Guidelines for Preparation of Action Plan – Prevention and Management of Heat-Wave

2017

National Disaster Management Authority
Government of India

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Foreword

The latest World Meteorological Organization statements on global climate during 2016 (published 21 March, 2017) indicate that the global temperatures continue to increase; and the year 2016 made history with a record global temperature, exceptionally low sea ice, unabated sea level rise and ocean heat. The extreme weather and climate conditions have continued into 2017. Globally, 2016 was the hottest year on record (approximately 1.1° C above pre-industrial levels), surpassing the record set in 2015. Heat waves are projected to increase in number, intensity and duration over most of the land area in the 21st century.

According to the India Meteorological Department (IMD), 2016 was the hottest year ever recorded since 1901 with country averaged annual mean land surface air temperature of 0.91^{o}C above the 1961-1990 average. The country also experienced significantly above-normal mean temperature during the 2016 hot weather season (March-May) with an anomaly of +1.36^{o}C, the second warmest ever since 1901.

India is also vulnerable to the impacts of climate change. Experts have been warning that the rising temperatures will lead to more floods, heat waves, storms, rising sea levels and unpredictable farm yields. There is evidence that climate change is causing an increase in severity and frequency of disasters as well as extreme weather events. Deforestation is also adding to environmental instability and contributing to global warming and climate change.

There has been an increasing trend of heat wave in India over the past several years whereby several States/district/cities/towns in India have been severely affected. In recent years, heat wave casualties have increased. In India heat wave caused 25,716 deaths from 1992 to 2016 in various States. State Governments reported 2,040 deaths in 2015 and 1,111 deaths in 2016. Heat wave also caused killed wildlife, birds, poultry, etc. across the country.

The increased occurrences and severity of heat wave is a wake-up call for all agencies to take necessary action for prevention, preparedness and community outreach to save human lives, livestock and wild life.

As a preliminary event to the National Platform for Disaster Risk Reduction 2017, NDMA in collaboration with Government of Telangana organized a two-day National Workshop on Heat wave risk reduction through sharing of best practices at Hyderabad on 22-23 February, 2017. The overall goal of the workshop was to guide States in operationalizing heat action plans in their respective states. The workshop was attended by 43 participants from 10 heat-prone States and various technical agencies. The Workshop recommended the constitution of an Expert Group for reviewing the National Guidelines. The Group was constituted in March 2017 and through successive deliberations, the Guidelines were reviewed.

Heat Wave Guidelines aim to facilitate the stakeholders in preparing a Heat Wave Action Plan by providing insights into heat-related illness and the necessary mitigative and response actions to be undertaken. It will also help in mobilization of and coordination among various ministries/departments, individuals and communities to help and protect their neighbours, friends, relatives, and themselves against avoidable health problems during spell of very hot weather.

We take this opportunity to express our deep appreciation of the commitment of various stakeholders who extended their willing support and cooperation to our efforts. We are grateful to the members of the Expert Committee for their expertise.

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I express my sincere thanks to the representatives of Odisha, Gujarat, Telangana, Andhra Pradesh, scientific and technical institutions, eminent professionals, non-governmental organisations and private sector for their valuable inputs which helped us improve the content and the presentation of this document.

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I am confident that this document will help Central Ministries and Departments, States and the Union territories in formulating effective Heat Wave action Plans that will improve our preparedness and response to heat waves in the future.

New Delhi

Dr V Thiruppugazh

May, 2017

Checklist for States to Develop Heat Action Plans

Step 1: Government Engagement

Setting up a Heat Action Plan requires participation from State and district government leaders, municipal health agencies, disaster management authorities and local partners. For example, Odisha has a dedicated heat wave committee chaired by the Odisha State Disaster Management Authority and has representatives from all other relevant departments.

Step 2: Appointing a State Nodal Agency and Officer

The State should appoint a head/nodal officer at the State or district levels, and depute an agency to oversee the Heat Action Plan. It should also build the capacity of key officials and agencies to recognize their roles in the State Heat Action Plan. The State Nodal Agency and Officer can then conduct table-top exercises, simulations, and drills before the heat season as well as identify and resolve communication gaps between participating departments, partners and the public.

Step 3: Vulnerability Assessment and Establishing Heat-Health Threshold Temperatures

It is important to identify vulnerable areas and populations in order to establish priorities and minimum thresholds for heat alerts and activities. Threshold temperatures can be determined by two methods: percentile approach and specific approach. The state should coordinate with the Indian Meteorological Department (IMD) to develop thresholds as well. Identifying local academic/research institutes like medical colleges can provide additional useful partners for coordination.

Step 4: Drafting and Developing the Heat Action Plan

The State Nodal Officer and Agency can then coordinate with the local IMD office to start receiving summer season forecasts annually from March to June and set up the early warning and alert system based on colour codes corresponding to different thresholds.

Step 5: Team Preparation and Coordination

Government leaders should ensure that State officials and agencies are well prepared for the heat season, key officials are well-trained and have information regarding pre, during and post heat season activities. Develop a clearly defined interagency emergency response plan with roles and information flows clearly marked out.

Step 6: Implementation and Monitoring

While the government departments (and partners) are responsible for implementing many components of a heat action plan, the public should be made aware of how to respond to extreme heat. Information, education and communication (IEC) materials play an important role in widely disseminating key messages to communities in advance. Specific messages should be developed to cater to vulnerable groups such as elderly, young children, outdoor workers and slum residents. “Do's-and-Don’ts” during a heat wave should be available in local languages and disseminated through media.

Step 7: Evaluating and Updating the Plan

The approach towards extreme heat must be flexible and iterative to determine if the strategies to deal with it are effective and with unintended negative consequences. After every heat season, the city or State must assess the efficacy of its heat action plan, including the processes, outcomes, and impacts. Stakeholders should then identify changes and improvements for the next heat season. The plan should be updated annually, and key officials and participants should be made aware of these changes.

Step 8: Strategies for Reducing Extreme Heat Exposures and Adapting to Climate Change (Long term plans)

States should consider mitigation strategies to reduce the impact of extreme heat, such as increasing the green cover in a city to reduce urban heat island effect, or implementing cool roofs to provide comfort as well as reduce the impact of increased urbanization. Vulnerability assessment should also consider climate change scenarios wherever possible.

1. Background & Status

1.1 Introduction

India, with approximately 1.32 billion people, is the second most populous country in the world with considerably high levels of population density. It is also among the worst disaster-prone countries of the world. As per 2011 census, 31 per cent of India's population lives in urban areas and the remaining 69 per cent live in rural areas. The trend shows that the number of persons living in urban areas will continue to grow at a faster rate than the population in the rural areas due to migration and increasing urbanization. Increasing urbanization and unique challenges associated with it such as heat wave island effect in cities will further exacerbate the problem of heat wave in many parts of our country.

The latest World Meteorological Organization statements on global climate during 2016 (published 21 March, 2017) indicate that the global temperatures continue to increase; and the year 2016 made history with a record global temperature, exceptionally low sea ice, unabated sea level rise and ocean heat. The extreme weather and climate conditions have continued into 2017. Globally, 2016 was the hottest year on record (approximately 1.1° C above pre-industrial levels), surpassing the record set in 2015. Heat waves are projected to increase in number, intensity and duration over most of the land area in the 21st century. India too is feeling the impact of increased temperatures. According to the India Meteorological Department (IMD), 2016 was the hottest year ever recorded since 1901 with country averaged annual mean land surface air temperature of 0.91^{o}C above the 1961-1990 average. The country also experienced significantly above-normal mean temperature during the 2016 hot weather season (March-May) with an anomaly of +1.36^{o}C, the second warmest ever since 1901. This is directly affecting the communities, undermining their livelihoods through gradual, insidious changes in temperature and rainfall patterns, and resulting in an increased frequency and intensity of hazards such as floods, cyclones, droughts, unseasonal rains and hailstorms, etc., causing extensive damage to crops and agro-rural economy.

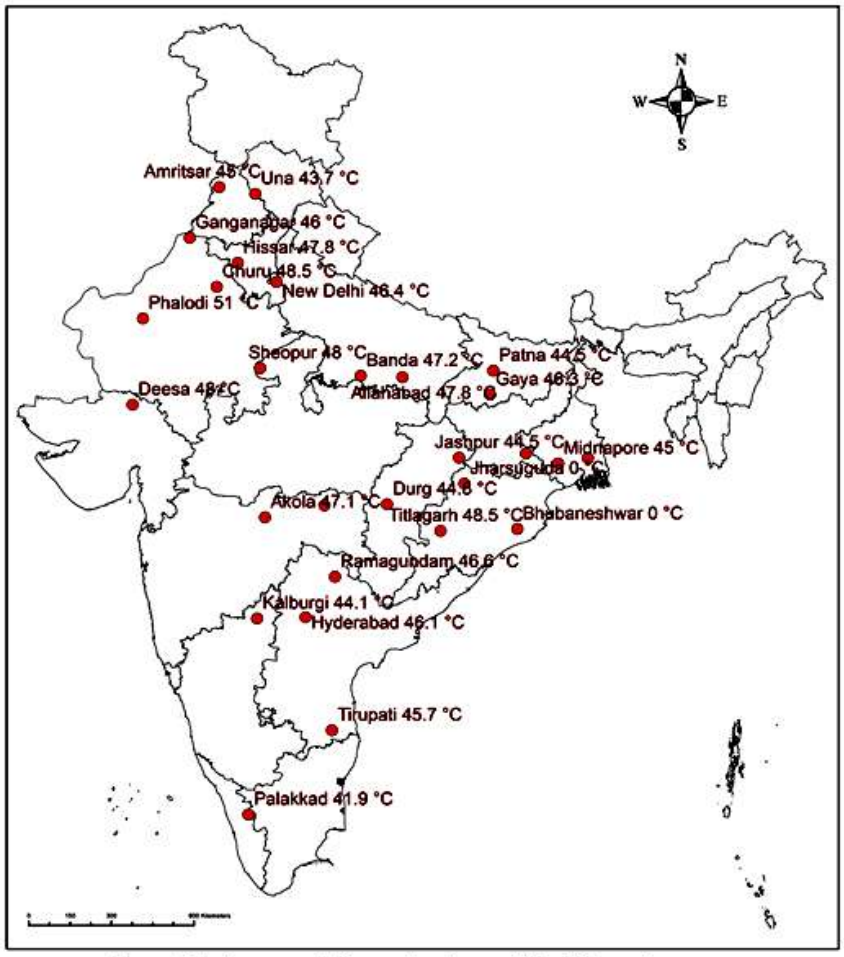


Figure 1: Higest ever recorded temperature at some station in the country

Heat wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the pre-monsoon (April to June) summer season. Heat waves

typically occur from March to June, and in some rare cases, even extend till July. On an average, five-six heat wave events occur every year over the northern parts of the country. In 2016, severe heat wave conditions affected Bihar, Jharkhand, Gangetic West Bengal, Odisha, Punjab, Haryana, Chandigarh & Delhi, Rajasthan, Maharashtra, West Madhya Pradesh and Gujarat.

The most notable temperatures have been: Hyderabad (Andhra Pradesh): 46.1°C, Khammam (Telangana): 48°C, Jharsuguda (Odisha): 45.4°C, Bhubaneshwar (Odisha): 44°C, Allahabad (Uttar Pradesh): 47.8°C, Delhi: 46.4°C, Jashpur (Chhattisgarh): 44.5°C, Kolkata (West Bengal): 44.5°C, Gaya (Bihar): 46.3°C, Nagpur (in Maharashtra): 47.1°C, Kalburgi (Karnataka): 44.1°C and Churu (Rajasthan) 48.0°C in 2015; and Phalodi (Rajasthan) 51°C, Titlagarh (Odisha) 48.5°C, Churu (Rajasthan) 48.5°C, Sheopur (MP) 48.0°C, Hisar (Haryana) 47.8°C, Banda (UP) 47.2°C, Ramagundem (Telangana) 46.4°C and Ganganagar (Rajasthan) 46.0°C, Jamshedpur (Jharkhand) 45.5°C in 2016. The highest-ever recorded maximum temperatures at some of the places in the country are given in Table 1 below. It shows that temperatures in excess of 46°C have been recorded in many parts of the country.

International experiences: After a major heat wave in Europe resulted in around 70,000 deaths in 2003, many research projects were carried out to assess the impact of heat and cold waves. This led to impact and adaptation assessments for a selection of climate-related health outcomes, especially for heat waves. EuroHEAT aimed to improve public-health responses to weather extremes, particularly to heat waves. Major findings from the EuroHEAT project were: adverse health effects of heatwaves are largely preventable; this requires a range of actions at different levels from health-system preparedness coordinated with meteorological early warning systems to timely public and medical advice and improvements to housing and urban planning.

Assessment and Prevention of Acute Health Effects and Weather Conditions in Europe (PHEWE) is a project set to investigate the association between meteorological variables during the warm season and acute health effects (mortality, hospital admissions) in 17 large European cities, and using this understanding to develop preventive strategies. Specific issues investigated included health-related threshold levels of a range of weather variables, form of the weather dose-health response curve, latency time between weather exposure and effect, specific air masses associated with health effects.

Climate Change and Adaptation Strategies for Human Health (cCASHh) is a similar project and it suggested that any comprehensive long-term strategy for minimizing the risks associated with global climate change requires the combination of planned adaptation (now and how) and mitigation. Apart from these plans in Europe, US has developed several plans in cities like New York, Chicago, California and other cities. These plans suggest best practices during the heat wave periods and resilience strategies to combat heat waves. Globally, many action plans were developed, tested and the results assessed based on the preparedness level, mitigation strategies and the impact it had on human health. We can learn from these plans and adapt to situation in India. This has been done in the Ahmedabad Heat Action Plan.

Many States in India experience a severe heat wave year after year. In 1998, heat wave in Odisha took away 2,042 lives. In 2015, casualties were abnormally high across the country and most of the deaths were concentrated in Andhra Pradesh, Telangana, Punjab, Uttar Pradesh, Odisha and Bihar breaking the records of previous years. The recent spread of heat wave to newer areas made people even more vulnerable as communities were caught unawares.

In 2012, Ahmedabad in Gujarat became the first city to start developing its heat wave action plan. . Followed by this, States like Bihar, Telangana, Odisha and Maharashtra started working towards developing their State-specific action plans. In 2016, Bihar also issued some guidelines to be followed during heat waves like closing of schools, avoiding cooking during peak hours, etc. In the same year, Odisha and Telangana prepared their heat wave action plans.

Scientific studies have been done in Ahmedabad, Nagpur and Bhubaneswar to identify threshold temperatures and vulnerability assessment in two cities of states of Odisha and Gujarat. Such studies are needed in other States too in order to develop contextualized action plans.

Lessons learnt from other States and countries can be implemented in order to protect vulnerable groups of population in the country. The recommended action plan for each State can be divided into short term and long term measures based on its socio-cultural context. Short term interventions like development of protocols and standard operating procedures for each department, improving communication activities, **water crisis management**, making all workplaces safe, and provision of medical treatment, **water facilities** and wash rooms at workplace and other strategic points can save many lives. Long term strategies like urban planning, specific budget allocation towards heat risk reduction in each department, increasing forest coverage, pollution control, promoting the use of public transport, encouraging green buildings and promoting sustainable growth in the cities can save lives of vulnerable people.

Extreme temperatures combined with high humidity and resultant atmospheric conditions adversely affect people leading to physiological stress, sometimes even death. Heat wave can affect human and animal health and also cause major disruption in community infrastructure such as power supply, public transport and other essential services.

Table 1: Heat Wave Reported during April – June 2016

State	Heat wave spell	Mean Daily Max. Temp (°C)	Recorded Max. Temp (°C)	Date	Station
West Bengal	10-12April; 16-17 April; 20-27 April; 30 April-1 May	39.6	45.0	23 April	Midnapore
Odisha	9-12 April; 16-29 April; 2 May	40.2	48.5	24 April	Titlagarh
Jharkhand	9-11 April; 16-21 April	43.0	45.8	23 April	Jamshedpur-AP
Bihar	9-11 April; 20,26,30 April	42.1	44.5	30 April	Patna-AP
				18 May	Gaya
Uttar Pradesh	16 April; 16-18 May; 22 May	42.7	47.2	2 May	Banda
				18 May	Banda
Haryana	3, 16 April; 22May	41.0	47.8	21 May	Hisar
Punjab	17 April; 2 May	41.8	45.0	18 May	Amritsar
Himachal Pradesh	2, 4,20 April	27	43.7	4 June	Una
Rajasthan	2-3 April; 15-16 April; 9-23 May; 4-10 June; 20-21 June	44.6	51.0	19 May	Phalodi
Madhya Pradesh	2-5 April; 16-17 April; 13-22 May; 4June; 7-11 June	42.9	48.0	19 May	Sheopur
Gujarat	17-19 May; 5 June	40.1	48.0	19 May	Deesa
				19 May	Ahmedabad
Maharashtra	21-22 April; 14-23 May; 2 June	43.4	47.1	18 May	Akola
Chhattisgarh	19-20 April	42.3	44.8	27 May	Durg
Andhra Pradesh	23-25 April; 24-26 May; 16 June	40.8	45.7	24 April	Tirupathi
Telangana	23-24 April; 22-27 May	43.7	46.6	25 May	Ramagundam
Kerala	28-30 April; 1-4 May; 9-10 May	36.7	41.9	26 April	Palkkad

Source: IMD, New Delhi

Heat wave is also called a “silent disaster” as it develops slowly and kills and injures humans and animals. Higher daily peak temperatures for a longer duration and more intense heat waves are becoming increasingly frequent globally due to climate change. India too is feeling the

impact of climate change in terms of increased instances of heat wave with each passing year. The adverse impacts of heat wave can be significantly reduced by educating people on the DO's and Don'ts of Heat Wave (Annexure 4) and developing a culture of reporting issues to health facilities on time thereby ensuring timely diagnosis and treatment.

1.2 Definition

Heat wave: Heat wave is a condition of atmospheric temperature that leads to physiological stress, which sometimes can cause deaths as well. The World Meteorological Organization defines a heat wave as five or more consecutive days during which the daily maximum temperature exceeds the average maximum temperature by five degrees Celsius. Different countries define heat wave differently in context of their local conditions. In India, heat wave is considered if maximum temperature of a station reaches at least 40°C or more for plains, 37°C or more for coastal stations and at least 30°C or more for hilly regions. Following criteria are used to declare a heat wave:

a) Based on Departure from Normal

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

b) Based on Actual Maximum Temperature (for plains only)

- *Heat Wave:* When actual maximum temperature ≥ 45°C
- *Severe Heat Wave:* When actual maximum temperature ≥47°C

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

As per the annual climate summary report of the IMD, the mean temperature over India has increased at a rate of 0.63°C/100 years since the beginning of the 20th century with large positive anomalies in the last couple of decades. The increase of mean temperature during summer season (March-May) in the same period has been at a rate of 0.56°C/100 years. On an average, more than eight heat wave days and one to three severe heat wave days are experienced during the hot weather season from March to July over north and central parts of the country. Also, many of the stations in northwest India, Gangetic plains, Central India and east coast India have experienced continued heat wave spell of more than 10 days, mostly during May and June. There has been an increasing tendency of extreme summer temperatures over most parts of the country in last five decades. Also, the impact of extreme temperatures is higher along the west coast of India.

The level of heat discomfort is determined by a combination of meteorological (temp, RH, wind, direct sunshine), social/cultural (clothing, occupation, accommodation) and physiological (health, fitness, age, level of acclimatization) factors. There will be no harm to the human body if the environmental temperature remains at 37° C. Whenever the environmental temperature increases above 37° C, the human body starts gaining heat from the atmosphere. If humidity is high, a person can suffer from heat stress disorders even with the temperature at 37°C or 38°C as high humidity does not permit loss of heat from human body through perspiration. To calculate the effect of humidity, Heat Index Values are used in some countries. The Heat Index is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature. Heat index chart used by the National weather Service of the USA given below

shows that if the air temperature is 34°C and the relative humidity is 75per cent, the heat index - how hot it feels - is 49°C. The same effect is reached at just 31°C when the relative humidity is 100per cent.

This chart, however, is developed for conditions prevailing in and acclimatization of people in colder countries; and is not directly applicable in India. The US National Weather Service states that the Heat Index calculation using this chart may produce meaningless results for temperatures and relative humidity outside of the range depicted on the chart. As temperature and humidity outside range of this chart are not uncommon in many parts of India, it cannot be directly used. The notion of looking at temperature and humidity in combination is good; however, in order to develop a usable matrix in the Indian context, more research needs to be done.

Temperature / Humidity Index by NOAA, for USA

Relative Humidity %	Temperature °C																
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
40	27	28	29	30	31	32	34	35	37	39	41	43	46	48	51	54	57
45	27	28	29	30	32	33	35	37	39	41	43	46	49	51	54	57	
50	27	28	30	31	33	35	36	38	41	43	46	49	52	55	58		
55	28	29	30	32	34	36	38	40	43	46	48	52	54	58			
60	28	29	31	33	35	37	40	42	45	48	51	55	59				
65	28	30	32	34	36	39	41	44	48	51	55	59					
70	29	31	33	35	38	40	43	47	50	54	58						
75	29	31	34	36	39	42	46	49	53	58							
80	30	32	35	38	41	44	48	52	57								
85	30	33	36	39	43	47	51	55									
90	31	34	37	41	45	49	54										
95	31	35	38	42	47	51	57										
100	32	36	40	44	49	56											

Caution | Extreme Caution | Danger | Extreme Danger

The US National Weather Service Heat Index Chart (http://www.nws.noaa.gov/os/heat/heat_index.shtml)

1.3 Heat Waves Impacts in India

Extreme positive departures from the normal maximum temperature result in a heat wave during the summer season. The rising maximum temperature during the pre-monsoon months continues till June, and in some cases till July, when the onset of southwest monsoon gets delayed over some parts of the country. In recent years, heat wave casualties have increased. Abnormally high temperatures were observed during April–June during 2010 to 2016 across the country. In India, heat wave caused 25,716 deaths from 1992 to 2016 across various states (Table 3). State Governments reported 2,040 deaths in 2015 and 1,111 deaths in 2016 (Table 2). Heat wave also caused the death of wildlife, birds, poultry, etc. across the country.

Table 2

No of Deaths due to Heat wave

(Information received by NDMA From respective States Government)

SN	State	2015	2016	2017*
1	Andhra Pradesh	1422	723	10
2	Bihar	-	Nil	
3	Chhattisgarh	-	1	
4	Delhi-NCR	-	-	
5	Gujarat	17	7	
6	Haryana			
7	Jharakhand	-	4	
8	Karnataka	-	Nil	2
9	Maharashtra	-	7	3
10	Madhya Pradesh	-	Nil	1
11	Odisha	60	36	2
12	Punjab			
13	Rajasthan	-	9	
14	Telangana	541	324	12
15	Tamil Nadu			
16	Uttar Pradesh	-	Nil	
17	West Bengal	-	Nil	
	Total	**2040**	**1111**	**29**

Source: Casualty data confirmed by Revenue and Disaster Management Division of respective State Government to the NDMA

*Reported up to 25th April 2017

Table 3

Year wise Deaths recorded due to Heat wave in India

Year	Casualty
1992	612
1993	631
1994	773
1995	1677
1996	434
1997	393
1998	3058
1999	628
2000	534
2001	505
2002	720
2003	807
2004	756
2005	1075
2006	754
2007	932
2008	616
2009	1071
2010	1274
2011	793
2012	1247
2013	1216
2014	1677
2015	2422
2016	1111

Source: compiled data from different sources, since 1992 to 2016

2. Media News published in the Hindu, 7th June 2015: http://www.thehindu.com/sunday-anchor/summer-of-2015-heat-wave-and-deaths/article7289830.ece
3. Revenue and Disaster Management Division of respective State Government
4. IMD report

1.4 Past experience on Heat-wave plan implementations

In 2013, the Ahmadabad Heat Action Plan was developed, which outlined several interventions such as public awareness and community outreach, building capacity of medical community, reducing heat exposure and promoting adaptive measures, and finally, developing an early warning system along with an inter-agency response plan. The key lessons on developing a heat action plan at the local level were: involving local city/district administration, using local IMD and health data (death registration, OPD, Indoor admission, ambulance calls)discussing issues with local and national institutions / experts, adapting HAPs developed in other countries / cities, monitoring and evaluating implementation and impact on mortality and morbidity.

Ahmedabad Heat wave Action provides a framework the following key lessons for other cities:

- Recognize Heat Wave as a major Health Risk.
- Map out the High Risk Communities.
- Setting up of Public Cooling Places.
- Issue Heat wave alerts through different media.

Odisha State Disaster Management Authority has taken the following steps to tackle heat wave:

- **Early warning systems:** Temperature and humidity levels, considered together, will determine the threshold for heat wave alerts. Bhubaneswar experiences up to 85 percent humidity in the summers, with Odisha's coastal regions facing even higher humidity.

- **Public outreach:** Temperature forecasts and heat alerts will be sent as bulk messages on mobile phones, including to the media for wider broadcast. Electronic screens at busy traffic intersections and market places will also display the information. The State is also developing a website and a mobile phone app that would not only provide heat alerts but also help users identify, via maps, heat shelters and drinking water availability along highways through the State.

- **Medical up-gradation and administrative measures:** Heat treatment wings have been planned in hospitals, and heat alerts would trigger early morning shifts for schools and offices.

2. Preparing a Heat Wave Plan

2.1 Heat wave and Disaster Management

"Disaster" is defined under section 2(d) of the Disaster Management Act, 2005 as a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, and is of such a nature or magnitude as to be beyond the coping capacity of the affected area. Heat wave has not been notified as a disaster by the Government of India yet. It is not in the list of twelve disasters eligible for relief under National/ State Disaster Response Fund norms. However, a State Government may use up to 10 per cent of the funds available under the SDRF for providing immediate relief to the victims of natural disasters that they consider to be disasters "within the local context in the State and which are not included in the notified list of disasters of the Ministry of Home Affairs subject to the condition that the State Government has listed the State specific natural disasters and notified clear and transparent norms and guidelines for such disasters with the approval of the State Authority."

2.2 Rationale for Heat wave Action Plan (HAP)

Many States are affected during the heat wave season, such as Andhra Pradesh, Telangana, Odisha, Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, Bihar, Jharkhand, West Bengal, Haryana, Punjab and Delhi.

It is likely that the number of actual heat wave related deaths is much higher than the number reported as heat related illnesses are often recorded inaccurately and figures from rural areas are hard to attain. The combination of exceptional heat stress and a predominantly rural population makes India vulnerable to heat waves. Vegetable vendors, auto repair mechanics, cab drivers, construction workers, police personnel, road side kiosk operators and mostly weaker sections of society are extremely vulnerable to the adverse impacts of heat waves such as dehydration, heat and sun strokes. Therefore, it is not surprising that these workers, homeless people and the elderly constitute the majority of heat wave casualties in India. It is time to devise a national level strategy and plan to combat this disaster. A comprehensive heat preparedness and response requires involvement from government authorities, non-governmental organizations and civil society.

2.3 Vulnerability Assessment

Identifying the vulnerable population helps in designing appropriate strategies and intervention at community level. Each city or town should carry out an assessment using available resources and robust scientific methods. One of the methods could be a case control study in a community or at a workplace to identify the most vulnerable population and the risk factors of being vulnerable. The first phase would be a household survey gathering information on socio-demographic data, medical conditions, medication use, adaptive practices during summer, community strategies and challenges faced during summers. A qualitative technique should be used to explore the opportunities, challenges and innovations during summers. The list of possible vulnerable population can be but not limited to pregnant/lactating women, elder (>=60 yr), children (<5 yr), persons with disabilities (physical or mental), persons with chronic diseases, persons suffering from immune

compromised diseases, and/or persons with debilitating conditions. Similar surveys can be done among different occupational groups to understand their challenges, practices and vulnerability risk at workplace. The vulnerability assessment done in Bhubaneswar identified that people with chronic disease(s) and poor housing conditions are more vulnerable to heat wave. Also, those who use solid fuels for cooking and those who travel a long distance during summer months are more susceptible to heat related illnesses. Besides Bhubaneswar, Ahmedabad has also done a survey on vulnerability assessment for traffic police. Similar exercises should be done in other cities/towns to identify the vulnerable populations.

2.4 Objective of Heat wave Action Plan

The Heat Wave Action plan aims to provide a framework for implementation, coordination and evaluation of extreme heat response activities in cities/town that reduce the negative impact of extreme heat. The Plan's primary objective is to alert those at risk of heat-related illness in places where extreme heat conditions either exist or are imminent, and to take appropriate precautions. The Plan also calls for preparedness measures to protect livestock/animals as extreme heat causes significant stress to them as well. The heat wave action plan is intended to mobilize departments and communities to help protect their neighbors, friends, relatives, and themselves against avoidable health problems during spells of very hot weather. The Plan also intends to help early warning agencies as well as the media. The administrative/preventive actions that need to be taken by multiple agencies/ministries/departments are enumerated in Table 5. All States/district/cities/town can learn from their/others' experiences and develop a plan to deal with heat wave effectively. In addition, the State Governments should also prepare a comprehensive plan to combat heat waves.

2.5 Key strategies

Severe and extended heat waves can also cause disruption to general, social and economic services. Government agencies will have a critical role to play in preparing and responding to heat waves at the local level, working closely with health and other related departments on a long-term strategic plan.

- Establish Early Warning System and inter-agency coordination
- Developing inter-agency response plan
- Preparedness at the local level for health system
- Health system capacity building
- Public awareness and community outreach
- Collaboration with non-government and civil society
- Assessing the impact – feedback for reviewing and updating the plan

3. Early Warning and Communications

3.1 Forecast and Issuance of Heat Alert or Heat Warning

India Meteorological Department (IMD), Ministry of Earth Sciences, is the nodal agency for providing current and forecast weather information, including warnings for all weather related hazards for optimum operation of weather-sensitive activities. It provides warning against severe weather phenomena like tropical cyclones, squally winds, heavy rainfall/snow, thunder-squall, hailstorm, dust storms, heat wave, warm night, fog, cold wave, cold night, ground frost, etc. It also provides real time data and weather prediction of maximum temperature, heat wave warning, extreme temperatures, and heat alerts for vulnerable cities/rural areas.

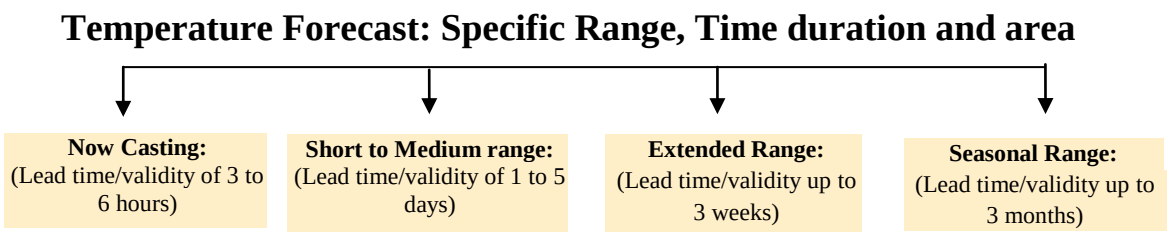
IMD issues forecasts and warnings for all weather related hazards in short to medium range (valid for the next five days) every day as a part of its multi-hazard early warning system. These warnings, updated four times a day, are available at http://www.imd.gov.in/pages/allindiawxfcbulletin.php.

A new system of exclusively heat-related warnings has been introduced with effect from 03 April, 2017. These warnings, valid for the next four days, are issued around 1600 hours IST daily and are provided to all concerned authorities (Departments of health, disaster management, Indian Red Cross and Indian Medical Association, NDMA etc.) for taking suitable action at their end. A bulletin in extended range with outlook for the next two weeks (for all hazards including heat wave) is issued every Thursday (available at http://www.imd.gov.in/pages/extended.php).

In addition to the above, Climate Forecast System based forecasts maps of daily maximum temperatures and their departures from normal for the next 21 days (issued every Thursday) are also available on IMD website (http://nwp.imd.gov.in/cfs_all.php?param=tmax and http://nwp.imd.gov.in/cfs_all.php?param=tmaxa, respectively).

From 2016, IMD has introduced a system of issuing seasonal temperature outlooks for the next three months. For 2017, the first outlook valid for March to May was issued on 28 February, 2017; and the second one valid for April to June was issued on 02 April, 2017. These seasonal outlooks are issued in the form of a press release on the IMD website, and through electronic and print media. These are also provided to all concerned Chief Secretaries, Disaster Managers and to the health sector through the India Medical Association (IMA).

The operational system of weather forecasts and warnings is summarized in the chart below:



3.2 Identification of Colour Signals for Heat Alert

IMD currently follows a single system of issuing warnings for the entire country through a colour code system as given below. This system advises on the severity of an expected heat hazard. However, threshold assessments carried out in different parts of the country tells us that there are different cut-off points that determine the warning signals appropriate for a specific

state/region. The States should, therefore, carry out their respective threshold assessments for mortality and provide the information to IMD so that it can provide specific warning alerts to those States.

Green (No action)	**Normal Day**	**Maximum temperatures are near normal**	**Comfortable temperature. No cautionary action required.**
Yellow Alert (Be updated)	Heat Alert	Heat wave conditions at district level, likely to persist for 2 days	Moderate temperature. Heat is tolerable for general public but moderate health concern for vulnerable people e.g. infants, elderly, people with chronic diseases. Avoid heat exposure.
Orange Alert (Be prepared)	Severe Heat Alert for the day	(i) Severe heat wave conditions may persist for 2 days. (ii) With varied severity, heat wave is likely to persist for 4 days or more.	High temperature. Increased likelihood of heat illness symptoms in people who are either exposed to sun for a prolonged period or doing heavy work. High health concern for vulnerable people e.g. infants, elderly, people with chronic diseases. Avoid heat exposure – keep cool. Avoid dehydration.
Red Alert (Take Action)	**Extreme Heat Alert for the day**	**(i) Severe heat wave may persist for more than 2 days. (ii) Total number of heat/severe heat wave days likely to exceed 6 days.**	**Very high likelihood of developing heat illness and heat stroke in all ages. Extreme care needed for vulnerable people.**

4. Dealing with Heat Related Illness

4.1 Prevention of Heat Related Illness:

Heat waves characterized by long duration and high intensity have the highest impact on morbidity and mortality. The impact of extreme summer heat on human health may be exacerbated by an increase in humidity. There is growing evidence that the effect of heat wave on mortality is greater on days with high levels of ozone and fine particulate matter. Global climate change is projected to further increase the frequency, intensity and duration of heat waves and attributable death (WHO).

Heat related illness is avoidable. It can be best prevented if the vulnerable populations/communities are made aware of prevention tips, basic Do's and Don'ts through effective use of various media. Knowledge of effective prevention and first-aid treatment, besides an awareness of potential side-effects of prescription drugs during hot weather, is crucial for physicians and pharmacists to best mitigate the effects of heat illnesses. The details of case definitions are mentioned in annexure 2.

Table 4: Symptoms and First Aid for various Heat Disorders

Heat Disorder	Symptoms	First Aid
Heat rash	Skin redness and pain, possible swelling, blisters, fever, headaches.	Take a shower using soap to remove oils that may block pores preventing the body from cooling naturally. If blisters occur, apply dry, sterile dressings and seek medical attention.
Heat Cramps	Painful spasms usually in leg and abdominal muscles or extremities. Heavy sweating.	Move to cool or shaded place. Apply firm pressure on cramping muscles or gently massage to relieve spasm. Give sips of water. If nausea occurs, discontinue.
Heat Exhaustion	Heavy sweating, weakness, Skin cold, pale, headache and clammy extremities. Weak pulse. Normal temperature possible. Fainting, vomiting.	Get victim to lie down in a cool place. Loosen clothing. Apply cool, wet cloth. Fan or move victim to air-conditioned place. Give sips of water slowly and if nausea occurs, discontinue. If vomiting occurs, seek immediate medical attention, call 108 and 102 for ambulance.
Heat Stroke (Sun Stroke)	High body temperature. Hot, dry skin. Rapid, strong pulse. Possible unconsciousness or altered mental status. Victim will likely not sweat.	Heat stroke is a severe medical emergency. Call 108 and 102 for ambulance for emergency medical services or take the victim to a hospital immediately. Delay can be fatal. Move victim to a cooler environment. Try a cool bath or sponging to reduce body temperature. Use extreme caution. Remove clothing. Use fans and/or air conditioners. **DO NOT GIVE FLUIDS ORALLY if the person is not conscious.**

4.2 Hospital Preparedness Measures for Managing Heat related Illness:

Director/In-charge of Hospitals in all States/Districts should ensure that the following measures are in place:

- A detailed action plan to tackle heat-related illnesses well in advance of hotter months.
- Standard Operating procedures to tackle all levels of heat-related illnesses. Capacity building measures for doctors, nurses and others staff should be undertaken.
- Cases with suspected heat stroke should be rapidly assessed using standard Treatment Protocols.
- Identify surge capacities and mark the beds dedicated to treat heat stroke victims and enhance emergency department preparedness to handle more patients.
- Identify RRT (Rapid Response Teams) to respond to any exigency call outside the hospitals.
- Ensure adequate arrangements of Staff, Beds, IV fluids, ORS, essential medicines and equipment to cater to management of volume depletion and electrolyte imbalance.
- May try to establish outreach clinics at various locations easily accessible to the vulnerable population to reduce the number of cases affected. Health Centers must undertake awareness campaigns for neighbourhood communities using different means of information dissemination.
- Primary centres must refer the patients to the higher facility only after ensuring adequate stabilization and basic definitive care.
- Hospitals must ensure proper networking with nearby facilities and medical centres to share the patient load which exceeds their surge capacities.
- All cases of heat-related illnesses should be reported to IDSP (Integrated Disease Surveillance Programme) unit of the district.

4.3 Acclimatization:

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

4.4 Identification of Heat Wave illnesses and recordings of casualties:

It is important to undertake an objective identification of heat wave illnesses and systematically record causalities resulting from heat wave. States may form committees at the district level with members not below the rank of Assistant Civil Surgeon, Tahsildar, and Inspector of Police to enquire into the deaths due to heat strokes / heat waves for correct reporting. In order to do so, the following four factors need to be taken into account:

- Recorded maximum temperature during the particular time period and place.
- Recording incidents, *panchnama* or others witnesses, evidence or verbal – autopsy.
- Postmortem/medical checkup report with causes.
- Local authority or Local body enquiry/verification report.

5. Roles and Responsibilities for Managing Heat Wave

5.1 Need for Data and Analysis

As heat wave is not a notified disaster at the national level, accurate information and data related to heat wave deaths and illnesses are not available. In order to prepare for and take necessary mitigative action against heat wave, we need data on age group, sex and occupation of those who die of heat wave. We also need to collect data on whether the deaths occurred indoors or outdoors. Similarly, data on the economic status of the people who died also needs to be collected. A format for collecting this data is provided at Annexure 2, which should be used by the DDMAs and SDMAs.

Data from various domains are very much needed to have a sound evidence-based policy and its proper strategization Valid and reliable data is needed for mortality as well as morbidity – the health outcomes directly as well as indirectly related to heat. Most of the recent work exploring the effects of ambient temperature on human health has not considered the direct heat-related health events such as heat strokes, heat exhaustion and fatigues. However, counter-intuitive it might seem, these direct health outcomes are often not preferred by the research community. This is because their definitions are not always standardized and the application of these definitions often may not be clinically feasible, especially in low and middle income country settings, with sub-optimal health system, such as India, leading to differential underestimation of such events. Moreover, these direct heat outcomes are often biased by other factors the affected area, thus compromising their validity. Instead, the research community has frequently examined the effects of heat on general health indicators that include all-cause mortality, disease-specific mortality and morbidity – cardiovascular and respiratory events being prominent among them, visits to emergency departments of health facilities, demand for ambulance services and others - which might be causally associated to soaring temperatures. Hence, availability of such data from vital registration systems of local and district bodies, various tiers of health facilities and health departments are essential to carry out meaningful analysis of heat-related health events.

Reliable meteorological data, which constitute the exposure variables, are also necessary for robust evidence generation in this field- this includes data regarding various dimensions of ambient atmospheric temperature, relative humidity, rainfall and wind flow. Standardized atmospheric pollution data are often used to control for their variations in these health prediction models, which can refine the dependency estimates of health outcomes on atmospheric heat.

Mortality data must be acquired from Registrar of Birth/Deaths at different levels. The determination of threshold values and characterizing the temperature-mortality relationship and vulnerability assessment. It would be help in preparation of heat action plan.

All these data are needed in a time-series format - collected at the same time intervals, at the same locations and for a considerable period of time, so that studies can be to identify even the smaller but critical effects of heat on the affected population can be based on statistical data. Along with strengthening the vital registration systems, a proper data sharing strategy among all stakeholders should be developed. Each death should be registered at the respective municipality and/or block and the concerned medical officer should provide a medical certificate for the same. The format given at the end of this chapter, which has been adopted from the Department of Health and Family Welfare, Government of Odisha, can be used for collecting data on heat wave related deaths.

5.2 Prevention, Preparedness and Mitigation Measures:

Cool Roofs to Provide Affordable Thermal Comfort: Urban residents living in slums have fewer options available to adapt to rising temperatures. This increases their vulnerability to heat and results in greater adverse impacts of extreme heat on these communities. In their issue brief "Rising Temperatures, Deadly Threat", the NRDC and IIPH Gandhinagar identified several specific factors that increase the vulnerability of slum residents to extreme heat:

- **Higher Exposure to Extreme Heat:** Slum residents are more likely to be exposed to heat since they work primarily outside or in unventilated conditions, they live in homes constructed of heat-trapping materials with tin or tarpaulin roofs, and their communities lack trees and shade.
- **Greater Susceptibility to Health Effects of Extreme Heat:** Lack of access to clean water, poor sanitation, over-crowding, malnutrition, and a high prevalence of undiagnosed/untreated chronic medical conditions due to poor access to healthcare heighten slum community members' susceptibility to extreme heat's effects on health.
- **Fewer Adaptation Options Available:** Slum residents lack control over their home and work environments, with limited access to (and inability to afford) reliable electricity and cooling methods like fans, air coolers and air conditioning, insufficient access to cooling spaces, and a dearth of health information on which to act. All these factors reduce slum residents' opportunities to adapt to increasing temperatures.

An affordable solution is cool roofs. A cool roof is a white reflective roof that stays cool in the sun by minimizing heat absorption and reflecting thermal radiation to help dissipate the solar heat gain. Studies have shown that cool roofs can be up to 30° C cooler than conventional roofs, and can bring the indoor temperatures down by 3-5° C. When implemented on a large scale, cool roofs can reduce the urban heat island effect in a city.[1,2] Cool roofs include coatings and treatments such as lime-based whitewash, white tarp, white china mosaic tiles and acrylic resin coating, and provide an affordable solution for providing thermal comfort.

Livestock preparedness during hot weather: Extreme heat causes significant stress to livestock. There is a need to plan well for reducing the impacts of high temperatures on livestock. Keeping an eye on the weather forecasts, and developing a mitigation plan for high to extreme temperature can be effective in ensuring that the livestock has sufficient shade and water on hot days.

Prevention, preparedness and mitigation measures for various stakeholders are enumerated in the following Table:

[1]Natural Resources Defense Council, "Looking Up: How Green Roofs and Cool Roofs Can Reduce Energy Use, Address Climate Change, and Protect Water Resources in Southern California", June 2012, https://www.nrdc.org/sites/default/files/GreenRoofsReport.pdf (last accessed on April 5, 2017)
[2]Vishal Garg, Cool Roofs Toolkit, "Cool Roof Activities in India", http://www.coolrooftoolkit.org/wp-content/uploads/2012/04/Vishal-Presentation.pdf (last accessed on April 5, 2017)

5.3 Table 5: Roles and Responsibilities for Managing Heat Wave

S. No.	Key Strategy	Tasks/ Activities	Central/ State Agencies & Their Responsibilities			
			Centre	**Responsibility**	**State**	**Responsibility**
1	Developing inter-agency response plan	Preparation of Heat Wave Action Plan	NDMA	Guidelines on preparing a Heat Wave Action Plan	SDMA/ DDMA/ Municipal Corporation and Local Bodies	Preparing a Heat Wave Action Plan and implementation
2	Establish Early Warning System and Inter - Agency Coordination	Early Warning and Coordination	IMD	Issue Heat wave alerts and weather forecasts on Short / Medium / Long range duration	State Governments/ District Administration	To disseminate the information received from IMD to the public at large
3	Preparedness at the local level for health system	Mitigating Heat Wave	• Ministry of Urban /Rural Development, • Ministry of Water Resources, • Ministry of Transport, • Ministry of HRD • Ministry of Panchayati Raj • Ministry of Labour • Ministry of Power • Others concern Ministry/Department	Give directives to construct shelters/ sheds, bus stands, enable access to public parks, water bodies, identify vulnerable places and provide drinking water points at those places and worksites, re-schedule school timings, avoid physical activities, set up awareness camps, reduce power cuts, issue advisory for labourers	• Dept. of Rural/Urban Dev. • Public Health and Engineering Dept. • Dept of Drinking Water & Sanitation • Dept. of Education • Dept. of Panchayati Raj • Dept of Labour & employment • Dept. of Power supply • Dept. of Forest & Environment • Dept of Animal Husbandry	To construct shelters/ sheds, bus stands, identify vulnerable places and provide drinking water points at those places and worksites, rescheduling school timings during summer, avoiding outdoor games/sports activities, follow the alerts/warning, disseminate Dos and Don'ts for general public and enable access to cool places.
			Ministry of Health and Family Welfare, and other concerned Ministry/Dept.	Give directives for stockpiling of ORS, creating Medical posts at places of mass gathering, Hospital preparedness, Training of Human Resources	Department of Health, Dept of Women and Child	Implementing heat action plan, Stockpiling of ORS, creating Medical posts at places of mass gathering

4	Health system capacity building or training programmes	Monitoring and Response	Ministry of Health and Family Welfare	• Surveillance • Deployment of Rapid Medical Response Teams • Hospital Preparedness	Health Department	• Surveillance • Deployment of Rapid Medical Response Teams • Specific health care for vulnerable groups
5	Collaboration with non government and civil society	Occupational Support and advisories	All Ministries/ Departments	Take necessary measures, wherever applicable	All Departments	Take necessary measures, wherever applicable
6	Public awareness and community outreach	Media campaign and IEC activities	Ministry of Information and Broadcasting	Extensive IEC campaigns to create awareness through print, electronic and social media	Dept of Information and Broadcasting/ SDMAs / Commissioners of Relief/ State Govt. / Health Dept	Extensive IEC campaigns to create awareness through print, electronic and social media
7	Documentation		Ministry of Health & Family Welfare through IDSP	Collecting Data from States and maintaining national-level data base.	Revenue Departments / SDMAs / DDMAs / Health Dept. through Nodal Officer	Collecting Data /Information and documentation for review/update the plan
8	Long Term Measures		• Ministry of Urban/Rural Development • Ministry of Environment Forests and Climate Change	Directive to promote cool roofs and heat reducing integrated development Improving the forest coverage and green areas	Dept of Urban / Rural Development, Forest Department/ SDMAs and other concerned Department	• Promote cool roofs and heat reducing integrated development plans • Improving the forest coverage and green areas

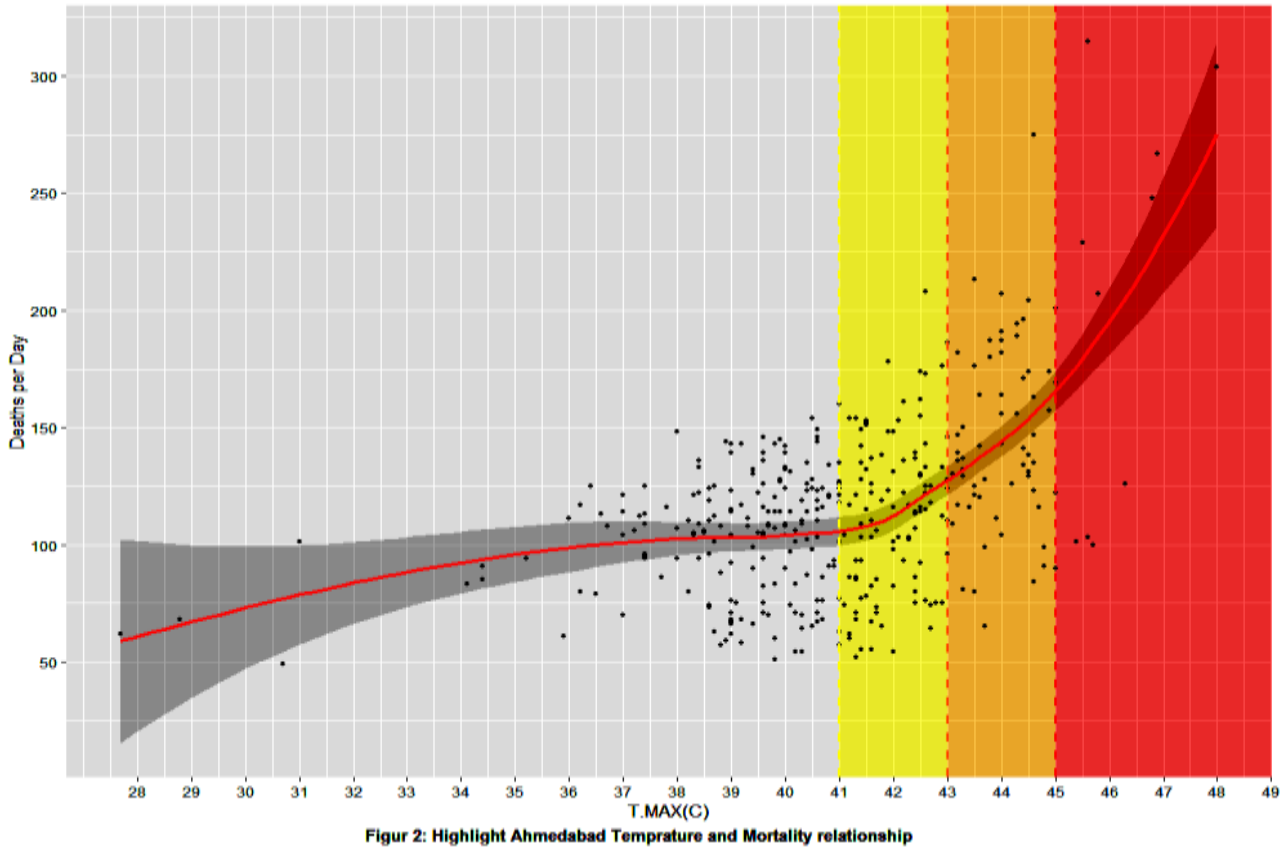
Annexure-1

Local Threshold Determination for Early Warning System

The cities of Ahmedabad, Nagpur and Bhubaneswar have chosen the daily Maximum Temperature (T.Max) to determine the threshold. In Ahmedabad, an important reason for selecting T.Max for threshold determination is the climate condition, which is dry and arid. Similarly, Nagpur also has a dry climate in summer.

A simple method used for developing the threshold is response-specific: obtain the long term (10-15 years) daily mortality data for the summer months from the city administration and correlate with the daily Maximum Temperature. A simple scatter plot of daily Maximum Temperature and daily All-cause mortality will give us the visual representation of the Temperature – Mortality relationship. Shown in Fig.2, by fitting a curve on the scatter plot, we can see a point of inflection or rapid rise of mortality - this is the threshold point. At this point (Temperature), the curve starts to go up (increase in deaths) rapidly.

The scientific community has developed many ways to determine the threshold. One is based only on the meteorological parameters, where the health data is not available or not reliable. A percentile-based threshold (90th, 95th and 99th percentile) could be contemplated as a warning trigger value if climate data is available and health date is not available or reliable. Recent research has indicated that this percentile based threshold works well in the data-sparse regions. This method is also used in developed countries. In Belgium, the 95th percentile of summer maximum temperature has been set as the threshold to issue warnings. While this threshold is set to capture the most extreme days, it should be noted that they have not been developed from, nor are they related to, any specific health impact, but are location specific.



Figur 2: Highlight Ahmedabad Temprature and Mortality relationship

Annexure: 2

Case Definitions

Range of Heat Illness - Typical Presentations-symptoms, sign and prognosis[3]

Clinical Entity	Age Range	Setting	Cardinal Symptoms	Cardinal / Important Signs	Pertinent Negative findings	Prognosis
Heat rash/ prickly heat/ Miliaria	All, but frequently children	Hot environment; +/- insulating clothing or swaddling (wrap in tight clothes)	Itchy rash with small red bumps at pores in the skin. Seen in setting of heat exposure; bumps can sometimes be filled with clear or white fluid	Diffused red colour skin or vesicular rash, itching of the skin without visible eruption	Not focally distributed like a contact dermatitis	Full recovery with elimination of exposure and supportive care
Heat cramps	All	Hot environment, typically with exertion, +/- insulating clothing	Painful spasms of large and frequently used muscle groups	Uncomfortable appearance, may have difficulty fully extending affected limbs/joints	No contaminated wounds/tetanus exposure; no seizure activity	Full recovery with elimination of exposure and supportive care
Heat exhaustion	All	Hot environment; +/- exertion; +/- insulating clothing or swaddling (wrap in a tight clothes)	Feeling overheated, lightheadedness, exhausted and weak, unsteady, feeling of vomiting, sweaty and thirsty, inability to continue activities	Sweaty/diaphoretic; flushed skin; hot skin; normal core temperature; +/- dazed, +/- generalized weakness, slight disorientation	No coincidental signs and symptoms of infection; no focal weakness; no difficulty in swallowing food or speech; no overdose history	Full recovery with elimination of exposure and supportive care; progression to heat syncope / stroke if continued exposure
Heat syncope	Typically adults	Hot environment; +/- exertion; +/- insulating clothing or swaddling (wrap in a tight clothes)	Feeling hot and weak; lightheadedness followed by a brief loss of consciousness	Brief, generalized loss of consciousness in hot setting, short period of disorientation, if any	No seizure activity, no loss of bowel or bladder continence, no focal weakness, no difficulties in food swallowing or speech	Full recovery with elimination of exposure and supportive care; progression to heat stroke if continued exposure
Heat Stroke	All	Hot environment; +/- exertion; +/- insulating clothing or swaddling (wrap in a tight clothes)	Severe overheating; profound weakness; disorientation, not fully alert, convulsion, or other altered mental status	Flushed, dry skin (not always), core temp ≥40°C or 104°F; altered mental status with disorientation, incoherent behaviour, coma, convulsion; tachycardia; +/- hypotension	No coincidental signs and symptoms of infection; no focal weakness; no difficulties in swallowing food or speech, no overdose history	25-50% mortality even with aggressive care; significant morbidity even if survives

[3]Source: IIPH Gandhi Nagar, Gujarat

Annexure: 3

Heat Illness Treatment Protocol[4]

Recognizing that treatment protocols may vary slightly according to the setting (EMS, health centre, clinic, hospital emergency department, etc.), the following should apply generally to any setting and to all patients with heat related illnesses:

1. Initial patient assessment primary survey (airway, breathing, circulation, disability, exposure), vital signs including temperature

2. Consider heat illness in differential diagnosis if:

    a. Presented with suggestive symptoms and signs
    b. Patient has one or more of the following risk factors:

        i. Extremes of age (infants, elderly)
        ii. Debilitation/physical deconditioning, overweight or obese
        iii. Lack of acclimatization to environmental heat (recent arrival, early in summer season)
        iv. Any significant underlying chronic disease, including psychiatric, cardiovascular, neurologic, hematologic, obesity, pulmonary, renal, and respiratory disease
        v. Taking one or more of the following:

            1. Sympathomimetic drugs
            2. Anticholinergic drugs
            3. Barbiturates
            4. Diuretics
            5. Alcohol
            6. Beta blockers

3. Remove from environmental heat exposure and stop physical activity

4. Initiate passive cooling procedures
    a. Cool wet towels or ice packs to axillae, groin, and around neck; if patient is stable, may take a cool shower, but evaluate risk of such activity against gain and availability of other cooling measures
    b. Spray cool water or blot cool water onto the skin
    c. Use fan to blow cool air onto moist skin

5. If temperature lower than 40°C, repeat assessment every 5 minutes; if improving, attempt to orally hydrate (clear liquids, ORS can be used but not necessary; cool liquids better than cold). If temperature is 40°C or above, initiate IV rehydration and immediately transport to emergency department for stabilization.

[4] Source: IIPH, Gandhinagar

Annexure-4

Heat Wave DO's and DON'Ts

DO's

Must for All

- Listen to Radio; watch TV; read Newspaper for local weather news.
- Drink sufficient water - even if not thirsty.
- Use ORS (Oral Rehydration Solution), homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. to keep yourself hydrated.
- Wear lightweight, light-coloured, loose, cotton clothes.
- Cover your head: Use a cloth, hat or umbrella.

Employers and Workers

- Provide cool drinking water near work place.
- Caution workers to avoid direct sunlight.
- Schedule strenuous jobs to cooler times of the day.
- Increasing the frequency and length of rest breaks for outdoor activities.
- Pregnant workers and workers with a medical condition should be given additional attention.

Other Precautions

- Stay indoors as much as possible.
- Keep your home cool, use curtains, shutters or sunshade and open windows at night. Try to remain on lower floors.
- Use fans, damp clothing and take bath in cold water frequently.
- If you feel faint or ill, see a doctor immediately.
- Keep animals in shade and give them plenty of water to drink.

DONT's

- Avoid going out in the sun, especially between 12.00 noon and 3.00 p.m.
- Avoid strenuous activities when outside in the afternoon.
- Do not go out barefoot.
- Avoid cooking during peak hours. Open doors and windows to ventilate cooking area adequately.
- Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrates the body.
- Avoid high-protein food and do not eat stale food.
- Do not leave children or pets in parked vehicles - as they may get affected by Heat Wave.

Annexure-5

Format A: Death reported due to Heat Wave (States report to NDMA)

Name of the State: **Year:** **Reporting Periods:** **Date of Reporting:**

District		Location						Occupation					Economic		
		Urban		Rural		Total		Farmers	Labours	Hawkers	Others	Total	BPL	APL	Total
	Age Group	M	F	M	F	M	F								
District 1	0-6 years														
	7-18 years														
	19-35 years														
	36-60 years														
	61 > above														
	Sub Total														
District 2	0-6 years														
	7-18 years														
	19-35 years														
	36-60 years														
	61 > above														
	Sub Total														
Total State															

*If any other information related to heat wave, please enclose a separate page.

Name and designation of the reporting officer: Signature with Date

Format B: Details of the death reported due to Heat-Wave (record kept with State government)

S. No.	Name and Address	Age	Sex (M/F)	Occupation	Place of death	Date and time of death	Max Temp recorded (Rectal and Oral)	Deaths reported during heat wave period or Not	List of chronic diseases present (Ask the family members)	Date and time of post mortem (If conducted)	Date and time of joint enquiry conducted with a revenue authority	Cause of death	Remarks	
													Related to post-mortem	Related to Joint enquiry
1														
2														
3														
4														

Name and designation of the reporting officer: Signature with Date

Annexure- 6

Format A

DAILY REPORT OF HEAT STROKE CASES AND DEATHS (District report to State government)

S. No.	Village	PHC	Block/City	Name & Son/ Daughter/Wife of	Urban U Rural R	BPL Y/N	Age/Sex	Date of attack of Heat Stroke	Any Antecedent illness	Cause of death	Death confirmed by MOs and MROs

Format B

(To be cumulated at the State Level and sent to Central Government)

DEATHS DUE TO HEAT RELATED ILLNESS -State …… **Date:**

S. No.	Name of the district (Name of all districts)	New cases admitted due to Heat Related Illness since the last reporting period	Cumulative no of cases admitted due to Heat Related Illness since 1st April ……..	Deaths reported due to Heat Related Illness since the last reporting period	Cumulative no of deaths due to Heat Related Illness since 1st April …..	Remarks (If any shortage of ORS/ IV fluids/ Treatment facilities etc…)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
TOTAL						

Format C

CASES AND DEATHS DUE TO HEAT RELATED ILLNESS - INDIA (Cumulated at the National Level)

Cumulative Data Form: **For the week ending:**

S. No.	State	New cases reported due to Heat Related Illness in last 7 days	Cumulative number of cases reported due to Heat Related Illness from 1st April	New Deaths reported due to Heat Related Illness in last 7 days	Cumulative number of deaths reported due to Heat Related Illness from 1st April 2016	Remarks
1	Andhra Pradesh					
2	Bihar					
3	Chhattisgarh					
4	Delhi					
5	Gujarat					
6	Jharkhand					
7	Karnataka					
8	Madhya Pradesh					
9	Maharashtra					
10	Odisha					
11	Rajasthan					
12	Telangana					
13	Uttar Pradesh					
14	West Bengal					
15	Haryana*					
16	Punjab*					
17	Tamil Nadu*					
	TOTAL					

***Added new heat-prone States**

List of Expert Group Members on National Guideline on Heat Wave

Name and Address	Present	Designation
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Dr. V. Thiruppugazh	JS (P&P), NDMA, New Delhi - 110029	Member
Shri Subhash Chander Bhan	Sr. Scientist-G and DGM, Indian Meteorological Department, New Delhi - 110003	Member
Dr. M. Mohapatra	Sr. Scientist-G and Head, Services Division, Indian Meteorological Department, New Delhi - 110003	Invitee Member
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Ms. Nehmat Kaur	Development Policy Economist, India Initiative, Natural Resource Defense Council (NRDC) K62, Second Floor, Green Park Main, New Delhi 110016	Member
Shri Shiva Shankar	Special Commissioner Government of A.P. Secretariat, Cundore, AP	Member

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Shri Anup Kumar Srivastava	Consultant –Drought and Food Security, NDMA
Dr. Saurabh Dalal	Consultant – Medical preparedness & Biological Disaster, NDMA
Dr. Shivraj Sahai	Sr. Consultant – Climate change, NDMA
Sri Chandra Kant	Project Associate, NDMA
Ms. Anshupriya	Consultant –Media, NDMA
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For more information on these "National Guidelines for Preparation of Action Plan – Prevention and Management of Heat wave"

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