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Management of Heat Stress and Related Illnesses

(A Guide for Policy Makers and Managers)

Indian Institute of Public Health, Bhubaneswar (IIPHB)

DECLARATION

LIST OF CONTRIBUTORS

Dr Bhuputra Panda, Additional Professor, PHFI-IIPH Bhubaneswar
Dr Ambarish Dutta, Additional Professor, PHFI-IIPH Bhubaneswar
Dr Upasona Ghosh, Senior Lecturer, PHFI-IIPH Bhubaneswar
Dr Kamal Lochan Mishra, ED, OSDMA, Government of Odisha
Mr Satya Ranjan Sahoo, CGM, OSDMA, Government of Odisha
Prof Dileep Mavalankar, Director, IIPH Gandhinagar
Prof Ajit Tyagi, Senior Advisor, IRADe
Mr Rohit Magrota, Deputy Director, IRADe
Dr Mahaveer Golechha, Associate Professor, IIPH Gandhinagar

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Contact: bhuputra.panda@iiphb.org

Management of Heat Stress and Related Illnesses

(A Guide for Policy Makers and Managers)

Indian Institute of Public Health, Bhubaneswar (IIPHB)
Plot No: 267/3408, Jaydev VIhar, Mayfair Lagoon Hotel Road, Bhubaneswar - 751013
Phone: +91-674-6655601

ODISHA STATE DISASTER MANAGEMENT AUTHORITY

(A GOVERNMENT OF ODISHA AGENCY)

OSDMA

FOREWORD

1st March, 2021

Heatwave is considered as a potential public health hazard. Emerging evidences suggest systematic planning, development of heat health warning system, capacity building of key stakeholders and effective inter-sectoral coordination could reduce heat-related risks to a great extent. It is important that public-health measures and advice on how to avoid negative health outcomes associated with extreme heat wave conditions, are communicated in advance.

Over the years, Government of Odisha has devoted significant time and resources to planning, management and mitigation of heatwave effects on the general population of the State. Considering the need for close coordination between meteorological offices, the health department and other line departments, the Odisha State Disaster Management Agency (OSDMA) was identified as the nodal agency for preparation of the heat action plan for the State.

The Indian Institute of Public Health (IIPH) - Bhubaneswar under the aegis of Public Health Foundation of India (PHFI) has been a technical partner of OSDMA for conducting research on vulnerability assessment and threshold studies in various cities/towns, and for building capacity of key officials on management of health stress and related illnesses.

I am happy to share that IIPH Bhubaneswar has developed a guide for capacity building of policy makers and managers on this theme. The guide has rich information on heat wave situation, early warning measures, preparedness of the health system, clinical management of heat stress cases and monitoring framework for day to day implementation of heat wave mitigation activities.

It is hoped that the guide developed by IIPHB will act as a catalyst for bringing together key stakeholders from health, education, emergency and other related departments for timely decision-making at state, district and sub-district levels.

DC-cum-ACS &
Managing Director, OSDMA

9th Floor, Rajiv Bhawan, Unit-5, Bhubaneswar-751001, Phone: (0674) 2395398, 2395531, Fax: (0674) 2391871
E-mail: osdma@osdma.org, Website: www.osdma.org

Dr Subhash Salunke

ଭାରତୀୟ ଜନସ୍ୱାସ୍ଥ୍ୟ ସଂସ୍ଥାନ ଭୁବନେଶ୍ୱର

IIPH

INDIAN INSTITUTE of PUBLIC HEALTH

ESTABLISHED BY PHFI

BHUBANESWAR

FOREWORD

2nd March, 2021

It is a well-known fact that climate change has several health consequences. Odisha as a state is prone to many extreme climatic conditions including cyclones, floods and heatwaves. Though considered as a naturalhazard, heatwaves were not getting the due attention for quite some time. However, during last ten years, government of Odisha is focusing on heatwave mitigation plans for the State in general and for cities/towns in particular.

With development of early warning system, training the key stakeholders on heat-related risks and effective communication strategies, adverse effects of heatwave on the general population could be greatly reduced. The Odisha State Disaster Management Agency (OSDMA), responsible for overviewing the disaster response system, has collaborated withIndian Institute of Public Health Bhubaneswar (IIPHB) on several initiatives in the domain of heat stress management – the most recent being conducting vulnerability assessment and training the district officials on heat stress management.

The faculty members from IIPH Bhubaneswar have developed a guide for policy makers and managers on management of heat stress and related illnesses. Many of the materials used in the guide have been derived from the earlier collaborative work of IIPHB with IRADe-IDRC and from other sources available in the public domain. The guide would be of immense help for the day to day implementation of heat wave mitigation activities.

I am confident that the Guide developed by IIPHBwill not only be used as a ready-to-use reference for the policy makers and managers but also act as a resource kit for developing city-specific heat action plans, issuance of public health advice and monitoring of activities of the government.

Dr Subhash Salunke
Senior Advisor, PHFI
Director, IIPH Bhubaneswar

INDIAN INSTITUTE OF PUBLIC HEALTH, BHUBANESWAR
Plot No. 267/3408
Jaydev Vihar
Mayfair Lagoon Road
Bhubaneswar 751 013
Odisha, India

CONTACT
P +91 674 665 5601
E contact@iiphb.org

OUR CENTRES
Gandhinagar
Hyderabad
Delhi
Bengaluru
Bhubaneswar
Shillong

PHFI OFFICE ADDRESS
Plot No. 47, Sector 44,
Institutional Area,
Gurugram 122 002, India
P +91 124 4781400 / 4722900
F +91 124 4781601
E contact@phfi.org

REGISTERED OFFICE
431A, 4th Floor Rectangle No.1
Behind Saket Sheraton Hotel
Commercial Complex D4, Saket
New Delhi 110 017

WWW.PHFI.ORG

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List of Abbreviations

ASHA	:	Accredited Social Health Activist
ACE	:	Angiotensin-Converting Enzyme
ADH	:	Antidiuretic Hormone
CMRF	:	Chief Minister's Relief Fund
DIC	:	Disseminated Intravascular Coagulation
DPH	:	Director of Public Health
IEC	:	Information Education Communication
IIPH	:	Indian Institute of Public Health
IMD	:	India Meteorological Department
GOI	:	Government of India
GOO	:	Government of Odisha
HAP	:	Heat Action Plan
HHWS	:	Heat Health Warning System
HRO	:	High Risk Occupation
HVI	:	Heat Vulnerability Index
HSAP	:	Heat Stress Action Plan
NDMA	:	National Disaster Management Agency
NDRF	:	National Disaster Response Fund
ORS	:	Oral Rehydration Salt
OSDMA	:	Odisha State Disaster Management Agency
PC	:	Principal Component Analysis
SDRF	:	State Disaster Response Fund
STG	:	Standard Treatment Guideline
SEOC	:	State Emergency Operation Center
SIHFW	:	State Institute of Health and Family Welfare
TOT	:	Training of Trainer
UHC	:	Urban Health Centre
UHI	:	Urban Heat Iceland
ULB	:	Urban Local Body
UTI	:	Urinary Tract Infection
WMO	:	World Meteorological Organization

Objectives of the Workshop (TOT mode)

Odisha is a disaster prone State. Over the years, the State has witnessed several episodes of cyclones, floods, natural calamities and heatwaves. While the State has received national and international recognition for its resilience in dealing with such natural calamities, the need for sensitizing the district and state level officials, including the health workforce, on the rising heatwave conditions was long felt. Moreover, the capacity of such key stakeholders in dealing with heat stress and related illnesses needed to be enhanced. Therefore, IIPH Bhubaneswar in collaboration with OSDMA (Government of Odisha) proposed to hold such sensitization-cum-capacity building workshops for key government functionaries in a TOT mode so that knowledge transfers could be ensured in a short period of time. Experts from IIPH Bhubaneswar, IRADe (New Delhi), IIPH Gandhinagar, OSDMA (GoO) and clinical experts will be involved in conducting the sessions for various stakeholders, using this guide as a resource.

This TOT module on heat stress and related illnesses aims to improve knowledge of key stakeholders on the aspects of heatwave and its implications on human health. The chapters in the Module could provide ready-to-use information, guidance and recommendations for the front-line workforce of the government.

This training module was designed, revised and expanded to cover a wide range of audience starting from district education officers to district project officers, district emergency officers, district medical officers working at primary and secondary levels of care, health care providers in the business of medical practice (doctors/ nurses/ para medics etc.), and programme implementers who are involved in day-to-day decision making during heat stress conditions.
Key objectives of this workshop on TOT mode are

1. To sensitize participants about heatwave situation and its associated health outcomes in global, national and local contexts
2. To create awareness on the scientific methods to manage heat stress conditions
3. To transfer knowledge on planning and implementation of heat stress mitigation strategies in various institutions across the state
4. To provide standard treatment protocols for management of heatwave associated health outcomes
5. To prepare them take up the role of district level trainers on heatwave and related illnesses

Outcomes of the Workshop

On completion of this workshop, the participant will

1. Recognize global, Indian and local situation of climate change and heatwave
2. Identify and adopt tools for vulnerability assessment in their respective geographic areas
3. Realize the importance of early warning and systems preparedness to cope with heatwave conditions and mitigate risks
4. Remember the steps in clinical management of heat stress and related illnesses which in turn could help prevent mortalities and morbidities
5. Internalize the monitoring framework and use the tools for monitoring
6. Become a trainer for the front-line work force

Topics covered in this guide

1. Introduction to climate change and heatwave
    - Global situation
    - Indian situation
    - Odisha situation
2. Vulnerability assessment
    - Groups, areas, occupations
    - Tools for vulnerability assessment
3. Early warning and system preparedness to cope with heatwave
    - Interpretation of heat alerts
    - Town-specific Heat action plan
    - IEC, BCC plan
    - Health Advisory for prevention
    - Role of OSDMA in Odisha
4. Clinical management of heat stress cases
    - Signs and symptom, diagnosis, management protocol
    - Hospital preparedness to deal with heat stress cases
5. Monitoring framework
    - Role of data
    - Collection methods
    - Analysis plan

Chapter 1: Climate Change and Rising Temperatures: World, India and Odisha

Climate Change is causing an increase in severity and frequency of extreme weather events and disasters. Heat is a well-known weather-related hazard and has been associated with increase in both mortalities and morbidities[1–3]. Extreme temperatures are among the most dangerous natural hazards, but rarely received due attention until early 21st century. Conditions of extreme temperature and high humidity adversely affect a vast majority of people living in temperate climatic zones which results in a lot of physiological stress and sometimes even death. About 25,716 deaths were reported from 1992 to 2016 due to heatwaves in our country[4]. However, there is no scientific study on assessment of actual number of fatalities thus far, therefore the cited data could just be the tip of an iceberg. According to recent estimates, such kind of extreme climatic conditions and the resultant mortalities and morbidities are likely to rise over the years.

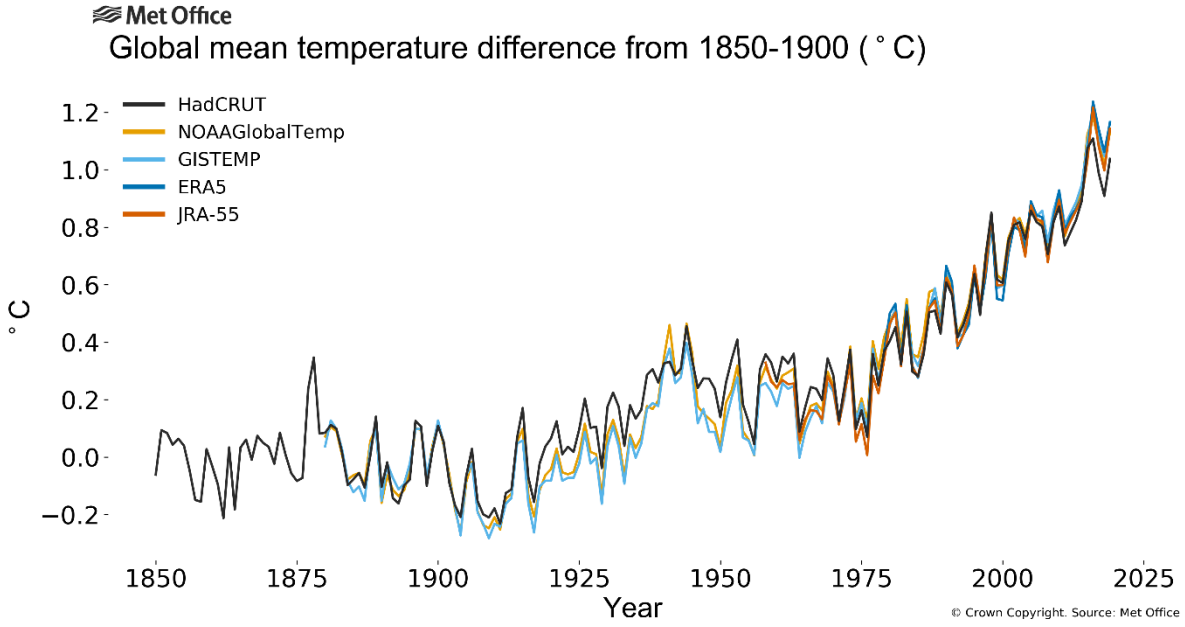
A global survey was conducted by the WHO on 'Health and Climate Change' during 2017-18 in which 101 countries participated. The survey included domains such as early-warning and response systems, integrated risk surveillance; vulnerability and adaptation assessments/ action on adaptation priorities; research and knowledge; capacity building; health services and technology; communications and advocacy; regulation; climate-resilient health facilities; and community empowerment.

The report found the following challenges[5]:

- National Planning on Health and Climate Change is Advancing but there is a Need to Strengthen the Comprehensiveness of Strategies and Plans
- Implementing Action on Key Health and Climate Change Priorities Remains Challenging for Countries
- Findings from Vulnerability and Adaptation Assessments for Health are Influencing Policy Prioritization
- Barriers to Accessing International Climate Finance for Health Adaptation and Mitigation Persist
- Multisectoral Collaboration on Health and Climate Change Policy is Evident yet Progress in this Area Seems Uneven across Sectors

The World Meteorological Organization (WMO) provisional report on the state of global climate (2019) says that the global average temperature in 2019 (January to October) was about 1.1 degrees Celsius above the pre-industrial period[6] (Figure 1). It further predicts the casualties due to heatwaves to become double in less than 20 years.

Figure 1 – Global mean temperature difference from 1850-1900



As per the press release of WMO on 3rd December, 2019, two major s occurred in Europe in late June and late July of 2019. In France, a national record of 46.0°C (1.9°C above the previous record) was set on 28 June 2019. National records were also set in Germany (42.6°C), the Netherlands (40.7°C), Belgium (41.8°C), Luxembourg (40.8°C) and the United Kingdom (38.7°C), with the heat also extending into the Nordic countries, where Helsinki had its highest temperature on record (33.2°C on 28 July).

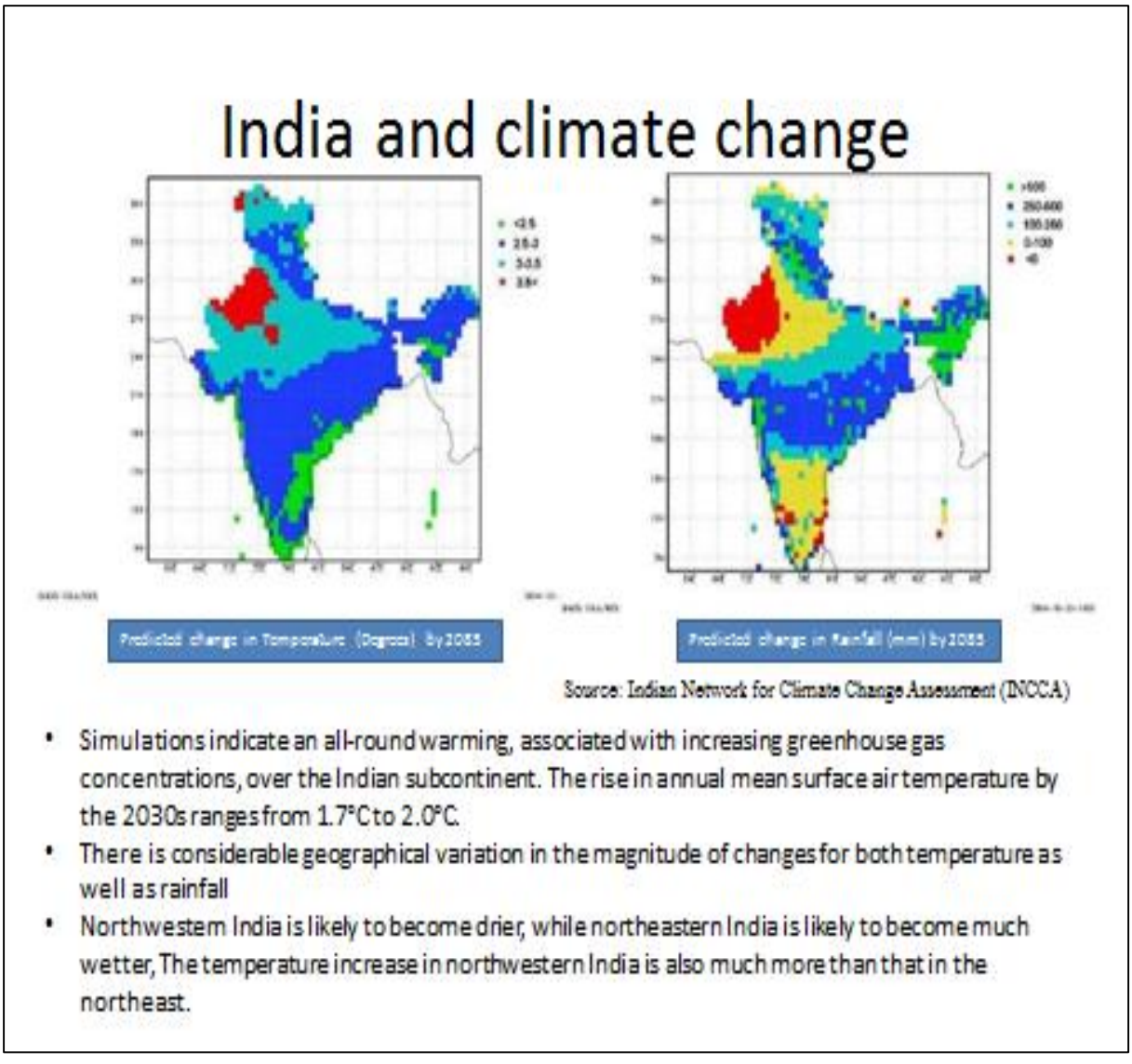
Australia had an exceptionally hot summer in 2019. The mean summer temperature was the highest on record by almost 1°C, and January was Australia's hottest month on record. The heat was most notable for its persistence but there were also significant individual extremes, including 46.6°C at Adelaide on 24 January, the city's highest temperature on record[6].

In India, March to June are typically the hottest months with temperatures reaching up to 45 to 48 degrees Celsius in certain areas before the cooling southwest monsoon arrives in July. During these summer months, it is extremely important to prevent heat related adverse events at district and sub-district levels with special focus on the vulnerable groups (eg, women

children, elderly, and slum dwellers). Development and implementation of a plan for adaptation to the temperature changes is as important as monitoring the short-term and long-term effects of exposure to heat stress.

In view of the ever-increasing temperature graphs across India, state governments and local governments in cities and regions in India are taking concrete steps to better prepare and protect local communities from the deadly heat (Figure 2). Emerging evidences indicate that heat related risks might be reduced through systemic development of city-specific / region-specific Heat Action Plans (HAP) that includes establishment of early warning systems, development of community awareness strategies and building capacity of key stakeholders at district and sub-district levels.

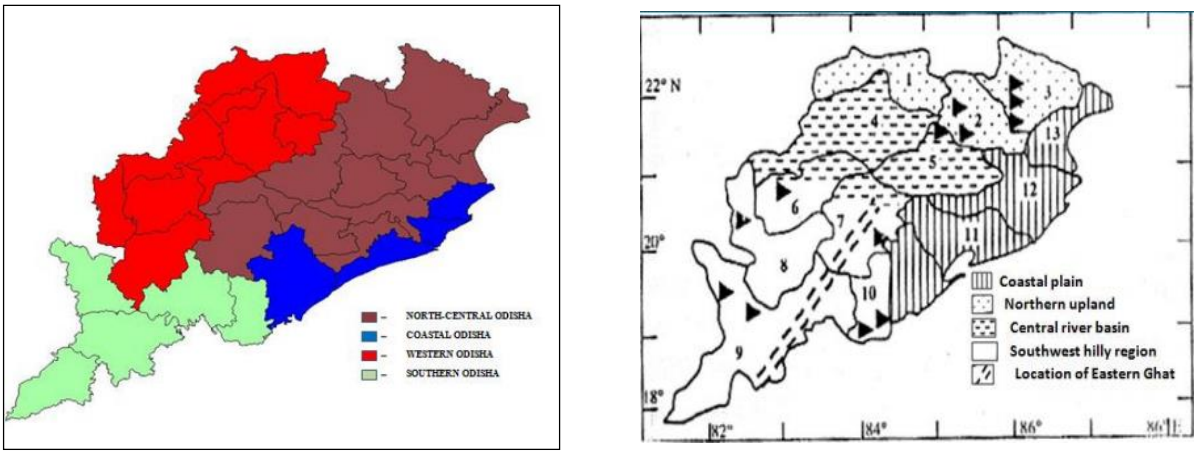
Figure 2 – India and climate change



Heatwave Situation in Odisha

Odisha is surrounded by the states of West Bengal to the north-east, Jharkhand to the north, Chhattisgarh to the west and north-west, Telangana to the south-west and Andhra Pradesh to the south. The state has 480 km of coastline along the Bay of Bengal on its east. As per 2011 Census Report, Odisha had about 4.20 Crore population with a sex ratio of 979 women per 1000 men. The population density in the State was 270 per square kilometer. With a blend of several physiographical features in Odisha, the state exhibits three broad distinct morphological features: coastal plains, southern mountainous and plateau, and western rolling uplands. The summer season in Odisha commences in March and stretches till June. The maximum temperature of Odisha, in the summer season, goes well above 40 degree Celsius in many regions. The pattern of Heatwave is different in different parts of the state: for instance, the coastal area experiences humid heat, whereas western regions experience more dry heat[7]. Different temperature zones and temperature ranges are given in (Figure 3)[7].

Figure 3 - Different temperature zones in Odisha and their temperature ranges



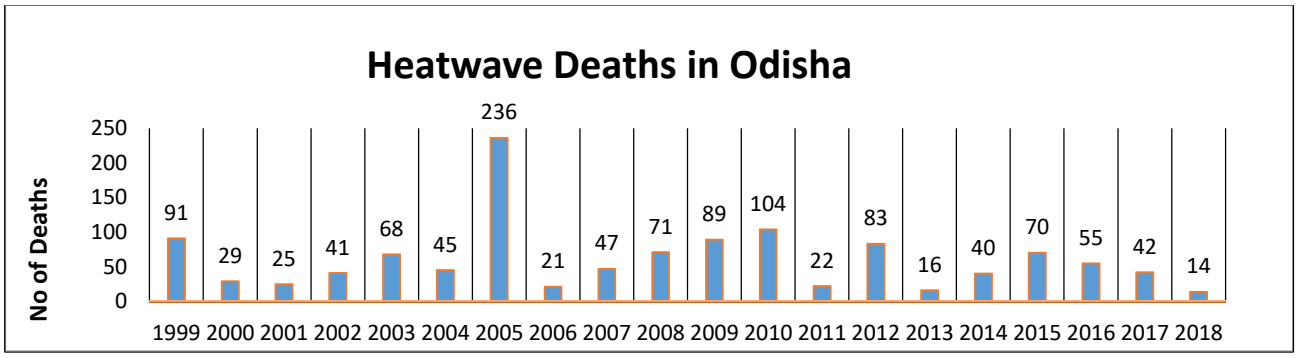
Coastal Odisha:θ>=35^0 C < 39^{0}C (Gopalpur, Paradeep, Puri); North-Central Odisha:θ>=42^{0}C < 44.5^{0}C (Balasore, Cuttack, Baripada, Phulabani, Keonjhar, Chandbali, Bhubaneswar); Western Odisha:θ>=44.5^{0}C <= 48^{0}C (Titilagarh, Bhawanipatna, Jharsuguda, Bolangir, Anugul, Sambalpur, Sundergarh, Hirakud) and Southern Odisha:θ>39^{0}C <=40^{0}C (Koraput)

Source: OSDMA Report, 2019

The pathophysiological mechanisms of the heat impact on the human body involve dehydration, increased blood viscosity and an impairment of the endothelial function, which enhances the risk for thrombo-embolic diseases and cardiovascular events[1,8,9]. Apart from impact on human life, heatwaves significantly affect economic productivity, crop production, and day-to-day work of various occupations.

As per the report of the Odisha State Disaster Management Agency (OSDMA, 2019), in the year 1998, the State of Odisha faced an unprecedented Heatwave situation which resulted in loss of 2042 lives. In the year 1999, the state implemented the first Heat Action Plan (HAP). Though extensive awareness campaigns have largely been reduced after the 1998 episode, still the number of casualties over the years is increasing. The vulnerable groups (farmers, daily workers, weaker sections) face the harshest consequences of exposure to heatwave conditions. Despite having a HAP in place the state experienced another massive Heatwave casualty in the year 2005 during which 236 lives were reportedly lost. Deaths due to heatwave in Odisha from 1999 to 2018 are summarized in Figure 4[7].

Figure 4 - Heatwave related deaths in Odisha (1999-2018)



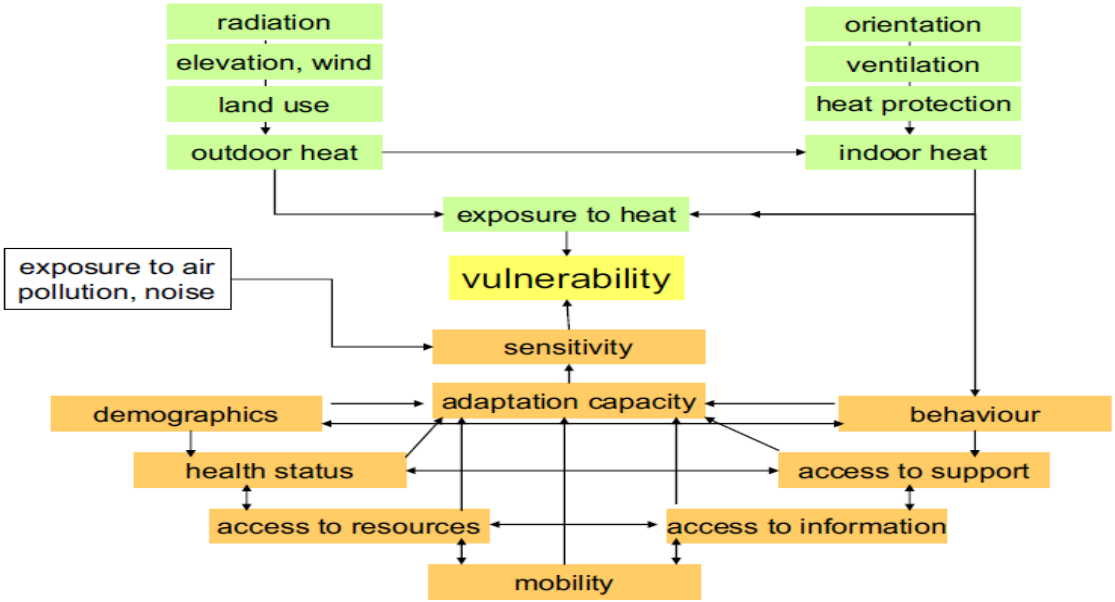
(Source: O/o Special Relief Commissioner, Odisha, 2019)

Chapter 2: Vulnerability Assessment

'Vulnerability' is defined as the inclination of an entity or a system to be negatively influenced by a hazard. Vulnerability also includes the concepts of sensitivity (the susceptibility to harm) and adaptive capacity (the capacity to cope and adapt)[10]. Health vulnerability is a complex and multidimensional concept because it encompasses individual biophysical characteristics as well as population-level characteristics. Age, income, discrimination, social isolation, vegetation, and health characteristics are some of those factors[11,12]. It is essential to conduct vulnerability assessment studies to identify communities in need of prioritized and focused interventions. Heat Vulnerability Indices (HVI) may be useful for screening and targeted risk-mitigation interventions.

Vulnerability to heatwave is affected by exposure to heat and the sensitivity of the individual. Physical factors such as, radiation, altitude, wind and land use that influence outdoor temperature. Whereas, orientation of houses, availability of windows, ventilation and heat protection measures influence the indoor temperature. Both in turn influence human exposure to heat (Figure 5).

Figure 5 – Factors affecting vulnerability and sensitivity to heatwave



Source: Tanja Wolf and Glenn McGregor. 2013. The development of a heatwave vulnerability index for London, United Kingdom, WHO European Centre for Environment and Health, Platz der Vereinten Nationen 1, 53113 Bonn, Germany.

On the other hand, sensitivity of people to heat depends on a number of factors, which may modulate adaptive capacity and the ability to cope with extreme temperatures. Adaptive capacity is further influenced by demographic characteristics (age, gender, family structure), health status (presence of co-morbidities), access to resources, support system, access to information and nature of mobility[13].

Exposure to heatwave conditions has direct and indirect health implications which are influenced by a complex interaction amongst physiological, environmental, and socio-economic factors. Past studies across the globe summarize that heatwaves could pose serious life threats to citizens and such risks increase manifold for certain sub-groups who are more vulnerable as compared to others. Those groups need special attention in terms of prevention, management and mitigation plans of the state government and local governments.

To make cities 'climate proof" is to undertake a substantial modification in the ways many things in the city are planned, designed and managed. It includes both the strategies to reduce climate change emissions, and to make the urban systems more resilient to impact of climate changes[10]. The first step towards a heat resilience city/town/region is to identify, map and assess the vulnerability of the population living in the area. Heatwave and health vulnerability assessment allows health department/ medical stakeholders to better understand and identify the people and places in the city that are more likely to face the adverse health impacts associated with heatwaves. Such assessment exercises subsequently help the city planners and implementers in targeted interventions to minimize health risks from heatwaves.

Vulnerable geographic areas during Heatwave

Heatwaves often result in rise in the differential temperatures between various parts of a city or region, consequently certain pockets become much hotter than the rest. The air, surface and soil temperatures in these areas influence the overall temperatures which results in considerable discomfort to people residing in those areas. Therefore, identification of such 'heat-retention' areas is critical to minimizing adverse events due to heatwave. This would help policy makers, planners and medical stakeholders in developing heat preparedness plans at local levels. Vulnerable areas within cities are enlisted as:

Slums: The poor population in these areas are affected more, due to their poor coping mechanisms and limited ability of the inhabitants to respond to health challenges during heatwave episodes. The night time outdoor microclimatic conditions along with poor housing

structure and poor access to services makes it extremely difficult to cope with heat stress. Women and children in these areas face the brunt the most.

Low income group neighborhoods: The inhabitants in low income group neighborhoods suffer from heat stress due to poor habitation, limited access to essential services and poor housing structures. It has been observed that people living in higher floors with poor ventilation and bad orientation of the buildings get adversely affected. People with disabilities and co-morbidities are equally affected as well.

Heatwave vulnerable hotspots: The hotspots identified by vulnerability assessment exercises experience significant rise in temperature as compared to rest of the city. These areas are most likely to report higher number of adverse events during heatwaves

Vulnerable groups during Heatwave

Women and children, infants and elderly, construction workers and traffic police, people from economically weaker sections and those with comorbidities are largely affected during heat stress conditions. Identification of these groups is much needed to avail medical professionals and to prioritize interventions within a town or city.

Woman: Women are more at risk of heat related mortality, as their ability to thermo-regulate is compromised. There are increasing evidences of still births among pregnant women who are exposed to heatwaves. Adverse social norms and gender discrimination further add to their problem.

Infants: With a different metabolic mechanism and poor ability to adjust to changes in temperatures, infants sweat less which considerably decreases their ability to cool down the body. Infants are more susceptible to heat-related deaths.

Children: They are physiologically more vulnerable to heat stress than adults. Heat related illnesses are associated with their physical activity, production of more metabolic heat/ kilogram in comparison to body weight, dehydration and lower cardiac output. Active surveillance is necessary during heatwave episodes with special focus on women

Elderly citizens: They are at a greater risk of related morbidity and mortality. With aging the cardiac output and capacity to circulate blood to the periphery reduces which pose serious health challenges.

Working Individuals: Those working in both indoors and outdoors during summer (eg, farmers, daily labourers, traffic police, construction workers) are at greater risk to dehydration and heat stress. Their capacity to thermoregulate get compromised on a regular basis; and exposure to heat for long durations leads to dehydration, kidney diseases, cardiovascular and pulmonary illnesses. Clothing patterns, use of PPE kits may hinder cooling down.

Economically Weaker Sections of Society: They often lack awareness and means to use protective measures. Many of these people suffer from chronic diseases which often gets aggravated because of prolonged exposure to heatwave.

People with Disabilities: They are most vulnerable to heatwaves as their ability to receive or respond to heat alerts is substantially reduced. In certain cases, such as spinal cord injury, the body doesn't allow itself to sweat. Besides, any form of physical or mental disability adds to their vulnerability to heatwave. Moreover, the information, education and communication (IEC) strategies adopted by the government often are not suitable for people with hearing loss or blindness.

Patients with chronic co-morbidities: Patients under chronic medication compromise their ability to gauge changes in the environmental temperature. Patients with conditions of heart diseases, mental illnesses, poor blood circulation and obesity are more at the risk of heat related illnesses. Overweight people often tend to retain body heat which makes them vulnerable to heat stress and its associated impacts.

Vulnerability studies by IIPH Gandhinagar

s globally are being increasingly recognized as public health problems. In India, there is no country-wide assessment of heat vulnerability. A recent study evaluated the demographic, socioeconomic, and environmental vulnerability factors and combined district level data from several sources including the most recent census, health reports, and satellite remote sensing data. Using principal component analysis (PCA) the authors developed a composite Heat Vulnerability Index (HVI) for India. The study found that of the total 640 districts, 10 districts were in very high risk category and 97 districts in high risk category (> 2SD and 2-1SD HVI). Most of the districts with higher heat vulnerability were found to be located in the central parts of the country[14].

The above study found that high vulnerability index (>0.70) had significant correlations with literacy rates, low income status, TV ownership, having toilets and drinking water and open

defecation practices. It found moderate correlation of 0.42 between HVI and average summer land surface temperatures (from satellite data) suggesting a relationship between higher temperatures and heat vulnerability. The index also showed moderate negative correlation (–0.46, $p < 0.001$) with urbanization signifying a possible greater vulnerability threat in rural areas. Outdoor workers were identified as being at a greater risk during s[14].

Vulnerability assessment study by IIPH Bhubaneswar

IIPH Bhubaneswar in 2018 conducted a study on effects of heat stress on health and productivity of high risk population in Bhubaneswar in collaboration with and funding support of IRADe and IDRC. It aimed to assess the impact of heat-stress on vulnerable population. Ten hot-spot clusters in Bhubaneswar city were identified for conducting the survey. We interviewed 25 to 30 randomly selected households in each hot-spot and interviewed about 100 individuals with high-risk occupation (HRO).

Key findings at Household level and high risk population level

1. At household level, the frequently reported symptoms of exposure to heat stress were: sweating (91.4%), headache (45.4%), dizziness (41.9%), %), dehydration (37.1%), excessive thirst (30.2), and heat rash (29.9%). The median discomfort period ranges from 10 am to 4 pm. Majority of respondents were aware of the treatment facilities available within the city, though the most preferred methods for receiving heat-stress information were Radio/TV (78.4) and Newspapers (27.5).
2. Comfortable clothing, using hand fans, electric fans/ac/cooler, and drinking water frequently were frequently used mechanisms to cope with heat-stress at individual level. About 77% and 63% households sought treatment from public and private healthcare providers, respectively. Distance and poor quality were the major reason for not availing public health care services. Though majority of households (84%) used piped water as principle source of drinking water, about 28% didn't have access to toilet at the household level.
3. With respect to financial risk protection, it was found that about 83% households did not have any health insurance.
4. 99% of high risk population faced problem due to heat-stress. Some of the frequently reported symptoms were: sweating (95%), excessive thirst (53%), dizziness (52%), headache (41%), heat rash (41%), dehydration (29%), and heat cramp/muscle cramp (17%). With respect to their health seeking behavior, it was found that 79.8% of respondents sought treatment from public healthcare providers. Distance (48.4) and poor quality (25.8) emerged as the main reasons for not availing public health care

services for those who didn't seek treatment. On an average, each respondent spent INR 182/- towards treatment. Further, 90% HRIs have no health insurance.

5. Drinking water frequently (92), comfortable clothing (57), frequently splashing your face with water/wet cloth (38) were most sought-after mechanisms to cope with heat-stress, since almost none (98%) had cooling facilities at workplace.
6. Two third of respondents reported that they had taken leave during summer due to excessive heat and the average length of such leaves was found to be 6 days. About 52% respondents reported loss in monthly income between INR 1,000 and INR 10,000.

Vulnerability

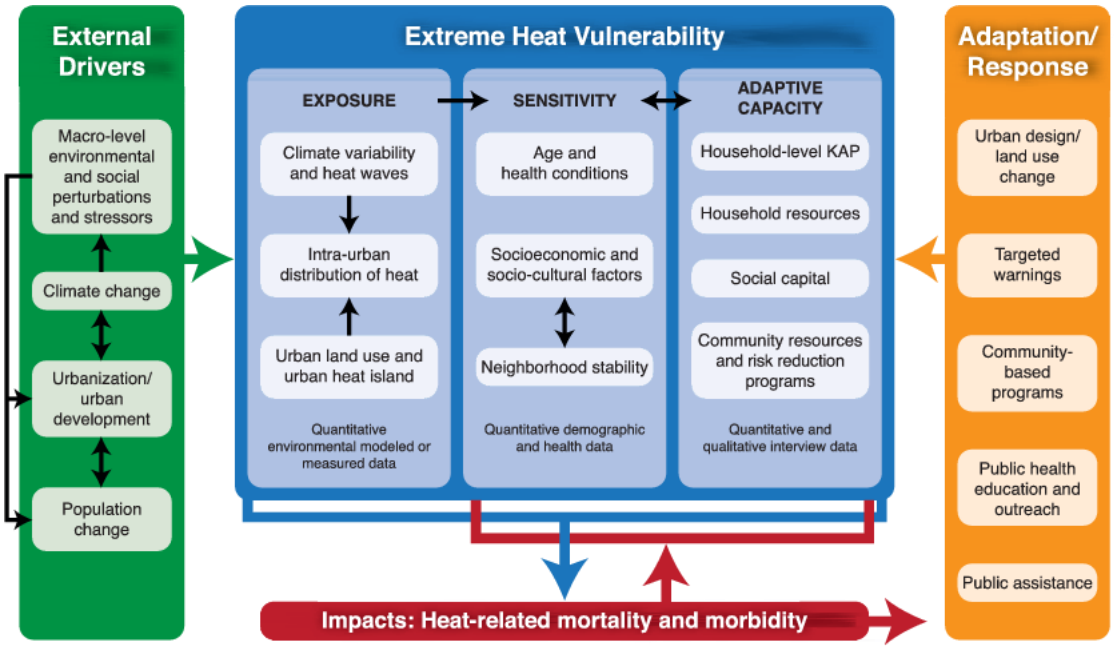
- In comparison to non-slum areas, slum residents are more at risk of getting exposure to heat because of the housing structures, heat trapping materials on roof (asbestos and tin), overcrowding, lack of electric supply, and access to water supply and exposure to additional heat during cooking because of use of solid fuel chullah. Slum dwellers suffered from skin diseases and infections. Chronic conditions and prolonged use of medication predisposes individuals to adverse effects of heat.
- The adaptive practices vary across the area because of socio-economic conditions and affordability. People in slum areas are more dependent on water and other traditional cooling mechanism, whereas, HHs in non-slum areas spends more on personal protection and architectural modification to avoid heat exposure.
- Nearly 80% of slum people believes, avoidance of sun, drinking enough liquids and proper clothing will save them from heat related events, whereas, more than 90% of non-slum people think that proper dressing, avoiding sun and taking rest in cooler place can prevent heat related illness.
- Males staying indoor were two times higher at risk of getting heat illness compared to females. Presence of kitchen outside the home makes the residents two times more vulnerable towards the heat exposure and illness. Presence of chronic conditions predisposes higher risk (2-4 times) of getting heat illness. Practice of cooling methods like use of fan/ac/cooler decreases the chance of getting heat illness by 60%. Further, it was found that most of the hazards occurred during the transport to the workplace.

Tools for vulnerability assessment

The world literature on the subject of vulnerability assessment and risk assessment is full of concepts, methods and techniques. As advocated by Wilhelmi and Hayden, the framework for extreme heat vulnerability analysis focuses on quantitative data at environmental level, demographic level and individual level (Figure 6). It proposes to study impact of heat on

mortality and morbidity which in turn could be helpful to design interventions such as targeted warnings, community-based programmes, public health education and public assistance[15].

Fig 6 - Extreme heat vulnerability analysis framework



Source: Wilhelmi and Hayden, 2014

Fritzsche et al have highlighted the importance of referring to disaster risk reduction approach (DRR) developed by the UN Office for Disaster Risk Reduction for vulnerability and risk assessment[16]. One of the most referred definition of vulnerability is estimated as a function of the urban area sensitivity and its adaptive capacity; and the vulnerability index is calculated using the following Equation:

$V=(S/n) - (AC/n)$,

Where V is the vulnerability, S is the sensitivity, AC is the adaptive capacity, and n is the number of the indicators being used.

Sensitivity refers to the factors that contribute to increase the susceptibility of an area to accumulate heat. The factors are enlisted below by considering five surface properties variables that define the sensitivity value[10,17,18].

	Indicator/Variable	**Description**
	Sky View Factor (SVF)	Ratio of the amount of sky hemisphere visible from ground level to that for an unobstructed hemisphere

	Indicator/Variable	Description
	Built Area Fraction	Ratio of building plan area to total ground area
	Impervious Surface Fraction	Ratio of unbuilt impervious plan area (paved, sealed) to total ground area.
	Street Incoming Solar Radiation	Potential solar radiation incoming for street surface
	Roofs Incoming Solar Radiation	Potential solar radiation incoming for roof surface

The adaptive capacity of an urban area is determined by its potential to adjust to heatwaves, and scholars agree on the role of green infrastructure to mitigate high temperature in urban areas. Adaptive capacity is then measured by considering two indicators - green areas and tree-cover Percentage

	Indicator/Variable	Description
	Trees	Ratio of the area covered by trees to the total ground area
	Green areas	Ratio of green areas (e.g., street green, green verge, house gardens, etc.) to the total ground area.

Exposure to heatwaves is given herewith by the combination of different factors that are summarized below

Indicator / variable	Description
Cultural heritage	Ratio of the area covered by tangible cultural heritage (e.g., historical buildings, churches, monuments, etc.) to the total ground area
University buildings	Ratio of the area occupied by university buildings to the total ground area
Industrial	Ratio of the area occupied by industrial facilities to the total ground area
Public buildings	Ratio of the area occupied by public buildings to the total ground area
Sport facilities	Ratio of the area occupied by sport facilities to the total ground area

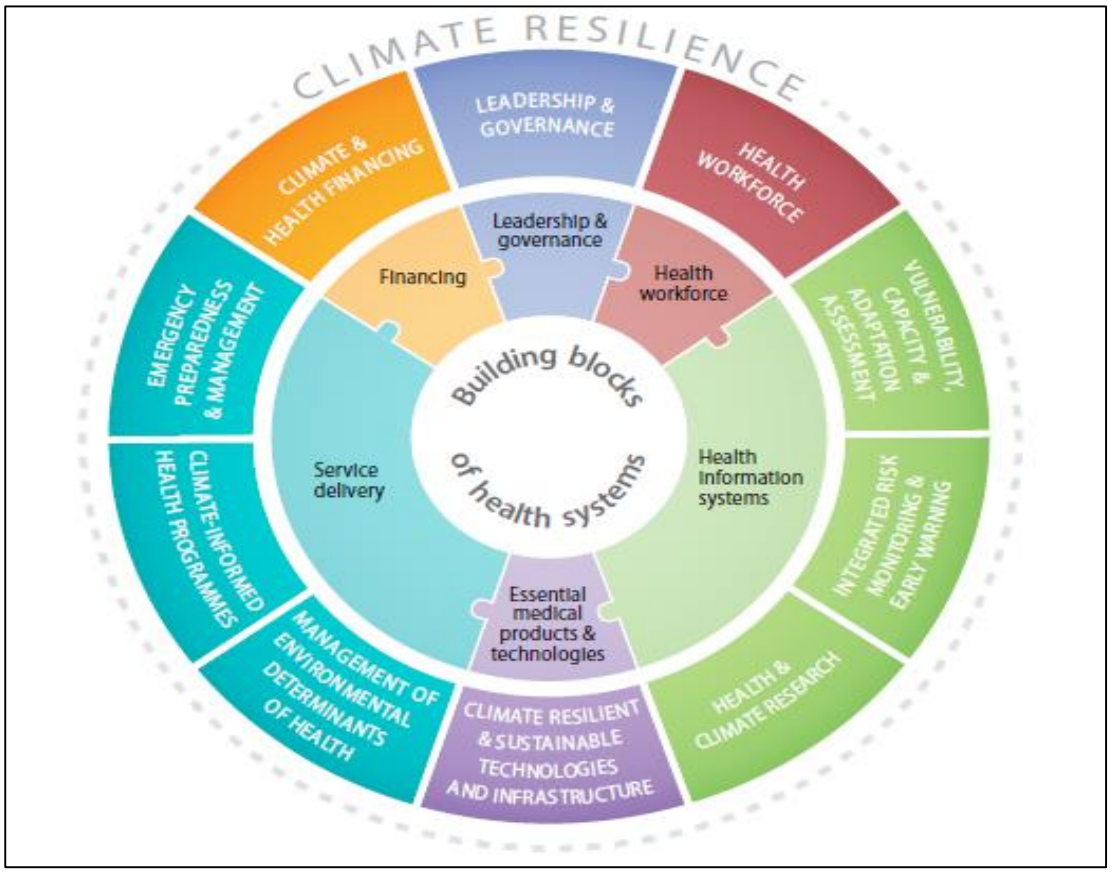
Indicator / variable	Description
Schools	Ratio of the area occupied by school facilities to the total ground area.
Parking lots	Ratio of the area occupied by parking lots to the total ground area
Bar	Number of bar within the area
Café	Number of café within the area
Restaurants	Number of restaurants within the area
Population aged 0–10 and 65+	Population aged 0–10 and 65+ within the area

Chapter 3: Early Warning Mechanism and Systems' Readiness

Although there is no generally accepted definition of a (Souch and Grimmond, 2006; Robinson, 2001), s in a health context can be considered as periods with sustained heat load or excessively hot weather that result in one of a number of heat-related health outcomes including mortality, morbidity and emergency service call-out (Kovats and Jendritzky, 2006).

Heat stress can be assessed using simplified biometeorogical indices, composed of one, two or multiple meteorological variables, or heat-budget models – numerical models that attempt to describe, in mathematic terms, the body's heat gains and losses. The choice of method for assessing heat stress will depend on the resources available to HHWS developers. Daily biometeorological index or heat-budget model values, along with health data (daily mortality counts, for example) are applied to the identification of threshold values beyond which the health effects of heat increase rapidly. Observed and forecast threshold values are often used as a basis for action within an HHWS[19].

Figure 7 – Climate resilience health system



Source: WHO, 2015

Health systems vary around the world, but all share some common features in their ultimate goals and general functions. WHO has identified six common "building blocks" that are necessary to support the delivery of Universal Health Coverage and improved outcomes. To ensure that climate resilience builds on and strengthens existing health systems, these building blocks are taken as a starting point for the expansion of primary components that specifically enhance climate resilience (Figure 7)[20].

In addition to changes in climate and other environmental and social determinants of health, health systems themselves are also changing rapidly. For this reason, the framework should be implemented in a flexible way to take into account different country contexts, and iteratively, take advantage of new evidence, experience and lessons learned from within and outside the country, as well as changing circumstances.

Structures such as buildings, roads, and other infrastructure absorb and re-emit the sun's heat more than natural landscapes such as forests and water bodies. Urban areas, where these structures are highly concentrated and greenery is limited, become "islands" of higher temperatures relative to outlying areas. These pockets of heat are referred to as "heat islands." Urban morphology, vegetation, and building materials play a major role in determining urban heat island (UHI) characteristics (Monaghan et al. 2014).

A Heat-health warning system (HHWS) must be developed at national and state level which would ensure that

1. All systems are based on thresholds that are related to actual heat–health outcomes. HHWS trigger mechanisms should be geared to the point where human health actually deteriorates. This threshold varies greatly from place to place and also depends on the scope of the system. It can also vary within a place.
2. HHWS nomenclature are clearly understood by the public, local stakeholders and decision-makers. Thus, on a national level, a standardized terminology, together with understandable criteria and messages, helps significantly with communication. This also applies at the local level, where messages may need to be tailored to reflect community characteristics
3. All systems are paired with an effective notification and response programme. These "mitigation plans" include lines of action defined by multiple stakeholders or agencies, interaction with the media and messages to the public as to how they should react to extreme weather
4. All systems are evaluated to determine their effectiveness

While raw-total mortality is what is initially obtained, a number of different methods of analysis have been undertaken. Given that heat exacerbates other ailments and that the official definition of a "heat-related death" has long been known to underestimate heat's true impact, analysing only official "heat-related deaths" has not generally been a basis for an HHWS.

Figure 8 – Risk assessment in Bhubaneswar

Risk Assessment

Bhubaneswar

Urban system	Impacts of climate change	Likelihood	Consequence	Risk score	Risk status
Water supply	Increased precipitation disrupts/ damages water supply infrastructure	3	3	9	Medium
	Increased precipitation causes increased incidences of urban flooding / water logging	4	3	12	High
	Increased temperatures will lead to increased demand for water thereby posing additional stress on the supply system	5	3	15	High
Housing	Increased precipitation causes greater health risks	4	3	12	High
	Increased temperature causes greater fire risks	4	2	8	Medium
Energy	Increased precipitation disrupts / damages power supply infrastructure	4	2	8	Medium
	Increased temperature leads to increased energy demand will increase, causing a shortage	4	3	12	High
Ecosystem	There will be additional stress on the ecosystems e.g. the water bodies may dry up	4	2	8	Medium

Source: Case study of Bhubaneswar City from Climate trends from INCCA 4x4 Assessment Report for 2030s, 2010

Heatwaves and interpretation of heat alerts

World Meteorological Organization defines a heatwave as five or more consecutive days during which the daily maximum temperature exceeds the average maximum temperature by five degrees Celsius.

Criteria for heatwave

The Indian Meteorological Department (IMD)considers Heatwave conditions if maximum temperature of a station reaches at least 40°C or more for Plains, 37°C or more for coastal stations and at least 30°C or more for Hilly regions[21].

i. **Based on departure from normal**

- Heatwave: Departure from normal is 4.5°C to 6.4°C
- Severe Heatwave: Departure from normal is >6.4°C

ii. **Based on actual maximum temperature (for plains only)**

- Heatwave: When actual maximum temperature ≥ 45°C
- Severe Heatwave: When actual maximum temperature ≥47°C

To declare heatwave, the above criteria should be met at least in 2 stations in a Meteorological sub-division for at least two consecutive days and it will be declared on the second day.

Color Signals for Heat Alert

Based on the criteria of heatwave, the Heat Action Plan (HAP) has developed the early warning system which has three color based heat alerts. These alerts will be issued by the Nodal officer (HAP) based on the data received from the Indian Metrological Department. Based on the alerts issued by different departments will activate their channel and perform predefined activities.

Heat- Health Temperature Warning for Bhubaneswar		
Yellow	Hot day advisory	36.2°C
Orange alert	Heat alert day	39.1°C
Red alert	Extreme heat alert day	Above 41.4°C

Source: OSDMA, 2019

Source: OSDMA, 2019

The health centers / hospitals will appoint a Nodal Officer to head the Heat Action Plan. The appointed nodal officer will be responsible for coordinating and communicating ahead of, and during, extreme heat events, and provide support staff through the Nodal Office as necessary. The Nodal Officer is considering adopting the following preparations under the 2019 Heat

Action Plan. The Urban Local Body (ULB) will issue heat alerts, based on thresholds determined by them, as an additional means of communication by using the following color signal system.

Hajat et al. (2010) have presented a useful analysis of the comparison of the prediction capacity of different approaches (synoptic, epidemiological, temperature humidity index, physiological classification) for identifying hot days that have significant health effects. They found little agreement between approaches regarding days identified as being "most dangerous" and concluded that the triggering of heat alerts and associated intervention strategies varies significantly. Much research has shown that heat vulnerability varies throughout the season, with higher vulnerability earlier in the warm season (Smoyer, 1998; Kalkstein, 2002; Basu and Samet, 2002; Dessai, 2002; Kysely, 2004).

Figure 9 - Heat-health warning system levels based on time or magnitude of the event

	Examples of nomenclature	*Description*
Pre-alert levels (temporal)	Seasonal vigilance	Activated during the whole summer season, though no heat event is forecast.
	Outlook	A heat event is expected during the next 3–5 days.
	Watch (warning)	A heat event is expected within the next 24–48 hours.
Alert level (severity)	Heat alert Heat advisory Warning Severe weather warning	Moderate heat event occurring or imminent
	Excessive heat warning Extreme heat alert Heat emergency Maximum mobilization Extreme weather warning	Significant heat event occurring or imminent

Source: WHO, 2015

When entering into the development of a warning system, the various "do's and don'ts" (lessons learned from the experiences of those who have worked with or helped to develop early warning systems for a wide range of societal concerns) need to be considered, in order to assist governments and other decision-makers in preparing effective warnings and in aiding the media and the public in interpreting and using such warnings (Figure 9).

Town specific heat action plan

'Heatwave' is not a notified disaster at national level in India, accurate information and data related to heatwave deaths and illnesses are not available. In order to take appropriate action, the mortality data as well as weather data should be gathered, compared and correlated.

Development of heat action plan is the step ahead to guide and help the officials to get clarity on their role for developing sound coordination.

The Heat-Wave Action plan aims to provide a framework for implementation, coordination and evaluation of extreme heat response activities in cities/town in India that reduces the negative impact of extreme heat. The Plan's primary objective is to alert citizens especially vulnerable groups at risk of heat-related illness in places where extreme heat conditions either exist or are imminent, and to take appropriate precautions, which are at high risk. Preventive heat management and the administrative action need to be taken by the concerned ministries/departments. All cities can learn from their experience and develop a plan to deal with Heatwave in their specific cities/town and thus reduce the negative health impacts of extreme Heat. In addition, the State Governments should also prepare a comprehensive plan to combat Heatwave.

Critical steps in planning responses to extreme heat conditions include[22]:

1. Identifying heatwave hotspots and vulnerable populations especially woman and the health risks specific to each group;
2. Developing effective strategies, agency coordination, and response planning to shape a Heat Action Plan that addresses heat-health risks;
3. Implementing the Heat Action Plan and activating heat alerts; and
4. Evaluating and updating the Heat Action Plan regularly.

Key Strategic Directions

The heatwave action plan is intended to mobilize people and communities to help protect their neighbours, friends, relatives, and themselves against avoidable health problems during spells of very hot weather. Broadcast media and alerting agencies may also find this plan useful. Severe and extended heat-waves can also cause disruption to general, social and economic services. For this reason, Government agencies will have a critical role to play in preparing and responding to heat-waves at a local level, working closely with health and other related departments on long term strategic plan.

1. ***Building Public Awareness and Community Outreach*** to communicate the risks of heatwaves and implement practices to prevent heat-related deaths and illnesses. Disseminating public messages on how to protect people against extreme heat through media outlets and informational materials such as pamphlets and advertisements on heat stress prevention. Efforts also include the use of social media such as SMS, text messages, email, radio and mobile applications such as WhatsApp. Special efforts are made to reach vulnerable populations including women through inter-personal communication as well as other outreach methods.

2. ***Utilizing an Early Warning System and Inter-Agency Coordination*** to alert residents of predicted high and extreme temperatures. The Indian Meteorological Department shares a daily five-day forecast with the Heat Action Plan Nodal Officer during the heat season. This will create formal communication channels to alert governmental agencies, the Met Centre, health officials and hospitals, emergency responders, local community groups, and media outlets of forecasted extreme temperatures.

3. ***Capacity Building Among Health Care Professionals*** to recognize and respond to heat-related illnesses, particularly during extreme heat events. Such trainings focus on primary medical officers and other paramedical staff, and community health staff so they can effectively prevent and manage heat-related cases so as to reduce mortality and morbidity.

4. ***Reducing Heat Exposure and Promoting Adaptive Measures*** by undertaking new efforts including mapping of high-risk areas of the city, increasing outreach and communication on prevention methods, access to potable drinking water and cooling spaces during extreme heat days. Collaboration with non-governmental organizations is also identified as a means to expand outreach and communication with the city's most at-risk communities.

Implementation of Heat Action Plan

Phase 1: Pre-heat season (Annually, January-March)

ULB Nodal Officer:

1. Convene key agency leaders to respond to extreme heat events.
2. Engage state and local agencies to facilitate internal communications.
3. Organize preventative training and outreach efforts for health workers, link workers, school children, and the local community with the Health Department.
4. Distribute multilingual pamphlets and posters with tips to prevent heat stress to hospitals, schools, and professional associations (*see pamphlets attached*).
5. Create a list of the high-risk areas of the city vulnerable to heatwaves for more focused activities on heat prevention.

ULB Health Department and Medical Professionals:

1. Enhance gender based targeted training programs, capacity building efforts and communication on heat illness for medical staff at local hospitals and Urban Health Centers (UHCs), based on the Framework of ULB Medical Professionals and Health Workers. These efforts should include nursing staff, paramedics, field staff and link workers, and consider the susceptibility of particular wards.
2. Have hospitals update their admissions and emergency case records to track heat-

related morbidity and mortality. Train hospitals to improve expedience of recording of cause of death certificates. Explore creation of simple, user-friendly means to track daily heat-related data and behavioral change impacts. The training could also include recording information education & communication (IEC) efforts.

3. Adopt heat-focused examination procedures at local hospitals and urban health centers.
4. Purchase and distribute reusable soft plastic ice packs for the citywide UHCs, 108 emergency centers, ambulances and hospitals.
5. Explore creation of ice pack dispensaries to increase access to vulnerable communities.

108 Emergency Service:

1. Create displays on ambulances during local events to build public awareness.
2. Identify at-risk areas of vulnerable populations, in part by utilizing the list of high-risk areas.

Phase 2: During the heat season (Annually, March -July)

ULB Nodal Officer:

1. Activate a **heat alert** and the local response citywide when extreme heat events are forecast by notifying the key agency leaders, the Deputy Municipal Commissioners in the ULBs and the state agencies in accordance with the Communication Plan. Special measures should be taken to ensure that heat alerts reach out to people with disabilities and women as well.
2. Monitor and increase the **heat alert** level when necessary to match the severity of the forecast and threshold established, and have the Municipal Commissioner convene a special meeting with key agency leaders.
3. Activate "cooling centers," such as temples, public buildings, malls, during a **heat alert** and/or the ULB run temporary night shelters for those without access to water and/or electricity.
4. Expand access to shaded areas for outdoor workers, slum communities, and other vulnerable populations. For example, confirm that night shelters stay open all day for migratory populations during a **heat alert**.
5. Hold a frequent, possibly daily, conference call to discuss reports and breaking developments during a **heat alert**, and ensure that communication channels remain operational.
6. Identify and set up public displays of temperature and forecasts, such as LED electronic scrolling boards.
7. Continue surveillance of temperature data and forecasts.
8. Communicate the suspension of all non-essential uses of water (other than drinking,

keeping cool) via the ULB's Water Project's protocol procedures during any water shortage.

9. Increase efforts to distribute fresh drinking water to the public. For example, expand potable water access during a **heat alert** at religious spaces including temples and mosques, drinking water bottles handouts to the poor, and high-risk areas (identified by the mapping of high-risk areas).
10. Communicate the local utility protocol to prioritize maintaining power to critical facilities (such as hospitals and UHCs).
11. Notify the Steering Committee and relevant agencies when the **heat alert** is over.

ULB Health Department and Medical Professionals:

1. Post heat-related illness prevention tips and how to stay cool around hospitals and UHCs.
2. Ensure adequate medical supplies available.
3. Produce weekly reports of the public health impact for ULB Nodal Officer during a **heat alert.**
4. Increase staffing at hospitals and UHCs to attend to the influx of patients during a **heat alert**, if feasible.
5. Increase link worker and community health worker outreach in at-risk neighborhoods during a **heat alert**, if feasible.
6. Have zonal health officer visit UHCs to confirm proper preparation has been made for heat- related illness and conduct case audits during heat season. (Template provided in Chapter 08)

108 Emergency Service:

1. Ensure adequate supply of ice packs and IV fluids.
2. Disseminate SMS text messages to warn local residents during a **heat alert**.

Phase 3: Post-heat season (Annually, July-September)

Nodal Officer:

1. Organize an annual Heat Action Plan evaluation meeting with key agency leaders and relevant stakeholders.
2. Evaluate the Plan process based on performance and revise accordingly.
3. Evaluate the reach and impact of the Plan and revise accordingly.
4. Evaluate effectiveness and reach of the IEC material on heatwaves to the communities
5. Explore other ways of reaching out to citizens for information dissemination. Post the revised Plan to the ULB website ahead of the 2016 heat season for stakeholders.
6. Build on the "Green Cover" activity to establish tree-plantation campaign in hotspot areas such as roadsides and during plantation festival in June. Incorporate student volunteers or incentivize builders to plant trees to help effect this effort.
7. Discuss establishing cooling centers facilities in high-risk areas around city.

ULB Health Department and Medical Professionals:

1. Perform an epidemiological case review of heat-related mortalities during the summer.
2. Conduct and gather epidemiological outcomes from the data on heat risk factors, illness and death, based on average daily temperatures.
3. Incorporate data and findings into future versions of the Heat Action Plan.
4. Measure mortality and morbidity rates based on data before and after the Plan's interventions.

IEC/BCC Plan

Communication and dissemination strategy

Reaffirming that countries have responsibility for ensuring the protection of the health, safety and welfare of their people, the WHO in it's resolution in 2011 asserted to ensure that WHO at all levels has enhanced capacity and resources; to strengthen the evidence base for health emergency and disaster risk-management; to support national and subnational assessments of risks and capacities for health emergency and disaster risk-management; and called upon Member States, donors and development cooperation partners to allocate sufficient resources for health emergency and disaster risk-management programmes[23].

Communication links the biometerological and weather-forecasting science components of an HHWS with the societal risk reduction components of an HHAP. A well-honed communication plan is therefore crucial for the success of an HHWS, especially in terms of how weather-forecast-based heat warnings are translated into action. It is imperative that the risk associated with an impending period of anomalous heat is communicated precisely and adjusted according to the target group[19].

Consequently, relay messages about a forthcoming extreme heat event, which may be action threshold specific (health authority, emergency service, media, community action groups) composed of clear, unambiguous language, are an essential element of any HHWS. Such messages need to be developed by NMHSs. The same communication principles extend to the communication and outreach elements associated with heat-intervention strategies which are part of a wider HHAP and discussed in the next chapter. Lastly, understanding the factors that influence human response to warnings – and therefore the effectiveness of an HHWS – can inform communication and education strategies.

The Heat Stress IEC provides information about key messages on sharing what, how, to whom and when to each stakeholders. With the hospital having maximum number of people visting

it daily and spending time here, reaching out to them becomes relatively easy and chances of key messages reaching out to their friends and family are also high. The IEC should be monitored at the steering committee level for its due implementation and also to ensure any mid-course correction. The communications channels in hospitals that could of potential use druing heatwave are:

1. **Use of Screens in the lobby**: The tv screen in the lobby to display information on do's and don't's during
2. **Patients prescription**: The prescription slip of the patients to carry information of saftey measures to be take during heatwave
3. **IEC display**: The IEC should be displayed in prominent places of the common areas of hospitals such as waiting areas, water taps, lifts/stairs. Notice boards etc.
4. **Distribution of leaflets**: The volunteers/ staff to distribute leaflets/phamphlets to people visiting the hospital
5. **Events**: Hospitals may also host health promotion events during heatwaves

Process of awareness and IEC plan

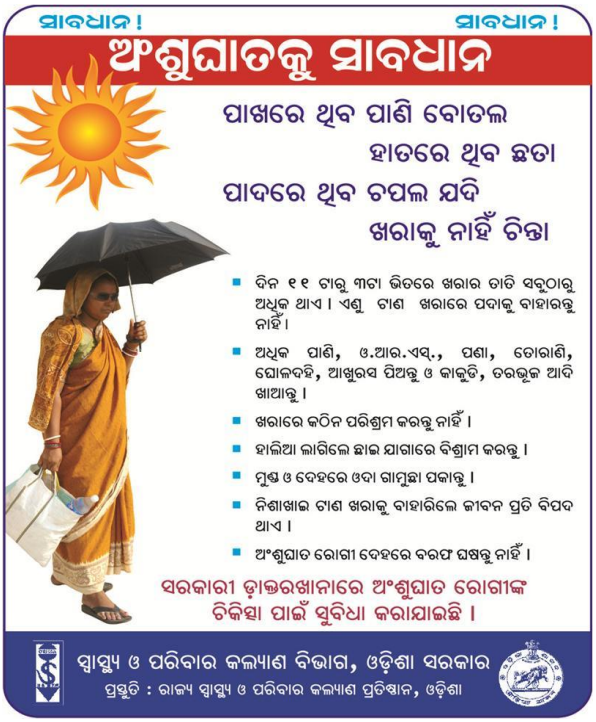
The proposal is initiated from the concerned nodal officer DPH and it communicates to State Institute of Health and Family Welfare (SIHFW) which develops the prototype of IEC in consultation with DPH (Figure 6). Once the prototype is approved by DPH, funding is released and the materials are printed at SIHFW and distributed to districts and to lower levels. For media (print and electronic), the SIHFW sends the prototype to Information and Public Relations (I&PR) Department. They publish it in Newspapers and disseminate it in electronic channels.

IEC in local language

To ensure wider outreach to communities and ensure better dissemination of information, it's very important that the IEC is prepared in the local language. Examples of heatwave advisory are shared below.

Every year all the District Collectors are instructed to take required precautionary measures for mitigating the heat-wave situation and the Chief Minister reviews the preparedness activities of the related departments. The chain of command that is followed after the issuance of a heat alert as depicted in figure.

IEC materials disseminated by the Government of Odisha



Source: OSDMA, Government of Odisha 2019

Health advisory for prevention of heat stress impact

Communicating risks in public health emergencies is the most important and yet often neglected aspect of disaster response system[24].

- Tailor information and communication systems to users' needs and involve local stakeholders to guarantee the flow of information across sectors.
- Preparation and training of personnel for ERC should be organized regularly and focus on coordination across involved stakeholders.
- Social media may be used to engage the public, facilitate peer-to-peer communication, create situational awareness, monitor and respond to rumours, public reactions and concerns during an emergency, and to facilitate local-level responses.
- Risk should not be explained in technical terms, as this is not helpful for promoting risk mitigation behaviours.

DO'S:

1. Listen to radio; watch TV, read newspaper for local weather forecast to know if a heatwave is on a way.
2. Drink sufficient water and as often as possible, even if not thirsty
3. Wear light weight, light colored, loose and porous cotton clothes. Use protective goggles, umbrella/hat, shoes or chappals while going out in sun.
4. While travelling carry water with you

5. If you work outside, use a hat or an umbrella and also use a damp cloth on your head, neck, face and limbs.
6. Use ORS homemade drinks like Lassi, Torani (Rice water), lemon water, buttermilk etc. which help to rehydrate the body.
7. Recognize the signs of heat stroke, heat rash or heat cramps such as weakness, dizziness, headache, nausea, sweating and seizures. If you feel faint or ill, see a doctor immediately.
8. Keep animals in shade and give them plenty of water to drink.
9. Keep your home cool, use curtains, shutters or sunshade and open windows at night
10. Use fans, damp clothing and take bath in cold water frequently.
11. Provide cool drinking water near work place.
12. Caution workers to avoid direct sunlight.
13. Schedule strenuous jobs to cooler times of the day.
14. Increasing the frequency and length of rest breaks for outdoor activities
15. Pregnant workers and workers with medical condition should be given additional attention.

DON'TS:

1. Do not leave children or pets in parked vehicle
2. Avoid getting out in the sun, especially between 12.00 pm to 3.00 pm.
3. Avoid wearing dark, heavy or tight clothing
4. Avoid strenuous activities when the outside temperature is high
5. Avoid cooking during peak hours. Open doors and windows to ventilate cooking area adequately.
6. Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrates the body.

Special Strategies for Vulnerable group

Communication Strategies	Cooling Strategies	Occupational Strategies
• Display Temperature and Forecast • Communicate Properly During Heatwaves • Implement IEC Plan for All the Vulnerable Groups • Open Help Line Centers	• Facilitate Public Access to Potable Water and Cool Spaces • Develop of Public Parks and Shaded Bus Stops • Map Community Resources • Campaign for Greening and Tree Plantation • Campaign for Cool Roof.	• Educate Outdoor Laborers • Enforce Labor Law and Coordinate with other Departments • Incentivise Cooling for Local/Outdoor Businesses

Need for emergency preparedness system

Heatwaves creates an emergency situation in people that makes their medical attention urgent for treatment and also avoid any fatality. Such situations inevitably lead to a rapid increase in demand for hospital services which ultimately has a crippling effect on its operational capacity. This urgently calls for deployment of a quick response plan that works towards such emergency preparedness and effectively responds to health emergency along with maintaining its regular health facility.

Understanding emergency preparedness

The emergency preparedness for heatwaves in hospital refers to the steps taken by it to be ready with response during emergency situation by giving adequate and emergency medical care. This would require continuous planning, coordination, capacity building, monitoring, appraising, and acting in accordance with the laid down procedures along with collaborative efforts from all the stakeholders. The hospital's emergency preparedness plan should generally take into account all aspects of heatwaves including the pre, during and post heatwaves.

Training and education should not be conceived as a "one-off" efforts, provided only once in the expectation that people will learn and remember what they need to know. Rather, training and education should be planned and budgeted as a continuous and scaled process, and scheduled to reinforce and update skills on a regular basis. In particular, local knowledge should be periodically tested through exercises including "tabletop" exercises (involving writing and discussion rather than physical action), sectoral drills, and even comprehensive Emergency Management System fi eld exercises involving all sectors[25].

Pre-heat season

1. Create and implement heat health guidelines on the diagnosis and treatment of heat stress, heat exhaustion, and heat stroke to reduce and prevent mortality and morbidity.
2. Use materials extensively for training and communication, including posters and pamphlets that inform patients about upcoming heat warnings and offer tips to prevent heat stress
3. Identify and relocate the most vulnerable hospital wards (e.g., the maternity or neonatal ward) from the top floor of hospitals, where temperatures reach the highest. Move patients to cooler parts of the building
4. Measure wards' morbidity and mortality rates before and after location change to evaluate the effectiveness of intervention
5. Set-up a steering committee to supervise, monitor the emergency preparedness, dealing with inflow of patients during heatwave and post heatwave evaluation
6. Establish Cool Wards within the hospitals
7. Ensure bed availability especially in emergency departments and special wards for heat related illness

8. Ensure adequate storage of IVs, ORS and other medicines for heat stress treatment
9. Increase medical doctors, nursing staff to ensure full coverage in case of an increase in admissions
10. Develop training modules or multiday training for health care providers, ward leaders, and paramedics on extreme heat and health, as well as specific heat case management and diagnosis, especially during heatwaves
11. Organize a training of trainers workshops for primary medical officers who can offer heat-specific advice (symptoms, diagnosis, and treatment including self-monitoring hydration) to their medical staff
12. Conduct workshops for link workers/front line health workers (ASHA; Anganwadi worker; community health workers) to increase outreach and community-based surveillance for heat illness in slum communities. Link workers should receive informational materials on how to counsel patients, what threshold temperatures apply for different levels of treatment, and surveillance protocols
13. Collaborate with private medical service providers/ research institutes to train emergency service professionals on responding to extreme heat emergency cases
14. Increase heat stress outreach and education for women in maternity wards before they leave the hospital, since newborns are particularly vulnerable to heat stress
15. Update heatwave monitoring and management protocols and programs, including tracking of daily heat-related data as per the monitoring sheet template shared below

During heat season

1. Adopt heat-focused examination procedures at local hospitals and Urban Health Centers. Examination of admitted patients for signs and symptoms of heat related illnesses should become routine, adding a brief procedure during the peak-heat summer months. The basic statistics of such patients should also be recorded to identify the locations, occupations, and sociodemographic characteristic features of city's residents who are most vulnerable to heat stress and illness.
2. Adapt pharmacological treatments according to Standard Treatment Guidelines (STGs).
3. If possible, postpone non-emergency hospitalizations and surgeries.
4. Ensure high risk patients are placed in rooms with air conditioning; less critical patients should at least have access to an area with air conditioning during the hottest hours of the day.
5. Increase liquid oral and intravenous intake of patients.
6. Modify diet accordingly with increased fruit and vegetables.
7. Adjust patient bed and personal clothing according to need.
8. Offer adequate health and social assistance for hospital discharge of high risk patients or postpone discharge till heatwave gets over.

9. Ensure availability of adequate number of Medical Mobile Vans in high risk areas of heatwaves
10. Maintain record of heatwave patients and report to Urban Local Body (ULB) on a daily basis, using a monitoring sheet
11. Expedite reporting cause of death certificates

Post-heat season

1. Share final data of gender based hospital admissions with the ULBs as per standard reporting format, during heatwave conditions
2. Provide feedback to the annual evaluation of heat action plan so as to document a set of key learnings during heatwaves and to avail an institutional memory

Inter-sectoral coordination

The need for greater coordination with other sectors in reducing illnesses due to Extreme Heat Events has been emphasized in the National Adaptation Plan for Climate Change and Human Health. it suggested sectors are listed below, however the list may be expanded or modified as per the need of the state /UT.

Meteorological Department

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

Water Board

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

Municipalities

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

Ministry of Environment, Forest Climate Change

- Develop/ encourage projects to decrease the 'Urban Heat Island effect'.
- Ensure green coverage in the cities through checking deforestation, urban planning and increasing plantation.

Ministry of Education

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

Ministry of Transport

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

Media & NGOs

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

Role of OSDMA in Odisha

The flow of information during a heatwave alert in depicted in the figure below. The State emergency operation center (SEOC) is connected to the regional divisional commissioners (RDC) and other line departments on the one hand and with the district emergency officers, block emergency officers and field officers on the other hand. Therefore, a lot of information exchange takes place among the various officials of district and sub-district levels with the state level nodal agency.

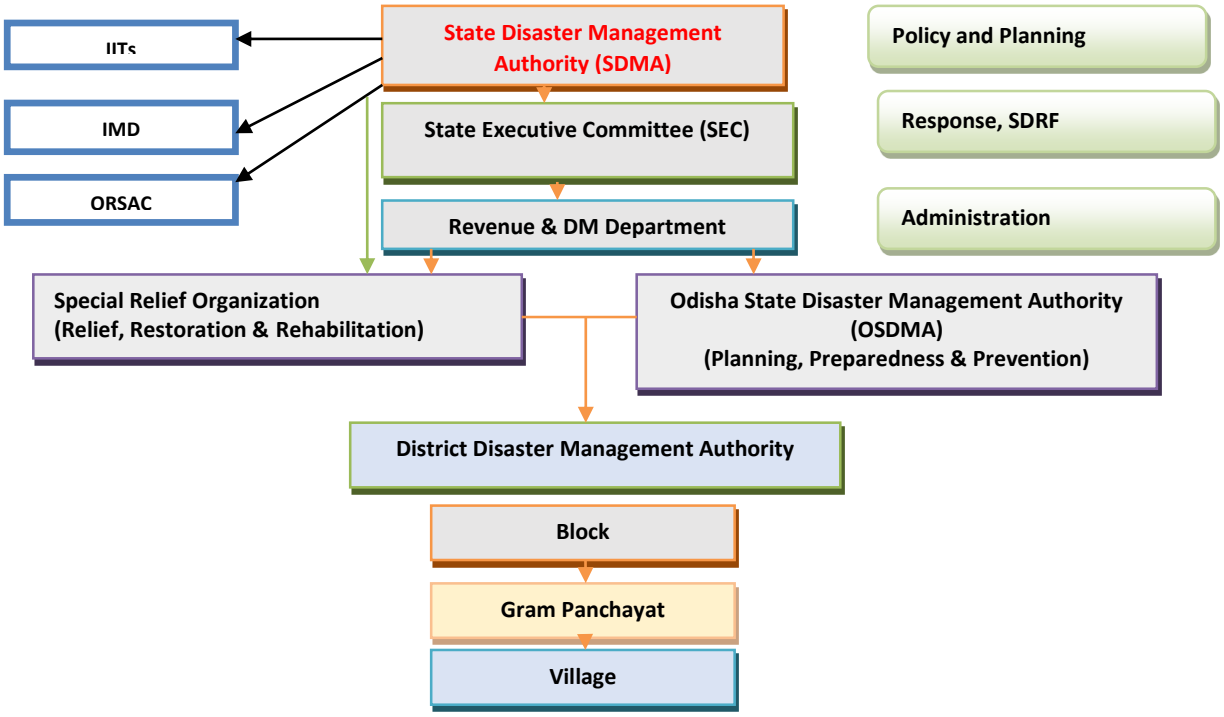
The institutional arrangements for heatwave management is depicted in the figure. During the summer months (March to June), the EOC (Control Room) at the state and also at the district levels become alert about Heatwave warning from analyzing the daily reports of India Meteorological Department (IMD). It currently provides weather forecast information on the basis of satellite imagery, mathematical modeling, GPS Sonde monitoring and Doppler radar system. It gives weather forecasting taking into account the temperature (both dry bulb temperature and dew point temperature), wind pattern, cloud pattern and a few other parameters. The temperature/ city forecast is done two times a day i.e. at 10 AM, & 6 PM for one week in respect of 16 cities in the State of Odisha. Besides city forecast, forecast along with warning are also issued for next five days at 10 AM, 1 PM, 6 PM & 9 PM. The 1 PM forecast is forwarded to state agencies and media by fax and Emails.

IMD gives a Heatwave forecast particularly during the months of March to May. The cut off temperatures for Heatwave Forecast is

- 37 °C for the coastal areas
- 40 °C for the interior areas

The IMD also provides warnings based on heat index (based on temperature and humidity).The reliability of these forecasts is up to a level of 85%. It disseminates information directly to Special Relief Commissioner (SRC) and Odisha State Disaster Management Authority (OSDMA by fax along with various state agencies, Doordarshan, All India Radio (AIR) and other media houses by mails. In case of an expected Heatwave, mails are also sent to all the district collectors for alertness and preparedness for action (Figure 10).

Fig 10 - Institutional mechanism for Heatwave management, Odisha



Source: OSDMA, Government of Odisha

Immediately upon receipt of such a warning, the state and district Emergency Operation Centres make necessary arrangements for flashing the warning through all forms of media. Simultaneously, departments of Health and Family Welfare, School and Mass Education, Labour & Employees' State Insurance, Transport and Commerce, Public Health Engineering & other related departments remain alert and put necessary emergency measures in place. The OSDMA is the nodal agency which is responsible for the prevention and mitigation activities. The most important work of the OSDMA is to sensitize the necessary stakeholders, engage in their capacity building in forms of intra-departmental trainings and prepare and share the

guidelines for different occupational groups, institutions, urban local bodies, PRI and civil societies. It works in tandem with the Special Relief Organization which acts as the main executing body under the leadership of the SRC during a Heatwave condition and issues directives to all the concerned governmental and non-governmental organizations for a prompt action. Apart from this, the OSDMA also involved in establishing the Heatwave related mortality tracking system and updating the data set periodically.

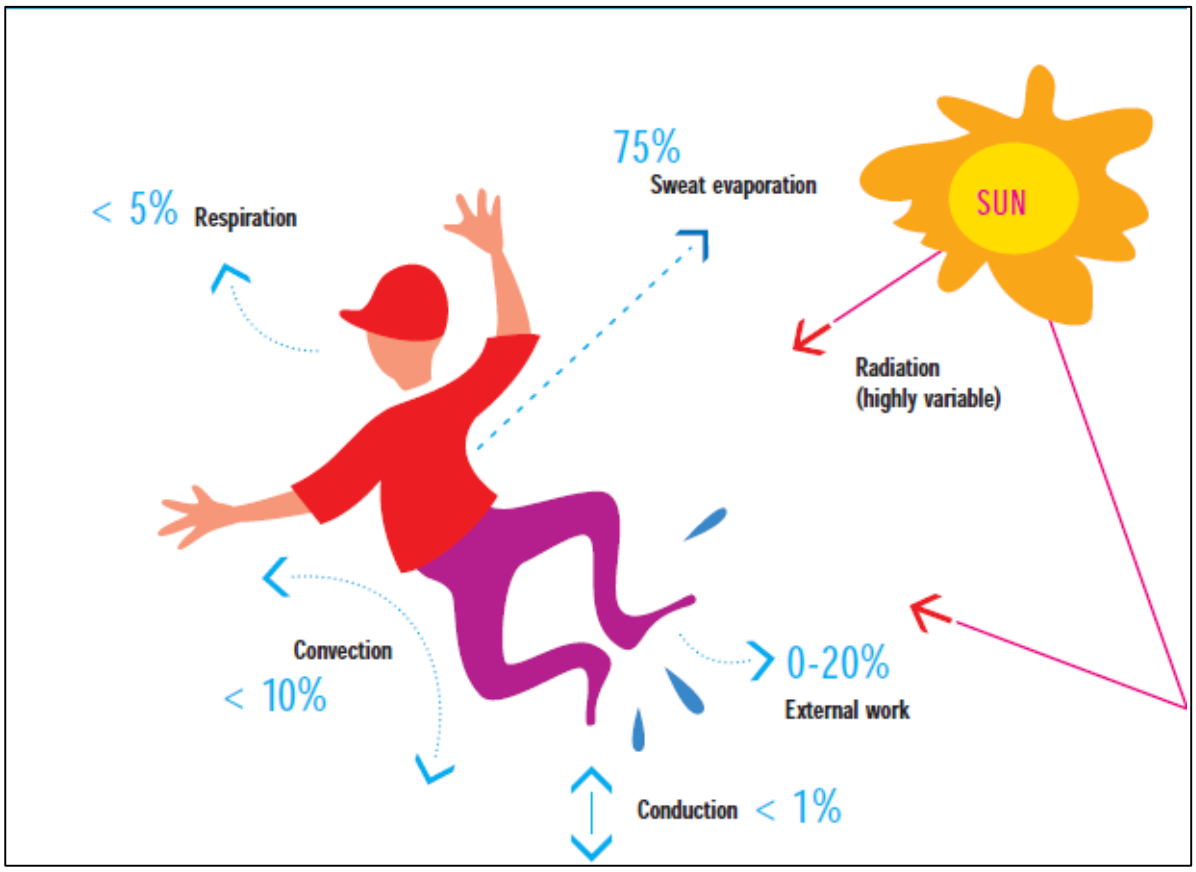
Ex-Gratia Relief

Earlier, the State Government had made provision in the Odisha Relief Code for payment of Rs.10,000/- towards ex-gratia relief to the bereaved family of each sunstroke victim. Since, there is no provision in the items and norms of expenditure for incurring expenditure from the State Disaster Response Fund (SDRF) & National Disaster Response Fund (NDRF) to provide relief to the victims of 'Heatwave', the State Government was incurring such expenditure out of the Chief Minister's Relief Fund (CMRF). However, the State Govt. has declared Heatwave as a State Specific Disaster with effect from 1st April 2015 under the revised provisions of SDRF/NDRF norms & made provision for payment of ex-gratia of Rs. 50,000/- to the next of kins of the sunstroke victims.

Chapter 4: Clinical management of heat stress and illnesses

Human body can lose excess heat by convection (warming of air or water around the body), by conduction (contact with solids, such as the floor), respiration (air inhaled is usually cooler and dryer than exhaled air) radiation and evaporation of sweat (Fig. 4). When air temperature and water vapour pressure increase, the gradients between skin and environment required for these heat losses decrease and heat loss is reduced. When air temperature approaches skin temperature, heat loss by convection approaches zero, and heat may even be gained when air temperature rises above skin temperature. In these cases the main (and sometimes only) avenue left for losing heat is by producing sweat and evaporation, and even this is compromised with increasing vapour pressure. Heat production then exceeds losses and the body temperature increases (Figure 11)[26].

Figure 11- Heat production and heat loss during heat stress



Source: Adapted from Havenith, 2003

Several effector mechanisms inside the body are involved in regulating body temperature. The most important ones for heat are sweat production to lose heat from the skin and skin blood flow to transport heat from the body core and the muscles to the skin. During heat stress, the

proper functioning of both systems is essential for thermal regulation. If they are unduly stressed and cannot match the thermoregulatory demands, this leads to excessive strain on the body and eventually may cause heat illness. Additional effector mechanisms are an increase in some hormones (antidiuretic hormone and aldosterone), in respiratory rate and in heart rate. For body temperature to remain stable (heat storage = 0), heat loss needs to balance heat production[27,28].

Heat related illnesses

Skin eruptions, heat fatigue, heat cramps, heat syncope, heat exhaustion and heat stroke are classical heat related illnesses. Most heat-related illnesses (except for skin eruptions and heat cramps) are in essence consequences of varying severity of failure in the thermoregulatory system. The least severe form is heat syncope, caused by a failure of the circulation to maintain blood pressure and supply oxygen to the brain. As soon as the patient is horizontal, the system recovers quickly. The decline in blood pressure is related to a reduction in venous return, caused by the expansion of the circulatory volume by dilation of skin arteries and veins, often combined with lowered plasma volume because of dehydration (Figure 12).

Figure 12 – Dehydration and associated symptoms

Degree of dehydration	Liquid loss (litres) for a 70 kg person	Symptoms
2%	1.4	Thirst
4%	2.8	Plus dry mouth
6%	4.2	Plus increased heat rate and increased body temperature
8%	5.6	Plus swollen tongue, difficult speech, reduced mental and physical performance
12%	8.4	Recovery only after parenteral fluid administration
14%	9.6	Rapid temperature increase and death

Source: Adapted from Havenith (2003)

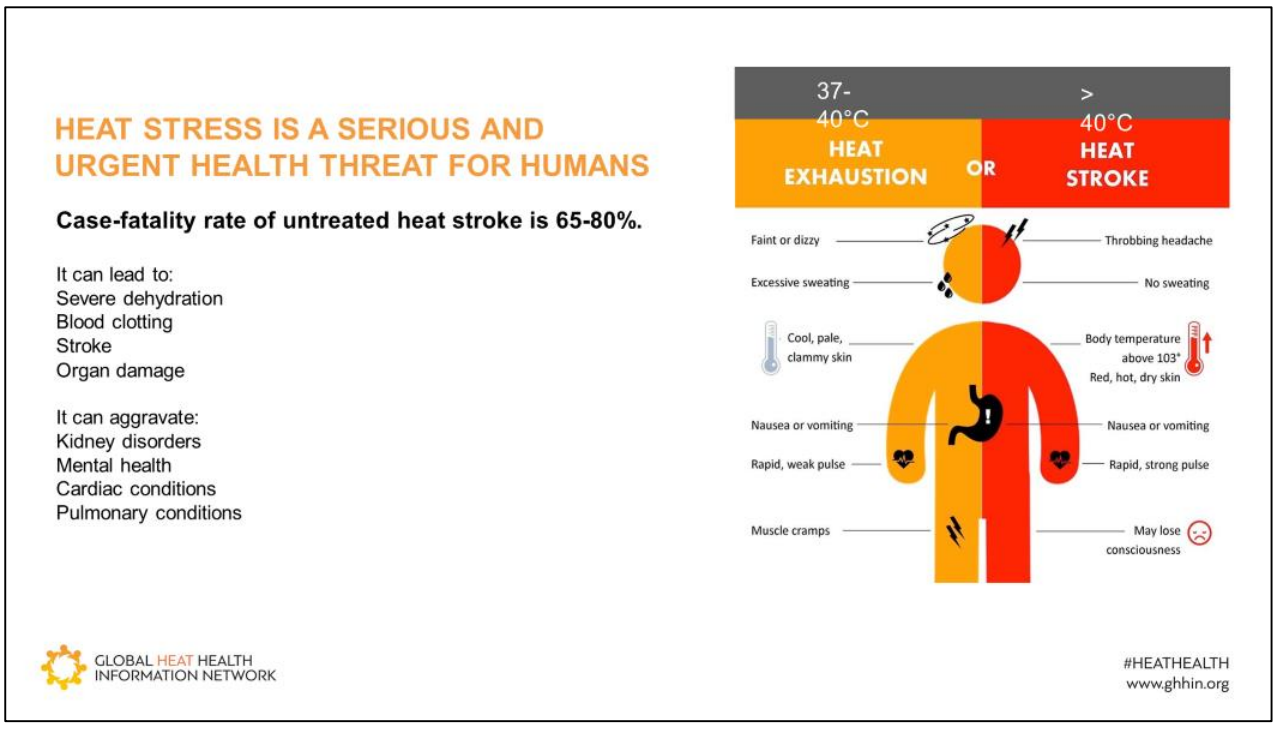
Classification of heat stress - clinical symptoms and treatment

Heat stroke is the most serious heat-related illness. It occurs when the body becomes unable to control its temperature: the body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down (Figure 13). When heat stroke occurs, the body temperature can rise to 106°F or higher within 10 to 15 minutes[29]. Heat-related stress range from minor to life-threatening, depending upon health status of individual (physiological condition) and

exposure (intensity, frequency and duration). Depending upon the severity of symptoms, Heat Stress can be categorized into five types.

1. Heat Rash
2. Heat Cramps
3. Heat Exhaustion
4. Heat Syncope
5. Heat Stroke

Figure 13 - Heat Exhaustion and Heat Stroke due to Heat Stress



Source: Global heat health information network. www.ghhin.org

Management of Heat Illness in Vulnerable Groups

Vulnerable groups relate to those who has more risks of getting heat related illnesses than the other community members. Heat-waves and extreme hot weather can cause death and also aggravate existing health conditions. Health effects of heatwaves can appear in all age and social groups and as a result of a wide range of factors; however, some people are more at risk of heat-related illness and death than others. The following factors need to considered for identification of vulnerable groups[30–32].

i. Individual risk factors (age and sex, existing illness, use of medication, being overweight, dehydration, reduced ability for acclimatization and pregnancy)

ii. Living environment risk factors (housing, urban heat island effect, internal cooling capacity, air pollution and working environment and work place conditions)

iii. Social risk factors (loneliness, lack of access to information systems and emergency services)

Based on the above risk factors we can broadly classify vulnerable groups as:

1. **Diabetic Patients**: Heat stress can increase the risk to hyperglycemia. Risk of dehydration is higher in case of diabetic people due to high levels of glucose in the blood which makes kidneys work harder and as it removes sugar by excreting urine. Along with the excess glucose, they also lose water and electrolytes which increases risk of dehydration. Lower blood volumes also increase glucose concentration in the blood and also induces transient insulin resistance that makes cells unable to metabolise glucose which may further increase blood sugar levels. The dosage of the patients may also need adjustment depending on their exposure to heat stress.

2. **Elderly/Old age group**: Aging slows the thermoregulatory process. The capacity to tolerate heat decreases, thirst sensation is delayed, sweating process is diminished. The elderly often suffers from comorbidity, physical and cognitive impairment and require to take multiple medications. Heat and sweating can lower the amount of fluid in the body, which can reduce blood volume and lead to dehydration. This may create strain on the heart.

3. **People with chronic diseases:** Those who have some preexisting diseases especially those with endocrine dysfunctions, cardiovascular diseases, neurological and physiological impairments, chronic respiratory diseases, those with liver and kidney problems and also those with high blood pressure.

4. **People taking certain medications:** The medicines which exacerbate dehydration and heat exhaustion, as well as diuretics, anti-inflammatory medicines, some antibiotics (sulphonamide), some antiviral medicines (indinavir), neuroleptics and antidepressants, benzodiazepines, amphetamines, analgesics, beta-blockers, Angiotensin-converting-enzyme (ACE) inhibitors and many more

5. **Overweight people:** They are prone to difficulties caused by heat-waves because of the tendency to retain more body heat; and prone towards high metabolic rate.

6. **People in certain occupations:** Those who work in outdoor conditions and are more exposed to heat-waves or who are exposed to high temperatures and heat radiation in the

workplace, or people who lose a lot of fluid during work, etc., may dehydrate and be more sensitive to heat illnesses;

7. **Socioeconomic status:** People whose socioeconomic status may make them more vulnerable, who because of certain social factors (ethnicity, occupation, education, social isolation, etc.) are vulnerable to heat-wave effects. These include homeless people, people who live in substandard conditions, children on the streets, internally displaced people, refugees, etc.

Risks to Pregnant Women, Children and Elderly People

Pregnant Women - Why at risk?

1. During pregnancy and in extreme heat, body works to cool both mother and the baby.
2. Heat causes the mother's blood vessels to contract in order to cool down, which then reduces the amount of nutrients that reach the foetus.
3. Blood volume greatly increases during pregnancy, which makes it more difficult to distribute fluids through the body.
4. Pregnant women naturally experience higher body temperature and periods of lower blood pressure which is exacerbated due to heat
5. Heat stress stimulates the release of maternal antidiuretic hormone or oxytocin, which reduces uterine blood flow. Increased Antidiuretic Hormone (ADH) leads to dehydration in the body.

What are the risks involved?

1. For women in their second and third trimesters, the hottest months of the year can be almost unbearable, especially in humid climates.
2. Higher risk of becoming dehydrated.
3. Temperature above 39 °C can result in neural tube defects in the fetus.
4. Overheating can cause chills, clamminess, dryness in mouth, excessive thirst, and excessive sweating.
5. Overheating after the first trimester can cause fatigue, dizziness, and nausea, with heat rash.
6. Increased risk of Urinary Tract Infections (UTI).
7. Heat stroke during pregnancy can also cause preterm labour, lower birth weight, miscarriages and maternal death

Children - Why at risk?

1. The body's ability to regulate its temperature isn't fully developed in the young.
2. Children are more susceptible to heat illness than adults due to greater surface area to body mass ratio (greater proportion of surface area than his overall weight), lower rate of sweating, and slower rate of acclimatization.
3. Children generate more heat because they have a higher metabolic rate
4. Children also rely on others to regulate their thermal environments and provide adequate fluid intake.

Elderly People - Why at risk?

1. Older people appear to be more vulnerable to heat possibly due to having fewer sweat glands, and their body may not adjust well to sudden or prolonged temperature change but also because of living alone and at risk of social isolation.

Specific Management by Category

Elderly/Old age group:

- Special attention to ongoing medication and preexisting disease.
- Try to accompany during travel
- Knowledge and awareness regarding heat stress and vulnerability.

Infant and Child up to four years:

- Special attention to hyperactive children.
- Continues hydration(oral/IV)
- Health promotion to parents regarding heat stress and its impact.
- Reduce exposure to direct heat during summer.

People with chronic diseases:

- Close monitoring of patients with endocrine and cardiac disorders.
- Change in medications if required.
- Health Education and promotion regarding heat stress
- Avoidance of excessive physical exertion and exposure of heatwaves.
- People taking certain medications:
- The medicines which exacerbate dehydration and heat exhaustion, as well as diuretics, anti-inflammatory medicines, some antibiotics (sulphonamide), some antiviral medicines (indinavir), neuroleptics and antidepressants, benzodiazepines, amphetamines, analgesics, beta-blockers, ACE inhibitors and many more should be closely monitored.

People in certain occupations:

- Educate laborers and workers regarding heat stress
- Encourage hydration by drinking water, chaas
- Encourage workers to seek medical attention if any discomfort

- Change in shift time and working hours
- Encouragement of wear light clothing's and self-protecting instruments.
- Labor Law Enforcement and Coordination
- Cooling Incentives for Local/Outdoor Businesses

People by socioeconomic status:

- Accessibility to pure potable water
- Public access to cool places
- Availability and accessibility of health care services
- Cool roof wherever possible
- Health education and promotion regarding Heat Stress and Preventive measures.

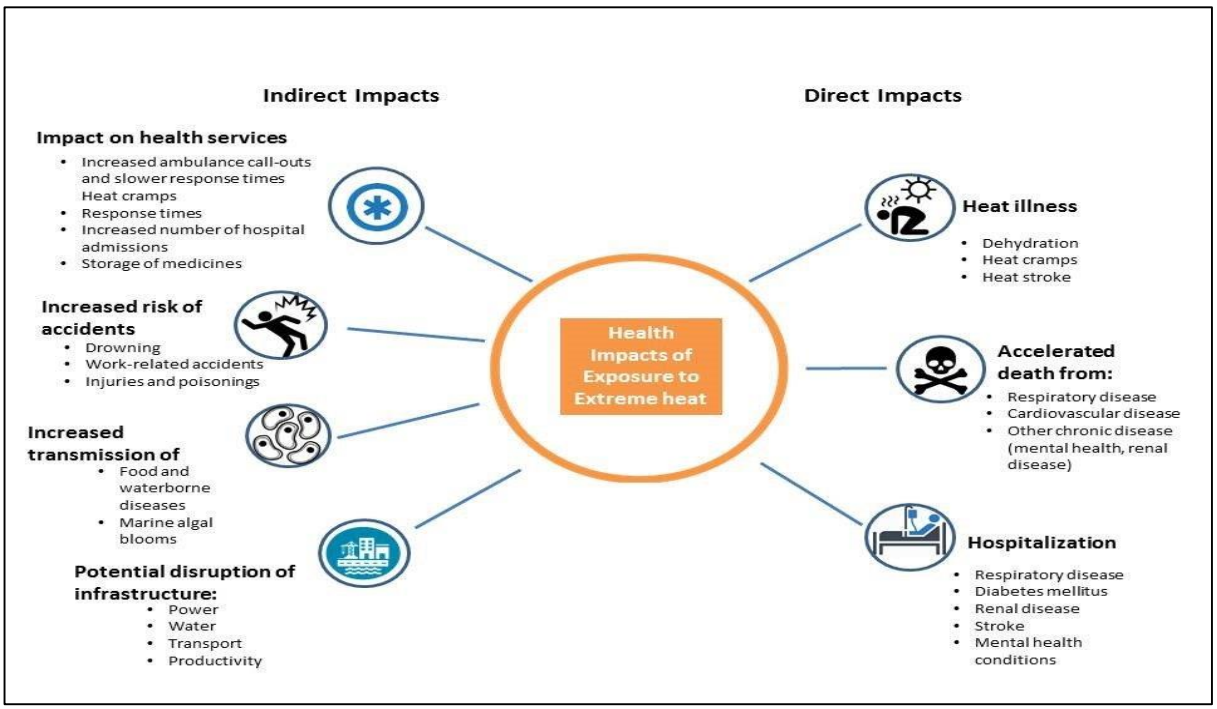
Chapter 5: Monitoring and surveillance of heat stress related mortality and morbidity

Need for an integrated monitoring and surveillance system in heatwave

There is now a greater understanding about mitigating the impacts of heatwave and adapting to changing temperatures. Monitoring and cataloguing these events are crucial in order to place an event in the historic perspective and in order to assess the potential impacts on human health and activities by combining the information with data from other catalogues[33]. While some of these elements are incorporated into heat-health planning for heatwaves, but we still have limited knowledge on better management.

In the earlier sections of the guide, we have already discussed about the consequences of exposure to extreme heat conditions. Reiterating the key discussion points of earlier sessions, the direct and indirect health impacts of heat are summarized (figure 14).

Figure 14 - Direct and indirect impacts of heat stress



Source: World Health Organization (https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health)

A robust system of monitoring and active surveillance of heat related health hazards ought to be an integral part of any district and sub-district interventions. This needs to be developed and embedded integrally within any action plan aimed at mitigating the health effects of

atmospheric heat. The importance of the surveillance system cannot be understated as it would inform the policy makers, planners and the first responders about how health problems related to ambient heat needs to be dealt in long, short and immediate terms, respectively. Importantly, indicators from the surveillance system will also help to monitor the efficiency and effectiveness of heat related actions instituted by various agencies at various levels.

Monitoring system at hospital level

The monitoring system at hospital levels will routinely help in gathering information on all aspects of the management. This process includes systematic observations and tracking of clinical outcome of cases.

Role of data

Good quality and appropriate data are integral to a robust surveillance system that can lead to evidence-based decision making, especially in terms of the timing and the scale of the mitigation measures to be mounted against the health hazards of ambient heat. Also, importantly, rigorous analysis of good quality surveillance data will provide opportunity to conduct retrospective analysis of the effectiveness of interventions, so that necessary course correction can be instituted for future.

Collection of data

The following data needs to be collected assuming they are available with desired reliability. In case of lacunae in the data system, it needs to be strengthened promptly.

1. **Heat illnesses** of heat that include heat exhaustion, heat cramps and heat stroke (dehydration being cross-cutting conditions to all these health states)
    a. Incident cases of these ailments
    b. Fatalities due to these ailments

This data needs to be captured, disaggregated by age and gender, and if possible disaggregated by occupation also. Occupations can be classified based on to what extent the practitioners are exposed to direct sunlight and ambient heat in their working environment. The unit of reporting can be wards of towns and villages to determine possible presence of "heat islands" in such areas from where many people report with the direct health effects of heat. For collection of this data a Sub-centre wise surveillance platform may be established and Multi-purpose health

workers and ASHAs may be trained to carry out his surveillance work. Syndromic surveillance of heat illnesses may be used for which there are standardized protocols.

2. **Other health effects** of heat to be tracked
    a. All-cause mortality
    b. Admission in health facilities
    c. Attendance in emergency care rooms
    d. Calls to ambulance services

These variables need to be captured as daily time-series aggregate data from municipalities/NACs or blocks and for (b) & (c) from various health facilities situated at different levels of the health system, both in the public as well as the private sector.

3. **Meteorological data** may include daily time-series of
    a. Maximum temperature
    b. Humidity

For a comprehensive surveillance system, atmospheric temperature data and heatwave warnings will have to be tracked as daily time-series, collected from meteorological centres. This data will help to raise appropriate alarm for oncoming health hazards when there is a prediction of a heatwave. Algorithms for forecasting model for excess deaths related to heatwave can also be developed from this data, such as the ICARO index (Nunes & Castro 1997) which estimates the vulnerability of local populations to heat, thus helping the authorities to mount a heat action plan appropriate and specific for the population.

Data analysis plan

The daily health hazards of heat as per serial numbers (1) and (2), mentioned above should be charted as daily time-series spanning over several weeks/months and if possible over few years as the information system matures to accommodate such information. The "spikes" and "surges" of health events from averages to be noted. The "spikes" in health effects may be correlated with "spikes" in maximum temperature and "lags" between the two if any may be noted to anticipate such problems in future. Temperature and humidity predictions for future (1 week or month whichever may be possible) may be collected from meteorological departments for "warnings" to be sent to the community. Warning systems may have severity grading: "green" denoting no additional risk due to heat, "orange" denoting moderate increase in risk and "red" denoting severe health risk due to heat. The analysis should also check long-term trends in spikes in health events, which should ideally become smoother once effective

mitigation measures are in place. In absence of such flattening of spikes of health events, modification of measures suitable to the local context has to be considered.

Table 1 – Sources of data, strengths and limitations

Type of surveillance data	**Sources of data**	**Strengths**	**Limitations**
Heat illnesses	Syndromic surveillance carried out from sub-centres by Multi-purpose health workers and ASHAs Health facility records	Can help to identify immediate effects of heat (and heatwave like situations) and can alert the health system	The reliability of data can be questionable
Other health effects of heat	Death registration system Health facility records	Can unravel the real burden of heat related health effects	A delay in registration can undermine the data
Meteorological data	From weather offices	Can lead to accurate and balanced warning systems Development of ICARO like indices to estimate the vulnerability of populations	The "lagged" effect of ambient heat is often neglected

Shared above is a template to be adapted by the local hospitals for a better health management. The summary of the data to be collected and their respective sources, strengths and limitations are given in Table 1. Since data collection and analysis is a continuous process and is applicable for both public and private sectors, we propose to capture age and gender disaggregated heat stress related events in a specific format at presented in Table 2.

OSDMA might need to develop a data management cell within its office to exclusively coordinate, monitor and regulate the data reporting system of districts and private health units. During summer months (March to June), this reporting should be made mandatory for every institution involved in the business of healthcare throughout the state. A coordination

committee headed by MD-OSDMA may be established to hold fortnightly meetings of the status of reports being submitted by various institutions/hospitals during the summer season. Any deviation / non-compliance may invite appropriate disciplinary action.

Table 2 – Format for daily heat mortality / morbidity data collection at health facility

Name of the health facility **Ward / GP no-**									
	No of cases	**Gender**			**Pregnant cases**	**Age** group **(years)**			
		M	**F**	**Others**		**0-14**	**15-35**	**35-60**	**>60**
Heat Cramps									
Heat Exhaustion									
Heat Stroke									
Mortality due to heat stroke									

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Annexures

Format-A
Daily Report to be submitted by Health Department on Cases and Deaths Due to Heat Related Illness
Date:

Sl. No.	Name of the District	New cases admitted/ treated due to Heat Related Illness during the day	Cumulative no. of cases admitted/ treated due to Heat Related Illness since 1st April 2018	Deaths reported due to Heat Related Illness during the day	Cumulative no. of deaths due to Heat Related Illness since 1st April 2018	Remarks (if any shortage of ORS/ IV fluids/ Treatment facilities etc.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total=					

(Name & Designation of the Reporting Officer)

(Signature & Seal)

Format-I

Information to be submitted with every joint enquiry report of heatstroke deaths

District- **Date:**

Sl. No.	Name of the deceased with Address (If unidentified, mention unidentified)	Age	Gender (Male/ Female/ Third Gender)	APL/ BPL	Occupation of the Deceased (Farmer/ Labourer/ Hawker/ Others-to be specified)	Place of attack of Heat Stroke					Date and time of attack of Heat Stroke	Date and time of Death	Whether the person was hospitalized?		Whether Cause of death (heat wave) confirmed by medical officer? (Yes/ No)	Any antecedent illness/ chronic disease present (Ask the family members)	Cause of death as per joint enquiry report	Whether Post mortem conducted? (Yes/ No)	Remarks
						Name of the Block/ ULB	Name of the Village/ Ward	Rural/ Urban	Indoor/ Outdoor	Location (c/op field/ market/ bus stop/street/ home/ office/ any other)			(Yes/ No)	If Yes- Name of the Hospital/ Health Centre					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)

(Name and Designation of the Reporting Officer)

(Signature with Seal)

Format-II

Details of the Death reported due to Heat Wave, Joint Enquiry & payment of ex-gratia

(Record to be maintained by Tahasil & District Office and weekly report to be submitted by District Office to SRC)

District- **Year-**

Sl. No.	Name of the deceased	Original Address of the deceased (Village/ GP/ Block/ULB)	Age	Gender (Male/ Female/ Third Gender)	Economic Status (APL/ BPL)	Occupation of the Deceased (Farmer/ Labourer/ Hawker/ Others-to be specified)	Place of attack of Heat Stroke					Date and time of attack of Heat Stroke
							Name of the Block/ ULB	Name of the Village/ Ward	Rural/ Urban	Indoor/ Outdoor	Location (crop field/ market/ bus stop/ street/ home/ office/ any other)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)

Date and time of Death	Maximum Temperature of the day (in °C) recorded at nearest weather station (mention the location of weather station	Whether the person was hospitalized?		Maximum Temperature Recorded (Rectal and Oral)	Date and Time of Post Mortem Conducted	Date of joint enquiry by the local revenue and medical officer.	Any antecedent illness/ chronic disease present (Ask the family members)	Remarks regarding cause of death		No. & Date of Sanction Order of ex-gratia	Name of the NOK	Date of Payment of ex-gratia
		(Yes/ No)	If Yes- Name of the Hospital/ Health Centre					As per Post Mortem/ Report of treating physician	As per Joint Enquiry Report			
(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)


गर्मी/लू के प्रकोप से बचाव
गर्मी/लू से बचाव के उपाय
फर्स्ट एड

INDIAN INSTITUTE of PUBLIC HEALTH
ESTABLISHED BY PHFI
BHUBANESWAR

Indian Institute of Public Health, Bhubaneswar (IIPHB)
Plot No: 267/3408, Jaydev VIhar, Mayfair Lagoon Hotel Road
Bhubaneswar - 751013
Phone: +91-674-6655601