patients with DHF Grades III & IV.

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IEC MATERIALS	*STG & OI DENGUE\DENGUE-clinician-guide_508.pdf* *STG & OI DENGUE\Dengue Info HCW.pdf*

3. MANAGEMENT OF ACUTE DIARRHOEA/ GASTROENTERITIS

INTRODUCTION	It is a self-limiting illness characterized by diarrhoea, abdominal cramps, nausea and vomiting, usually caused by viruses or bacteria (E. coli, V. cholera, Staph. aureus, Bacillus cereus, etc). May be associated with systemic symptoms like fever, malaise, etc. These patients are more likely to have invasive diarrhoea caused by the bacteria (E.coli, Shigella, Salmonella, Campylobacter, etc.) or parasite (Amoeba). Persistent diarrhoea is defined as an episode that lasts longer than 14 days. The causes and treatment of persistent diarrhoea are different from acute diarrhoea; so, it should be investigated and treated as per the cause and dietary modifications like low lactose, no lactose or mono-saccharide diet.
TREATMENT	
NON PHARMACOLOGICAL	➢ Adequate fluid replacement - juices, soups and glucose/electrolyte drinks (oral rehydration solution) ➢ Patient should be asked to take only sips of fluid.
PHARMACOLOGICAL	1. Indicated only in very ill patients with systemic symptoms associated with bloody diarrhoea, traveller's diarrhoea or in cholera infection. **Tab. Ciprofloxacin 500 mg 2 times a day for 3-5 days.** 2. In amoebic dysentery **Tab. Metronidazole 800 mg 3 times a day for 7 days.** Or **Tab. Tinidazole 2 g orally as single dose with food.**
IN ACUTE GIARDIA INFECTION	**Tab. Tinidazole 2 g orally as single dose with food** **Or** **Tab. Metronidazole 400 mg 3 times a day for 3 days.**
INDICATIONS FOR HOSPITALIZATION	Patients with clinical signs of dehydration especially young children or elderly, suspected cholera, immune suppressed patients and those with severe systemic symptoms.
REFERENCES	*Gastroenteritis. In: Management of Common GI Problems. R Guan, J Kang and H Ng (eds), Medimedia Asia Pvt Ltd., chapter 06, june 2012* *Diarrhoea and Constipation. In: Harrison's Principles of Internal Medicine. Fauci, Braunwald, Kasper et al (eds), 20th Edition, McGraw Hill Company Inc., New York, 2018.*

4. **MANAGEMENT OF RESPIRATORY TRACT INFECTIONS** (RTIs)

4.1 MANAGEMENT OF H1N1 Flu Virus (Swine Flu)

<table>
<tr><td>INTRODUCTION</td><td colspan="2">A human respiratory infection caused by an influenza strain that started in pigs. Influenza-like illness caused by Influenza A (H1N1).</td></tr>
<tr><td>CLINICAL FEATURES</td><td colspan="2">➢ Fever
➢ Cough, running nose and sore throat.
➢ Headache, bodyache, fatigue
➢ Diarrhoea and vomiting</td></tr>
<tr><td>INVESTIGATIONS</td><td colspan="2">➢ Routine haematological, biochemical, radiological and microbiological tests
➢ RT PCR or isolation of the virus in culture or four-fold rise in virus specific neutralizing antibodies at designated centres.</td></tr>
<tr><td>TREATMENT</td><td colspan="2">The guiding principles of treatment are:
1. Early implementation of infection control precautions to minimize nosocomial/ household spread of disease. Voluntary home quarantine for close contacts of suspected, probable and
Confirmed cases for at least 7 days after the last contact with the case.
2. Prompt treatment to prevent severe illness & death.
3. Screening of all individuals seeking consultations for flu like symptoms, examination by a doctor for early identification and follow up of persons at risk. Notify all suspected cases, clusters of ILI/SARI cases to the State Health Authorities and the Ministry of Health &Family Welfare, Govt. of India.
4. Follow guidelines on categorization of Influenza A H1N1 cases during screening for home isolation, testing treatment, and hospitalization.</td></tr>
<tr><td>Category-A
Patients with mild fever plus cough/sore throat with or without bodyache, headache, diarrhoea and vomiting do not require Oseltamivir and give symptomatic treatment. Monitor and reassessment by thedoctor at 24 to 48 hours. No testing of the patient for H1N1 is required.

Confine patients to their home and to avoid mixing up with public and high-risk members in thefamily.</td><td>Category-B
i. In addition to all the signs and symptoms mentioned under Category-A, if the patient has high grade fever and severe sore throat, may require home isolation on Oseltamivir.

ii. In addition to all the signs and symptoms mentioned under Category-A, individuals having one or more of the following high-risk conditions shall be treated with Oseltamivir.

Children with mild illness but with predisposing risk</td><td>Category-C
In addition to the above signs and symptoms of Category-A and B, if the patient has one or more
of the following:
Breathlessness, chest pain, drowsiness, fall in blood pressure, sputum mixed with blood, bluish discolouration of nails.

Children with influenza-like illness who had a severe disease as manifested by the red flag
signs (Somnolence, high and persistent fever, inability to feed well, convulsions, shortness of breath, difficulty in breathing, etc).

Worsening of underlying chronic</td></tr>
</table>

	factors; pregnant women; persons aged 65years or older; patients with lung diseases, heart disease, liver disease, kidney disease, blood disorders, diabetes, neurological disorders, cancer and HIV/AIDS; patients on long-term cortisone therapy. No tests for H1N1 are required for Category-B (i) and (ii). Confine all patients of Category-B (i) and (ii) at home and to avoid mixing with public and high risk members in the family.	conditions. All patients in Category-C require testing, immediate hospitalization and treatment as follows: **Clinical specimens:** Nasopharyngeal swab, throat swab, nasal swab, wash or aspirate, andtracheal aspirate (for intubated patients) to be collected by a trained physician/ microbiologist preferably before administration of the antiviral drug. Specimens should be stored at 4°C in viral transport media and transport samples to designated laboratories within 24 hours. If there is delay in transportation, store samples at –70°C. Also collect paired blood samples at an interval of 14 days for serological testing.
NONPHARMACOLOGICAL	1. Patient should be kept in dedicated isolation room and treated by dedicated doctors, nurses and paramedical workers. If dedicated isolation room is not available, then patients can be cohorted in a well-ventilated isolation ward with beds kept one meter apart. 2. Reinforce standard infection control precautions, i.e. all those entering the room must use high efficiency masks, gowns, goggles, gloves, cap and shoe cover. 3. Restrict number of visitors and use personal protective equipment (PPE). 4. Dispose waste properly by placing it in sealed impermeable bags labelled as bio-hazard.	
Pharmacological	1. Tab. Osltamivir or Syp. (12 mg per ml) both for prophylaxis and treatment. Dose andduration to be modified as per clinical condition, if needed.	

Weight	**Dose**	**Age**	**Dose**
<15 kg	*30 mg twice a day for 5 days*	*< 3months**	*12 mg twice a day for 5 days*
15-25 kg	*45 mg twice a day for 5 days*	*3-5 months*	*20 mg twice a day for 5 days*
24-<40 kg	*60 mg twice a day for 5days*	*6-11 months*	*25 mg twice a day for 5 days*
>40 kg	*75 mg*	**Chemoprophylaxis not recommended*	

	twice a day for 5days	*Unlesssituation judged critical due to limited dateon use in this age group.*
*(**Caution:** Dose dependent (usually above 300 mg/day) transient gastrointestinal side effects (nausea, vomiting); bronchitis, insomnia and vertigo and sporadic transient neuropsychiatric events (self-injury or delirium).*		
	2. Give supportive therapy for fever and upper respiratory symptoms (for details see respective sections). **Note:** Salicylate/aspirin is strictly contraindicated in any influenza patient due toits potentialto cause Reye's syndrome. 3. Monitor suspected cases for clinical/radiological evidence of lower respiratory tract infection and for hypoxia (respiratory rate, oxygen saturation, level of consciousness). Suspected cases not having pneumonia do not require antibiotic therapy. 4. Maintain airway, breathing and circulation (ABC) 5. In patients with signs of tachypnoea, dyspnoea, respiratory distress and oxygen saturation less than 90% supplement with oxygen therapy. Mechanical ventilation for patients with severe pneumonia and acute respiratory failure (SpO2< 90% and PaO2< 60 mmHg with oxygen therapy). Non-invasive ventilation when mechanical ventilation is not available. Use HEPA filters on expiratory ports of the ventilator circuit/high flow oxygen masks. Administer prophylactic antibiotics to patient son mechanical ventilation. 6. Maintain hydration, electrolyte balance and nutrition. Expect complications to be similar to seasonal influenza and treat accordingly. Immuno modulating drugs and high dose corticosteroids (potential for harm) are not beneficial in treatment of ARDS or sepsis associated multi-organ failure. Low dose corticosteroids (hydrocortisone 200-400 mg/day) may be useful in persisting septic shock (SBP < 90 mmHg). Adult and children to be discharged 7 and 14 days after symptoms have subsided, respectively. The family of patients discharged earlier should be educated on personal hygiene and infection control measures at home; children should not attend school during this period. Administer chemoprophylaxis to all close contacts of suspected, probable and confirmed cases including health care personnel. Close contacts include household/ social contact, family members, workplace or school contact, fellow travellers, etc. Provide prophylaxis till 10 days after last exposure (maximum period of 6 weeks).	
REFERENCES	*Swine Flu. Clinical management Protocol and Infection Control Guidelines. Directorate General of Health Services . Ministry of Health and Family Welfare. Government of India.*	

	http://mohfwh1n1.nic.in/ accessed on May 28th, 2018. *Government of India Guidelines for H1N1 Influenza cases. Influenza NICD Recommendations for the diagnosis, prevention, management and public health response. May 25th 2017* *Guidelines for Management of suspected Swine Flue (H1N1 Viral). IAP Guidelines* *Seasonal Influenza. Center for Disease Control and Prevention. http://www.cdc.gov/flu/ professionals/antivirals/index.htm accessed on February 4, 2015.*

4.2 MANAGEMENT OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

INTRODUCTION	COPD is A group of lung diseases that block airflow and make it difficult to breathe. It is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases.
CLINICAL FEATURES	Chronic bronchitis - cough/ expectoration for at least 3 months in a year for 2 or more years Emphysema – mostly due to inhalation of smoke, air pollution, infections and genetic.
DIAGNOSIS	Clinical - dyspnoea, chronic cough or sputum production, and/or history of exposure to risk factors for the disease. Spirometry post-bronchodilator FEV1/FVC <0.70 confirms the presence of persistent airflow obstruction. Chest X-ray – hyperinflation.
TREATMENT	A COPD management programme includes four components: Assess and monitor disease, reduce risk factors, manage stable COPD, manage and prevent exacerbations, actively identification of co-morbidities. The spirometric classification of severity of airflow limitation is divided into four grades based on post-bronchodilator FEV1 using the fixed ratio FEV1/FVC <0.70 as GOLD 1 (mild; FEV1≥ 80%predicted), GOLD 2 (moderate; 50% ≤ FEV1<80% predicted), GOLD 3 (severe; 30% ≤ FEV1<50%predicted) and GOLD 4 (very severe; FEV1<30% predicted).
NONPHARMACOLOGICAL	Cessation of smoking, Avoiding inhalation of smoke from other sources (home or occupational)

PHARMACOLOGICAL	**A. Severe acute bronchospasm** 1. ***Oxygen inhalation*** (24-28%) with the venturi mask or through nasal prongs at flow rate of1-2 liters/min. 2. ***Salbutamol solution 2.5 mg*** inhaled using nebulization 4-6 times a day and as and when required. 3***. Inj. Aminophylline 250-500 mg*** (5 mg/kg) dissolved in 20 ml of 5% dextrose given slowly over 20 minutes (not given if patient already receiving theophylline) or has liver disease followed by infusion at the rate of 0.5 mg/kg/h. 4. ***Oral/parenteral Amoxycillin 500 mg+ Clavulanic acid 125 mg*** 3 times a day for 7-10 days. 5. ***Tab Prednisolone 1-2 mg/kg/day*** for 5 days. *Refer the patient to hospital for further treatment/assisted ventilation if no response to above treatment, severe cyanosis and/or altered sensorium.* **B. Maintenance treatment** ***1. Salbutamol***-metered dose inhaler (MDI) inhalation 200 mcg 4 times a day and as and when required (use spacer, if coordination is a problem for the patient). Or ***Terbutaline*** metered dose inhaler 250 mcg 4 times a day and as and when required. 2. If no complete response to the above, give Ipratropium bromide inhalation 200 mcg 2 times a day. 3. ***Tab. Theophylline 100-200 mg*** 3 times a day given after meals. 4. If patient is expectorating yellowish sputum, ***oral Amoxycillin 500 mg+ Clavulanic acid 125 mg*** 3 times a day for 7-10 days. 5. Steroids have a very limited role in selected patients only, if at all required should be administered by the specialist only. Indication about home therapy of oxygen to be decided by the specialist and if indicated, should be taken for 15 hours a day. Use of mucolytics has no proven benefit. Regular use of anti-tussives is contraindicated in stable COPD. Respiratory stimulants are not recommended.
REFERENCES	*Chronic Obstructive Pulmonary Disease (COPD). In: Harrison's Principles of Internal Medicine.Fauci, Braunwald, Kasper et al (eds), 20th Edition, McGraw Hill Company Inc., New York, 2018.* *Global Strategy for Diagnosis, Management and Prevention of COPD. The Global Initiative for Chronic Obstructive Lung Diseases (GOLD). Updated Oct. 2017.*

4.3 MANAGEMENT OF PNEUMONIA

INTRODUCTION	Pneumonia is an inflammation in alveolar tissue, most often caused by a microbial agent. Commonly caused by Streptococcus pneumoniae (typical). Pneumonia is an Infection that inflames air sacs in one or both lungs, which may fill with fluid.
CLINICAL FEATURES	• Productive cough, • Sudden onset of fever, • Chest pain, • Shortness of breath and (in some cases) pleuritic chest pain; • Systemic symptoms -headache, bodyache and delirium • **Atypical pneumonia syndrome** - gradual onset, a dry cough, shortness of breath and a prominence of extra pulmonary symptoms (headache, myalgia, fatigue, sore throat, nausea, vomiting and diarrhoea) and abnormalities on chest X-ray despite minimal signs of pulmonary involvement (other than rales). • **Primary atypical pneumonia caused by Mycoplasma** - violent, episodic cough with small mucoid sputum preceded by fever with or without chills and may be accompanied by profound weakness.
DIAGNOSIS	X-ray chest Sputum examination (Gram stain and culture), AFB staining.
TREATMENT	
NON PHARMACOLOGICAL	Adequate fluids, promoting expectoration (gravity drainage, primarily used in bronchiectasis).
PHARMACOLOGICAL	• **Outpatient Management** 1. For previously healthy patients who have not taken antibiotics within the past 3 months: Azithromycin 500 mg orally first dose followed by 250 mg daily for 4 days or 500 mg daily for 3 days. Or Clarithromycin 500 mg orally twice a day. Or Doxycycline 100 mg orally twice a day. 2. For patients with co-morbid conditions e.g. chronic heart, lung, liver or renal disease, diabetes, alcoholism, malignancy, asplenia, immunosuppressive state , use of antibiotics within last 3 months Levofloxacin 750 mg/Moxifloxacin 400 mg/ Gemifloxacin320 mg orally daily Or Azithromycin 500 mg orally first dose followed by 250 mg daily for 4 days or 500 mg daily for 3 days. Or Clarithromycin 500 mg orally twice a day + Amoxicillin 1 g orally thrice a day Or Amoxicillin-Clavulanate 2 gram orally twice a day Or Cefpodoxime 200mg orally twice a day Or Cefuroxime 500 mg orally twice a day. 3. In regions with high rate (>25%) of infection with a high level (MIC ≥16 mcg/ml) macrolid-resistant Streptococcus Pneumoniae consider alternatives mentioned at number 2 in patients with co-morbidities. • **Inpatient Management not requiring intensive care** Levofloxacin 750 mg/Moxifloxacin 400 mg/ Gemifloxacin320 mg orally dailyOr IV Levofloxacin 750 mg daily/Ciprofloxacin 400 mg 8-

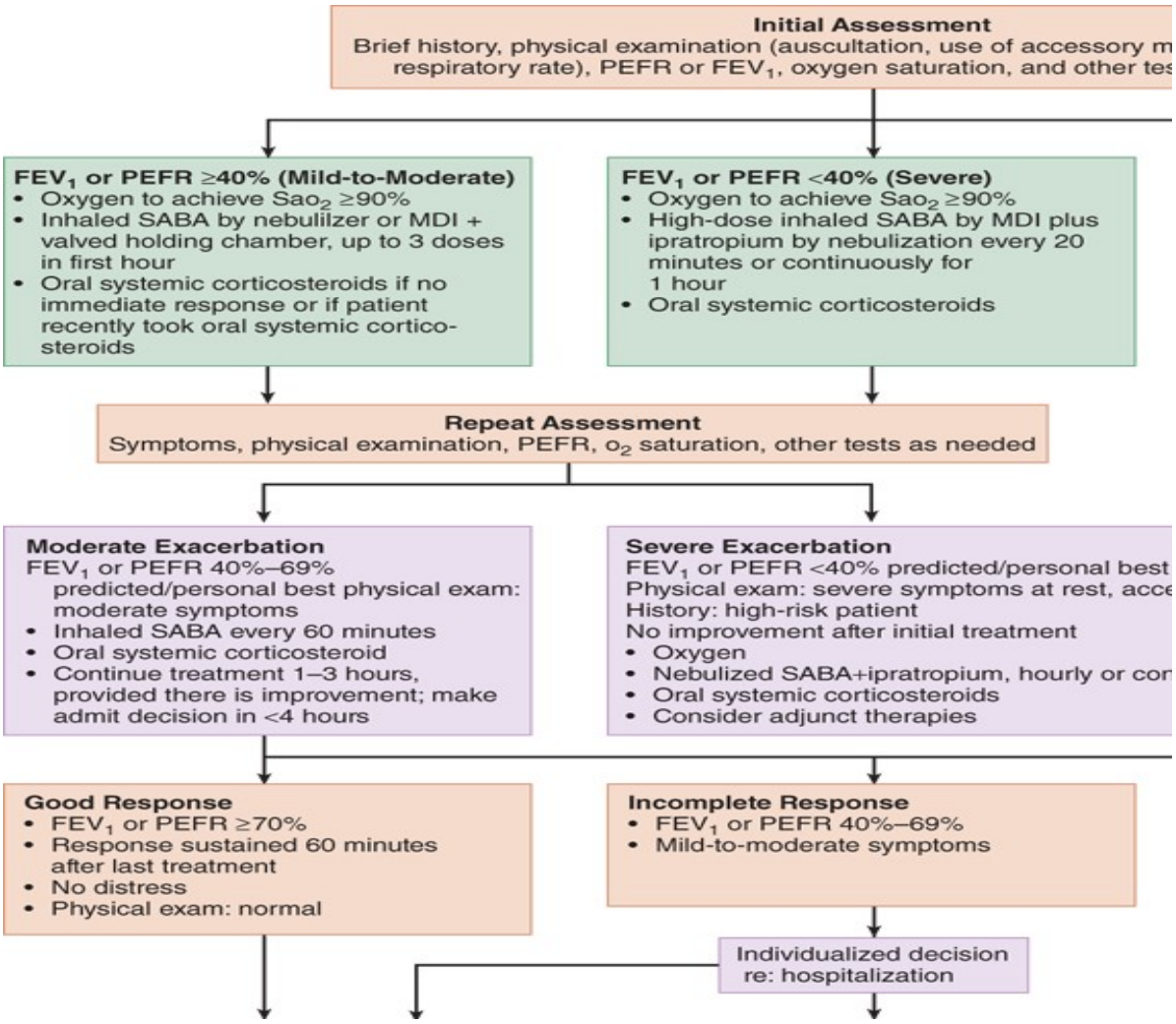
	12hourly/Moxifloxacin 400 mg daily. Or Azithromycin 500 mg orally first dose followed by 250 mg daily for 4 days or 500 mg daily for 3days.Or Clarithromycin 500 mg orally twice a day + Amoxicillin 1 g orally thrice a day Or Amoxicillin- Clavulanate 2 gram orally twice a day Or Cefpodoxime 200 mg orally twice a day Or Cefuroxime 500 mgorally twice a day. Or IV Ampicillin 1-2 g 4-6 hourly Or Cefotaxime 1-2 g every 4-12 hrs Or Ceftriaxone 1-2 g every 12-24 hrs. • **Inpatient Intravenous Management requiring intensive care** 1. Azithromycin 500 mg orally first dose followed by 250 mg daily for 4 days or 500 mgdaily for 3 days.OrLevofloxacin 750 mg/Moxifloxacin 400 mg/ Gemifloxacin 320 mgorally daily Or IV Levofloxacin 750 mg daily/Ciprofloxacin 400 mg 8-12hourly/Moxifloxacin 400 mg daily + Cefotaxime 1-2 g every 4-12 hrs Or Ceftriaxone 1-2 g every 12-24 hrs Or IV Ampicillin- sulbactam 1.5-3 g 6 hourly. 2. For patients allergic to beta lactam fluoroquinolone + aztreonam 1-2 g every 6-12 hrs. 3. For patients at risk for Pseudomonas infection a. Piperacillin-Tazobactam 3.375-4.5 g every 6 hours OrCefepime 1-2 gm twice a day Or Imipenem 0.5-1 g every 6-8 hrs Or Meropenem 1 g every 8 hrs + Ciprofloxacin 400 mg 8- 12 hrly Or IV Levofloxacin 750 mg daily. Or b. Piperacillin-Tazobactam 3.375-4.5 g every 6 hours OrCefepime 1-2 gm twice a day Or Imipenem 0.5-1 g every 6-8 hrs Or Meropenem 1g every 8 hrs +Aminoglycoside (Gentamicin/amikacin/tobramycin all weigh based dosing administered daily) + Azithromycin/fluoroquinolone. 4. For patients at risk for MRSA infection, add vancomycin or linezolid 600 mg twice a day.
REFERENCES	*Pneumonia. In: Harrison's Principles of Internal Medicine. Fauci, Braunwald, Kasper et al (eds), 20th Edition, McGraw Hill Company Inc., New York, 2018.* *Guidelines for the Management of Adult with Community-acquired Pneumonia - American Thoracic Guidelines. Am J Resp and Critical Care Medicine, Jan 15, 2018.* *IDSA Guidelines. Update of Practice Guidelinees for the Management of Community Acquired Pneumonia in Immunocompetent Adults. Clinical Infections Diseases 2003; 37: 1405-1433.* *IDSA Guidelines. Practice Guidelines for Outpatient Parenteral Antimicrobial Therapy. Clinical Infections Diseases 2004; 38: 1651-1672.* *Current Medical Diagnosis and Treatment 2018. 57th edition.*

4.4 MANAGEMENT OF BRONCHIAL ASTHMA

<table>
<tr><td>INTRODUCTION</td><td colspan="2">Bronchial asthma is a condition in which a person's airways become inflamed, narrow and swell and produce extra mucus, which makes it difficult to breathe. A chronic inflammatory disease characterized by increased responsiveness of the airways to a number of stimuli resulting in their narrowing which is reversible spontaneously or with treatment.</td></tr>
<tr><td>SYMPTOMS AND SIGNS</td><td colspan="2">• Episodic/variable
• Wheeze
• Shortness of breath
• Chest tightness
• Cough
• Signs could be none (common) or wheeze—diffuse, bilateral, expiratory (+inspiratory) and tachypnoea.
• Helpful additional information
✓ Personal or family history of asthma or atopy (eczema, allergic rhinitis)
✓ History of worsening after use of aspirin/NSAID ingestion, use of beta- blockers (including glaucoma drops)
✓ Recognised triggers – pollens, dust, animals, exercise, viral infections, chemicals, irritants Pattern and severity of symptoms and exacerbations.</td></tr>
<tr><td>DIAGNOSIS</td><td>Indications for referral for specialist opinion:
further investigation
COPD
Diagnosis unclear or in doubt
Unexpected clinical findings, e.g. crackles, clubbing, cyanosis, heart failure
Spirometery or PFTs don’t fit in the clinical picture
Suspected occupational asthma
Persistent shortness of breath (non-episodic, or without associated wheeze)
Unilateral or fixed wheeze
Stridor
Persistent chest pain or atypical features
Weight loss</td><td>Differential diagnoses in adults:
COPD
Cardiac disease
Tumour - laryngeal, tracheal, lung Bronchiectasis
Foreign body
Interstitial lung disease
Pulmonary emboli
Vocal cord dysfunction
Hypertension
Aspergillosis

Differential diagnosis in children
Episodic viral wheeze
Congenital heart disease
Aspiration - GERD, pharyngeal inco- • ordination, tracheo-oesophageal fistula
Cystic fibrosis
Immunodeficiency</td></tr>
</table>

	Persistent cough and/or sputum production Non-resolving pneumonia Severe eosinophilia	Immotile cilia syndrome
• Consider chest X-ray in any patient presenting atypically or with additional symptoms		
TREATMENT		
NON PHARMACOLOGICAL	Identify and avoid the trigger factor(s), stop smoking and do regular breathing exercises, e.g. 'Pranayama'. Reduce weight (for obese patients with asthma).	



PHARMACOLOGICAL MANAGEMENT

Fig. 1.12. Management algorithm for treating acute asthma in a hospital

Life-threatening asthma

Treatment of life-threatening episode should be immediate and no time should be spent ondetailed

clinical history.
Oxygen inhalation 4 L/min to maintain SpO2>90%.
Inj. Terbutaline 10 mcg/kg subcutaneously or IV (maximum 40 mcg/day).
Inhaled Salbutamol/Terbutaline preferably by nebulizer (as discussed above).
Ipratropium Bromide 250 mcg by nebulizer with Salbutamol.
Inj. Hydrocortisone 10 mg/kg IV. Inj. Aminophylline 5 mg/kg bolus slowly followed by 0.8-1.2mg/kg/hour slow infusion (If patient has received theophylline preparation in last 72 hours; reducebolus dose to 2.5 mg/kg).
Inj. Magnesium sulphate 40 mg/kg in 50 ml 5% dextrose as slow infusion over 30 minutes can beconsidered.
If no response do arterial blood gas analysis, X-ray chest and serum electrolytes. Intubate the patient if no or poor respiratory effort, increased carbon dioxide with respiratory acidosis. Transfer to intensive care unit as early as possible.
If above therapy fails. Transfer should be arranged so that oxygen and inhalation therapy can be continued on the way.

Notes:

- Antibiotics are required only if there is a consolidation, high grade fever or polymorphonuclear leucocytosis.
- Mere presence of crackles is not an evidence of pneumonia and does not warrant antibiotics.
- Mucolytics and cough syrups are not helpful.
- Sedation should be avoided in acute asthma.
- Non-sedating antihistaminics may be used, if associated allergic rhinitis is there.

Long-term management of asthma
Long-term asthma management depends on severity over a period of time. (Table 1.14).

	Symptoms	**Night Time Symptoms**	**PEFR**
Step 4	Continous	Frequent	≤ 60% predicted
Severe Persistent	Limited Physical Activity	Variability > 30%	
Step 3	Daily use beta-2 agonist daily attack affects activity	>1 times a week	>60%<80% predicted
Moderate Persistent		variability 20-30%	
Step 2	>1 times a week but	>2 times a month	≥ 80% predicted
Mild Persistent	< 1 times a day		variability 20-30%
Step 1	< 1 times a week	<2 times a month	≥ 80% predicted
Intermittent	Asymptomatic and normal PEFR between attack	variability < 20%	

Treatment of Chronic Asthma

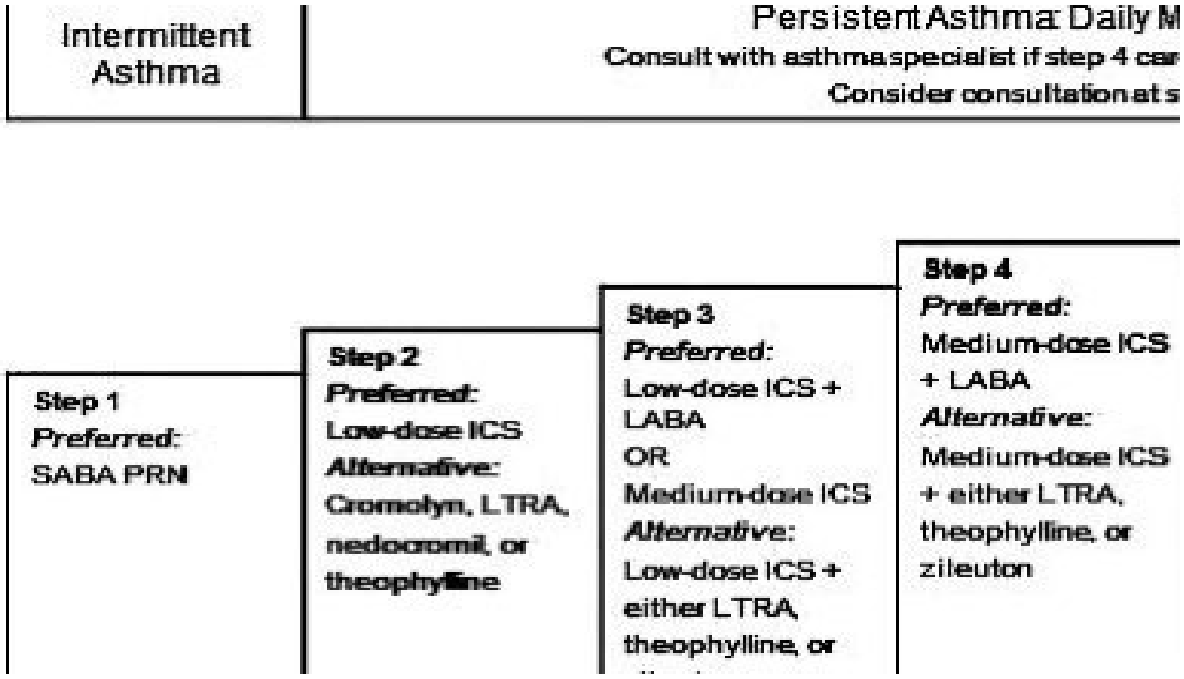


Figure 1.13 gives summary of stepwise management in adults; and in children aged 5-12 years.

SABA = short-acting beta2-agonist; ICS = inhaled corticosteroid; LTRA = leukotrienereceptor antagonist; LABA = long-acting beta2-agonist.

Estimated equipotent daily dose of inhaled corticosteroids for adults and children older than 5 years.

Drug	Low daily dose (mcg)	Medium daily dose (mcg)	High daily dose (mcg)
Budesonide	**200-400**	**>400-800**	**>800-1600**
Fluticasonepropionate	**100-250**	**>250-500**	**>500-1000**
Mometasone furoate	**200**	**>400**	**>800**

Note: Patients on high daily dose of ICS except for short periods should be referred to a specialist for assessment to consider alternative combinations of controllers. Maximum recommended doses on prolongeduse are associated with increased risk of systemic side effects.

Fig. 1.13. Summary of stepwise management.

REFERENCES

Pocket Guide for Asthma management and Prevention (for adults and children older than 5 years).Global Initiative for Asthma. 2017.

The British Guidelines on Management of Asthma: A National Clinical Guideline. British Thoracic Society, Scottish Intercollegiate Guidelines Network, September 2016.

Facility Based IMNCI (F-IMNCI) Participants Manual. WHO, UNICEF, and Ministry of Health &Family Welfare, Government of India, 2009.

Global strategy for Asthma management and prevention 2016.

4.5 MANAGEMENT OF ALLERGIC RHINITIS

INTRODUCTION	This is an IgE mediated hypersensitivity of mucous membrane of the nasal passage.
CLINICAL FEATURES	Sneezing, itching, watery nasal discharge and a feeling of nasal obstruction. Maybe associated with allergic conjunctivitis and bronchial asthma. Seasonal allergic rhinitis (SARIHay fever)-sneezing, itching watery rhinorrhoea and conjunctivitis are prominent symptoms. Perennial allergic rhinitis (PAR)- nasal discharge is more viscous or purulent , nasal blockage, postnasal discharge and hyposmia.
DIAGNOSIS	If patient is having two or more symptoms (viz. sneezing/itching, nasal discharge and nasal blockage) occurring for more than one hour on most days.
TREATMENT	
NON PHARMACOLOGICAL	Avoid allergens.
PHARMACOLOGICAL	1.**Tab. Cetirizine 10-20 mg** in a single daily dose for 7 days In Children 5mg in a single daily dose. **Or** **Tab.Chlorpheniramine maleate 4 mg** 6-8 hourly for 7 days. In Children 1-2years 1mg twice daily; 2-5 years 1mg every 3-6 hours; 6-12 years 2mg every 4-6 hours. (Caution: Not recommended for children under 1year) **Or** **Tab.Pheniramine maleate 25-50 mg** 8 hourly for 7 days. In Children 0.5mg/kg/day divided in 3 doses. The duration of treatment may need to be extended depending upon the response of the patient. 2. If nasal obstruction and rhinorrhoea, Normal saline nasal drops 1-2 drops in each nostril 2 times daily. **Or** **Xylometazoline 0.1% nasal drops** 1-2 drops 2-3 times daily for 5-7days. In Children 0.05% 1-2 drops 2 times daily. **Or** **Oxymetazoline 0.5% nasal drops** 2-3 drops 2-3 times daily for 5-7 days. In Children 0.025% 1-2 drops 2 times in each nostril 3. In case signs and symptoms are persistent

	Betamethasone nasal drops 2-3 drops 2-3 times a day. **Or** **Hydrocortisone nasal drops** 2-3 drops 2-3times a day. **Or** **Beclomethasone inhaler** (50mcg/puff) 2 puffs 12 hourly. **Or** **Budesonide (50-100 mcg/puff)** 1-2 puffs a day. **Or** **Fluticasone 150mcg/puff** 1-2 puffs a day. Or **Topical Azelastine intranasal spray** 2-3 times a day. 4. In case of no response to the treatment outlined above, **Tab. Prednisolone 5-60 mg/day** in 3-4 divided doses for 5-7 days. Or **Tab.Dexamethasone 0.5-5.0 mg/day** in 3-4 divided doses for 5-7days. **Or** **Tab.Betamethasone 0.5-5.0 mg/day** in 3-4 divided doses for 5-7days. 5. **Tab. Ranitidine 150mg** 12 hourly, **Or** **Tab. Omeprazole 20mg** once daily empty stomach.
REFERENCES	*Mechanism and Treatment of Allergic Rhinitis. In: Scott Brown's Otolaryngology. J B Booth (ed), 8thEdition, September 2018 .watkinson, clarke.*

5. MANAGEMENT OF NUTRITIONAL DEFICIENCIES

5.1 MANAGEMENT OF PROTEIN ENERGY MALNUTRITION (PEM)

INTRODUCTION

Nutritional **marasmus** and **kwashiorkor** are two extreme forms of malnutrition. Such extreme forms are rare; most cases suffer from mild and moderate nutritional deficit.

CLINICAL FEATURES

- Milder forms may just present with failure to thrive, i.e. decreased rate of weight gain.
- Marasmus is characterized by gross wasting of muscle and subcutaneous tissues resulting in emaciation, marked stunting, and no oedema.
- Markedly retarded growth, psychomotor changes, and oedema of dependent parts are three essential clinical features of kwashiorkor.
- PEM is usually associated with:

1. Anaemia due to iron, protein, vitamin B12, or folic acid defi ciency,
2. Xerophthalmia due to vitamin A deficiency, and
3. Other micronutrient deficiencies including magnesium, copper, zinc, vitamins B, C, D and K.

ASSESSMENT OF NUTRITIONAL STATUS

Under nutrition is classified by WHO into moderate and severe forms as shown in Table 19.6. Reference values for weight for height are provided in Table 19.7.

Severe Acute Malnutrition(SAM)

SAM among children of 6-59 months of age is defined by UNICEF as any of the following:

1. Weight for height below -3 SD of median WHO growth reference
2. Visible severe wasting
3. Presence of bilateral pedal oedema
4. Mild upper arm circumference <11.5cm.

These children are at high risk of death and they require urgent attention and management in the hospital. In children of <6 month of age MUAC cannot be used, and SAM should be diagnosed in the presence of 1, 2, and 3.

Table 19.6. WHO Classification for severity of under-nutrition

	Moderate under-nutrition	**Severe under-nutrition**
Symmetrical oedema	No	Yes
Weight for height (measure of wasting)	SD score-2 to -3 (70-79% of expected)	SD score ≤ 3 (<70 % of expected)
Height for age (measure of stunting)	SD score" – 2 to – 3 (85-89% of expected)	SD score ≤ 3 (<85 % of expected)

a. This includes kwashiorkar and marasmic kwashiorkar.

b. SD score = $\frac{\text{Observed value – expected value}}{\text{Standard deviation of reference population}}$

c. Median (50th percentile of NCHS standards).

Table19.7.NCHS/WHO Normalized reference values for weight-for-height/length.

Table19.7.NCHS/WHO Normalized reference valu

Boys' weight (kg)			Length (cm)	G
-3 SD	-2SD	Median		Median
2.6	2.8	3.3	50	3.4
3.6	3.8	4.5	55	4.5
4.7	5.1	6.0	60	5.9
5.7	6.2	6.3	65	7.1
6.6	7.2	8.4	70	8.2
7.5	8.1	9.5	75	9.1
8.2	8.9	10.4	80	10.1
9.1	9.8	11.5	85	11.2

Indian Academy of Paediatrics (IAP) takes a weight of more than 80% of expected for age as normal. Grades of malnutrition are: Grade I (71-80%), Grade II (61-70%,) Grade III (51-60%) and GradeIV (≤50%) weight of expected value for that age. Alphabet k is post-fixed in the presence of oedema.

TREATMENT

1. Mild to moderate under-nutrition. Mild and moderately under-nourished children are best treated in their own home surroundings. Domiciliary treatment of malnourished children by
their mother is economical, offers in-built advantage of practical health education, and is associated with minimal recurrence risk.
2. The parents should be advised to increase the food intake of the child by all available means. The child should receive adequate amount of calories and protein in the diet, which should be prepared from the locally available, inexpensive foods.
3. The child should be kept under surveillance by using a growth chart and effort should be made that he does not slip down to severe malnutrition.

10 steps of management of malnutrition-

1. Treat/prevent hypoglycaemia
2. Treat/prevent hypothermia
3. Treat/prevent dehydration
4. Correct electrolyte imbalance
5. Treat/prevent infection
6. Correct micronutrient deficiencies
7. Start cautious feeding
8. Achieve catch-up growth
9. Provide sensory stimulation and emotional support
10. Prepare for follow-up after recovery

Assess	Classify	Action to take
If age upto 6 months and • Visible severe wasting • W/L <70% or • Oedema of both feet • If age 6 months and above and MUAC<11 cm or oedema of both feet or W/H<70% and one of the following • Danger sign • Fail appetite test or Severe Pneumonia or • Blood in stool or Fever/hypothermia	Severe Complicated Malnutrition	Refer urgently to Therapeutic Feeding Unit (TFU), also called Stabilization Centre (SC) for an in-patient management of the child.
If age 6 months and above and • MUAC<11 cm or oedema of both feet or W/H<70%	Severe Uncomplicated	Manage in OTP using the health post OTP protocol
Pass appetite test	Malnutrition	
If MUAC 11 cm to 11.99 or W/H70% to 79.99%andNo oedema of both feet	Moderate Acute Malnutrition	Refer to supplementary feeding program if available Counsel on child feeding and Care
If MUAC≥12 cm and no oedema of feet	No acute malnutrition	Counsel the mother and congratulate her

TIME FRAME FOR 10 STEPS		
Stabilisation		**Rehabilitation**
Day 1-2	Days 3-7	Weeks 2-6
Hypoglycemia ---------- > Hypothermia ---------- > Dehydra---------- > Electrolytes ---------- > Infection---------->> Micronutrients -------no iron----------with iron---- > Cautious feeding ---------- > Catch up growth ---------- > Sensory stimulation ---------- > Prepare for follow-up --- ---------- >		

Hospital management of severe malnutrition is given in (Table 19.8). Initial treatment involves managing complications. The aim is to treat complications and stabilize the child.

Severe malnutrition

Severely wasted children and those with oedema need hospitalization. Other indications for admission in an undernourished child are severe dehydration, severe diarrhoea, hypothermia, shock, systemic infection, severe anaemia, jaundice, bleeding, age less than one year, or persistent loss of appetite. Those with severe stunting alone may be managed in the community. Hospital management of severe malnutrition is summarized in Table 19.8.

Table 19.8. Hospital management of severe malnutrition

Problem Measurement	**Problem Measurement**
Hypothermia(rectal temperature<35.5oC)	Keep under a heat source, such as radiant warmer, room heater, hot air blower or 200 W bulb, and warm upto rectal temp. 37.0ºC within in 2-3 hours. If electric gadgets are not available, cover the child well. Warm up with Kangaroo technique (placing the naked child on mothers' bare chest and covering them both together with cloth and blanket). Monitor rectal temperature half hourly. Investigate and treat for infection and hypoglycaemia. Check for hypoglycemia, whenever, hypothermia is found. Prevent hypothermia
Hypoglycaemia (blood sugar <54 mg/dl)	• 10% glucose, 5-10 ml/kg IV immediately followed by IV infusion of a dextrose containing solution. • If IV dose cannot be given immediately, give the nasogastric dose first. Give appropriate antibiotics and start feeding as soon as possible. Give 2-hourly feeds, day and night, at least for the first day. • If the initial blood glucose was low, repeat the measurement (using finger prick or heel prick blood) and estimate blood sugar after 30 minutes. If the

		axillary temperature falls <35°C or if there is deterioration in the level of consciousness anytime, repeat the blood sugar measurement
	Dehydration (as assessed by WHO classification)	Whenever possible, rehydrate a dehydrated child with severe malnutrition orally or through a nasogastric tube. In addition to ORS start potassium supplements to prevent hypokalemia (syrup potassium chloride-15 ml of the syrup provides 20 mEq of potassium (See hypokalaemia) ORS 5 ml/kg body weight every 30 minutes for the first 2 hours; then 5-10 ml/ kg alternate hours for up to 10 hours. The amount offered in this range should be based on the child's willingness to drink and the amount of ongoing losses in the stool. Starter formula is given in alternate hours during this period until the child is rehydrated. Monitor every 30 min for the first 2 h and then hourly. Check respiratory rate, pulse rate, urine output and frequency of stools and vomiting. If the child has already received IV fluids for shock and is switching to ORS, omit the first 2-hour treatment and start with the amount for the next period of up to 10 hours. Stop ORS immediately on signs of over hydration (increasing respiratory rate by 5/min and pulse rate by 15/min), and reassess after 1 h.
	Severe dehydration: weak pulse, oliguria	The only indication for IV infusion in a severely malnourished child is circulatory collapse caused by severe dehydration or septic shock. Severe dehydration: Administer (N/2) saline with 5%dextrose at slower infusion rates of 15 ml/kg over the first hour with continuous monitoring (pulse rate, pulse volume, respiratory

		rate, capillary refill time, urine output). Monitor pulse and respiratory rates every 5-10 min. If there is improvement (pulse slows; faster capillary refill) at the end of the first hour of IV fluid infusion, consider diagnosis of severe dehydration with shock. Repeat rehydrating fluid at the same rate over the next hour and then switch to ORS at 5-10ml/kg/hour, either orally or by nasogastric tube. If there is no improvement or worsening after the firsthour of the fluid bolus, consider septic shock and treat accordingly (Fig. 19.3). **Caution:** • Do not use 5% dextrose alone • Add potassium to the IV fluids at the rate of 1.5 ml per 100 ml after the patient passes urine. 1 ml of potassium chloride provides 2 mm of of potassium. Do not increase to more than 40 mEq/litre. • Monitor frequently and look for features of over hydration and cardiac decompensation. • Increasing respiratory rate (> 5 per minute) and increasing pulse rate (> 15 per minute), increasing oedema and periorbital puffiness indicates over-hydration which may be dangerous and may lead to heart failure.
	Septic shock (clinical features similar to severe dehydration)	See Fig. 19.3 Give blood/plasma transfusion 10 ml/kg over 3 hours. Start antibiotics; as given in Infections. Fluid management is similar to that of severe dehydration.
	Dyselectrolytaemia	Give supplemental potassium at 3-4 mEq/kg/day for at least 2 weeks. Potassium can be given as syrup potassium chloride; the most common preparation available has 20 mEq/15 ml.

		On day 1, give 50% magnesium sulphate IM once(0.3 ml/kg up to a maximum of 2 ml). Thereafter, give extra magnesium (0.4–0.6 mEq/kg daily) orally. If oral commercial preparation is not available give injection magnesium sulphate (50% which has 2mEq/ml) orally as magnesium supplements mixed with feeds for 2 weeks. Prepare food without adding salt to avoid sodium overload.
	Infections	Assume all children with severe malnutrition admitted in a hospital have an infection and give broad-spectrum antibiotics. If specific infections are detected such as dysentery, malaria, pneumonia, worm infestations, tuberculosis, treat as per STG of that particular condition. (Table 19.9). Hypoglycaemia and hypothermia are often signs of severe infection
	Congestive heart failure (tachycardia, cardiomegaly)	Restrict fluid intake. Give Inj Frusemide 1 mg/kg stat
	Severe anaemia (haemoglobin<4 g/dl)	Give whole blood or packed cell transfusion, if Hb is< 4g/dl or Hb is 4-6 g/dl and child has respiratory distress. Give 10 ml/kg slowly over 4-6 hours and give Inj. Frusemide 1mg/kg at the start of the transfusion. Do not repeat blood transfusion within 4 days.
	Vitamin A Deficiency	Give a single dose of vitamin A orally to all children:<6 months: 50,000 IU; 6 months - 1 year: 1,00,000 IU; >1 year: 2,00,000 IU; Children < 8 kg irrespective of age should receive 1.00,000 IU orally. Give half of the above dose, if injectable (intramuscular) vitamin A needs to be given. Give same dose, on Day 0,1 and 14 if there is clinical evidence of vitamin A deficiency.
	Vitamin K deficiency or bleeding	Inj Vitamin K 2.5 mg IM single dose

	tendency	
	Zinc	2 mg/kg/day for at least 2 weeks Give 0.2 ml/kg of 50% solution of magnesium sulphate IV single dose.
	Folic acid Deficiency	Give folic acid 5 mg on day 1 followed by 1 mg/day for at least 2 weeks.
	Copper	0.3 mg/kg/day (if separate preparation not available use commercial preparation).

Signs of improvement
During these seven days, a child with kwashiorkor will lose weight and a marasmic child gains little or nothing because the tissue gains are masked by excess body water loss.

Rehabilitative phase (2-6 weeks)
Aim: Restore normal weight for height.
Starting point: Child has started showing signs of recovery of appetite and change of expressions.

Table 19.10. Initiation of cure

Start Feeding	Initiate feeds as early as possible. If oral feeding is not possible, give nasogastric feeding. Start with a lower volume of feed at frequent intervals; no. of feeds varying from 12 feeds on first and second day and 6 to 8 feeds on days 3- 7. Ensure night feeds. If tolerated, milk-based diets are most suitable (80 kcal/kg/d) and protein (0.7 g/kg/d). The caloric intake should not exceed 100 kcal/kg/d on the first day. Increased gradually over one week to 150kcal/kg/day of energy and 2-3 g/kg/d of proteins. Total amount of fluids should

		be 130 ml/kg/d. Sugar and oil can be added to provide extra calories.
	Lactose – intolerance (stool pH, 5.5 on twoseparate occasions)	• Reduce the total lactose load in the diet by diluting the milk for 3 or 4 days or substituting a part of milk feeds by formulae based on lactose-free milk protein (calcium caseinate),sugar and oil, soyabean, meat or vegetable protein mixtures.
	Other nutrients	Supplement the diet with minerals and trace elements as follows: Potassium chloride (1.2- 2.4 g/L of feed), magnesium chloride (300-600 mg/L of feed), zinc acetate (20 mg per day),copper acetate (2 mg/L of feed), selenium (6-10 mcg/kg/day) and folic acid (1 mg per day). Do not give iron at this stage. Add iron only after a week of therapy. Vitamins of B complex group are not useful in initial therapy.
	Intensive feeding (to recover lost weight)	Replace the initial milk diet with home diet as soon as possible. Provide therapeutic diet as follows: fluids 150ml/kg/day, energy 175-200 kcal/kg/day, protein 2-4 g/kg/day. The diet prescribed for the child should be such, which the family can afford to provide for the baby within its limited income, can be easily cooked at home, does not perish easily, is culturally

		acceptable and easily available in the local market.
REFERENCES	*Protein Energy Malnutrition. In: Ghai's Essential Paediatrics. Ghai OP, Gupta P, Paul VK (eds), 8th Edition, New Delhi, Interprint, 2013.* *Facility Based IMNCI (F-IMNCI) Participants Manual. WHO, UNICEF, and Ministry of Health &Family Welfare, Government of India, 2009.*	

5.2 MANAGEMENT OF IRON DEFICIENCY ANAEMIA (IDA)

INTRODUCTION	A haemoglobin (Hb) level below 11 g/dl for children 6 months to 6 years old, and <12 mg/dl for children 6-14 years is considered as anaemia. 1. **Anaemia due to decreased RBC production. It may be due to**: (a) Deficiency of iron, folic acid, vitamin B12, copper, protein, etc. (b) Bone marrow infiltration - acute and chronic leukaemia, disseminated malignant diseases, myelofibrosis, etc. (c) Bone marrow aplasia- aplastic anaemia ,pure red cells aplasia 2. Anaemia due to increased RBC destruction, i.e. haemolytic anaemia-thalassaemia major, sickle cell disease, hereditary spherocytosis, G6PD deficiency, haemolytic anaemia, malaria, etc. 3. Anaemia due to excessive blood loss -massive oesophageal variceal bleeding, rectal polyps, etc. In cases like ankylostomiasis, Meckel diverticulum, etc., there may be only occult bleed.
CLINICAL APPROACH IN A CHILD WITH ANAEMIA	(a) Nutritional iron deficiency anaemia (IDA) is uncommon below 6 months of age in term born child with normal birth weight. (b) Most thalassaemics are normal at birth and usually start becoming anaemic between 6-18months of age. (c) Constitutional aplastic anaemia (Fanconi pancytopenia) presents between 5-10 years, whereas congenital pure red cell aplasia can manifest in fi rst few months. (d) Megaloblastic anaemia occurs in infants and toddlers preschool children with prolonged exclusive breastfeeding by undernourished mothers. (e) Presence of splenomegaly and hepatomegaly suggests the diagnosis of either haemolytic anaemia or leukaemia (usually there is associated lymphadenopathy) or anaemia of chronic infection/inflammation. (f) Presence of petechial and/or purpuric spots is suggestive of concomitant thrombocytopenia and points towards the diagnosis of acute leukaemia, aplastic anaemia or megaloblastic anaemia.
INVESTIGATIONS	Initial investigations to be carried out in cases of anaemia—estimation of Hb%, TLC, DLC and platelet count, examination of peripheral blood smear for RBC size and shapes, anisopoikilocytosis, presence of immature cells and haemoparasites, reticulocyte count. Currently, most of the laboratories use electronic cell counters for haematological investigations which give additional useful information such as MCV, MCH, MCHC, etc.

	The following important information can be gathered from the above investigations: (a) Type of anaemia on the basis of cell size, such as microcytic (MCV <80fl), normocytic and macrocytic (MCV >90fl), and on the basis of Hb content, i.e. hypochromic ornormochromic. (b) Associated thrombocytopenia and/or neutropenia (bicytopenia or pancytopenia) is suggestive of aplastic anaemia, megaloblastic anaemia, or bone marrow infiltration due to leukaemia, etc. (c) Increased, normal or decreased reticulocyte count is suggestive whether anaemia is due to decreased production or increased destruction of RBCs.
DIFFERENTIAL DIAGNOSIS	The following section describes the differential diagnosis of cases of anaemia according to preliminary investigations results: 1. **Microcytic hypochromic anaemia** Two important causes are: i. IDA—reticulocyte count is normal or mildly elevated. ii. Thalassaemia major—reticulocyte count is usually 4-6%. Peripheral smear also shows target cells and numerous nucleated RBCs. Elevated foetal haemoglobin (HbF) on blood electrophoresis confirms the diagnosis. Lead poisoning and pyridoxine responsive anaemia, sideroblastic anaemia and copper deficiency are rare. 2. **Macrocytic normochromic anaemia** i. Megaloblastic anaemia of B12 and folate deficiency is common and may have associated neutropenia and/or thrombocytopenia. Reticulocyte count is usually low. Bone marrow examination reveals megaloblastic changes. ii. Other causes of macrocytic anaemia are liver diseases, hypothyroidism, thiamine deficiency and some inborn errors of metabolism. 3. **Normocytic normochromic anaemia** This group comprises a large number of causes: i. Congenital or acquired aplastic anaemia—usually have bicytopenia or pancytopenia and decreased reticulocyte count. Bone marrow aspiration or biopsy is confirmatory. ii. Bone marrow infiltration such as leukaemia and other neoplasms, storage disorders, myelofibrosis, etc. Diagnosis is confirmed by bone marrow examination. iii. Haemolytic anaemia—such as immune haemolysis, hereditary spherocytosis, G6PD deficiency, etc. Reticulocyte count is increased. iv. Anaemia resulting from acute blood loss.
CAUSES	• Nutritional deficiency

	• Prematurity, • Perinatal blood loss • Cow milk feeding
CLINICAL FEATURES	• Pallor, • Irritability, • Pica • Absence of organomegaly and lymphadenopathy (10-15% may have mild splenomegaly).
TREATMENT	Iron deficiency anaemia is very common between the age of 9 month and 1 year because of transition of diet and is also known as physiological anaemia of infancy. Regular supplementation of iron in dose of 1mg/kg/day is recommended in children after 6 month of age and in premature babies, after 4 months of age. If any child does not respond to oral therapy, then he should be investigated for other cause of anaemia such as: **Non pharmacological** After the period of exclusive breastfeeding (6 months), cereal based diet should be added. Encourage green leafy vegetables and fruits. **Pharmacological** **Severe anaemia (Hb <6 g/dl)** Blood transfusion to all children with Hb ≤ 4g/dl and children with Hb 4-6 g/dl with any of the following: dehydration, shock, impaired consciousness, heart failure, fast breathing, very high parasitaemia (>10 of RBCs) 1. Give packed cell transfusion, usually 2-3 ml/kg at one time under close monitoring to severely anaemic children (Hb <4-5 g/dl). 2. Inj. Frusemide (1 mg/kg/dose) may be administered, if there is evidence of cardiovascular overload. **Mild (<11 g/dl) to moderate anaemia (6-9 g/dl)** **Initiation of therapy** - Oral ferrous salts (sulphate, gluconate, etc.) are the preferred therapeutic iron preparation. Syr./Drops/Tab. Ferrous Sulphate/Ferrous gluconate/Ferrous fumarate 2-3 mg/kg/day of elemental iron in 2-3 divided doses to be given between meals for 8-12 weeks after normal Hb concentration for age is achieved. Older children who can take tablets Iron Folic acid tablets and Tab Vitamin B12 Usual Iron preparations have 35-50 mg elemental iron per 5 ml of syrup or per ml of drops. Elemental content of various ferrous salts is – Ferrous sulphate 20%, Ferrous gluconate 12%, Ferrous fumarate 33%, Colloidaliron 50%. (**Caution:** Milk or milk products, tea or any other calcium preparation should particularly be avoided one hour before or after the drug). **Response to therapy** - Decreased irritability and improved appetite is

	seen in 12-24 hours. Reticulocytosis is seen within 2-3 days and rise in Hb is noticeable by 5th-7th day. Rate of rise of Hb is0.25-0.4 g/dl/day (daily or even weekly estimation of Hb% is not required). Usually normal Hb levels are obtained by about 8-12 weeks. If the response is inadequate, check for the prescribed dose, compliance, presence of diarrhoea and/or mal absorption, infections (particularly urinary tract infection and tuberculosis), occult blood loss or congenital hemolytic anaemia and disorders of RBC production(β thalassaemia trait) which may have been misdiagnosed as IDA. **Modification or step up therapy** - ***Parenteral iron therapy is usually not recommended in children***. However, it is necessary, if there is interference to absorption of oral iron, chronic diarrhoea or malabsorption, occult bleeding from GIT when oral iron therapy may not maintain desired Hb. Parenteral iron therapy may also be used in severely anaemic child not likely to take oral therapy because of socioeconomic reasons. When parentral iron is required, the total dose may be calculated: Dose of iron required (mg) = wt (kg) × 2.5 × Hb deficit Hb deficit is the difference of desired normal Hb and present Hb. To this dose, 10 mg/kg should be added for replenishing the stores. Inj. Iron Dextran or Iron Sorbitol Citric acid complex (50 mg/ml) deep gluteal IM injection (preferred) or infusion after a test dose. The total dose of iron may be given as a single dose IV or as multiple daily doses IM not exceeding 5 mg/kg/dose spread over several days, if the volume is too large.
REFERENCES	*Diseases of the Blood. In: Nelson's Textbook of Paediatrics. Kliegman RM, Stantun, St Geme, Schor,20th Edition, Harcourt Publishers International Company, 2015.*

6. Biosafety Level 3

Biosafety Level 3 is applicable to clinical, diagnostic, teaching, research, or production facilities where work is performed with indigenous or exotic agents that may cause serious or potentially lethal disease through the inhalation route of exposure. Laboratory personnel must receive specific training in handling pathogenic and potentially lethal agents, and must be supervised by scientists competent in handling infectious agents and associated procedures. All procedures involving the manipulation of infectious materials must be conducted within BSCs or other physical containment devices.

A BSL-3 laboratory has special engineering and design features.

The following standard and special safety practices, equipment, and facility requirements apply to BSL-3.

A. Standard Microbiological Practices

1. The laboratory supervisor must enforce the institutional policies that control access to the laboratory

2. Persons must wash their hands after working with potentially hazardous materials and before leaving the laboratory.

3. Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human consumption must not be permitted in laboratory areas. Food must be stored outside the laboratory area in cabinets or refrigerators designated and used for this purpose.

4. Mouth pipetting is prohibited; mechanical pipetting devices must be used.

5. Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware must be developed and implemented. Whenever practical, laboratory supervisors should adopt improved engineering and work practice controls that reduce risk of sharps injuries. Precautions, including those listed below, must always be taken with sharp items. These include:

a. Careful management of needles and other sharps are of primary importance. Needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal.

b. Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.

c. Non-disposable sharps must be placed in a hard walled containerfor transport to a processing area for decontamination, preferably by autoclaving.

d. Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plastic ware should be substituted for glassware whenever possible.

6. Perform all procedures to minimize the creation of splashes and/or aerosols.

7. Decontaminate work surfaces after completion of work and after any spillor splash of potentially infectious material with appropriate disinfectant.

8. Decontaminate all cultures, stocks, and other potentially infectious materials before disposal using an effective method. A method for decontaminating all laboratory wastes should be available in the facility, preferably within the laboratory (e.g., autoclave, chemical disinfection, incineration, or other validated decontamination method). Depending on where the decontamination will be performed, the following methods should be used prior to transport:

a. Materials to be decontaminated outside of the immediate laboratory must be placed in a durable, leak proof container and secured for transport.

b. Materials to be removed from the facility for decontamination must be packed in accordance with applicable local, state, and federal regulations.

9. A sign incorporating the universal biohazard symbol must be posted at the entrance to the laboratory when infectious agents are present. Posted information must include the laboratory's biosafety level, the supervisor's name (or other responsible personnel), telephone number, and

required procedures for entering and exiting the laboratory. Agent information should be posted in accordance with the institutional policy.

10. An effective integrated pest management program is required.

11. The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, and exposure evaluation procedures. Personnel must receive annual updates or additional training when procedural or policy changes occur. Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. Therefore, all laboratory personnel and particularly women of childbearing age should be provided with information regarding immune competence and conditions that may predispose them to infection. Individuals having these conditions should be encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

B. Special Practices

1. All persons entering the laboratory must be advised of the potential hazards and meet specific entry/exit requirements.

2. Laboratory personnel must be provided medical surveillance and offered appropriate immunizations for agents handled or potentially present in the laboratory.

3. Each institution should consider the need for collection and storage of serum samples from at-risk personnel.

4. A laboratory-specific biosafety manual must be prepared and adoptedas policy. The biosafety manual must be available and accessible.

5. The laboratory supervisor must ensure that laboratory personnel demonstrate proficiency in standard and special microbiological practices before working with BSL-3 agents.

6. Potentially infectious materials must be placed in a durable, leak proof container during collection, handling, processing, storage, or transport within a facility.

7. Laboratory equipment should be routinely decontaminated, as well as, after spills, splashes, or other potential contamination.

a. Spills involving infectious materials must be contained, decontaminated, and cleaned up by staff properly trained and equipped to work with infectious material.

b. Equipment must be decontaminated before repair, maintenance, or removal from the laboratory.

8. Incidents that may result in exposure to infectious materials must be immediately evaluated and treated according to procedures described in the laboratory biosafety manual. All such incidents must be reported to the laboratory supervisor. Medical evaluation, surveillance, and treatment should be provided and appropriate records maintained.

9. Animals and plants not associated with the work being performed must not be permitted in the laboratory.

10. All procedures involving the manipulation of infectious materials must be conducted within a BSC, or other physical containment devices. No work with open vessels is conducted on the bench. When a procedure cannot be performed within a BSC, a combination of personal protective equipment and other containment devices, such as a centrifuge safety cup or sealed rotor must be used.

C. Safety Equipment (Primary Barriers and Personal Protective Equipment)

1. All procedures involving the manipulation of infectious materials must be conducted within a BSC (preferably Class II or Class III), or other physical containment devices.

2. Workers in the laboratory where protective laboratory clothing with a solid-front, such as tie-back or wrap-around gowns, scrub suits, or coveralls. Protective clothing is not worn outside of the laboratory. Reusable clothing is decontaminated before being laundered. Clothing is changed when contaminated.

3. Eye and face protection (goggles, mask, face shield or other splash guard) is used for anticipated splashes or sprays of infectious or other hazardous materials. Eye and face protection must be

disposed of with other contaminated laboratory waste or decontaminated before reuse. Persons who wear contact lenses in laboratories must also wear eye protection.

4. Gloves must be worn to protect hands from exposure to hazardous materials. Glove selection should be based on an appropriate riskassessment. Alternatives to latex gloves should be available. Gloves must not be worn outside the laboratory. In addition, BSL-3 laboratory workers:

a. Changes gloves when contaminated, glove integrity is compromised, or when otherwise necessary. Wear two pairs of gloves when appropriate.

b. Remove gloves and wash hands when work with hazardous materials has been completed and before leaving the laboratory.

c. Do not wash or reuse disposable gloves. Dispose of used gloves with other contaminated laboratory waste. Hand washing protocols must be rigorously followed.

5. Eye, face, and respiratory protection must be used in rooms containing infected animals.

D. Laboratory Facilities (Secondary Barriers)

1. Laboratory doors must be self-closing and have locks in accordance with the institutional policies. The laboratory must be separated from areas that are open to unrestricted traffic flow within the building. Laboratory access is restricted. Access to the laboratory is through two self-closing doors. A clothing change room (anteroom) may be included in the passageway between the two self-closing doors.

2. Laboratories must have a sink for hand washing. The sink must be hands-free or automatically operated. It should be located near the exit door. If the laboratory is segregated into different laboratories, a sink must also be available for hand washing in each zone. Additional sinks may be required as determined by the risk assessment.

3. The laboratory must be designed so that it can be easily cleaned and decontaminated. Carpets and rugs are not permitted. Seams, floors, walls, and ceiling surfaces should be sealed. Spaces

around doors and ventilation openings should be capable of being sealed to facilitate space decontamination.

a. Floors must be slip resistant, impervious to liquids, and resistant to chemicals. Consideration should be given to the installation of seamless, sealed, resilient or poured floors, with integral cove bases.

b. Walls should be constructed to produce a sealed smooth finish that can be easily cleaned and decontaminated.

c. Ceilings should be constructed, sealed, and finished in the same general manner as walls. Decontamination of the entire laboratory should be considered when there has been gross contamination of the space, significant changes in laboratory usage, for major renovations, or maintenance shut downs. Selection of the appropriate materials and methods used to decontaminate the laboratory must be based on the risk assessment.

4. Laboratory furniture must be capable of supporting anticipated loads and uses. Spaces between benches, cabinets, and equipment mustbe accessible for cleaning.

a. Bench tops must be impervious to water and resistant to heat, organic solvents, acids, alkalis, and other chemicals.

b. Chairs used in laboratory work must be covered with a non-porous material that can be easily cleaned and decontaminated with appropriate disinfectant.

5. All windows in the laboratory must be sealed.

6. BSCs must be installed so that fluctuations of the room air supply andexhaust do not interfere with proper operations. BSCs should be located away from doors, heavily traveled laboratory areas, and other possibleairflow disruptions.

7. Vacuum lines must be protected with HEPA filters, or their equivalent. Filters must be replaced as needed. Liquid disinfectant traps may be required.

8. An eyewash station must be readily available in the laboratory.

9. A ducted air ventilation system is required. This system must provide sustained directional airflow by drawing air into the laboratory from “clean”areas toward “potentially contaminated” areas. The laboratory shall be designed such that under failure conditions the airflow will not be reversed.

a. Laboratory personnel must be able to verify directional airflow. A visual monitoring device, which confirms directional airflow, must be provided at the laboratory entry. Audible alarms should be considered to notify personnel of air flow disruption.

b. The laboratory exhaust air must not re-circulate to any other area of the building.

c. The laboratory building exhaust air should be dispersed away from occupied areas and from building air intake locations or the exhaust air must be HEPA filtered. HEPA filter housings should have gas-tight isolation dampers, decontamination ports, and/or bag-in/bag-out (with appropriate decontamination procedures) capability. The HEPA filter housing should allow for leak testing of each filter and assembly. The filters and the housing should be certified at least annually.

10. HEPA filtered exhaust air from a Class II BSC can be safely re-circulated into the laboratory environment if the cabinet is tested and certified at least annually and operated according to manufacturer’s recommendations. BSCs can also be connected to the laboratory exhaust system by either a thimble (canopy) connection or directly exhausted to the outside through a hard connection. Provisions to assure proper safety cabinet performance and air system operation must be verified. BSCs should be certified at least annually to assure correct performance. Class III BSCs must be directly (hard) connected up through the second exhaust HEPA filter of the cabinet. Supply air must be provided in such a manner that prevents positive pressurization of the cabinet.

11. A method for decontaminating all laboratory wastes should be available in the facility, preferably within the laboratory (e.g., autoclave, chemical disinfection, or other validated decontamination method).

12. Equipment that may produce infectious aerosols must be contained in primary barrier devices that exhaust air through HEPA filtration or other equivalent technology before being discharged into the laboratory. These HEPA filters should be tested and/or replaced at least annually.

13. Facility design consideration should be given to means of decontaminating large pieces of equipment before removal from the laboratory.

14. Enhanced environmental and personal protection may be required by the agent summary statement, risk assessment, or applicable local, state, or federal regulations. These laboratory enhancements may include, for example, one or more of the following: an anteroom for clean storage of equipment and supplies with dress-in, shower-out capabilities; gas tight dampers to facilitate laboratory isolation; final HEPA filtration of the laboratory exhaust air; laboratory effluent decontamination; and advanced access control devices, such as biometrics.

15. The BSL-3 facility design, operational parameters, and procedures must be verified and documented prior to operation. Facilities must be re-verified and documented at least annually.

Animal Biosafety Level 3 Checklist
The following items fall under the category of secondary barriers pertaining to the laboratory facility design.

Item	Issue	Y/N	Comment
1	Signage: biohazard sign, agents used, name, and telephone number.		
2	Lab separated from building traffic.		
3	Self-closing and self-locking door at entry.		
4	Movement of supplies or wastes can be through a separate double-door access or autoclave.		
5	Double-door entry (inward opening) into the animal room that includes a change room and shower(s).		
6	A hands-free or automatically operated hand wash-		

	ing sink is provided in each animal room near the exit door.		
7	Internal building services such as light fixtures, duct-work, and piping are arranged to minimize horizon-tal surfaces.		
8	Interior of surfaces of walls, floors, and ceilings where BSL-3 agents are handled are constructed for easy cleaning and decontamination.Walls, ceilings, and floors should be smooth, impermeable to liquids and resistant to chemicals. Seams, if present should be sealed.		
9	Windows are not recommended. Any windows must be resistant to breakage and must be sealed.		
10	Ventilation should be provided in accordance with criteria from the Guide for the Care and Use of Laboratory Animals.		
11	A ducted ventilation system is provided to create directional airflow from clean areas toward contami-nated areas.		
12	Exhaust air is not re-circulated to any other area of the building.		
13	The outside exhaust must be dispersed away from occupied areas and air intakes or must be HEPA-fil-tered.		
14	Lab personnel must verify direction of airflow. Provide visual monitoring device at animal room entry.		
15	Consideration should be given to installing an HVAC control system to prevent sustained positive pressur-ization of the animal spaces.		
16	Audible alarms to notify personnel of HVAC system failure.		
17	Biological safety cabinets, when connected to the exhaust system must be done in a manner that avoids		

	interference with the air balance of the cabinets or building exhaust system.		
18	Biological safety cabinets are located away from doors, room supply louvers, and from heavily-traveled areas.		
19	Vacuum lines are to be protected with disinfectant traps and HEPA filters.		
20	Eyewash station available inside the laboratory?		
21	Illumination adequate for all activities?		
22	A method for decontaminating all laboratory wastes is available in the facility.		

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