UTTAR PRADESH
STATE DISASTER MANAGEMENT AUTHORITY

Shri Yogi Adityanath

Hon'ble Chief Minister of Uttar Pradesh

UTTAR PRADESH
STATE HEAT WAVE ACTION PLAN
2025

योगी आदित्यनाथ

मुख्य मंत्री
उत्तर प्रदेश

आज़ादी का अमृत महोत्सव

लोक भवन,
लखनऊ - 226001

संख्या :
दिनांक :

संदेश

यह प्रसन्नता का विषय है कि उ0प्र0 राज्य आपदा प्रबन्धन प्राधिकरण द्वारा प्रदेश में हीट वेव के प्रभावी प्रबन्धन के उद्देश्य से पुनरीक्षित स्टेट हीट एक्शन प्लान 2025 तैयार किया गया है।

वर्तमान में जलवायु परिवर्तन एक वैश्विक समस्या है। प्रदेश में ग्रीष्म काल में अत्यन्त उच्च तापमान व दीर्घ अवधि तक प्रवाहित होने वाली हीट वेव का प्रतिकूल प्रभाव प्रदेशवासियों पर पड़ता है। हीट वेव का दुष्प्रभाव विशेष रूप से बच्चों, वृद्धों, अस्वस्थ व्यक्तियों एवं खुले क्षेत्र में कार्य करने वाले श्रमिकों पर अधिक पड़ता है। प्रदेश में हीट वेव प्रबन्धन कार्य-योजना के प्रभावी क्रियान्वयन से हीट वेव के प्रतिकूल प्रभावों को न्यूनतम किया जा सकता है।

मुझे पूर्ण विश्वास है कि उ0प्र0 राज्य आपदा प्रबन्धन प्राधिकरण द्वारा तैयार किया गया स्टेट हीट एक्शन प्लान, प्रदेश में हीट वेव के कारण जनमानस पर पड़ने वाले दुष्प्रभावों को न्यूनतम करने में प्रभावी होगा। मैं उ0प्र0 राज्य आपदा प्रबन्धन प्राधिकरण द्वारा तैयार किए गए स्टेट हीट एक्शन प्लान हेतु शुभकामनाएँ व्यक्त करता हूँ।

(योगी आदित्यनाथ)

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MESSAGE

As climate change and high heat occurrences intensify, the global heat situation is fast becoming a pressing and increasingly urgent matter of concern. Increasing global temperatures, predominantly attributable to anthropogenic activities like greenhouse gas emissions, are resulting in increasingly frequent, severe and extended heatwaves. These episodes pose a considerable threat to public health, economic stability, agricultural output and environmental integrity. Extreme heat immediately leads to heat-related diseases and fatalities, particularly affecting vulnerable groups such as the elderly, children and individuals with pre-existing health disorders.

Uttar Pradesh State Disaster Management Authority (UP SDMA) is responsible for the development and implementation of strategies to reduce risks due to various disasters including heatwave. Considering the growing threat of extreme heat on the population, there is an urgent need to implement an effective HAP in order to protect the citizens from growing risks associated with extreme heat events. HAP provides a thorough framework for addressing heat-related risks, boosting resilience and encouraging sustainable activities. UP SDMA has developed and implemented the State Heat Action Plan (HAP) for prevention and management of heat related illnesses.

This State HAP serves as a key policy document and outlines the processes, duties, early warning and reaction mechanism for line departments and other organisations during a heat wave, as also provides crucial adaptation measures to protect communities and preserve lives from excessive heat.

I am thankful to Mr Ram Kewal (IAS), Additional Chief Executive Officer, UP SDMA, Dr Kaneez Fatima, Project Director, UP SDMA, Mohammad Danish, Scientist-D, IMD Lucknow and the Team for their support and dedication in the development of State HAP and its effective implementation. I am grateful to Dr Mahaveer Golechha, Professor and Head, Indian Institute of Public Health-Gandhinagar and Lead-HAP and Dr Kashif Imdad, Member, State Advisory Committee (Disaster Management), UP for their invaluable contribution and technical expertise in the development of State HAP 2025.

I am sure this plan will help all stakeholders to adopt a state-wide strategy to enforce preventive, mitigation and adaptive measures for prevention and management of heat related illnesses.

(Lt Gen Yogendra Dimri)

मनोज कुमार सिंह
मुख्य सचिव
Manoj Kumar Singh
Chief Secretary/CEO UP
SDMA

उत्तर प्रदेश शासन
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MESSAGE

Heat Action Plans are indispensable for safeguarding vulnerable populations from heat related ailments and fatalities. The State is prone to heat waves, which warrant a State Heat Action Plan on the basis of which the departmental Heat Action Plans can be evolved and executed. In this backdrop, the formulation of State Heat Action Plan is a significant milestone event in the ambit of Heat Wave Management.

I am sure that this document will assist in minimising the heat wave impact on the vulnerable populations in the State.

My compliments to Uttar Pradesh State Disaster Management Authority for conceptualizing and preparing the State Heat Action Plan 2025. I hope the Plan will be used extensively to address the challenges posed by Heat Waves.

Signed by
(Manoj Kumar Singh)
Date: 10-03-2025 10:12:04

पी0 गुरू प्रसाद
प्रमुख सचिव,
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Principal Secretary, Revenue

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MESSAGE

A significant global issue, extreme heat is becoming more widely acknowledged, and it is being exacerbated by climate change. The frequency, intensity, and duration of heat waves are increasing, resulting in severe health hazards, environmental challenges, and socio-economic impacts. Extreme heat is primarily caused by human-induced climate change. The combustion of fossil fuels results in the emission of greenhouse gases, such as carbon dioxide, which trap heat in the atmosphere. In order to address this challenge, it is necessary to coordinate efforts across a variety of sectors in order to implement effective adaptation and mitigation strategies.

For the state of Uttar Pradesh, extreme heat is a multifaceted crisis fuelled by climate change, posing significant threats to public health and economic stability. Urgent action is required to build resilience against these increasingly frequent and severe heat events. To better address heat-related health issues, we need to invest in preparedness, early warning system, long term mitigation and climate resilient health systems.

Heat Action Plans are indispensable for safeguarding vulnerable populations from heat-related ailments and fatalities. They seek to prevent heat related illnesses and other health issues associated with extreme temperatures by providing structured responses to heat waves. These strategies include early warning systems that notify communities of imminent heat waves, thereby enabling the implementation of opportune preventive measures. This is essential to guarantee that high-risk populations receive the necessary information and assistance during extreme weather events.

I am happy to learn that the Uttar Pradesh State Disaster Management Authority is leading the efforts for mitigating the negative impact of extreme heat on population, economy and livelihood through state and district heat action plans. Furthermore, this work has been extended to cities as well.

By implementing a comprehensive heat strategy, the state will significantly mitigate the harmful impact of high heat on the people, improve the adaptive capacity of its infrastructure, and develop a culture of preparedness and resilience among its citizens.

(**P. Guruprasad**)

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ABBREVIATIONS

IMD	India Meteorological Department
IEC	Information Education Communication
DM	Disaster Management
THI	Temperature–Humidity Index
AIR	All India Radio
NDMA	National Disaster Management Authority
NDRF	National Disaster Response Fund
SDRF	State Disaster Response Fund
SEOC	State Emergency Operation Centre
DEOC	District Emergency Operation Centre
ULBs	Urban Local Bodies
PHC	Primary Health Centre
CHC	Community Health Centre
UHC	Urban Health Centre
ORS	Oral Rehydration Solutions
ICDS	Integrated Child Development Services
ANM	Auxiliary Nurse and Midwife
SDM	Sub Divisional Magistrate
BDO	Block Development Officer
UPSRTC	Uttar Pradesh State Road Transport Corporation
UP SDMA	Uttar Pradesh State Disaster Management Authority
DDMA	District Disaster Management Authority

CHAPTER-1

INTRODUCTION AND OVERVIEW

1 Introduction and Overview

1.1 Background

The global issue of severe heat is a complicated and diverse subject with extensive repercussions. It transcends mere discomfort; it poses a substantial risk to human health, ecosystems, economy, and global stability. The planet is undergoing a phase of markedly elevated temperatures, a phenomena influenced by a confluence of forces, chiefly anthropogenic climate change and natural climatic variability. The combustion of fossil fuels (coal, oil, and natural gas) emits greenhouse gases, including carbon dioxide, methane, and nitrous oxide, into the atmosphere. These gases retain heat, resulting in a gradual increase in the planet's temperature. The warming effect is the principal catalyst for the sustained rise in global average temperatures recorded over the last century and a half. The scientific consensus strongly indicates that this warming trend is primarily due to human activity.

Extreme heat immediately leads to heat-related diseases and fatalities, particularly affecting vulnerable groups such as the elderly, children, and individuals with pre-existing health disorders. Elevated temperatures can aggravate pre existing respiratory and cardiovascular conditions, resulting in hospital admissions and mortality. Elevated temperatures exacerbate air quality, heightening the likelihood of respiratory issues. Extreme heat has a variety of economic effects. Drought and heat stress cause reduced agricultural yields, resulting in food shortages and price rises. Increased energy demand for cooling strains power grids, potentially resulting in blackouts and economic disruptions. Damage to infrastructure caused by heat expansion and wildfires results in significant financial losses. Heat reduces worker productivity, which has an impact on economic production. Extreme heat has a huge influence on ecosystems. It contributes to more frequent and intense wildfires, which result in habitat loss, reduced biodiversity, and air pollution. Melting glaciers and ice sheets from rising temperatures contribute to sea-level rise, endangering coastal residents and ecosystems. Changes in precipitation patterns cause more frequent and severe droughts and floods, impacting agricultural operations and water supplies. Heat stress also affects marine life, causing coral bleaching and ocean acidification. The effects of excessive heat are unevenly distributed. Developing countries and underprivileged people frequently lack the resources to adapt to changing climate conditions, making them disproportionately vulnerable to its harshest consequences. This raises important considerations about climate justice and rich nations' responsibilities to finance adaptation efforts in vulnerable places.

Uttar Pradesh and Climate Change Impact

Because of deteriorating climatic conditions, Uttar Pradesh is susceptible to a number of natural calamities. The state has suffered both droughts in areas where water shortage is severe due to depleted aquifers and flash floods from the Ganges. Since roughly three-quarters of the population depends on agriculture, this has put a significant financial and health burden on some of the state's poorest towns. Natural disasters have caused a loss of livelihood owing to crop destruction and animal deaths, but they have also caused food insecurity in the area, which has caused population displacement.

El-Nino Southern Oscillation, which raises summertime temperatures across much of India, also has an impact on Uttar Pradesh. As a result, Uttar Pradesh is projected to see extended periods of above-average temperatures during the summer months of March through July.

The majority of current efforts to combat global warming are directed towards reducing climate change. Yet, there is a compelling need for further scientific study and initiatives on climate adaptation, centred on public health for the most vulnerable communities, in light of forecasts of higher temperatures, rising sea levels, and shifting disease patterns in India. Communities in the area already face health risks from extreme heat, including dehydration, heat cramps, fatigue, heat syncope or heat stroke, and even heat-related death. Extreme heat events will only get worse due to climate change.

Increased temperatures are directly correlated with higher rates of heat related death and morbidity. In India, where scorching temperatures are increasing to extreme levels and increasing mortality and morbidity due to climate change, there is evidence of this connection everywhere over the country. All areas of the Indian subcontinent are expected to experience a rise in average temperatures of 5°C by the year 2100 (Kumar et al, 2006). Global climate models predict an increase in both the frequency and length of heat waves. These predictions should concern everyone since rising temperatures and unpredictable precipitation might result in widespread fatalities from drought, illness, floods, famine, excessive heat, and humidity.

Increasing rates of heat-related disease and mortality during heat waves are particularly noticeable in low-income communities, particularly among employees who often labour in extremely hot environments. Public health adaptation measures for heat-related illness are specific to these areas due to the lack of mechanical air conditioning and the constrained infrastructure, including water treatment and distribution networks.

Through improved communication about the factors that make individuals susceptible to heat, people may be encouraged to avoid such situations, heat-related illnesses and deaths in Uttar Pradesh could be substantially avoided.

Heat waves are defined by the World Health Organization as extended periods of unusually high temperatures that raise morbidity and mortality. A heat wave's characteristics as well as the susceptibility of the impacted populations determine the scope and intensity of its health impacts. The frequency and severity of heat waves are increasing globally. Globally, the last three decades have seen all of the warmest years on record (USAID, 2019).

In conjunction with other factors, such as relative humidity, very high temperatures can cause heat waves that can kill thousands of people, ruin crops, and harm infrastructure. Heat waves can also put a burden on essential services. Hospital admissions rise together with the need for water and power for cooling, frequently at rates that exceed hospital capacity.

More heat records will be set every season as a result of climate change, posing threats to the global populace in general and the elderly, young children, pregnant women, people with chronic health conditions, people with disabilities, and those who work outside in

particular. In addition, a large portion of the world's workforce is employed outside, including, for instance, farmers, agricultural workers, and construction workers. In addition, a sizable amount of the world's population now resides in cities, where thermal energy is trapped and gradually released by buildings and pavement, subjecting city dwellers to greater temperatures (USAID, 2019).

The susceptibility and exposure of the affected population is a major determinant of the direct and indirect effects of heat waves. The most vulnerable may suffer terrible effects if health services are not equipped to handle heat extremes. Extreme heat can have direct effects on a person's physiological reactions and functions as well as indirect effects on food and water security and other activities that enhance health systems more generally as well as jeopardise hard-won improvements in health, nutrition, and WASH.

1.2 Geo-Physical Details of Uttar Pradesh

Uttar Pradesh is bordered by the state of Uttarakhand to the north-west, Haryana and Delhi to the west, Rajasthan to the south-west, Madhya Pradesh to the south, Chhattisgarh and Jharkhand to the south-east and Bihar to the east. Situated between 23°52'N and 31°28'N latitudes and 77°3' and 84°39'E longitudes, this is the fourth largest state in the country in terms of area, and the first in terms of population.

Geo-morphologically Uttar Pradesh can be divided into three topographical regions:

1. The Shivalik foothills of Himalayas and the Terai region border U.P. on the North.

2. The Gangetic Plains are characterised by a flat topography and highly fertile alluvial soils. Its flat topography comprises of several physical features like rivers, lakes, ponds, elevation ranging from 60 mts in the east to 300 mts in the north-west and a gradient of 2 mts / sq. km.

3. The Vindhya Hills and plateau to region in the south vindhyas are a discontinuous range of hills and mountains. The southernmost stratum of Gangetic plains in U.P. is rendered by hard and varied topography of hills, high lands and plateaus,

The climate of the state is tropical monsoon. The average temperature varies in the plains from 3 to 4 °C in January to 43 to 48 °C in May and June. There are three distinct seasons winter from October to February, summer from March to mid-June, and the rainy season from June to September.

Table 1: Uttar Pradesh at a Glance

Population (2021)	24.34	Crores
Total Reported Area	241	Lakh ha.
Division	18	
Districts	75	
Tehsil	351	
Blocks	825	
Gram Panchayat	59075	
Revenue Village	106774	
No. of Farmers	2.88	Crore
Work Force in Agriculture	3.90	Crore
Agro Climate Zones	9	
Net Sown Area	165.38	Lakh ha.
Net Irrigated Area	144	Lakh ha.
Irrigation (Net Sown Area)	87	%
Gross Sown Area	268.59	Lakh ha.
Gross Irrigated Area	217	Lakh ha.
Cropping Intensity	162.41	%
Population Department on Agriculture	68	%
Agriculture in SGDP	23.9	%
Per Capita income of the State (2020-21)	65338	Rs

1.3 Climate of India (IMD, 2024)

The country's annual mean land surface air temperature during the year 2024 was +0.65°C above the 1991-2020 average. Thus, making the year 2024 the warmest year on record since 1901 (Fig. 2). The five warmest years on record, in descending order, are 2024 (+0.65°C), 2016 (+0.54°C), 2009(+0.40°C), 2010 (+0.39°C) and 2017 (+0.38°C). 10 out of the 15 warmest years were observed in the recent fifteen years (2010-2024). The past decade (2015-2024) was also the warmest decade on record, with the decadal averaged annual mean temperature anomaly (Actual-LPA) of 0.31°C. The country averaged annual mean temperature during 1901-2024 showed a significant increasing trend of 0.68°C /100 years (Fig.2). During the same period, significant increasing trends were observed in maximum (0.89°C /100 years) and minimum (0.46°C /100 years) temperatures.

The all India averaged seasonal mean temperature was above normal for all the seasons during the year 2024: the winter season (January – February, with an anomaly of +0.37°C), pre-monsoon season (March-May, with an anomaly of +0.56°C), southwest

monsoon (June - September, +0.71°C) season and post-monsoon season (October- December, with an anomaly of +0.83°C).

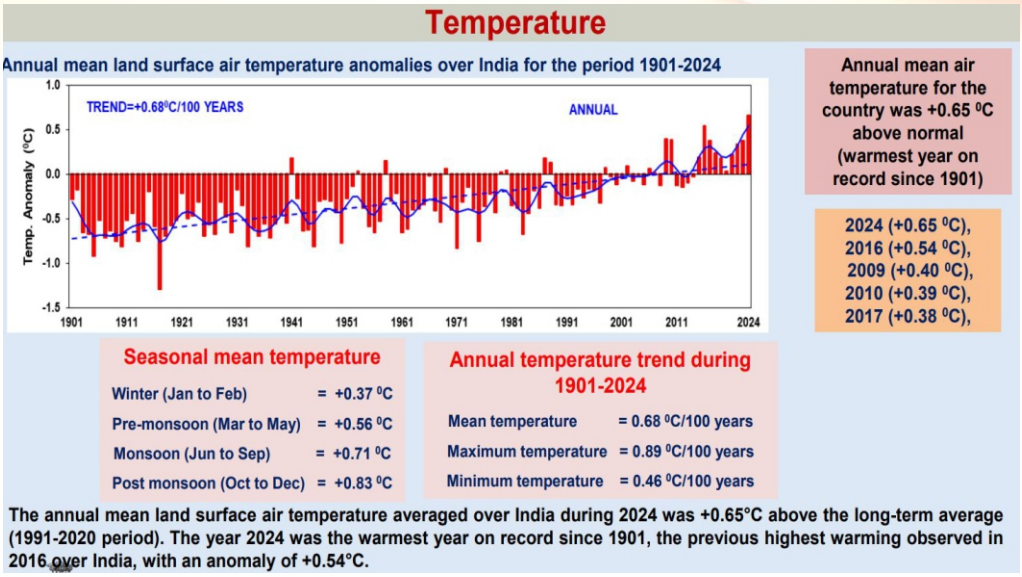

Figure-1: Temperature Trend in India between 1901-2024

The monthly mean temperatures averaged over the country during 2024 were above normal for all the months of the year except March (close to normal with an anomaly of +0.22°C). The mean monthly temperatures averaged over the country during October was the highest recorded (with an anomaly of +1.23°C) and the 2nd highest during July & September (with anomalies of +0.70°C and +0.76°C respectively) since 1901.

In addition, the mean temperature during November was the 3rd highest (with an anomaly of +0.84°C), and May & August were the 4th highest (with anomalies of +0.69°C and +0.45°C respectively) since 1901. In 2024, the monthly maximum temperature averaged over the country was the 2nd highest (with an anomaly of +0.62°C) since 1901 for November. In 2024, the monthly minimum temperatures averaged over the country were the highest during July, August, September, and October with anomalies of +0.89°C, +0.59°C, +0.99°C and +1.78°C respectively, since 1901 and the 2nd highest ever recorded (with an anomaly of +0.79°C) for February since 1901.

1.4 Heat Induced Hazards in the state of Uttar Pradesh

The state of Uttar Pradesh is located in the centre of the Indo-Gangetic plain. Uttar Pradesh's climate ranges from temperate in the east to extremely dry in the west to semi arid in the Bundelkhand and Agra zone. As a result, it is quite challenging to classify it within a certain climatic context. Nevertheless, the winters are frigid and the summers are extremely scorching. Typically, heat waves start in the northwest of India or across northern Pakistan and spread to the neighbouring states, including Uttar Pradesh. In the event of development, a heat wave could also form locally across the area. State experience heatwave condition from March to June(Figure- 2.6) In April the land area becomes hot with daytime maximum temperatures often reaching above 40°C. The temperatures start to rise over Uttar Pradesh in March. At many locations, the difference between the highest and lowest temperatures throughout this season is found to be greater than 15°C. By the end of May and the beginning of June, maximum temperatures quickly increase and surpass 46°C, resulting in extremely hot summers, especially over the SW U.P. (Bundelkhand). When high pressure (3000 7600 metres) in the atmosphere strengthens and stays over a region for several days to several weeks, heat waves result. The air sinks toward the surface when there is a lot of pressure. This falling air covers the atmosphere like a dome. In the year 2024, Jhansi was the hottest place in Uttar Pradesh with maximum temperature of 49 degrees Celsius, followed by Prayagraj 48.8, Agra with 48.6, , Varanasi 47.8 degree Celsius.

Table 2: Maximum Temperature at Major Station of Uttar Pradesh during the last 4 years

	2024	2023	2022	2021
Station	Maximum	Maximum	Maximum	Maximum
Lucknow	46.0	43.2	45.1	41.9
Barabanki	46.0	43.5	41.8	40.0
Hardoi	45.0	43.5	43.0	40.2
Kanpur(IAF)	**48.4**	45.0	46.3	42.7
Kanpur(City)	46.8	43.0	44.0	42.2
L.Kheri	45.1	42.0	42.0	42.2
Gorakhpur	44.0	43.7	42.4	41.0
Varanasi AP	**47.8**	44.5	45.2	43.4
Varanasi BHU	47.2	43.6	45.0	43.6
Ballia	44.0	43.5	41.5	41.4
Churk	47.0	44.2	45.0	43.5
Bahraich	45.4	42.0	41.4	41.0
Prayagraj	**48.8**	45.7	46.8	44.3
Fatehpur	47.2	NA	NA	NA
Banda	44.8	44.6	47.7	45.2
Sultanpur	47.0	43.6	44.4	43.0
Ayodhya	45.0	43.5	42.5	41.0
Fursatganj	47.2	44.5	45.4	42.8
Ghazipur	NA	NA	NA	NA
Fatehgarh	45.1	43.9	43.8	42.4
Basti	45.0	44.0	43.0	43.0
Jhansi	**49.0**	46.5	46.2	44.9
Orai	47.4	43.6	46.1	NA
Hamirpur	**48.2**	44.5	44.2	42.2
Bareilly Ob	45.3	41.8	41.2	41.5
Shahajhanpur	43.5	41.5	42.4	41.5
Najibabad	43.2	40.5	39.8	40.8
Moradabad	44.2	NA	NA	NA
Muzaffarnagar	43.0	41.2	41.4	40.1
Meerut	44.6	41.5	42.7	41.2
Etawah	45.4	43.0	42.2	39.0
Agra Taj	**48.6**	46.0	45.6	44.0
Aligarh	45.8	43.4	44.2	43.0
Bulandsahar	46.0	NA	NA	NA

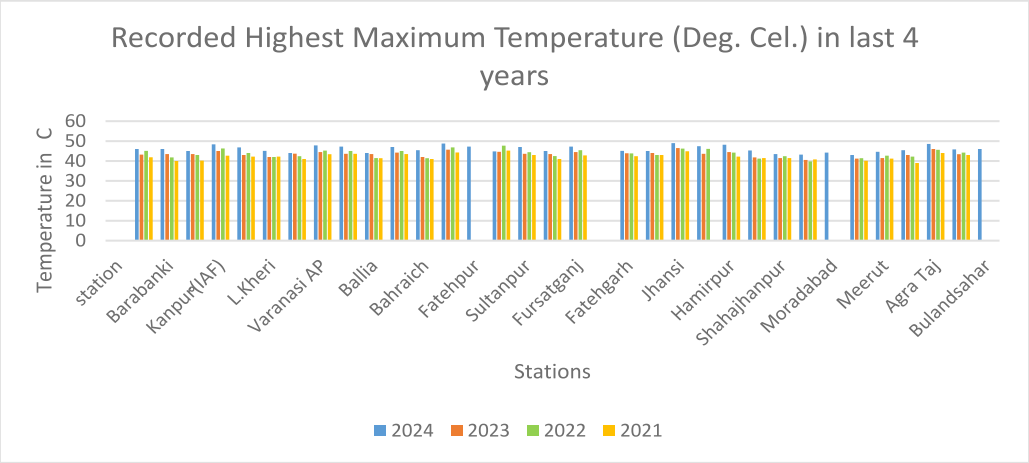

Figure-2: Recorded Highest Maximum Temperature

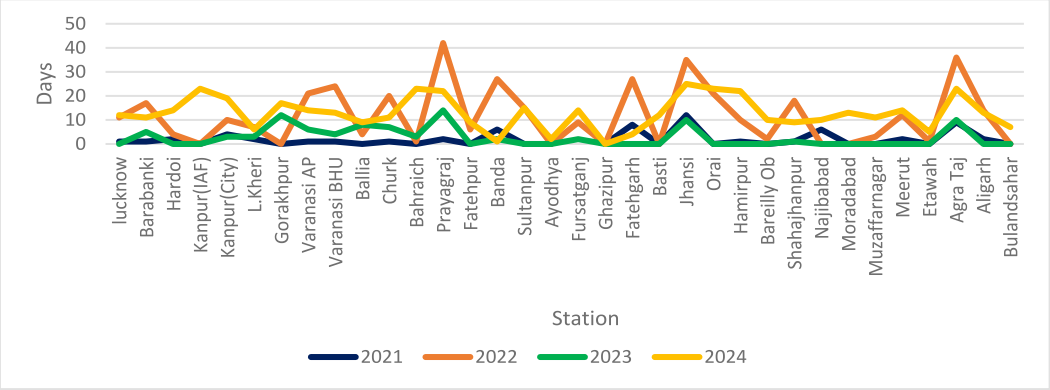

Figure-3: Number of days with Heat wave in the last 4 years

Table 3: No. of Heatwave Days-2021-2024

Station	2021	2022	2023	2024
Lucknow	1	11	0	12
Barabanki	1	17	5	11
Hardoi	2	4	0	14
Kanpur(IAF)	NA	NA	NA	23
Kanpur(City)	4	10	3	19
L.Kheri	2	7	3	6
Gorakhpur	0	0	12	17
Varanasi AP	1	21	6	14
Varanasi BHU	1	24	4	13
Ballia	0	4	8	9
Churk	1	20	7	11
Bahraich	0	1	3	23
Prayagraj	2	42	14	22
Fatehpur	0	6	0	9
Banda	6	27	2	1
Sultanpur	0	15	0	15
Ayodhya	NA	NA	NA	2
Fursatganj		9	2	14
Ghazipur	0	0	0	0
Fatehgarh	8	27	0	4
Basti	NA	NA	NA	12
Jhansi	12	35	10	25
Orai	0	21	0	23
Hamirpur	1	10	0	22
Bareilly Ob	0	2	0	10
Shahajhanpur	1	18	1	9
Najibabad	6	0	0	10
Moradabad	NA	NA	NA	13
Muzaffarnagar	0	3	0	11
Meerut	2	12	0	14
Etawah	0	1	0	5
Agra Taj	9	36	10	23
Aligarh	2	14	0	13
Bulandsahar	NA	NA	NA	7
Total	**62**	**397**	**90**	**436**

1.4.1 Impact of Heat Wave

Impact of Heat Wave on Life and Livelihood

The human thermoregulatory system has limits. Our muscles generate heat, which must be shed to the environment to maintain our core temperature of about 36.7^0C. Evaporation of sweat helps human bodies to keep cool when it is hot, however, when there is excessive sweating it leads to dehydration with consequent rise in internal body temperature which is fatal. More or less, Uttar Pradesh population might be acclimatized to heat and humidity but there is an upper level of heat tolerance limit. However, acclimatization to heat can only offer limited protection. When temperature soars beyond the tolerance limit, precautionary measures like avoiding the sun and physical exertion, maintaining hydration, and resting in a cool place are suggested.

However, serious challenges arise when extreme heat events linger for prolonged periods, as cessation of activities for weeks is often not an option.

Impact of Heat Wave On Agriculture

Apart from, impact on human life, the Heat Wave has also been found to profoundly affect crop production both in terms of quantity and quality. Primarily, crop loss happened due to flower drop and higher mortality in new plantations. Rabi and Jayad crops are more impacted. Any extreme change in temperature would affect the productivity.

Loss of Labour Hours due to Heat Wave

Extreme weather events, including heat waves, heavy rainfall, and snowfall, have a detrimental impact on the productivity and efficiency of the informal workforce, particularly agricultural workers and manual laborers such as rickshaw pullers, construction workers, and fruit sellers (Li et al., 2016). According to the International Labour Organization (ILO, 2019), if the current global warming trends persist, the overall percentage of lost working hours is projected to rise to 2.2% by 2030. This translates to the equivalent of losing 8 crore full-time jobs or approximately US$ 2,400 billion (ILO, 2019). However, the distribution of lost working hours is not uniform across regions. Southern Asia and Western Africa are expected to experience a loss of 5.3% and 4.8% of total working hours, respectively, corresponding to around 4.3 crore and 90 lakh full-time jobs.

In India alone, between the years 2001 and 2020, approximately 259 billion labor hours were lost annually due to humidity and heat waves, resulting in a total cost of Rs. 46

lakh crores (Deshpande, 2022). Heat waves impede labor efficiency by hindering workers in physically demanding occupations from operating at their full potential due to excessive sweating, exhaustion, and dehydration. The ILO (2019) further estimates that by 2030, India will lose approximately 5.8% of its total labor hours due to the combined effects of heat and humidity. The loss of labor hours caused by heat stress has severe repercussions for India, considering that roughly 90% of the country's labor force is employed in the informal sector, with a significant portion engaged in physically demanding occupations (Barthwal et al., 2022; ILO, 2019).

This vulnerability exposes the Indian economy to the adverse consequences of heat waves. The agricultural sector is expected to bear the brunt of the impact from lost work hours, followed by the construction sector (ILO, 2019a). The implications of these losses extend beyond immediate economic consequences, affecting the livelihoods and well-being of individuals and communities dependent on these sectors. Additionally, heat stress exacerbates existing social and economic disparities, as marginalized groups and those engaged in informal labor are disproportionately affected by the consequences of extreme heat (Barthwal et al., 2022).

In conclusion, extreme weather events, particularly heat waves, pose a significant threat to the productivity and efficiency of the informal workforce in India. The projected increase in lost working hours due to heat and humidity highlights the urgent need for measures to mitigate and adapt to the effects of climate change. Addressing this issue requires a comprehensive approach that encompasses both immediate interventions, such as improved working conditions and access to protective measures, as well as long-term strategies focused on sustainable development and climate resilience (ILO, 2019). By prioritizing the protection of workers and implementing effective policies, India can work towards reducing the impact of extreme heat on labor hours and securing a more sustainable and inclusive future.

India, the nation hit hardest by heat stress, experienced a reduction of 4.3 percent in working hours in 1995, and it is projected that this number will increase to 5.8 percent by 2030(Table-4). Additionally, due to its large population, India is expected to suffer a substantial loss of approximately 34 million full-time jobs in 2030 as a direct consequence of heat stress. While the agricultural sector will bear the brunt of the impact in India, the construction sector is also anticipated to face a growing loss of working hours as heat stress affects both male and female workers.

Uttar Pradesh has the largest share of the labour force in India, accounting for 19.3% of the total labour force in 2022. This is followed by Bihar (11.5%), Madhya Pradesh (10.3%), and West Bengal (9.4%). The share of the labour force in Uttar Pradesh has been declining in recent years, from 21.2% in 2011. This decline is due to a number of factors, including the decline in the agricultural sector, the growth of the informal sector, and the migration of workers to other states.

The labour force in Uttar Pradesh is young, with a median age of 29 years. The majority of the labour force is employed in the agricultural sector (55%), followed by the services sector (30%) and the industrial sector (15%). The unemployment rate in Uttar Pradesh is high, at 12.2% in 2022. This is higher than the national average of 7.8%. The unemployment rate is highest among youth, with a rate of 22.4% in 2022.

While projecting ILO (2019) this can be inferred that between 2001 and 2020, Uttar Pradesh lost an average of 50.271 billion labor hours per year due to heat waves. This is equivalent to losing 1.38 million full-time jobs for a year. The total cost of the heat waves was Rs. 88,780 crore, which is about $1.1 billion USD.

The government of Uttar Pradesh has taken a number of initiatives to address the challenges facing the labour force, including providing skill training, creating jobs in the industrial sector, and promoting entrepreneurship. However, more needs to be done to improve the quality of life for workers in Uttar Pradesh.

Table 4: Working hours lost to heat stress, by sector and country, Southern Asia, 1995 and 2030 (projections)

	1995						2030					
	Agriculture	Industry	Construction	Services	Total	Total (thousand full-time jobs)	Agriculture	Manufacturing	Construction	Services	Total	Total (thousand full-time jobs)
India	5.87	2.95	5.87	0.63	4.31	15519	9.04	5.29	9.04	1.48	5.8	34056

Source: ILO, 2019

Millions of individuals in the Indian brickmaking industry, most of whom have migrated from impoverished villages to the outskirts of cities, are employed under unfavorable circumstances. These workers, including many young children, face multiple challenges such as low socio-economic status, harsh working conditions, and inadequate or nonexistent wages. Their work exposes them to various hazards, including high ambient temperatures and radiant heat from brick kilns, while their awareness of occupational safety and health (OSH) matters remains limited.

The workers in this industry endure extreme ambient temperatures, particularly during hot summer months, which can soar to 40-45°C. They also encounter high levels of radiant heat emitted by the kilns where the bricks are fired. Compounding their heat exposure, they lack sufficient on site cooling options, exacerbating the risk (Lundgren Kownacki et al., 2018).

Sett and Sahu (2014) conducted an assessment of the impact of heat stress on the productivity and health of female brickmaking workers in West Bengal. Their findings revealed that a mere 1°C increase in temperature led to approximately a 2 percent decline in productivity. The workers surveyed in the study took only short breaks of 10-15 minutes in shaded areas when they were completely exhausted, returning to work thereafter. Elevated temperatures significantly elevated their physiological stress parameters, including peak heart rate and cardiac strain. While the majority of workers were aware of their heat stress symptoms, theylacked the necessary knowledge and resources to implement preventive measures.

1.5 Rationale of Uttar Pradesh State Heat Action Plan

Building resilience into health systems can help reduce the burden of heat waves on public health by1) improving preparedness by enhancing forecasting expertise and investing in vulnerability assessments to inform risk management and communicate practical recommendations, especially to the most vulnerable populations, for reducing heat risks, and 2) improving heat interventions by emphasising inter-sectoral collaboration and implementing responsible The development of heat-health action plans (HHAPs), which include a heat wave early warning system (HEWS) and emergency public health interventions, is taking place in several places across the world.

The Uttar Pradesh State Heat Action Plan, serve as the key policy document that outline the processes, duties, early warnings, and reaction mechanisms for line departments and other organisations during a heatwave, are crucial adaptation measures to protect communities and preserve lives from excessive heat.

1.6 Purpose and key strategies of Uttar Pradesh State Heat Action Plan

The Uttar Pradesh State Heat Action Plan aims to provide a framework for the implementation, coordination, and evaluation of extreme heat response activities in the State for reducing the negative impact of extreme heat event. ThePlan's primary objective is to develop and implement heat health communication specially targeted towards vulnerable population, those most at risk of heat-related illness. Thisplan will also involve the inter-departmental coordination framework, which is multidimensional in nature for enhancing collaboration and coordination between all line departments for efficient implementation of State Heat Action Plan. The Standard Operating Procedures have also been laid down by the UPSDMA for the prevention and management of heat related illnesses.

Establish Early Warning System and Inter-Agency Coordination to alert residents on predicted high and extreme temperatures. Who will do what, when, and how is made clear to individuals and units of key departments, especially for health.

Capacity building / training programme. These are very important for mitigation and disaster Risk Reduction. Training of the medical community on various aspects of heatwave – related health hazard is essential to recognize and respond to heat-related illnesses, particularly during extreme heat events. Heat stroke is the medical emergency and training on the identification of heatstroke cases and the process of patient stabilisation before further evacuation should be imparted to the medical community.

Public Awareness and community outreach Disseminating public awareness messages on how to protect against the extreme heat-wave through print, electronic and social media and Information, Education and Communication (IEC) materials such as pamphlets, posters and advertisements, short video film and Television Commercials (TVCs) on Do's and Don'ts and treatment measures for heat related illnesses.

Collaboration with non-government and civil society: Collaboration with non governmental organizations and civil society organizations to improve bus stands, building temporary shelters, wherever necessary, improved water delivery systems in public areas and other innovative measures to tackle Heat wave conditions.

1.7 Objectives of the Uttar Pradesh State Heat Action Plan

1. To develop and implement various strategies for extreme heat events
2. To develop and implement an early warning system in partnership with IMD for alerting those populations at risk and carrying out activities by the line departments
3. To take appropriate measures for the Prevention and Mitigation against Heat Related Illnesses
4. To build capacity of state and district level inter-department officials for efficient and coordinated implementation of state heat action plan
5. To make more and appropriate use of adaptation and mitigation strategies for reducing heat waves and its impact on human health, livelihood and economy
6. To identify vulnerable population and heat hotspots
7. To reduce the heat related illnesses
8. To enhance resilience of communities against extreme heat events
9. To make Uttar Pradesh state more resilient against extreme heat wave

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CHAPTER-2

EARLY WARNING SYSTEM AND HEAT HEALTH COMMUNICATION

2 Early Warning System and Heat Health Communication

2.1 Introduction

Early warning systems (EWS) for disaster prevention are essential for alleviating the effects of natural disasters and other emergencies. Their objective is to deliver prompt and precise knowledge regarding forthcoming events, enabling people, communities, and governments to implement preventive measures and mitigate losses of life and property. Effective Early Warning Systems encompass a sequence of actions, including monitoring, forecasting, distribution, and response. Effective Early Warning Systems (EWS) encompass not only the issuance of alerts but also the establishment of preparedness and response mechanisms at the community level. This encompasses the instruction of communities regarding evacuation protocols, the formulation of emergency response strategies, the establishment of communication frameworks, and the distribution of emergency provisions. The involvement of local leaders and the promotion of community engagement are essential for the effective execution of initiatives.

Heatwave early warning systems are integral part of with heat action plan and require for reducing the human health consequences of heatwaves. In India, Indian Meteorological Department provide forecast for the heatwave event as part of early warning systems (Lowe et al, 2011). This is pivotal for predicting possible health outcomes, triggering effective and timely response plans for the vulnerable populations. Due to significant increase in frequency and severity of extreme heat events, several countries have established early warning systems. Early warning systems are often based on meteorological indicators (typically maximum, minimum, or mean temperatures, and occasionally the level of humidity, as well as a cut-off point at which a significant rise in mortality is anticipated (Issa et al, 2021).

The early warning system is also involving notification of heatwave events, and communication of prevention responses. After several devastating heatwave events in 2010 and 2016, many cities and states across the country implemented early warning system as a risk reduction strategy (Lowe et al, 2011).

Early warning systems can enhance the preparedness of decision-makers and enhance preparedness against the disaster. Early warning systems for natural hazards is based both on sound scientific and technical knowledge. Accurate and timely alert systems are essential part

of early warning system. The Uttar Pradesh State Disaster Management Authority has collaborated with IMD in Uttar Pradesh for establishing an effective early warning system.

2.2 Heat Wave Definition (NDMA, 2019)

Heat wave is a condition of atmospheric temperature that leads to physiological stress, which sometimes may cause death. According to the World Meteorological Organization, a heat wave is declared when daily maximum temperature exceeds the average maximum temperature by five degrees Celsius for five or more consecutive days. Different countries define heat wave differently in contest of their local conditions. In India, heat wave conditions are considered of maximum temperature of a station reaches at least 40°Cor more for plains, 37°C or more for coastal areas and at least 30°C or more for hilly regions.

As per India Meteorological Department (IMD) following criteria is used to declare a heat wave conditions in India:

Criteria for Heat Wave (IMD)

Heat wave need not be considered till Maximum Temperature of a station reaches at least 40º C for Plains and at least 30º C for Hilly regions.

a) Based on Departure from Normal

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

b) Based on Actual Maximum Temperature

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

Source: Indian Meteorological Department, http://www.imd.gov.in

2.3 Temperature Humidity Index

Heat stress is caused by a combination of environmental factors (temperature, relative humidity, solar radiation, air movement, and precipitation). Many indices combining different environmental factors to measure the level of heat stress have been proposed.

Temperature–Humidity Index (THI), combination of temperature and humidity that is a measure of the degree of discomfort experienced by an individual in warm weather; it was originally called the discomfort index. The index is essentially an effective temperature based on air temperature and humidity; it equals 15 plus 0.4 times the sum of simultaneous readings of the dry- and wet-bulb temperatures. Thus, if the dry-bulb temperature is 90° F (32° C) and the wet-bulb temperature is 50° F (10° C), the discomfort index is 15 + 0.4 (140), or 71. Most

people are quite comfortable when the index is below 70 and very uncomfortable when the index is above 80 to 85 (*Figure 4*).

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 regions. 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 thatif the air temperature is 34°C and the relative humidity is 75 per 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 100 percent (*Figure 4)*.

Temperature/ Humidity Index

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

Source: Calculated °F to °C from NOAA's National Weather Service

Figure-4: Temperature Humidity Index

2.4 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 from IMD. 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 below figure, 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
(*Figure 5 and 6*).

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) of maximum daily temperature 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.

The Uttar Pradesh State Disaster Management Authority has constituted a team of renowned academicians in the field to devise a localised early warning system for major cities within the state. The research group's preliminary report has achieved a significant milestone by establishing the Heat Threshold and formulating an index specific to all the districts of Uttar Pradesh. This accomplishment stems from a meticulous analysis of daily Temperature and Humidity records spanning from January 1981 to October 2023. The ongoing analysis includes correlating this data with daily mortality rates. Furthermore, first time temperature and mortality analysis has been done for the cities of Lucknow and Agra.

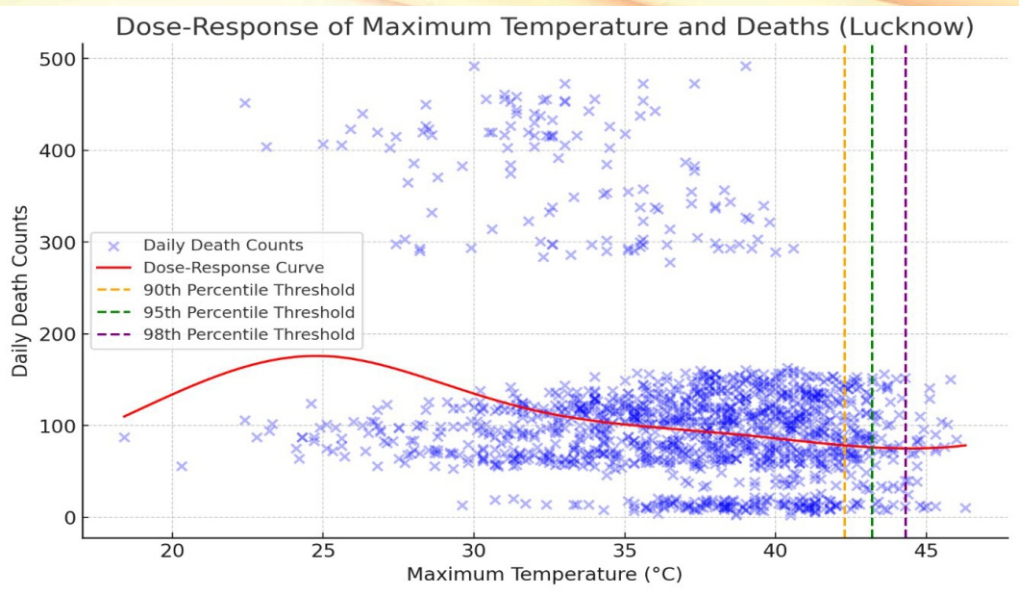

Figure-5: Lucknow Temperature and mortality relationship

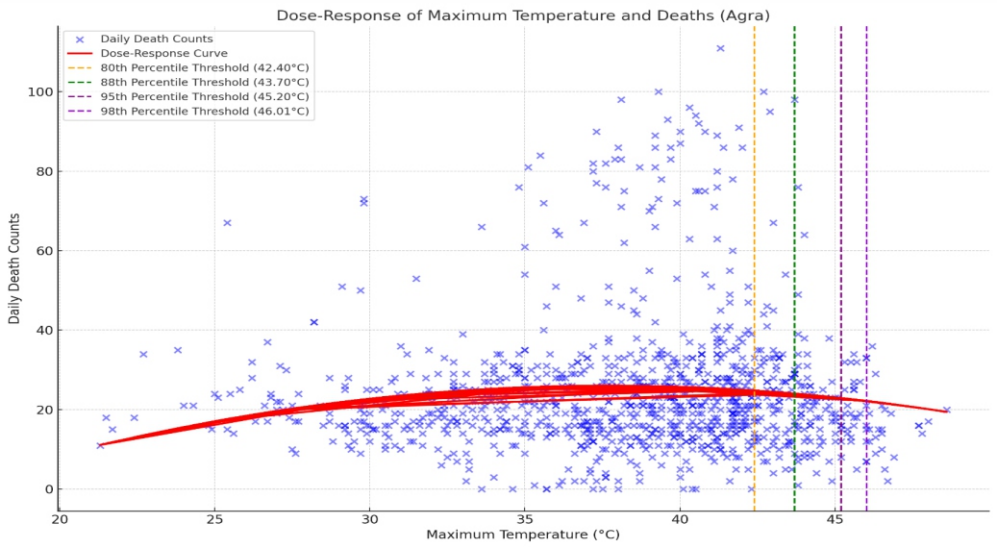

Figure-6: Agra Temperature and mortality relationship

2.5 Local Threshold Determination for the districts of Uttar Pradesh

Heat alert aims to inform residents, emergency services and other stakeholders about the impending heatwave conditions. Issuing a heat alert is a proactive measure to protect public health and safety during extreme heat events. It involves a coordinated effort between meteorological agencies, health organizations, emergency services and the public. *Table 3.2* shows the 80th, 88th and 95th percentiles of annual maximum temperature to calculate thresholds. The yellow alert is indicated by 80th percentiles, orange alert by 88th percentiles and red alert by 95th percentiles.

To conduct a District Wise Heat Threshold Determination for Uttar Pradesh, a comprehensive analysis of historical temperature data, statistical methods and regional characteristics was considered based on percentile values of temperature trends from 1982 to 2023. It is crucial to establish these thresholds based on the long term temperature patterns specific to each district. Analysing historical temperature data for Uttar Pradesh involved examining temperature trends, variability and extremes over an extended period. Our findings, using trend analysis of maximum temperature between April and June, show how often and how much temperatures have changed from the historical average. ***From 1982 to 2023, the maximum temperature over Uttar Pradesh has dramatically increased (Table 5).***

Although some districts show a decrease in temperature but overall temperature in April, May and June has continuously increased for the majority of districts of Uttar Pradesh (*Table 3.1*). The districts of Saharanpur, Bijnor, Muzaffarnagar, Shamli, Hamirpur, Shahjahanpur, Amroha, Moradabad, Meerut and Sitapur experienced the highest mean maximum temperatures during the months of April, May and June in Uttar Pradesh. These districts are particularly susceptible to extreme heat conditions. Although the above-average temperature increase may seem relatively small at just 1.4 degrees Celsius, the impact of this rise can be exponential, especially when considering the cumulative effect over time and across various sectors.

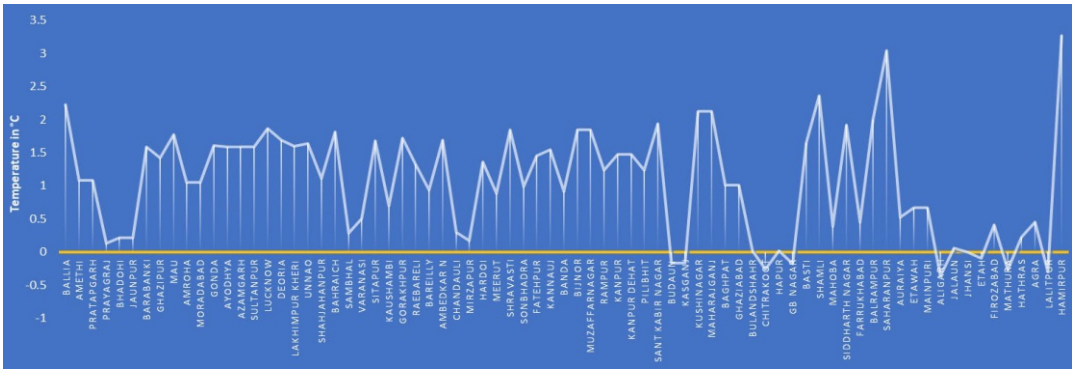

Figure 7: Increase/decrease of maximum temperature for the month of April, 1982 and April, 2023.

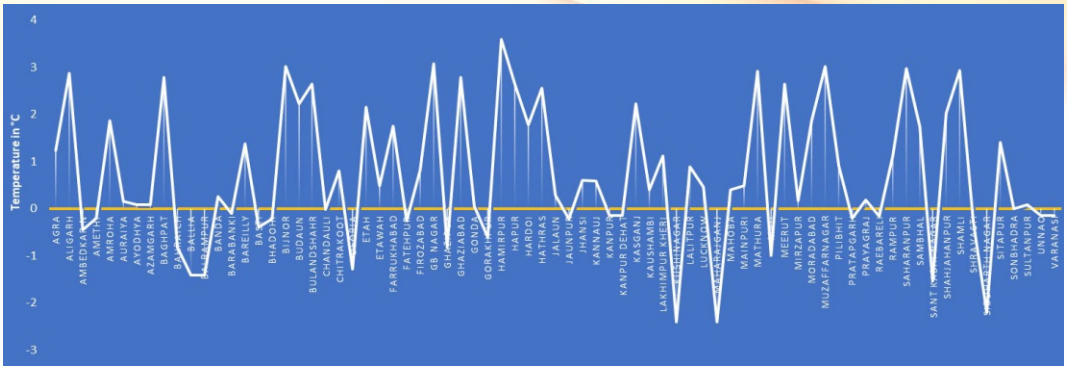

Figure 8: Increase/decrease of maximum temperature for the months of May, 1982 and May, 2023.

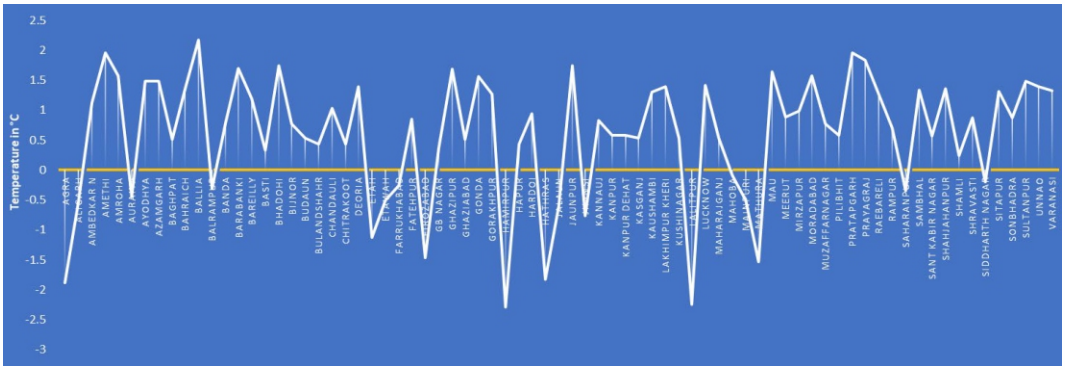

Figure 9: Increase/decrease of maximum temperature for the month of June, 1982 to June, 2023.

Table 5: District-wise maximum temperature recorded for the months of April, May and June of 1982 and 2023.

District Name	1982			2023			Difference* (1982-2023)		
	April	May	June	April	May	June	April	May	June
AGRA	42.72	45.39	46.75	43.17	46.63	44.87	0.45	1.24	-1.88
ALIGARH	42.00	42.92	45.38	41.64	45.80	44.84	-0.36	2.88	-0.54
AMBEDKAR NAGAR	41.75	45.32	45.00	43.44	44.87	46.12	1.69	-0.45	1.12
AMETHI	42.14	45.44	44.54	43.22	45.23	46.50	1.08	-0.21	1.96
AMROHA	40.33	41.76	43.38	41.38	43.62	44.95	1.05	1.86	1.57
AURAIYA	43.01	45.89	45.76	43.53	46.04	45.31	0.52	0.15	-0.45
AYODHYA	41.78	44.93	44.76	43.37	45.02	46.25	1.59	0.09	1.49
AZAMGARH	41.78	44.93	44.76	43.37	45.02	46.25	1.59	0.09	1.49
BAGHPAT	40.07	41.67	44.07	41.08	44.46	44.58	1.01	2.79	0.51
BAHRAICH	40.14	43.58	43.55	41.95	42.76	44.9	1.81	-0.82	1.35
BALLIA	42.33	45.29	44.74	44.56	43.88	46.91	2.23	-1.41	2.17
BALRAMPUR	39.94	44.04	44.75	41.94	42.62	44.44	2.00	-1.42	-0.31
BANDA	42.92	45.61	45.33	43.84	45.87	46.11	0.92	0.26	0.78
BARABANKI	41.42	45.01	44.6	43.01	44.91	46.3	1.59	-0.1	1.70
BAREILLY	41.21	42.56	44.37	42.15	43.94	45.56	0.94	1.38	1.19
BASTI	41.14	44.72	45.12	42.79	44.33	45.45	1.65	-0.39	0.33
BHADOHI	43.62	45.6	44.62	43.83	45.38	46.36	0.21	-0.22	1.74
BIJNOR	38.74	40.81	43.18	40.58	43.82	43.95	1.84	3.01	0.77
BUDAUN	42.20	43.08	45.01	42.03	45.31	45.55	-0.17	2.23	0.54
BULANDSHAHR	41.52	42.42	44.33	41.54	45.07	44.76	0.02	2.65	0.43
CHANDAULI	43.08	44.89	44.77	43.38	44.87	45.80	0.3	-0.02	1.03
CHITRAKOOT	43.37	44.94	44.99	43.11	45.74	45.42	-0.26	0.8	0.43
DEORIA	42.25	45.24	44.98	43.94	43.96	46.37	1.69	-1.28	1.39
ETAH	42.65	43.9	46.64	42.55	46.06	45.51	-0.1	2.16	-1.13
ETAWAH	42.72	45.39	46.26	43.39	45.88	45.76	0.67	0.49	-0.5
FARRUKHABAD	42.39	43.84	46.16	42.84	45.59	45.90	0.45	1.75	-0.26
FATEHPUR	42.19	45.67	45.15	43.64	45.41	46.00	1.45	-0.26	0.85
FIROZABAD	42.92	45.56	46.76	43.33	46.38	45.3	0.41	0.82	-1.46
GAUTAM BUDDHA NAGAR	41.44	41.98	44.24	41.26	45.05	44.61	-0.18	3.07	0.37
GHAZIPUR	42.84	45.67	45.24	44.26	44.85	46.93	1.42	-0.82	1.69
GHAZIABAD	40.07	41.67	44.07	41.08	44.46	44.58	1.01	2.79	0.51
GONDA	40.94	44.43	44.24	42.55	44.48	45.8	1.61	0.05	1.56
GORAKHPUR	41.94	45.29	45.05	43.66	44.68	46.32	1.72	-0.61	1.27
HAMIRPUR	34.33	38.39	42.30	37.6	41.98	40.01	3.27	3.59	-2.29
HAPUR	41.52	42.42	44.33	41.54	45.07	44.76	0.02	2.65	0.43
HARDOI	41.65	43.63	45.25	43.01	45.41	46.19	1.36	1.78	0.94
HATHRAS	42.36	43.87	46.8	42.58	46.43	44.97	0.22	2.56	-1.83

JALAUN	43.55	45.8	45.9	43.61	46.08	45.3	0.06	0.28	-0.6
JAUNPUR	43.62	45.6	44.62	43.83	45.38	46.36	0.21	-0.22	1.74
JHANSI	43.37	45.3	45.63	43.37	45.90	44.87	0.00	0.6	-0.76
KANNAUJ	41.98	44.97	45.31	43.53	45.55	46.14	1.55	0.58	0.83
KANPUR NAGAR	42.11	45.73	45.09	43.58	45.58	45.67	1.47	-0.15	0.58
KANPUR DEHAT	42.11	45.73	45.09	43.58	45.58	45.67	1.47	-0.15	0.58
KASGANJ	42.2	43.08	45.01	42.03	45.31	45.55	-0.17	2.23	0.54
KAUSHAMBI	43.11	45.59	45.07	43.81	45.99	46.37	0.7	0.4	1.3
LAKHIMPUR KHERI	40.84	43.31	44.47	42.44	44.43	45.86	1.6	1.12	1.39
KUSHINAGAR	40.89	45.02	44.9	43.01	42.62	45.44	2.12	-2.4	0.54
LALITPUR	41.89	43.98	45.47	41.59	44.87	43.22	-0.3	0.89	-2.25
LUCKNOW	41.61	44.87	44.94	43.48	45.33	46.36	1.87	0.46	1.42
MAHARAJGANJ	40.89	45.02	44.9	43.01	42.62	45.44	2.12	-2.4	0.54
MAHOBA	43.25	45.53	45.62	43.64	45.93	45.53	0.39	0.4	-0.09
MAINPURI	42.72	45.39	46.26	43.39	45.88	45.76	0.67	0.49	-0.5
MATHURA	42.39	43.55	46.37	42.12	46.46	44.84	-0.27	2.91	-1.53
MAU	42.56	45.57	45.21	44.33	44.57	46.85	1.77	-1	1.64
MEERUT	40.41	41.84	43.87	41.29	44.49	44.76	0.88	2.65	0.89
MIRZAPUR	43.32	45.16	44.73	43.49	45.33	45.72	0.17	0.17	0.99
MORADABAD	40.33	41.76	43.38	41.38	43.62	44.95	1.05	1.86	1.57
MUZAFFARNAGAR	38.74	40.81	43.18	40.58	43.82	43.95	1.84	3.01	0.77
PILIBHIT	40.73	42.47	44.17	41.97	43.38	44.75	1.24	0.91	0.58
PRATAPGARH	42.14	45.44	44.54	43.22	45.23	46.5	1.08	-0.21	1.96
PRAYAGRAJ	43.32	45.65	44.73	43.45	45.83	46.56	0.13	0.18	1.83
RAEBARELI	42.23	45.53	45.1	43.56	45.37	46.37	1.33	-0.16	1.27
RAMPUR	39.62	41.23	43.03	40.86	42.35	43.73	1.24	1.12	0.7
SAHARANPUR	37.08	40.51	43.44	40.12	43.49	43.09	3.04	2.98	-0.35
SAMBHAL	41.55	42.39	44.06	41.84	44.12	45.40	0.29	1.73	1.34
SANT KABIR NAGAR	40.96	45.06	45.01	42.9	43.52	45.58	1.94	-1.54	0.57
SHAHJAHANPUR	41.23	43.05	44.64	42.34	45.07	46.00	1.11	2.02	1.36
SHAMLI	38.52	41.42	44.1	40.88	44.35	44.34	2.36	2.93	0.24
SHRAVASTI	40.36	43.83	43.92	42.2	43.57	44.8	1.84	-0.26	0.88
SIDDHARTH NAGAR	39.79	44.13	44.14	41.71	41.92	43.94	1.92	-2.21	-0.2
SITAPUR	41.08	43.62	44.9	42.76	45.02	46.22	1.68	1.4	1.32
SONBHADRA	41.97	44.58	44.21	42.96	44.57	45.09	0.99	-0.01	0.88
SULTANPUR	41.78	44.93	44.76	43.37	45.02	46.25	1.59	0.09	1.49
UNNAO	41.87	45.30	44.80	43.51	45.15	46.19	1.64	-0.15	1.39
VARANASI	43.4	45.42	45.38	43.9	45.27	46.71	0.5	-0.15	1.33

Note: a minus (-) value indicates decreased temperature and a plus (+) value indicates increased temperature. *Difference signifies the difference in maximum recorded temperatures in the month in 1982 and 2023.

Table 6: District wise Heat threshold for Uttar Pradesh.

SL NO	District	Heat Threshold		
		Yellow Alert	Orange Alert	Red Alert
1	AGRA	40.54	43.08	45.26
2	ALIGARH	40.03	42.55	44.78
3	AMBEDKAR NAGAR	39.67	42.20	44.36
4	AMETHI	39.87	42.43	44.55
5	AMROHA	39.33	42.00	44.33
6	AURAIYA	40.44	43.01	45.11
7	AYODHYA	39.67	42.20	44.36
8	AZAMGARH	39.98	42.58	44.71
9	BAGHPAT	39.61	42.01	44.43
10	BAHRAICH	38.81	41.26	43.44
11	BALLIA	39.18	41.62	43.83
12	BALRAMPUR	38.45	40.72	42.94
13	BANDA	40.58	43.30	45.31
14	BARABANKI	39.68	42.24	44.38
15	BAREILLY	39.34	42.00	44.25
16	BASTI	39.27	41.73	43.93
17	BHADOHI	40.28	42.98	45.02
18	BIJNOR	36.47	39.08	41.48
19	BUDAUN	39.92	42.52	44.72
20	BULANDSHAHR	39.74	42.29	44.63
21	CHANDAULI	39.52	42.26	44.38
22	CHITRAKOOT	39.86	42.64	44.66
23	DEORIA	39.08	41.50	43.67
24	ETAH	40.22	42.80	44.93
25	ETAWAH	40.50	43.05	45.15
26	FARRUKHABAD	40.01	42.59	44.75
27	FATEHPUR	40.37	43.03	45.10
28	FIROZABAD	40.50	43.05	45.15
29	GAUTAM BUDH NAGAR	39.96	42.40	44.69
30	GAZIPUR	39.71	42.31	44.48
31	GHAZIABAD	39.55	42.11	44.48
32	GONDA	39.36	41.82	43.94
33	GORAKHPUR	39.38	41.85	44.08
34	HAMIRPUR	40.51	43.21	45.27
35	HAPUR	39.33	42.00	44.33
36	HARDOI	39.73	42.35	44.49
37	HATHRAS	40.30	42.87	45.05
38	JALAUN	40.55	43.23	45.34
39	JAUNPUR	39.98	42.58	44.71
40	JHANSI	40.40	43.05	45.14

41	KANNAUJ	40.10	42.63	44.74
42	KANPUR NAGAR	40.51	43.21	45.27
43	KANPUR DEHAT	40.26	42.86	44.96
44	KASGANJ	39.65	42.29	44.50
45	KAUSHAMBI	40.52	43.23	45.24
46	LAKHIMPUR KHERI	39.30	41.87	44.11
47	KUSHINAGAR	38.75	41.08	43.30
48	LALITPUR	39.07	41.66	43.80
49	LUCKNOW	39.94	42.55	44.65
50	MAHARAJGANJ	38.49	40.84	43.05
51	MAHOBA	40.48	43.21	45.30
52	MAINPURI	40.26	42.80	44.92
3	MATHURA	40.40	42.95	45.12
54	MAU	39.39	41.89	44.14
55	MEERUT	39.33	42.00	44.33
56	MIRZAPUR	39.88	42.65	44.69
57	MORADABAD	39.02	41.69	43.97
58	MUZAFFAR NAGAR	38.47	41.19	43.65
59	PILIBHIT	38.82	41.50	43.91
60	PRATAPGARH	40.14	42.77	44.88
61	PRAYAGRAJ	40.53	43.15	45.21
62	RAIBEARELI	40.24	42.88	45.02
63	RAMPUR	39.34	42.00	44.25
64	SAHARANPUR	38.19	41.01	43.65
65	SAMBHAL	39.59	42.21	44.41
66	SANT KABIR NAGAR	38.94	41.30	43.51
67	SHAHJAHANPUR	39.50	42.05	44.30
68	SHAMLI	39.16	41.81	44.29
69	SHRAWASTI	39.05	41.39	43.49
70	SIDDHARTH NAGAR	37.83	40.05	42.25
71	SITAPUR	39.51	42.08	44.26
72	SONBHADRA	39.02	41.80	43.95
73	SULTANPUR	39.87	42.43	44.55
74	UNNAO	40.12	42.73	44.82
75	VARANASI	40.12	42.72	44.83

In Uttar Pradesh, the significance of heat alerts cannot be overstated, especially considering the varying thresholds that dictate these alerts. As temperatures soar across the State, the calculated heat thresholds range from 36.47°C to 40.58°C for Yellow Alert, 39.08°C to 43.30°C for Orange Alert and 41.48°C to 45.34°C for Red Alert in different districts of Uttar Pradesh. These thresholds serve as crucial indicators, delineating the severity of heat conditions and prompting appropriate responses from authorities and the public alike. With such diverse thresholds, ranging from moderate to extreme, it becomes imperative for Uttar Pradesh to implement robust heat wave mitigation and adaptation strategies tailored to each alert level.

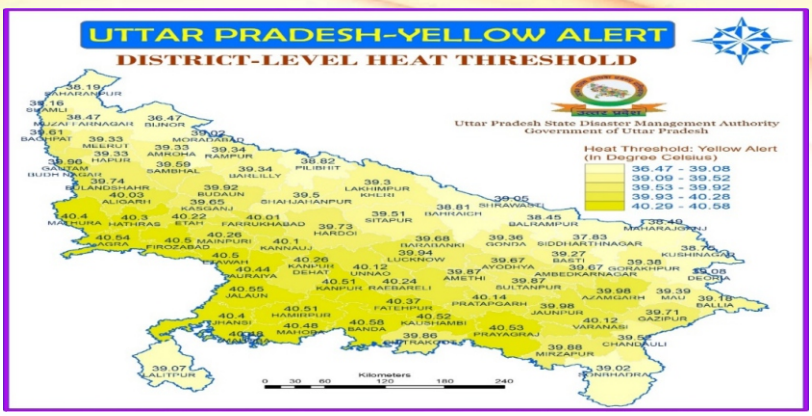

Figure 10: District wise heat threshold at 80th percentile (Yellow Alert).

2.5.1 Heat Threshold (Yellow Alert)

In Uttar Pradesh, Banda, Jalaun and Agra are among the top districts experiencing the highest yellow alert temperatures, indicative of elevated heat levels. These districts, along with Prayagraj, Kaushambi and Hamirpur, face significant heat challenges, impacting daily life and agricultural activities. With Kanpur Nagar, Etawah and Firozabad also on the list, it underscores the widespread nature of heat vulnerability in the region. The yellow alert signifies a cautionary phase, urging residents and authorities to take preventive measures against heat-related illnesses and agricultural stress. Given Uttar Pradesh's diverse landscape and population density, understanding heat thresholds in these districts is crucial for effective heat wave management and adaptation strategies.

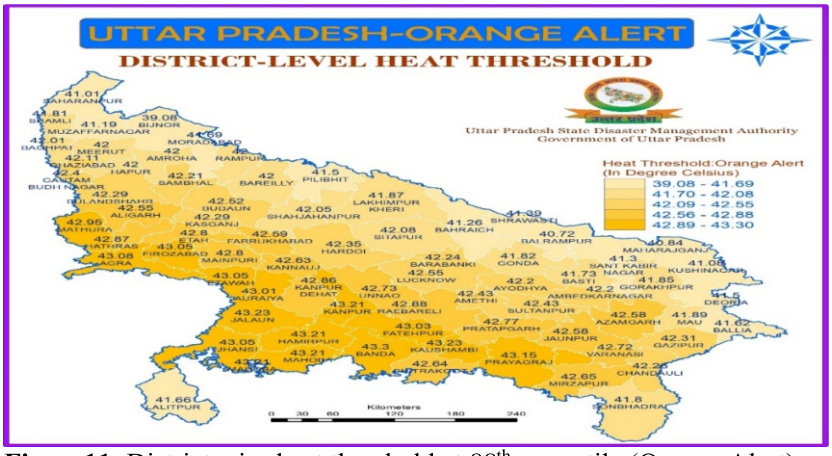

Figure11: District wise heat threshold at 88thpercentile (Orange Alert).

2.5.2 Heat Threshold (Orange Alert)

Districts like Banda, Jalaun and Kaushambi top the list with the highest orange alert temperatures, indicating heightened heat levels that pose significant risks to public health and agricultural activities. With Hamirpur, Kanpur Nagar, Mahoba, Prayagraj and Agra also experiencing extreme heat, it underscores the widespread vulnerability to heat waves across the state. The orange alert serves as a critical warning, urging residents and authorities to

take immediate action to protect themselves from heat-related illnesses and mitigate the impact on crops and livestock. Additionally, districts like Etawah, Firozabad, Jhansi and Fathepur facing high orange alert temperatures highlight the urgent need for proactive heat wave management and adaptation strategies.

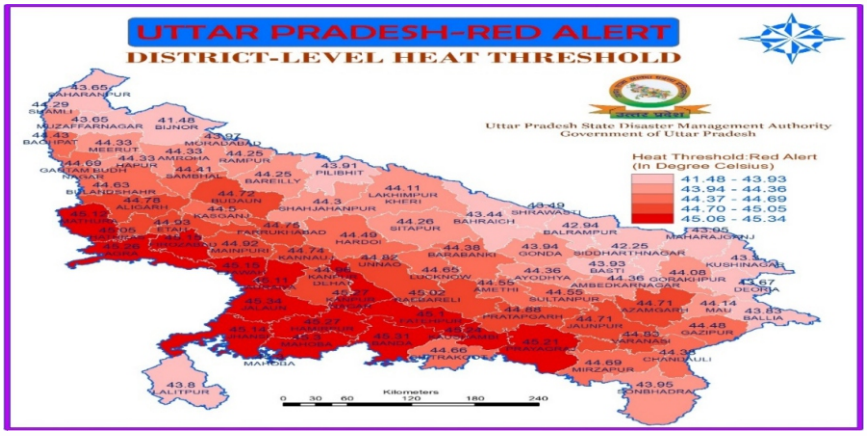

Figure 12: District wise heat threshold at 95th percentile (Red Alert).

2.5.3 Heat Threshold (Red Alert)

Several districts experienced exceptionally high-temperature threshold, warranting red alert classifications to signify the severity of the heat waves. Banda, Jalaun and Mahoba lead the list with temperatures soaring as high as 45.31°C, 45.34°C and 45.30°C, respectively. These extreme temperatures pose significant health risks and necessitate immediate interventions to protect vulnerable populations from heat-related illnesses. Districts like Agra, Hamirpur, Kanpur Nagar and Kaushambi are also grappling with intense heat. Besides there are another seven districts with temperatures hovering above 45°C. The red alert underscores the urgency for local authorities to implement heat wave management strategies, including the establishment of cooling centers, distribution of emergency supplies and dissemination of public health advisories. Additionally, efforts to mitigate the impact on agriculture, such as promoting water conservation and heat-resistant crop varieties, are crucial to safeguarding livelihoods in these districts. Collaborative action is essential to ensure the well-being and safety of communities amid these extreme heat conditions in Uttar Pradesh.

The establishment of heat thresholds for yellow, orange and red alerts in Uttar Pradesh represents a significant step towards enhancing the state's resilience to extreme heat events. Through rigorous data collection, statistical analysis and collaboration with experts, we have developed scientifically grounded criteria to define heat thresholds tailored to the specific climatic conditions of each district. This initiative provides vital information for early warning systems, allowing authorities to issue timely alerts and implement targeted measures to mitigate the adverse effects of heat waves on public health, agriculture, water resources and infrastructure. By proactively addressing heat-related risks, Uttar Pradesh can better protect its population and minimise economic losses and foster climate resilience.

2.6 Heat Alert Warning Systems in State of Uttar Pradesh:

Early warning systems can enhance the preparedness of decision-makers and their readiness to harness favourable weather conditions. Early warning systems for natural hazards is based both on sound scientific and technical knowledge.Accurate and timely alert systems are essential. Collaboration with India Meteorological Department (IMD) is needed to develop heat warning systems (HWS), trigger a warning, determine the threshold for action and communicate the risks. The IMD provides warnings based on heat index (based on temperature and humidity). It disseminates information to Relief Commissioner (RC), District Magistrates and all other concerned authorities including Doordarshan, All India Radio (AIR) by email. Immediately upon receipt of such a warning, the state and district Emergency Operation Centers make necessary arrangements for flashing the warning through all forms of media. Simultaneously, departments of Health and Family Welfare, Education, Labour,

Transport, and other related departments remain alert and put necessary emergency measures in place. During a Heat Wave condition EOC at Relief Commissioner Office issues directives to all the concerned governmental organizations for a prompt action. Apart from this, Relief commissioner office is also involved in establishing the Heat Wave related mortality recording system.Heat wave forecast is transmitted to Divisional Commissioners, District Magistrates and all other concerned authorities through email and fax by State Control Room. CUG phones have been given to all commissioner, DMs, ADMs, SDMs and Tehsildars. The warning is sent through mass SMS to all. Apart from this IMD gives this data to All India Radio and also to Doordarshan. AIR and Doordarshan widely displays this alert through their mediums.

Department of information publishes Do's and Dont's in various state level as well local Hindi/ English Daily Newspapers and other electronic media. 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.

The operational system of weather forecasts and warning is summarized in the chart below (*Figure 13*):

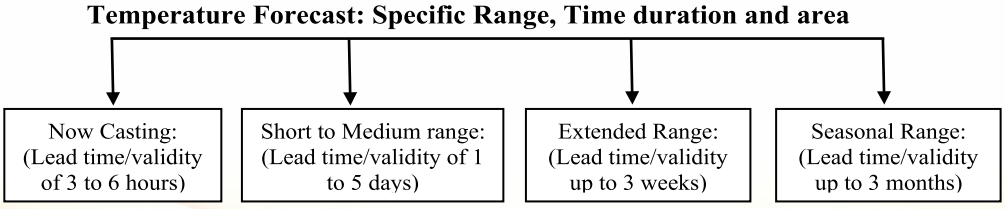

Figure 13: Temperature Forecast

2.7 Declaring Heatwave for the Uttar Pradesh State During 2024:

For declaring the heat wave, the above criteria should be met for 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. The early warning would be communicated to line department from UPSDMA through Heat Wave Early Warning Communication System (*Figure 11*).

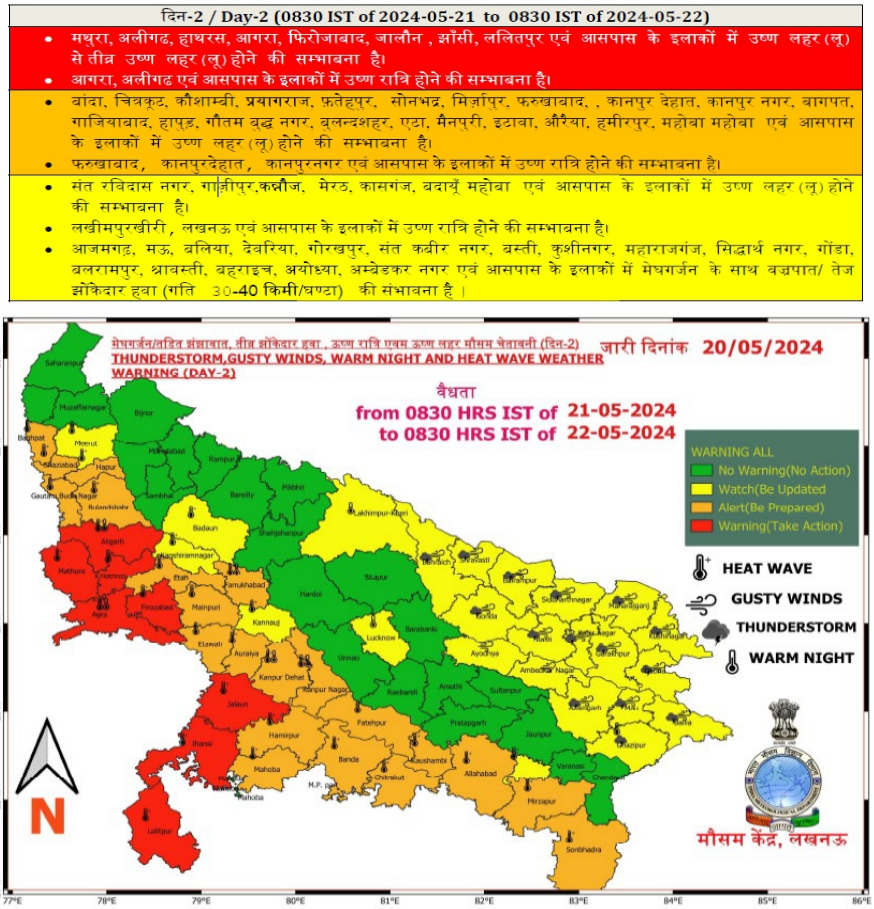

Figure 14: Early Warning System IMD

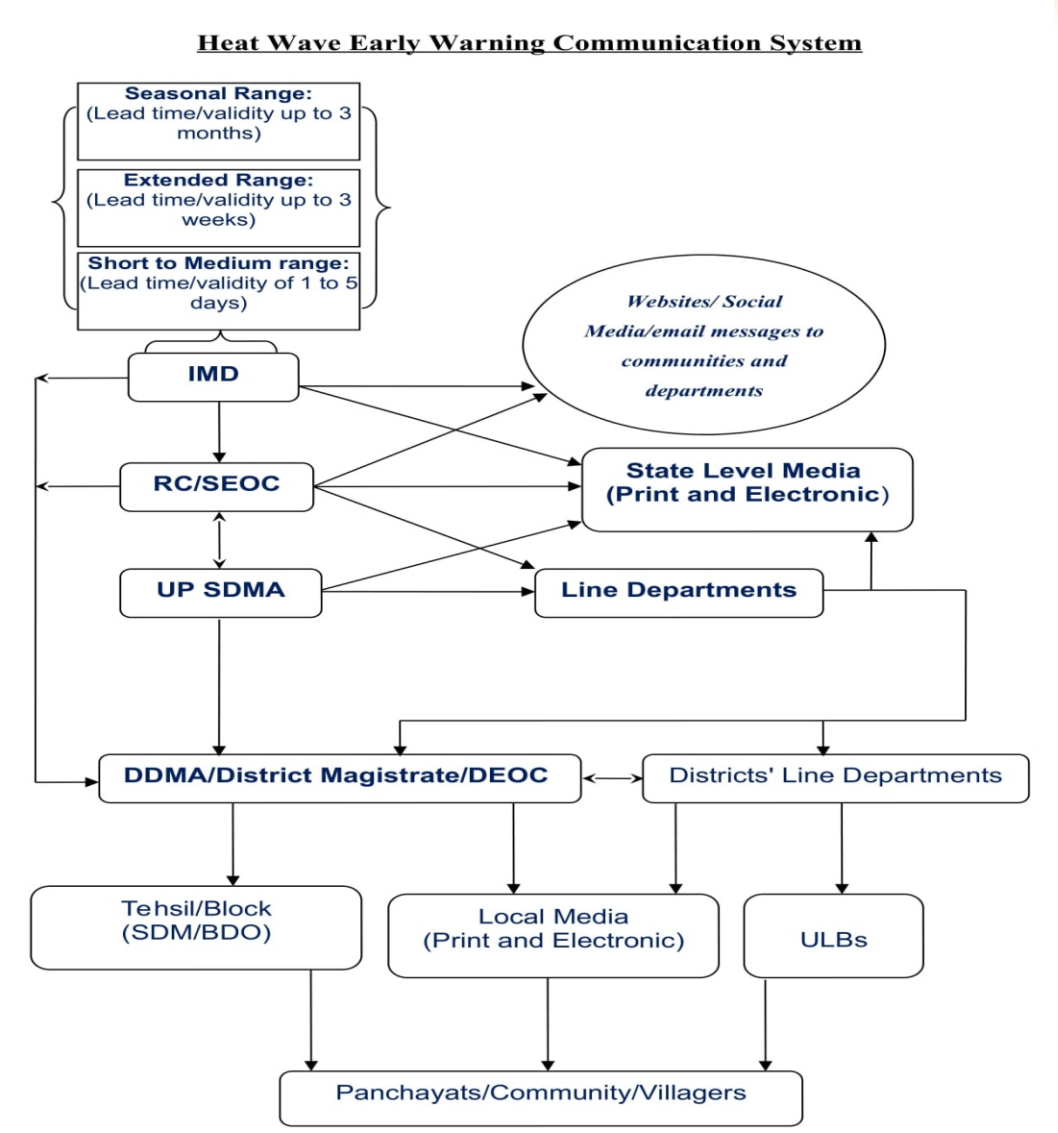

Figure-15: Early Warning Communication System

2.8 Colour Code Signals for HeatWave Alert and Suggested Actions (NDMA, 2019)

Colour Code	Alert	Warning	Impact	Suggested Actions
Green (No Action)	Normal Day	Maximum temperatures are near normal	Comfortable No cautionary action required temperature	Normal Activity
Yellow Alert (Be updated)	Heat Alert	Heatwave conditions at Isolated pockets persists 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	(a) Avoid heat exposure. (b) Wear lightweight, light-colored, loose, cotton clothes. (c) Cover your head
Orange Alert (Be prepared)	Severe Heat Alert for the day	i) Severe heat wave condition persists for 2 days (ii) Through not severe, but heat wave persists for 4 days or more	High temperature. Increased likelihood of heat illness symptoms in vulnerable and prolonged exposed people	(a) Avoid heat exposure- keep cool. Avoid dehydration (b) Wear lightweight, light-colored, loose, cotton clothes (c) Cover your head (d) Drink sufficient water- even if not thirsty (e) Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. to keep yourself hydrated (f) Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrates the body (g) Take bath in cold water frequently.
Red Alert (Take urgent action as per Uttar Pradesh State Heat Action Plan)	Extreme Heat Alert for the day	i) Severe heat wave persists for more than 2 days. (ii) Total number of heat/severe heat wave days exceeding 6 days.	Very high likelihood of developing heat illness and heat stroke in all ages	Along with suggested action for orange alert, extreme care needed for vulnerable people. First-aid and immediate hospitalization of heat exhaustion and heat stroke cases

Yellow alert	Hot day advisory	41.1- 43-degree C
Orange alert	Heat alert day	43.1- 44.9-degree C
Red alert	Extreme heat alert day	≥ 45-degree C

CHAPTER-3

FINANCIAL PROVISIONS FOR HEAT WAVE IN UTTAR PRADESH

3 Financial Provisions for Heat Wave in Uttar Pradesh

3.1 Heat-Wave and Disaster Management Section 2 (d) of the Disaster Management Act 2005 defines "disaster" as a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, and is of such a magnitude to be beyond the coping capacity of the affected area. Heat-wave has not been notified as a disaster by Government of India yet. Heat wave is not notified 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

उत्तर प्रदेश शासन
राजस्व अनुभाग–11
संख्या– 303 /1–11–2016–4(जी)/16
लखनऊः दिनांकः 27 जून, 2016

अधिसूचना

भारत सरकार द्वारा राज्य आपदा मोचक निधि और राष्ट्रीय आपदा मोचक निधि (2015–20) से व्यय के सम्बन्ध में मानक एवं दरों को निर्धारित करते हुये पत्र संख्या–32–7/2014– एन0डी0एम0–1, दिनॉक 08.04.2015 के बिन्दु संख्या–13 में निम्न व्यवस्था दी गयी है:–

13.	State specific disaster within the local context in the State, which are not included in the notified list of disaster eligible for assistance from SDRF/NDRF, can be met from SDRF within the limit of 10% of the annual funds allocation of the SDRF.	• Expenditure is to be incurred from SDRF only (and not from NDRF), as assessed by the State Executive Committee (SEC). • The norm for various items will be the same as applicable to other notified natural disaster, as listed above. or • In these cases, the scale of relief assistance against each item for 'local disaster' should not exceed the norms of SDRF. • The Flexibility is to be applicable only after the State has formally listed the disaster for inclusion and notified transparent norms and guidelines with a clear procedure for identification of the beneficiaries for disaster relief for such local disaster; with the approval of SEC.

2. राज्य में बेमौसम भारी बारिश, आंधी/तूफान, आकाशीय बिजली एवं लू–प्रकोप से प्रत्येक वर्ष बड़ी संख्या में जन–धन की हानि होती है। अतः भारत सरकार द्वारा दी गयी उक्त व्यवस्था के दृष्टिगत शासनादेश संख्या–249/1–11–2015–4(जी)/2015, दिनांक 15.04.2015 (यथा संशोधित दिनांक 16.04.2015) को निरस्त करते हुये श्री राज्यपाल महोदय बेमौसम भारी बारिश, आंधी/तूफान, आकाशीय बिजली एवं लू–प्रकोप को राज्य आपदा घोषित किये जाने की सहर्ष स्वीकृति प्रदान करते हैं।

3. उक्त राज्य आपदा से प्रभावित व्यक्तियों/परिवारों को भारत सरकार द्वारा राज्य आपदा मोचक निधि के लिये निर्धारित मानक एवं दरों के अनुसार राहत प्रदान की जायेगी।

4. उक्त राज्य आपदाओं के सम्बन्ध में होने वाला व्यय अनुदान संख्या–51 के अन्तर्गत लेखाशीर्षक "2245–प्राकृतिक विपत्ति के कारण राहत–05–स्टेट डिजास्टर रिस्पांस फण्ड–800–अन्य व्यय–06–स्टेट डिजास्टर रिस्पांस फण्ड से व्यय–09–राज्य सरकार द्वारा घोषित अन्य आपदाओं हेतु डिजास्टर रिस्पांस फण्ड से व्यय–42–अन्य व्यय" से वहन किया जायेगा।

5. प्रदेश सरकार द्वारा लिये गये उपरोक्त निर्णय के अनुसार कार्यवाही सुनिश्चित की जाय।

(सुरेश चन्द्रा)
प्रमुख सचिव।

संख्या व दिनांक तदैव

प्रतिलिपि निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषितः–

1– महालेखाकार, (लेखा एवं हकदारी) प्रथम, उ0प्र0, इलाहाबाद।
2– समस्त मण्डलायुक्त, उ0प्र0
3– समस्त जिलाधिकारी, उ0प्र0

(अनिल कुमार)
सचिव एवं राहत आयुक्त।

U.O. 2016 //Pg72

State specific natural disasters and notified clear and transparent norms and guidelines for such disasters with the approval of the State Authority.

As per above-mentioned clause, State Government of Uttar Pradesh has notified "Heat wave" as State Specific disaster. Thus, now heat wave is also covered for relief from SDRF. Notification issued in this regard is given in the box.

All the concerned departments and District Magistrates have been instructed to take required precautionary measures for mitigating the heat-wave situation.

3.2 REVISED LIST OF ITEMS AND NORMS OF ASSISTANCE FROM STATE DISASTER RESPONSE FUND (SDRF) AND NATIONAL DISASTER RESPONSE FUND(NDRF)

(Period 2022-23 to 2025 26, MHA Letter No. 33 03/2020-NDMA-l Dated10.10.2022, modified vide letter no. 33-03/2020-NDMA-l Dated 11.07.2023)

	Gratuitous Relief	Norms for Assistance
a)	Ex- Gratia payment to families of deceased persons.	Rs. 4.00 lakh per deceased person including those involved in relief operations or associated in preparedness activities, subject to certification regarding cause of death from appropriate authority.
b)	Ex- Gratia payment for loss of a limb or eyes.	Rs. 74000/- per person, when the disability is between 40 % and 60 %. Rs. 2.50 lakh per person, when the disability is more than 60 % Subject to certification by a doctor from a hospital or dispensary of Government, regarding extent and cause of disability.
c)	Grievous injury requiring hospitalization	Rs. 16,000/- per person requiring hospitalization for more than a week. Rs. 5,400/- per person requiring hospitalization for less than a week. Note-injured persons getting treatment under the 'Ayushman Bharat' Yojna will not be eligible for relief under this item.

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CHAPTER-4

PREVENTION AND MANAGEMENT OF HEAT RELATED ILLNESSES

4 Prevention and Management of Heat Related Illnesses

4.1 Introduction

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 fi ne particulate matter. The frequency, severity, intensity and duration of heat wave and related mortality is going to increase further due to rapid global climate change.

Thermoregulation is the process that enables our body to maintain a normal core temperature. The hypothalamus regulates body temperature. It causes us to shed heat and maintain a normal core temperature by activating receptors in your skin and other organs. Our body uses sweat evaporation to release heat when it becomes really warm (make the heat go away). If the heat entering person body is more than the rate of heat leaving the body, the core temperature will rise and the person will be at risk for a heat-related illness.

The risk of heat-related illnesses is determined by heat exposure (ambient and internally produced heat from exertion), individual vulnerability (influenced by age, pregnant status, and concurrent disorders), and socio-cultural variables (including environmental exposure, poverty, lack of social cohesion, lack of access to health care, and limited worker protections).

Geographical location, employment (e.g., farming, construction, driving deliveries), social isolation, and time spent outdoors or in hot spots, such as urban heat islands and places with less greenery, all affect how much each person is exposed to heat-related dangers.

Heat-related illnesses range from mild to life-threatening, and heat exposure exacerbates many common health conditions, including cardiac, respiratory, and kidney diseases.

Heat related illnesses 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. Physicians and pharmacists must have knowledge of effective prevention and first-aid treatment of heat related illnesses. It is also crucial to have an awareness of potential side-effects of prescription drugs during hot weather, to ensure the mitigation of heat illnesses.

Acclimatization

Those who come from cooler climatic conditions to warmer places face the risk of Heat Wave illnesses and need to be acclimatized. Acclimatization is achieved by gradual exposure to the hot environment during a Heat Wave. They should be advised not to move out in the open for at least one week to help the body acclimatize to the heat. They should also be advised to drink plenty of water.

4.2 Livestock preparedness During Hot Weather

Extreme heat causes significant stress to livestock. There is a need to plan well for reducing the impact 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.

4.3 Vulnerable Population:

Heat waves and hot weather can be deadly and make pre-existing medical issues worse. All age groups and a variety of conditions can have an impact on one's health, but some people are more susceptible than others are to heat-related illnesses and even mortality. Children, elderly individuals, homeless people, persons with pre-existing ailments, outdoor and indoor laborers, emergency responders, members of low-income communities, pregnant women, athletes, and others are among the groups most at risk from heat(*Figure:12*).

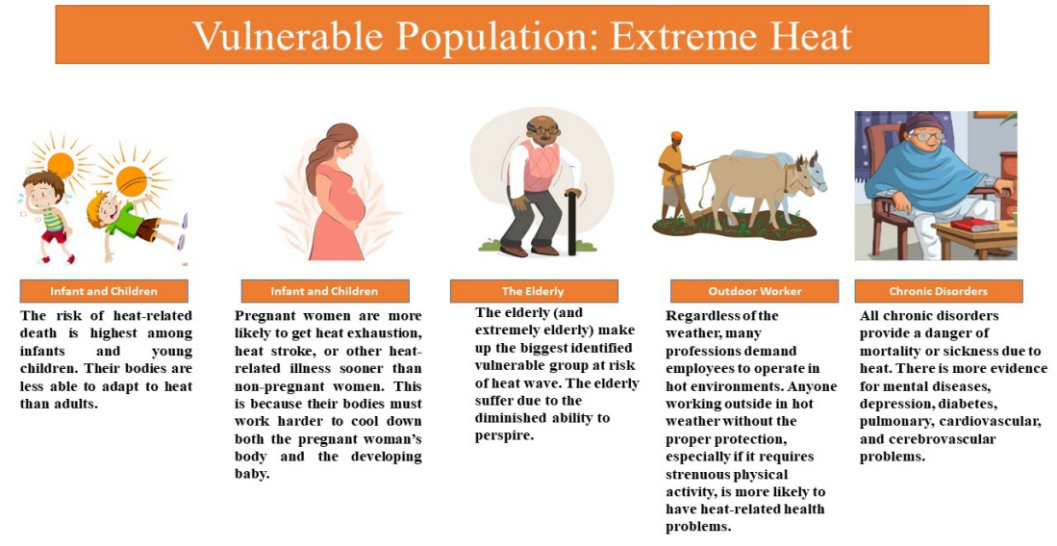

Figure 16: Vulnerable Population-Extreme Heat

4.4 Hospital Preparedness Measures for Managing Heat related Illness

Director/In-charge of hospitals, CHCs, PHCs and UHCs should ensure the following measures:

- A detailed action plan to tackle Heat related illnesses well in advance of hotter months.
- Operational framework-preparing specific health adaptation plan, development of guidelines and response plan for climate sensitive diseases.
- Need for updating Heat Health Action Plan and issuing Advisory for Hospital Preparedness, Surveillance and weekly monitoring including Capacity Building.
- Promoting Strategic media coverage of climate and health, linkages at the state level in regional languages to increase support for climate mitigation and adaptation responses.
- Long term measures such as adopting cool roof, improving green forest coverage and analyzing health impacts in urban planning.
- Standard Operating Procedures totackle all levels of Heat related illnesses. Capacity Building measures for doctors, nurses and other staffs should be undertaken.
- Cases with expected heat stroke should be rapidly assessed using standard treatment protocols.
- Identify search capacities and mark the beds dedicated to heat stroke victims and enhance emergency department preparedness to handle more patients.
- Identify RRT (Rapid Response Team) to respond to any exigency call outside the hospital.
- Ensure adequate arrangements of staff, beds, IV Fluids, ORS, essential medicines and equipment's 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 in campaigns for neighbourhood communities using different means of information dissemination.
- Primary Health Centers must refer the patients to higher facility only after ensuring adequate stabilization and basic definitive care (cooling and hydration).
- Hospitals must ensure proper networking with nearby facilities and medical centers to share the patient load which exceed their search capacities.

4.5 Case Definitions of various Heat related illnesses

Clinical Entity	Age Range	Setting	Cardinal Symptom	Cardinal Signs	Pertinent Negatives	Prognosis
Heat Rash	All, But frequently children	Hot environment; +/- insulating clothing or swaddling	Itchy Rash with small red bumps at pores in setting of heat exposure; bumps can sometimes be filled with clear or white fluid	Diffuse maculopapular rash, occasionally pustular, at hair follicles; pruritic	Not focally distributed like a contact dermatitis; not confluent patchy; not petechial haemorrhages	Full recovery with elimination of exposure and supportive care
Heat Cramps	**All**	Hot environment typically with exertion; +/- insulating clothing or swaddling	Painful spasms of large and frequently used muscle groups	Uncomfortable appearance may have difficulty fully extending affected limbs /joints	No contaminate wound/tetanus exposure; no seizure activity	Full recovery with elimination of exposure and supportive care
Heat Exhaustion	**All**	Hot environment; +/- exertion; +/- insulating clothing or swaddling	Feeling overheated, lightheaded, exhausted and weak, unsteady, nauseated, 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 aphasia, /dysarthria, no overdose history	Full recovery with elimination of exposure and supportive care; progression if continued exposure
Heat Syncope	Typically, adult	Hot environment; +/- exertion; +/- insulating clothing or swaddling	Feeling hot and weak; light-headedness followed by 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 aphasia/dysarthria	Full recovery with elimination of exposure and supportive care, progression if continued exposure
Heat Stroke	**All**	Hot environment; +/- exertion; +/- insulating clothing or swaddling	Severe overheating, profound weakness, disorientation, obtundation, seizures or other altered mental status	Flushed dry skin (not always), core temperature ≥ 40-degree C, altered mental status with disorientation, possibly delirium, coma, seizures, tachycardia, +/- hypotension	No coincidental signs and symptoms of infection; no focal weakness; no aphasia/dysarthria, no overdose history	25-50% mortality even with aggressive care, significant morbidity if survive

4.6 Symptoms and First Aid for various Heat Related Illnesses

Heat Disorder Symptoms First Aid	Heat Disorder Symptoms First Aid	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 Bskin. 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 foremergency medical services or take the victim to a Health center or 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.**

4.7 Clinical evaluation or differential diagnosis

Mild heat illness: A rectal temperature is most reliable measurement as alternatives; oral, tympanic, axillary and skin temperature are less accurate. Core temperature and absence of central nervous system symptoms will help the diagnosis and treatment of heat related illnesses. In the absence of hyperthermia, presence of central nervous system symptoms suggests the investigation for differential diagnosis.

Heat Exhaustion: In the case of heat exhaustion, the skin may appear pale associated with tachycardia or hypotension. Headache, dizziness, nausea, vomiting as well as diarrhoea and loss coordination may occur. Such patients are advised to be in supine position with elevation of legs. They are instructed to remove excess clothing and are moved in cool shaded environment. Oral fluids are recommended for rehydration. Vital signs should be monitored with the transport to emergency department if symptoms do not improve after 20-30 minutes of onset.

Heat Cramps: Exercise associated muscle cramps are more common during hot and humid environment and is characterized by dehydration, depletion of electrolytes, hyponatremia etc. The treatment includes rest, prolonged stretching of affected muscle groups and oral sodium intake. For severe conditions, intravenous Normal Saline may be very useful for more rapid relief for severe cramping.

Heat Stroke: Heat Stroke requires immediate diagnosis and early treatment. It is characterized by the elevation of core temperature associated with involvement of central nervous system disturbances. Rectal temperature is recommended to obtain as early as possible. Treatment regime includes stabilizing airway, breathing and circulation. Onsite cooling is preferred generally. Applying ice packs or wet towels to axillary, groin, head, neck region is alternative option. The combination of rapid fan movement and spraying moderate temperature mist of water tends to have effective evaporative and convective cooling. Intravenous hydration needs to be recommended to maintain renal blood flow. In rural areas, community settings, patients should be kept in cool shaded environment without excess clothing till ambulance reach. The curative action taken in this time may decide the degree of cell damage leading to organ failure. Prevention of stroke includes the identification of older population having chronic medical disease or physical disabilities, which lack access to air conditioning and providing them the cooler environment.

The clinical evaluation or differential diagnosis is given in the below chart (*Figure 13*)

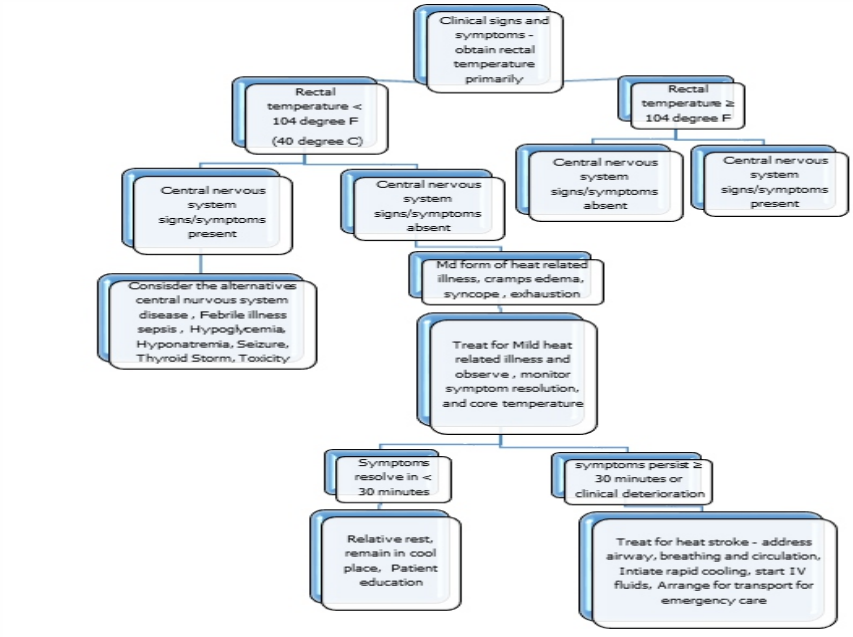

Figure 17: Algorithm for the initial evaluation of a patient with suspected heat related illness

4.8 Heat Illness Treatment Protocol (NDMA, 2019)

Recognizing that treatment protocols may vary slightly in different the settings (EMS, health centers, clinics, hospital emergency departments, etc.), the following should apply in general to any setting and to all patients with heat related illnesses:

1. Initial assessment and primary survey of patient (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:
      - Extremes of age (infants, elderly)
      - Debilitation/physical reconditioning, overweight or obese
      - Lack of acclimatization to environmental heat (recent arrival, early in summer season)
      - Any significant underlying chronic disease, including psychiatric, cardiovascular, neurologic, hematologic, obesity, pulmonary, renal, and respiratory diseases
      - Taking one or more of the following:
        - Sympathomimetic drugs
        - Anticholinergic drugs
        - Barbiturates
        - Diuretics
        - Alcohol
        - Beta blockers
3. Remove from environmental heat exposure and stop physical activity
4. Initiate passive cooling procedures
   - 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
   - Spray cool water or blot cool water on to the skin
   - 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.

4.9 Heat Stroke Treatment (Sorensen and Hess, 2022)

Heat stroke is a medical emergency that needs to be treated urgently in order to avoid permanent complications and death. Without prompt treatment, mortality from classic heat stroke approaches 80% and from exertional heatstroke approaches 33%. Central nervous system dysfunction and a core body temperature of more than 40°C are the defining features of heat stroke.

Heat stroke, treatment need to bestarted with maintaining the airway, breathing, and circulation, immediately followed by rapid cooling. The delayin cooling can be associated with worse outcomes. Initial management should always be focused on rapidly reducing the core body temperature to 38° to 39°C, ideally within 30 minutes after presentation. The most effective cooling methods are cold-water immersion and ice-water immersion. A combination of evaporative and conductive cooling techniques, such as the infusion of cold fluids, the application of ice packs to the neck, groin, and axillae, and fanning, are used as treatment if resource availability, ongoing cardiopulmonary resuscitation, airway compromise, or other factors prevent cold-water immersion (*Figure 14*).

Antipyretic medications should not be used since they make heat stroke patients worse and can exacerbate coagulopathy and end organ damage. Dantrolene is not often used to treat heat stroke; however, it has been linked to a shorter cooling time without an improvement in recovery rates. Agitation, pain, and shivering can be managed with benzodiazepines.

Successfully cooled patients who make it through the hyper thermic-neurologic phase are at a high risk of progressing to the late hepatic-renal and hematologic-enzymatic stages. The most effective care for these patients should be provided by a multidisciplinary team in an Intensive Care Unit.

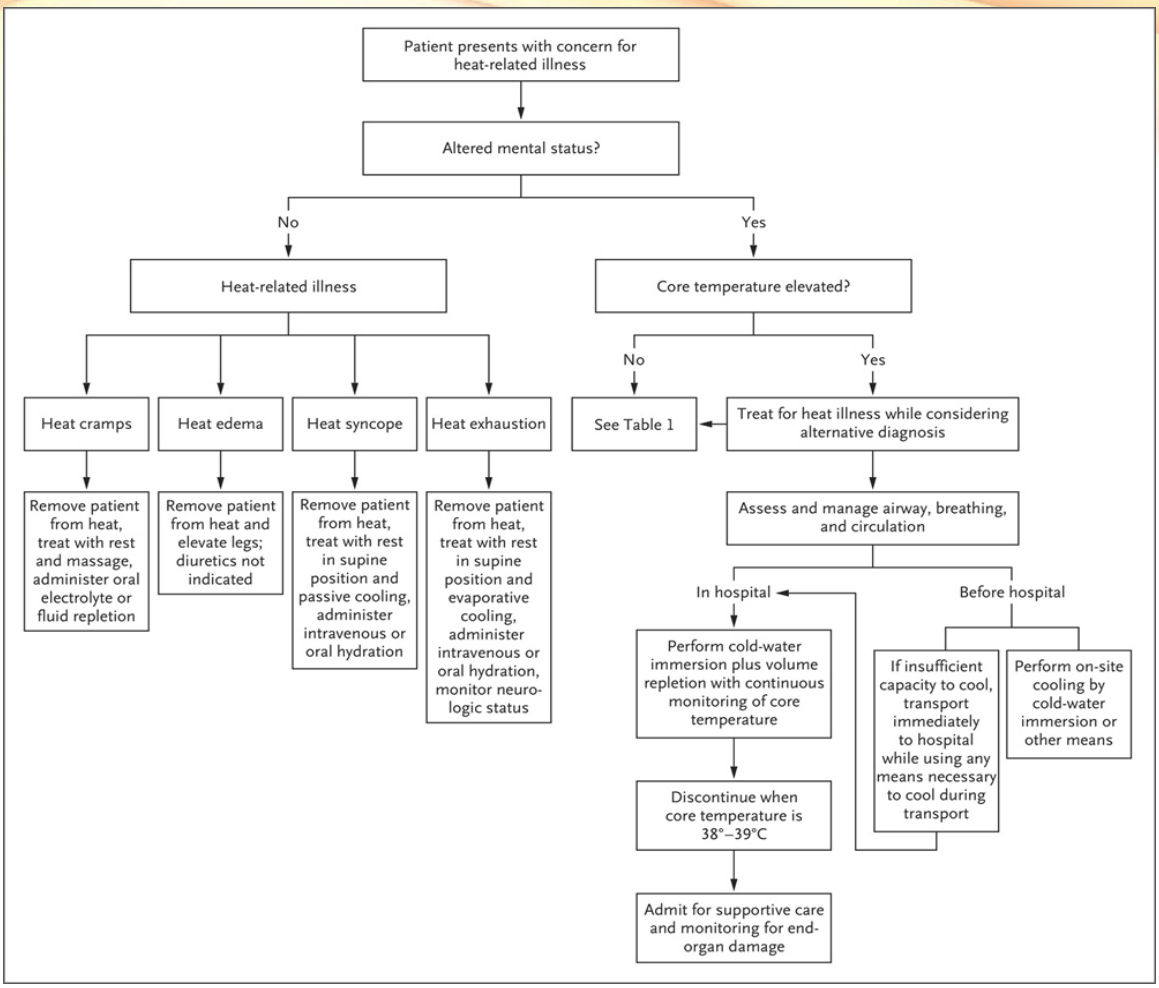

Figure 18: Heat Stroke Treatment Protocol

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CHAPTER-5

INTER-DEPARTMENT COORDINATION FRAMEWORK WITH ROLES AND RESPONSIBILITIES OF LINE DEPARTMENTS AND CAPACITY BUILDING AND TRAINING

5 Inter-department Coordination Framework with roles and responsibilities of line departments

5.1 Introduction

Inter-department coordination is very essential for successful implementation of Heat Action Plan. As Heat Action plan strategies and activities are multi dimensional in nature, therefore, active participation of various line departments is essential for effective implementation of heat action plan. Every department is equally important and have some role to play in order to save loss of lives, livelihood and economy due to extreme heat events. In this chapter, the roles and responsibilities of key line departments have been enlisted.

5.2 Phases of Heat Action Plan Implementation

The Heat Action Plan shall be implemented in 3 Phases annually

Phase-I: – Pre -Heat Season (February to March)

Pre-Heat Season is devoted to develop early warning systems, communication plan of alerts to the general public, health care professionals and voluntary groups (care givers) with emphasis on training and capacity building of these groups.

Phase-II: - During the Heat Season (April to July)

High alert, continuous monitoring of the situation, coordination with all the departments agencies concerned on one hand and general public and media on the other hand is the focus of this phase.

Phase-III: – Post -Heat Season (August to October)

In Phase – III concentration is on evaluation andupdating of the plan. It is important at the end of the summer to evaluate whether the heat health action plan has worked. Continuous updating of plan is a necessity. Global climate change is projected to further increase the frequency, intensity and duration of heat-waves and attributable deaths. Public health prevention measures need to take into consideration the additional threat from climate change and be adjusted over time.

5.3 Roles and Responsibilities of the Departments

Uttar Pradesh State Disaster Management Authority /DDMA

Phase-I: - Pre Heat season (February to March)

- Constitute a heat wave action plan committee: Prevention and Mitigation of Impacts of Heat Wave, with Chairman and Nodal Officer as Member Secretary, representatives of all departments to be member of this committee.
- Committee should meet at-least 3 times in year, once in pre-heat, during-heat and post-heat season.
- Establish heat mortality tracking system and update datasets
- Designate point of contact for each department for heat wave
- To review preparedness instructions to all concerned departments for the heat season
- Develop and Implement State Heat Action Plan- Capacity Building initiative at state level
- Preparation of a list of high risk areas in the State / District vulnerable to heat waves for more focus in planning to mitigate adverse effects of Heat wave
- Convene meetings at state /district level with the concerned Departments/ Agencies/ NGOs involved in response mechanism to Heat waves to review the action plan periodically
- Develop and Distribute pamphlets and posters with tips to prevent heat stress in local language to hospitals, schools, and professional associations

Phase-II: - During the Heat Season (April to June)

- Led the implementation of State/District Heat Action Plan
- Monitoring of implementation of various activities of Uttar Pradesh State/District Heat Action Plan
- Establishing incident and emergency management teams
- Monitoring district level heat action plan implementation
- Organizing meeting with concerned departments during heat season
- Awareness relating to prevention and management of heat related illnesses
- Advertisements on safety tips through local newspapers, radio and television channels.
- Issue of timely information and warnings to all key Departments / Agencies, State Emergency Operation Center (SEOC), DEOC etc.
- Communicate locations of emergency facilities and cooling centers/shaded areas with each Department / Organization.
- Inform power supply Companies to prioritize maintaining power to critical facilities (such as hospitals) during extreme heat events
- Notify all the stakeholders when the heat alert is over.
- Ex-Gratia Relief- After declaring heat wave as State Specific disaster vide notification no- 303/1-11-2016-4(G)/ 2016 dated 27 June 2016, ex-gratia relief of Rs. 4.00 Lakh is given to the family of each deceased due to heat stroke from State Disaster Response Fund (SDRF). A person needs hospitalization due to heat wave is also eligible to get relief from SDRF as per norms.

Phase-III: – Post -Heat Season (July to October)

- Review of quantitative and qualitative data for process evaluation and improvements.
- Annual evaluation of Heat Action Plan by organizing a meeting with key Departments/agencies and relevant stakeholders.
- Evaluate the Plan process based on the reach and impact.
- Revision of Plan based on the feedback and suggestion received from stakeholders.
- Revision Action Plan ahead of summer season next year for information of all stakeholders.

Medical and Health Department

Phase-I: - Pre Heat season (February to March)

- Designing and initiating targeted training programs, capacity building efforts and communication on heat illness for medical staff at Community Health Centers (CHCs), Public Health Centers (PHCs) / including nursing staff, paramedics, field staff and link workers (ANMs, ASHA Workers, etc.), while paying special attention to the susceptibility of particular wards.
- Up-dation of admissions and emergency case records in Hospitals to track heat-related morbidity and mortality and also to create simple, user-friendly means to track daily heat-related data and behavioural change impacts. Train hospitals to record information on education and communication (IEC) efforts and to ensure recording of cause of death in death certificates.
- Adopt heat-focused examination procedures at local hospitals and urban health centers.
- Developing of SMS facility to reach the field level staff during emergency periods.
- Checking of inventories of medical supplies including ORS powder in PHCs and other Local Hospitals.
- Purchase and distribute reusable soft plastic ice packs for the CHCs, 108 emergency centers, ambulances and hospitals.
- Explore creation of ice pack dispensaries to increase access to vulnerable communities in high risk areas.
- **To provide following services through 108 Emergency Service**
    - Ensure adequate supply of IV fluids.
    - Prepare handouts for paramedics about heat related illness.
    - Create displays on ambulances to build public awareness during major local events.
    - Identifying routes to high risk areas and to reach vulnerable sections of population in shortest time possible by utilizing the list of high-risk areas.

Phase-II: - During the Heat Season (April to June)

- Display of heat-related illness prevention tips and how to stay cool around hospitals, PHCs and CHCs.
- Equip all hospitals/ PHCS/ CHCs with additional supplies of medicines and commodities.
- Ensure adoption of Heat illness treatment and prevention protocols at health facilities.

- Deploy additional staff at hospitals and PHCs/CHCs to attend to the influx of patients during a heat alert, if feasible.
- Keep emergency wards ready in all PHCs / CHCs and Hospitals
- Increase outreach of community health workers in at-risk neighbourhoods during a heat alert
- Report Heatstroke patients to Nodal Officer on daily basis and generate weekly reports on public health impacts of Heat wave for Nodal Officer, during a heat alert.
- Expedite recording of cause of death in death certificates.
- **Ensure that 108 /104 EMERGENCY SERVICE:**
    - Activate dynamic strategic deployment plan for ambulances.
    - Adequate supply of ice packs, IV fluids and medicines.
    - Keep accurate records of pre-hospital care.
    - Adequate staff on duty and restrict leave if necessary.

Phase-III: – Post -Heat Season (July to October)

- Perform an epidemiological case review of heat-related mortalities during the summer.
- Conduct and gather epidemiological outcomes from the data on heat risk factors, illness and death, based on average daily temperatures.
- Measure mortality and morbidity rates based on data before and after the Plan's interventions.
- Provide data to key Agency / Department.
- Incorporate data and findings into future versions of the Heat Action Plan.
- Participate in annual evaluation of Heat Action Plan review the revised Heat Action Plan.
- To ensure 108 Emergency Service

Education Department

Phase-I: - Pre Heat season (February to March)

- Review the departmental action plan with concerned officials and others stakeholders (School/Colleges, etc.).
- Organize awareness camps classes on heat wave related illness/sunstrokes for teachers and also students.
- Prepare SOP for hot weather impact reduction to education system and safe environment for students.
- Explain importance of proper shade, availability of drinking water and other facilities for Students
- Distribute pamphlets/posters on heat related illness prevention; Do's and Don'ts for display and further distribution to students in Schools and Colleges.
- Ensure availability of ceiling fans in class room's proper shade
- Ensure availability with of ORS, Ice pack, and Cool drinking water

Phase-II: - During the Heat Season (April to June)

- Display posters and distribute pamphlets on prevention of heat related illness in Schools and Colleges
- Identify shelter space, of shade, drinking water, ORS facilities with signs
- Restrict working hours as per the weather conditions and monitor early warning when Heat wave is declared
- No open-air classes to be conducted
- Ensure school buses are parked in sheds, sprinkle water on the roof of the buses, before commuting.
- Distribute heat protection materials at local schools and orient school teachers to equip them with knowledge of heat protection tips and activities which they can disseminate in classrooms.
- Scheduling of examinations before starting of Heat period normally and also avoid examination during orange and red alert
- Hostels operated by Social Welfare, Minority, and by Private Institutions to ensure proper measures are adopted to provide sufficient water and arrangements to keep the environment in the hostels cool. Ensure sufficient power supply is available, access to health facility is available, fans/cooler's are installed.

Phase-III: – Post -Heat Season (July to October)

- Review implementation and effectiveness of Plan.
- Obtain and give feedback for further improvement of Plan.

India Meteorological Department (Uttar Pradesh Regional Office)

Phase-I: - Pre Heat season (February to March)

- Issue prior Warnings with details of temperature and districts
- Establish system of early warning and forecasting in collaboration with UPSDMA

Phase-II: - During the Heat Season (April to June)

- Provide daily/ weekly forecasts
- Communicate Heat wave alerts/warnings promptly
- Update heat wave details regularly in their website
- Determine threshold district wise e.g. Percentile method

Phase-III: – Post -Heat Season (July to October)

- Provide season report containing duration of Heat wave and location-wise maximum temperatures.
- Participate in annual evaluation of heat action plan.

Information and Public Relations (I and PR) Department

Phase-I: - Pre Heat season (February to March)

- Identification of areas to post warnings and information during heat season.
- Securing advertisement / scrolling slots for announcements regarding Heat waves.
- Designing information and awareness material in the form of pamphlets, posters etc. on Heat waves in local language for distribution to the general public, especially focusing on identified high risk areas in the State and vulnerable groups of population.

Phase-II: - During the Heat Season (April to June)

- Create awareness among public through advertisements in regional languages
- Display hoardings at important places
- Create awareness through TV and Radio spots and jingles
- Conduct regular press conferences at the State level and District level through concerned Ministers, Secretaries and Collectors on the risks and dangers of heat related illness.
- Circulate heat wave warnings i.e. text alerts or WhatsApp messages in collaboration with private sector telecom companies in addition to traditional media.
- Send warnings in bulk to the public via centralized email databases during heat waves.
- Develop SMS alert system from time to time on treatment systems to send messages to private doctors and medical professionals at Government hospitals including PHCs and UHCs.
- Utilize local radio FM broadcast through special programmes and during popular programmes to alert the public.
- Explore other means of communication like Facebook, Twitter and Whats App.
- Collect all news items/reports on Heatwaves daily and report to Government. Conducting regular press conferences at the state level and District level on the risks and dangers of heat related illness.

Phase-III: – Post -Heat Season (July to October)

- Evaluate reach of advertising / public messages and other means of communication like social media (face book, twitter etc.) to target groups.
- Participate in annual evaluation in Heat Action Plan.

Labour and Employment Department

Phase-I: - Pre Heat season (February to March)

- Organize training for employers, outdoor labourers and workers on health impacts of extreme heat and protective measures to be taken during high temperature periods.
- Utilize maps of construction sites and outdoor work spots preferably overlaying with irradiation map from IMD or heat island map to identify more high-risk outdoor workers and to conduct publicity campaigns during high-risk days.
- To regulate construction/work site contactors to provide drinking water, ORS and shelter to worker's labourers.
- To Instruct Factory/industry managements to provide cool drinking water, ORS and shelter to worker's labourers.
- Preparing a list of factory medical officers, contractors and house side non-factory workers to include in heat alert and action communication.
- Heat illness orientation planning for factory medical officers.

Phase-II: - During the Heat Season (April to June)

- Encourage employers to shift outdoor workers schedules away from peak afternoon hours (12 – 4pm) during a heat alert.

- Ensure provision of shelters/ cooling areas, water and supply of emergency medicines like ORS, IV fluids etc. at work sites by employers.
- Report cases of heat related illnesses to nearest public health facilities

Phase-III: – Post -Heat Season (July to October)

- Obtain feedback on cases, plan, and measures taken
- Participate in annual evaluation of heat action plan.

Rural Development Department

Phase-I: - Pre Heat season (February to March)

- Collecting information on the works sanctioned under MGNREGS programme and other schemes in High risk areas to plan for mitigation effort during heat period
- To ensure shade and supply of adequate drinking water at work spots
- Ensure Adequate drinking water supply

Phase-II: - During the Heat Season (April to June)

- Reschedule of working hours to avoid intense heat timings in all the works sanctioned under MGNREGS on red alert days
- Provision of additional drinking water in heat vulnerable areas
- Training of local volunteer in first aid for heat related illnesses
- Shelters / cooling areas wherever necessary.

Phase-III: – Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

Urban Development Department

Phase-I: - Pre Heat season (February to March)

- High Risk Area mapping and identification of vulnerable groups particularly destitute, homeless, beggar homes and old age homes to concentrate on mitigation efforts during heat alert period.
- Identification of areas to provide shelters and drinking water during heat alert period.
- Special care in restricting outdoor activities and functions during heat period.
- Identification of NGOs / Rotary Clubs / Lions Clubs and Corporate houses (under Corporate Social Responsibility) to provide shelters, drinking water, medical supplies and temporary homes during heat days.
- Adequate drinking water supply.

Phase-II: - During the Heat Season (April to June)

- Disseminate SMS text messages to warn residents of high risk areas and vulnerable sections of population during a heat alert.
- Activate “cooling centers,” such as public buildings, malls, temples, schools and State Government or Local body, run temporary night shelters for those without house or access to water and/or electricity at home.
- Expand access to shaded areas for outdoor workers, slum communities, and other vulnerable sections of population.
- Keep open the parks for a longer duration during evenings.

- All non-essential uses of water (other than drinking, keeping cool) may be suspended, if necessary.
- Distribution of fresh drinking water to the public by opening water centers at people congregation points like market places, labour addas, etc. Water may be distributed through pouches to the poor in the identified high-risk areas.
- Actively involve NGOs and Corporate houses in providing shelter and drinking water facilities to vulnerable population

Phase-III: – Post -Heat Season (July to October)

- Collect data related to implementation of Action Plan and provide feedback to key agency / department.
- Participate in annual evaluation of Heat Action Plan.

Animal Husbandry Department

Phase-I: - Pre Heat season (February to March)

- Review and discuss implementation of Heatwave Action Plan for safeguarding cattle
- Prepare material like Posters and pamphlets for tips to take care of cattle and poultry during heatwaves
- Conduct training for department, field workers as well as for cattle and poultry farmers on heat wave management plan in Animal Husbandry sector
- Review availability of necessary medicines for treatment of cattle / poultry affected by Heatwave
- Prepare plan for drinking water for cattle with water department

Phase-II: - During the Heat Season (April to June)

- Display posters and distribute pamphlets on the precautionary measures to be taken to safeguard cattle and poultry birds during heat period in villages and important junctions.
- Ensure adequate stock of medicines in all veterinary hospitals.
- Ensure visit of field staff during heat wave to villages for follow up action in treatment of cattle / poultry birds.

Phase-III: – Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

Transport Department and UPSRTC

Phase-I: - Pre Heat season (February to March)

- Review the departmental action plan with concerned officials and others stakeholders.
- Review plan with Depot Managers/Zonal Managers
- To create awareness among the Staff and Passengers through meetings, Pamphlets, Posters and Banners on the ill effects of Heat Wave and Sunstroke during summer.
- Organize heat wave risk awareness programmes for Bus drivers, staff at bus stands
- Explain importance of proper shade, availability of drinking water and other facilities for passengers in bus stations
- Distribute pamphlets/posters on heat related illness prevention; Do’s and Don’ts for display further distribution to passengers at Bus Stations, Bus Shelters.

- Ensure supply of safe drinking water to its Staff and Passengers in the depots and bus stations
- Planning to provide ORS, Ice packets etc. and medical services in Bus stations.

Phase-II: - During the Heat Season (April to June)

- Display posters and distribute pamphlets on prevention of heat related illness in bus stands, auto stands etc.
- Ensure availability of shade / shelters, drinking water, ORS packets etc., in bus stands, auto stands etc.
- Ensure availability of water and ORS packets in long distance buses.
- Do not run buses as par as possible during peak hours (12 4 pm) when Heat wave is declared.
- Report heat related illnesses to nearest health facilities

Phase-III: – Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

Agriculture Department

Phase-I: - Pre Heat season (February to March)

- Review the departmental action plan with concerned officials and others stakeholders.
- Ensure heatwave action plan is revised and all the officials are trained in implementing preparedness measures under the department.
- Organize stakeholder meeting and capacity building programmes for the farmers on
- implementation of contingency plans.
- Organize convergence meetings and prepare policy needs for plan implementation.

Phase-II: - During the Heat Season (April to June)

- Monitor the implementation of the action plan
- Ensure support to farmers for documenting and prepare for availing risk transfer facilities for reducing impacts to agriculture due to heatwaves
- Ensure early warnings, dissemination and its last mile connectivity

Phase-III: – Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

Women and Child Development Department

Phase-I: - Pre Heat season (February to March)

- Women, children and infants are most vulnerable to heatwave seasons. WCD has to take essential precautionary measures to ensure that essential nutritional services will not get effected during the time of heatwaves.
- Setting up of nutritional resource centres at Anganwadi centres to supplement nutritional deficiency in children.
- Pre-heatwave necessary precautionary methods such as provision of proper stock of ORS, buttermilk and other rehydration methods may be arranged well in advance
- Create surveillance mechanism on tracking children, lactating mothers and women through ICDS and Anganwadi centres in the state.

- Capacity building of Anganwadi Sevikas, Asha workers, ANM nurses and ICDS workers to identify symptoms in women and children and to report it when necessary.

Phase-II: - During the Heat Season (April to June)

- Use opportunities, such as nutrition day, SHG meetings for creating awareness and educate young girls and mothers regarding the dangers of Heat Waves, its related health impacts and the precautionary measures to be taken.
- Display IEC materials at Anganwadis and encourage integrated child development scheme (ICDS) workers to disseminate Heat Wave related information with special focus on infants, children below five years, pregnant and lactating mothers to protect them from heat related illnesses
- Provision of drinking water and first aid at all the Anganwadi Centres
- Ensure that visits to homes by AWWs are done early mornings, so as not to be exposed to high temperatures.
- ORS, buttermilk and other dehydration methods should be provided to all the school going children under Anganwadi centres and mid-day meal scheme

Phase-III: – Post -Heat Season (July to October)

- Evaluate the reach of Aanganwadi workers and ICDS programme in reducing the heat related illnesses in all heatwave affected districts
- Participate in annual evaluation of heat action plan.

Police Department

Phase-I: - Pre Heat season (February to March)

- Review the departmental action plan with concerned officials and others stakeholders.
- Conduct joint capacity building and awareness building activities to the police staff posted in vulnerable blocks and districts on topics such as importance of periodic hydration, working in shade and effects of pollution combined with heatwave.
- Shifting of work hours of Traffic personnel in the early morning and late evening along with convenient shifts throughout the day with enough rest.
- Prepare SOP for managing heatwave related health causalities.
- Address the thick material of police uniforms that trap heat addition to the body heat.
- Update the guidelines for police personnel on duty and creating awareness at all levels.

Phase-II: - During the Heat Season (April to June)

- Provision of drinking water, preferably in earthen pots to keep the police personnel hydrated
- Proper usage of caps and sun glasses for traffic police in prolonged shifts from morning to afternoon.
- Management of traffic through traffic lights instead of police personnel standing out in the sun.

Phase-III: – Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

Fire Department

Phase-I: - Pre Heat season (February to March)

- Check the readiness of vehicles and firefighting equipment to face any emergency situations
- Ensure capacity building activities of staff and officials
- The department shall coordinate community and school children capacity building activities on heatwave preparedness
- Prepare SOP for managing heat related health causalities. (Handling of the patient's transpiration etc.)

Phase-II: - During the Heat Season (April to June)

- Obtain feedback on Fire calls, plan, and measures taken
- Monitor the weather situation and early warnings

Phase-III: – Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan

Electronics and IT Department

Phase-I: Pre-Heat Season (February to March)

- Development of Disaster and Emergency Management System which includes Heat waves and prepare a Dashboard to monitor heat wave scenario
- Mapping of Risk areas and dissemination of early warnings and alerts to all stakeholders automatically through web and mobile applications.
- To develop an application/App related to awareness generation, quick information sharing on the Heat Wave Risk Reduction
- R&D activities to promote the utilization of S&T in the field of Heatwave risk reduction

Phase-II: During Heat Season (April to June)

- Send real-time information through Dashboard/Interface on all activities related to Heatwave
- Activity to be displayed on Dashboard / Interface/online Monitoring Tool
- Generate reports encompassing all activities undertaken during heat wave alerts to use for evaluation of systems and action plan

Phase-III: Post-Heat Season (July to October)

- Analyze data collected during the heat season
- Assess the effectiveness of communication strategies
- Collect data on temperature
- Collect data on the number of downloads of mobile app and map accordingly
- Gather feedback on communication efforts
- Support data collection and analysis for monitoring the effectiveness of the HAP

Uttar Pradesh Power Corporation Limited/Vidyut Vitran Nigam Limited

Phase-I: Pre-Heat Season (February to March)

- Ensure infrastructure is ready for high demand and carry out maintenance work
- Prepare for load management during peak heat
- Inform public about energy conservation during heatwaves
- Promote the use of energy-efficient appliances and support initiatives for cooling centers
- Replace and upgrade all the damaged transformers and replace loose wires
- Awareness generation to run the AC at more than 25 degree centigrade

Phase-II: During Heat Season (April to June)

- Track and manage power demand in real-time
- Execute load management and emergency plans
- Maintain and enhance the reliability of electrical supply, especially during peak heat periods
- Continuously monitor power infrastructure for issues
- Provide regular updates on energy conservation

Phase-III: Post-Heat Season (July to October)

- Analyze data collected about power related issues during the heat season
- Assess effectiveness of load management and emergency plans
- Revise programs based on lessons learned
- Gather feedback on power supply measures

Environment, Forest and Climate Change Department

Phase-I: Pre-Heat Season (February to March)

- Increase plantation activity
- To develop and disseminate guidelines about ensuring animal protection in zoos
- To develop a climate summary highlighting extreme heat and climate change for the state of Uttar Pradesh
- To ensure forest areas are safe and secure
- To ensure availability of adequate amount of drinking water in gardens/parks/zoos
- To develop and implement plan for maintaining water bodies in forest area for wildlife animals and birds

Phase-II: During Heat Season (April to June)

- To ensure implementation of directives and guidelines for making water available for animals in reserved/ protected forests / parks and sanctuaries and make necessary provisions
- Issue directives to the zoo authorities for special arrangements for the animals in zoo to protect them from the effect of Heat Wave
- Directive for provision of water to human habitations facing water scarcity inside reserved forests
- Keep gardens and park open during heat alert so that people may take shelters in case of heat wave under tree shades etc
- Provide drinking water, shelters and ORS for public

Phase-III: Post-Heat Season (July to October)

- Analyze data collected about impact of extreme heat in forest areas during the heat season
- Analyse the extreme heat data and prepare a summary
- Assess effectiveness of various action taken during pre-heat and heat season
- Gather feedback on measures undertaken by the department

Indian Railways / Lucknow Metro Rail Corporation LTD

Phase-I: Pre-Heat Season (February to March)

- Display posters and distribute pamphlets developed by UP SDMA on prevention of heat related illness
- Develop and disseminate guideline for ORS corners at railway stations
- Use white refractory paints or other cool roof techniques on rail/metro roof
- Explain importance of proper shade, availability of drinking water and other facilities
- Conduct capacity building workshop for Railway Station Stakeholders for prevention and management of heat related illnesses

Phase-II: During Heat Season (April to June)

- Ensure availability of shade, drinking water, ORS etc. for staff and visitors.
- Display of Heat alert with Do and Don'ts
- Play audio and video clip developed by UP SDMA during heat season on prevention of heat related illnesses
- Ensure safety of passenger suffered with heat related illnesses and develop protocols for first aid and onward shifting to nearest health facility
- Ensure collection of data related to heat related illnesses at Railway Station and report the same to UP SDMA

Phase-III: Post-Heat Season (July to October)

- Analyze the data about impact of extreme heat on railway sector
- Assess effectiveness of various action taken during pre-heat and heat season
- Gather feedback on measures undertaken by the department

Uttar Pradesh Jal Nigam (Water Department)

Phase-I: Pre-Heat Season (February to March)

- Develop a guideline for management of water supply issues during heat season with well-defined roles and responsibilities
- Develop a plan for releasing water in canals during summer
- Identify and map vulnerable areas for ensuring additional water supply during extreme heat events
- Educate the public on water safety and availability
- Sensitization and awareness about sprinkler irrigation
- Promote water conservation and efficient water use among citizens
- Restoration of water bodies and activities for increasing ground water

Phase-II: During Heat Season (April to June)

- To ensure water supply in the state, Municipal Corporations, Districts, Taluka and villages
- Ensure additional and adequate water supply during heatwaves
- To ensure adequate supply of drinking water at bus depot, vulnerable areas and prominent places
- Provide regular updates on water safety and availability

Phase-III: Post-Heat Season (July to October)

- Analyze data collected during the heat season
- Conduct meeting to review implementation of Heat Wave mitigation measures by the department
- Assess the effectiveness of emergency water supply plans
- Gather feedback on water supply measures
- Revise programs based on lessons learned

Panchayati Raj Department

Phase-I: Pre-Heat Season (February to March)

- Identify and map high-risk villages for effective action during peak summer
- Develop a plan and guidelines for prevention of heat-related illnesses including village level community committees
- Convening meetings of ward members to ensure proper information regarding the warning signals reached the people through all media modes
- Plan for monitoring of heat related illnesses at village level
- Prepare proper shade, cool roof, availability of drinking water and other facilities for the Public and animal
- Arrangements for water kiosks, tube wells, tankers at prominent locations
- Encourage for alternative livelihood activities like Construction of ponds, artificial lakes for cooling the environment by evaporation
- Capacity building of Sarpanch, Gram Sewak and other relevant stakeholders for prevention and management of heat related illnesses

Phase-II: During Heat Season (April to June)

- Community awareness campaign for spreading messages through banners, posters developed by UPSDMA
- Establish ORS corners at Panchayat Bhawan, Bus Stop and Community Bhawan
- Ensure availability of water and electricity during extreme heat days
- Monitor and report cases related to heat related illnesses
- Sensitize vulnerable population on Heat Wave

Phase-III: Post-Heat Season (July to October)

- To review the implementation of the heat action plan activities at village level
- Obtain the feedback for further improvement of Plan
- Revise programs based on lessons learned

NGOs, SHGs, Community Groups and Other social organisations

Phase-I: - Pre Heat season (February to March)

- Identification of NGOs, Voluntary Organizations in reaching out to the Public, especially vulnerable groups.
- Conduct training programmes, workshops and outreach sessions with NGOs/CSOs/ Self-help groups and mobilizers such as ASHA workers, Anganwadis, and Ward Committees in Municipalities to inform
- Encourage discussions for finding early signs of heat exhaustion with local doctor or Health Centre.
- Inform fellow community members about how to keep cool and protect oneself from heat.

Phase-II: - During the Heat Season (April to June)

- Take all precautions to avoid Heat related illness
- Awareness and community outreach on prevention and management of heat related illnesses
- Keep cool and hydrated during the heat season by drinking water, staying out of the sun, and wearing light clothing
- Check on vulnerable neighbours, particularly during a heat alert
- Limit heavy work in direct sun or indoors, if poorly ventilated, especially during a heat alert

Phase-III: – Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

District Development officer (DDO)/ District collector/ Municipal commissioner

Phase-I: - Pre Heat season (February to March)

- Constitute a District Heat Action Plan Committee, with District Collector as Chairman and DDO as Member Secretary, with representatives of all departments to be member of this committee
- The committee should meet at-least 3 times in year, once in pre-heat, during-heat and post-heat season
- Collector should monitor all-cause death and all hospital admission cases during heat season
- To review preparedness for the heat season in the district
- To issue necessary instruction to all concerned departments for better inter-sectoral co-ordination

Phase-II: - During the Heat Season (April to June)

- Meeting of District Heat Action Plan Committee
- Collector at district should monitor all-cause death and all hospital admission during heat season
- To monitor the implementation of the Heat Action Plan
- To issue necessary instruction regarding strict adherence of the plan
- To ensure mid-course correction

Phase-III: – Post -Heat Season (July to October)

- To review the implementation of the heat action plan
- Participate in annual evaluation of heat action plan

Block Development Officer (BDO) at Taluka level

Phase-I: - Pre Heat season (February to March)

- Supervise preparedness of the Gram Panchayats
- To issue necessary instruction to all concerned departments for better inter-sectoral co-ordination
- Monitor all-cause death and all hospitals admission during heat season
- Arrangements for establishing rehabilitation centers and materials required thereof
- Arrangements for supply of good quality drinking water/ORS and other items of basic necessities
- Explain importance of proper shade and cool roof to the village level

Phase-II: - During the Heat Season (April to June)

- To monitor the implementation of the Heat Action Plan.
- To issue necessary instruction regarding strict adherence of the plan
- To deploy monitors/ supervisors to concurrent monitoring and feedback.

Phase-III: – Post -Heat Season (July to October)

- To review the implementation of the heat action plan
- Participate in annual evaluation of heat action plan

5.4 Capacity Building and Training

Capacity building and training are essential components of an effective heat action plan. A heat action plan (HAP) designed to reduce the dangers associated with high heat is only as effective as the people who implement and respond to it. Even the most comprehensive plan will be ineffective without adequately trained people and empowered communities. Investing in comprehensive capacity development and training programs is more than simply an expense; it is vital to the success and efficacy of any heat action plan. This ensures that the plan's provisions are effectively implemented, that the public is properly informed and protected, and that communities are empowered to build resilience in the face of the growing threat of extreme heat. A HAP necessitates a collaborative endeavor among several stakeholders, encompassing government entities, healthcare practitioners, emergency personnel, and community organizations. Capacity building and training guarantee that all individuals comprehend their roles and responsibilities, promoting a unified response. This encompasses comprehending the plan's procedures, communication protocols, and emergency response tactics. Training is essential for individuals engaged in the surveillance and forecasting of heatwaves. This encompasses meteorologists, data analysts, and anyone tasked for issuing warnings. Efficient training guarantees precise forecasts and the prompt issuance of clear, actionable alerts to the public.

The UP SDMA has carried out several consultation and capacity-building workshop for enhancing inter-agency coordination and collaboration for efficient implementation of various strategies under State Heat Action Plan. This involves conduction of state level inter-agency workshop with various line department officials for building their capacities in implementation of various heat action plan activities. In this workshop, discussion was mainly concentrated on roles and responsibilities of line department officials. The UP SDMA has also conducted capacity building workshops for district level stakeholders.

Table 7: Capacity Building and Training Workshop organised by UP SDMA

S. No.	Date and Place	No. of Participants	Key Collaboration with stakeholders
1	**Review of DRR Activities for Heatwave- 9-11 Jan 2024** Location: Water and land management institute Telibagh Lucknow	**75**	**District Disaster Expert**
2	**Preparedness of Uttar Pradesh State Heat Action Plan-2024 (Inter-agency Line Department Capacity Building Workshop)- 20 Feb. 2024** Location: State Disaster Management Institute, UP SDMA	**50**	Officers from, Revenue, Home Department, Agriculture, Health and family welfare, Panchayati raj, Revenue, Irrigation Secondary Education, Food and Civil Supply, Rural Department, Urban Department, Department of Women and Child Development, Forest and Environment, Labour Department, Tourism Department, Animal Husbandry, Information

			and Technology, Energy Department, Transport Department, Fire, and Jal Nigam Department.
3	**Heat Wave- Early Planning and Effective Action- Building Capacities of district level stakeholders- 01 March 2024** Location: Deen Dayal Upadhyaya State Institute of Rural Development (SIRD).	**225**	Officers from Revenue Department (ADM F/R) Health Department (CMO/ ACMO), Disaster Experts
4	**Early Planning and Effective Action NGOs-** 19th April 2024 Location: State Disaster Management Institute (UP SDMA) Date:	**50**	UNICEF, State NGOs, District NGOs

Figure 19: Capacity Building and Training Workshop organised by UP SDMA

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CHAPTER-6

INFORMATION, EDUCATION AND COMMUNICATION

6 Information, Education and Communication

6.1 Introduction

Information Education and Communication (IEC) is an important tool in health promotion for creating supportive environment and strengthening community action. The IEC in health programmes aims to increase awareness, change attitude and bring about behaviour change.

IEC provides a platform for the discussion of important health issues to foster an understanding of concepts, underlying principles, and benefits of health initiatives. IEC is essential to achieving better health outcomes in all public health interventions.

It is recognised as a viable and cost-effective approach to addressing broader determinants of health, risk factors, building trust and commitment, fostering community participation, and empowerment towards development and implementation of health initiatives.

Recognising importance of IEC, IEC pamphlet has been developed under Uttar Pradesh State Heat Action Plan for creating awareness regarding prevention and management of heat related illnesses.

It is important to note that these are preventable deaths. Informing the public on the preventive actions to be taken, reporting early to health facility, timely diagnosis and treatment, would reduce the deaths attributable to heat waves. IEC can play an important role in preventing mortality and morbidity due to heat related illnesses.

The IEC- posters can be used in crowded places Bus Station, Railway Station, Schools, Cinemas and for larger awareness. Health advisories can also be circulated through social media- Facebook, WhatsApp, Mass emails etc.

- **UP SDMA** has developed a short-animated video **(लू से बचें, और बचाऐं)** about heat wave do's and dont's links of the video film is https://www.youtube.com/watch?v=AQs0lvQZxxA

- **District Gonda** has developed a short-animated video **(लू से बचें, और बचाऐं)** about heat wave do's and dont's links of the video film **is Heat Wave Awareness Video from DDMA Gonda**

https://www.youtube.com/watch?v=0u1xRQz5Xhs

Heat Wave Poster Making Painting Competition are conducted in all District

All District Spread Public awareness for Heatwave Prevention through Poster and essay Competitions in Schools/Colleges and Poster making Competitions were organized in all the Districts

The State EOC, IMD has Developed early warning communication system for disseminating a word on early actions.

- Existing Weather Monitring system of IMD in the State of UP

  - 69 AWS (Automatic Weather Station)

  -132 ARG (Automatic Rain Gage)

  -1 Doppler Radar

हरा (कोई कार्रवाई नहीं)	सामान्य दिन	अधिकतम तापमान सामान्य के निकट है।
पीला (अद्यतन किया जाये)	गर्मी चेतावनी	1—जिला स्तर पर गर्मी की लहर की स्थिति होने की संभावना है। 2 दिनों के लिए जारी रहेगी।
नारंगी (तैयार रहो)	गंभीर गर्मी वाले दिन के लिए चेतावनी	1—गंभीर गर्मी की लहर की स्थिति 2 दिनों के लिए जारी रहेगी। 3—विविध तीव्रता के साथ, गर्मी की लहर की संभावना है। 4 दिनों या उससे अधिक के लिए बनी रह सकती है।
लाल चेतावनी (कार्रवाई करें)	अत्यधिक गर्मी वाले दिन के लिए चेतावनी	1—गंभीर गर्मी की लहर 2 से अधिक दिनों के लिए बनी रह सकती है। 2—गंभीर गर्मी की लहर, 6 दिन से अधिक होने की संभावना है।

Red Alert	Extreme Heat Alert For The Day
Orange Alert	Heat Alert Day
Yellow Alert	Hot Day
White	Normal Day

IMD

State EOC

6.2 IEC Materials for awareness and outreach

IEC Banner and pamphlets developed by UP SDMA in 2025

Uttar Pradesh State Heat Action Plan

अत्यधिक गर्मी गर्भवती महिलाओं के स्वास्थ्य के लिए गंभीर खतरा बन सकती है।

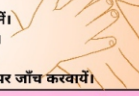
समय पर सावधानी बरतें और उन्हें सुरक्षित रखें!

गर्मी के कारण गर्भावस्था के दौरान जटिलताएँ:

- भ्रूण की वृद्धि के कारण शरीर की गर्मी बढ़ती है।
- शिशु पर प्रभाव:
  - जन्म के समय कम वजन।
  - जन्मजात हृदय दोष।
  - समय से पहले प्रसव।
- पसीना अधिक आने से निर्जलीकरण होती है अतः श्रम समय से पहले शुरू हो सकता है।
- अत्यधिक गर्मी से उच्च रक्तचाप, गर्भावधि मधुमेह का खतरा।

गर्भवती महिलाओं को गर्मी से बचाने के उपाय:

- धूप में बाहर जाने से बचें, खासकर दिन के सबसे गर्म समय (दोपहर 12 से 4 बजे)।
- खूब पानी पिएँ और हल्के, ढीले कपड़े पहनें।
- ठंडी और हवादार जगहों पर समय बिताएँ।
- प्यास न होने पर भी बार - बार पानी पियें।
- समय - समय पर नजदीकी स्वास्थ्य केन्द्र पर जाँच करवायें।



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Uttar Pradesh State Heat Action Plan

बच्चे गर्मी के प्रति अत्यन्त संवेदनशील होते हैं।
तीव्र गर्मी से बच्चों के स्वास्थ्य पर नकारात्मक प्रभाव पड़ता है।

बच्चों को अत्यधिक गर्मी से बचाये!

बच्चों का शरीर अधिक गर्मी उत्पन्न करता है।

बच्चों को पसीना कम आता है।

बच्चों का शरीर गर्मी के प्रति अनुकूलन में अधिक समय लेता है।

बच्चों के शरीर की सतह क्षेत्र अधिक होने के कारण शरीर जल्दी गर्मी सोखता है।

बच्चों को कम प्यास लगती है।

बच्चों की प्रतिरोधक क्षमता कम होती है।

बच्चों को गर्मी से बचाने के उपाय:

- धूप में बाहर जाने से बचें, खासकर दिन के सबसे गर्म समय (दोपहर 12 से 4 बजे)।
- खूब पानी पिएँ और हल्के, ढीले कपड़े पहनें।
- ठंडी और हवादार जगहों पर समय बिताएँ।
- प्यास न होने पर भी बार - बार पानी पियें।

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Uttar Pradesh State Heat Action Plan

लू / तापघात स्वास्थय के लिए खतरनाक हो सकता है।
गर्मी जनित रोगो से बचाव संभव है।

गर्मी और लू से बचाव के उपाय

सुबह जल्दी (5-8 बजे) या शाम को (5-7 बजे) खेतों में काम करें। दोपहर 12 - 4 बजे के बीच धूप में बाहर जाने से बचें।

काम करते समय एवं बाहर जाते समय पानी की बोतल साथ में रखें।

शराब, चाय, कॉफी एवं अन्य गर्म पेय पदार्थों का सेवन ना करें। इनसे निर्जलीकरण होता है।

वाष्पीकरण से बचने के लिए फसलों को सुबह जल्दी या देर शाम को पानी दें।

आपके पशुओं को भरपूर पानी और छाया मिले।

शरीर को ठंडा रखें। हल्के, ढीले और सूती कपड़े पहनें। सिर को टोपी, गमछा या छाते से ढकें।

अधिक पानी पिएं, दिनभर तरल पदार्थ जैसे छाछ, नींबू पानी, सत्तू शरबत, शिकंजी, बेल शरबत का सेवन करें।

सिरदर्द, चक्कर आना, उल्टी, अत्यधिक पसीना आना। अगर आपको ये लक्षण महसूस हों तो तुरंत मरीज को नजदीकी स्वास्थ्य केन्द्र लेकर जायें।

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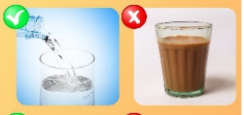
उत्तर प्रदेश आपदा प्रबंधन प्राधिकरण द्वारा जनहित में जारी

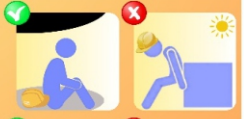
Uttar Pradesh State Heat Action Plan

कार्यस्थल पर स्वयं को सुरक्षित और स्वस्थ रखें

प्यास न होने पर भी बार - बार पानी पीयें। चाय, कॉफी, शराब और सॉफ्ट ड्रिंक का सेवन न करें।



काम के दौरान बीच - बीच में विश्राम करें।



हल्का और ताजा भोजन खाएं। मसालेदार और तेलयुक्त भोजन का सेवन न करें।

बाहर जाते समय अपना सिर ढक कर रखें।

Technically Supported by UNICEF, Uttar Pradesh & Indian Institute of Public Health-Gandhinagar
उत्तर प्रदेश आपदा प्रबंधन प्राधिकरण द्वारा जनहित में जारी

Heatwave Poster 2025 Link: https://UP SDMA.up.nic.in/2024/HAPPOSTER2024.pdf

6.3 Do's and Don't

Heat Wave conditions can result in physiological strain, which could even result in death. To minimize the impact during the heat wave and to prevent serious ailment or death because of heat stroke, the following measures are useful:

DO's

- Listen to Radio, watch TV, read Newspaper for local weather forecast to know if a heat wave is on the way
- Drink sufficient water and as often as possible, even if not thirsty
- Wear lightweight, light-coloured, loose, and porous cotton clothes. Use protective goggles, umbrella/hat, shoes or chappals while going out in sun.
- While travelling, carry water with you.
- If you work outside, use a hat or an umbrella and also use a damp cloth on your head, neck, face and limbs.
- Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. which help to re-hydrate the body.
- 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.
- Keep animals in shade and give them plenty of water to drink.
- Keep your home cool, use curtains, shutters or sunshade and open windows at night.
- Use fans, damp clothing and take bath in cold water frequently.
- 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.

DONT's

- Do not leave children or pets in parked vehicles.
- Avoid going out in the sun, especially between 12.00 noon and 3.00 p.m.
- Avoid wearing dark, heavy or tight clothing.
- Avoid strenuous activities when the outside temperature is high. Avoid working outside between 12 noon and 3 p.m.
- 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.

The best defence against extreme heat is to be prepared, and remember:

Get ready: Take steps now to prepare your home, workplace, and community for preparation and prevention of heat wave.

Get set: Know the symptoms of heat-related illnesses and what to do in an emergency.

Go: Check on those who may need help during an extreme heat event, like children, elderly family members, homebound neighbours, or outdoor workers.

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CHAPTER-7

BEST PRACTICES

7 Best Practices

Adapting to and mitigating the effects of excessive heat requires a multifaceted strategy that includes large-scale urban planning and infrastructure upgrades, community-level projects, and individual acts. Urban heat mitigation techniques are complex and call for a coordinated strategy that includes community involvement, infrastructure upgrades, building design, and urban planning. Extreme heat events are on the rise, but there are things you can do now—in your own home, workplace, or neighbourhood—to reduce your current and future risks. Here are some ways through which we can reduce the impact of Heat Wave to some extent. In this chapter, some of the best practices are mentioned and these can be implemented at various levels.

7.1 Cool roof (NDMA, 2021)

Numerous cooling solutions have been proposed and discussed to mitigate the worsening heat stress in urban areas. These solutions can be classified into three categories: gray, green, and blue strategies, according to their cooling techniques, which are engineering-based (e.g., cool roofs, shading facilities, and advanced building façade materials), vegetation based (e.g., green roof, lawn, urban parks, street trees), and water-based (e.g., waterbodies, misting, irrigation, sprinkling), respectively.

Cool roofs (reflective roofs) are been widely used for reducing the negative impact of extreme heat in urban areas. Cool roofs are specially designed roofing systems that reflect more sunlight and absorb less heat than traditional roofs. They provide several benefits, especially in regions experiencing extreme heat. There are many advantages of cool roofs and cooling technologies.

Energy Savings: Cool roofs significantly reduce the energy required for cooling buildings. By reflecting sunlight, they lower indoor temperatures, which decreases reliance on air conditioning systems. This can lead to substantial savings on energy bills, particularly in hot climates where cooling demands are high.

Health Benefits: Cool roofs help mitigate heat-related health issues by reducing the risk of heat exhaustion and other heat-induced illnesses. Implementing cool roof technology across urban areas could potentially offset a significant percentage of heat-related mortality associated with urban heat islands.

Improved Indoor Comfort: By maintaining cooler indoor temperatures, cool roofs enhance occupant comfort. Studies indicate that cool roofs can lower maximum indoor temperatures by approximately 1.2 to 3.3°C (2.2 to 5.9°F) in non air-conditioned homes, making living spaces more pleasant during extreme heat.

Reduction of Urban Heat Island Effect: Cool roofs contribute to lowering ambient temperatures in urban areas, which helps combat the urban heat island effect—a phenomenon where cities become significantly warmer than their rural surroundings due to human

activities and infrastructure. This reduction can improve overall air quality and contribute to climate change mitigation

Cool roofs provide a range of benefits that enhance energy efficiency, improve comfort and health, extend roof life, reduce urban heat effects, and contribute positively to environmental sustainability—all crucial factors in combating the challenges posed by extreme heat conditions.

Now majority of the population is migrating to urbanising cities, where development is soaring and turning open space into paved, heat-retaining roads and roofs. The urban heat island effect is exacerbated, temperatures rise, poor air quality results, and more energy is required to maintain a comfortable temperature through the use of fans and air conditioning. A straightforward and affordable answer to these problems with urbanisation is the use of cool roofs. Reflecting sunlight, cool roofs release less heat. Compared to standard roofs, cool roofs can assist keep indoor temperatures down by 2 to 4°C (3.6 - 9°F) depending on the environment.

The roof is a crucial part of the building envelope since it directly affects the structure's energy requirements and the inhabitants' thermal comfort. The main way cool roofs work is by reflecting more sunlight that strikes the roof back into the atmosphere than a typical roof surface would. Internationally, cool roofs are recognised as an efficient way to save energy and money, keep cities cooler, and lessen the impact of urban heat islands. Cool roof initiatives have been implemented in major cities throughout the globe, including New York City. According to research, planting shade trees and installing highly reflecting pavement and roofs around the city will, on average, lower a city's ambient air temperature by 2 to 4 degrees Celsius during the summer (Figure 15).

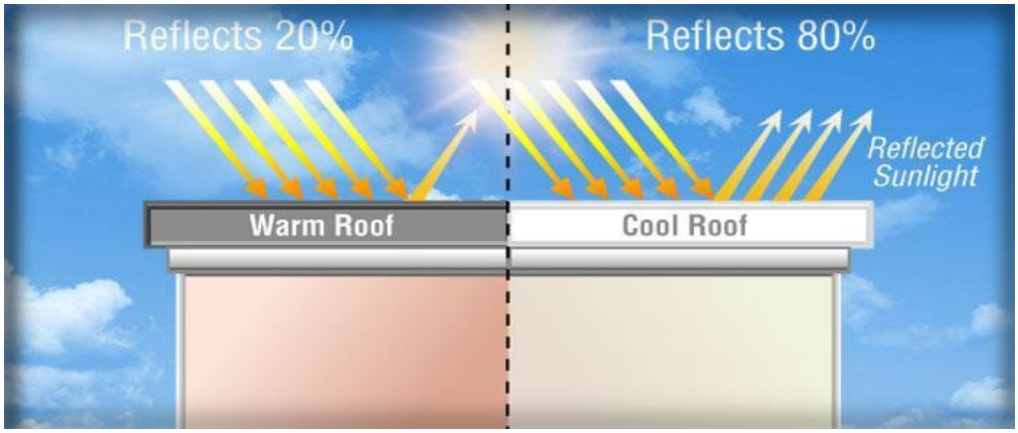

Figure 20: Cool Roof Demonstration

Source: Heat Island Group, Lawrence Berkley National Lab

Cool roofs techniques can be broadly divided into following major categories and building owners can choose from these techniques as appropriate for implementing cool roofs.

Coated cool roofs: these roofs involve the coating of a material or paint with high reflectivity on top of a conventional roof material to increase the roof surface's solar reflectance index. These are liquid applied coatings made of simple materials such as lime wash or an acrylic polymer or plastic technology and are usually white in color.

Membrane cool roofs: these roofs involve using pre-fabricated materials such as membranes or sheeting to cover an existing roof in order to increase the roof surface's SRI. These types of roofs can be polyvinyl chloride (PVC) or bitumen-based.

Tiled cool roofs: these roofs involve the application of high albedo, china mosaic tiles or shingles on top of an existing roof or to a new roof.

Special cool roof materials such as Mod Roof: these roofs, made of coconut husk and paper waste, have been installed in households around Gujarat and Delhi and can serve as an alternative to reinforced cement concrete roofs.

The cost implications vary by the type of material used for cool roofing. However, most of these materials have been applied locally in India and are available through local vendors.

7.2 Use cool paving materials in driveway

Hot pavement also transfers heat to the surrounding air, adding to the urban heat island effect. Cool pavement stays cooler in the sun than traditional pavement by reflecting more solar energy or enhancing water evaporation. Cool pavement can be created from asphalt and concrete, as well as through the use of coatings or grass paving.

7.3 Green Infrastructure for reducing impact of Urban Heat Island

Cities create "urban heat islands" when there are dense clusters of pavement, buildings, and other surfaces that absorb and hold heat in place of natural land cover. This has the impact of raising energy expenditures (for air conditioning, for instance), air pollution levels, and illnesses and deaths brought on by the heat.

For those who live in cities, the Urban Heat Island (UHI) effect is one of the most dangerous environmental risks. The UHI impact is anticipated to become more intense due to climate change. Urban green infrastructure (UGI) may be implemented in this situation to help promote a resilient urban environment and aid in the adaptation and mitigation of climate change.

Urban Green Infrastructure (UGI), which is defined as "a strategically planned network of natural and semi-natural areas with other environmental features designed and

managed to deliver a wide range of ecosystem services, is acknowledged as one of the most crucial strategies to mitigate UHI and to promote a resilient environment in cities. Green Infrastructure is in fact known to be an effective strategy to reduce heat intensity. With urban forests being the most effective, the cooling capability of UGI can vary significantly and varied across plant species including grass, shrubs, and trees. Trees, green roofs, and vegetation can help reduce urban heat island effects by shading building surfaces, deflecting radiation from the sun, and releasing moisture into the atmosphere.

A new study conducted with data from 93 European cities estimates that one third of deaths attributable to heat islands could be avoided if trees covered 30% of urban space (Iungman et al, 2023) (*Figure 16*).

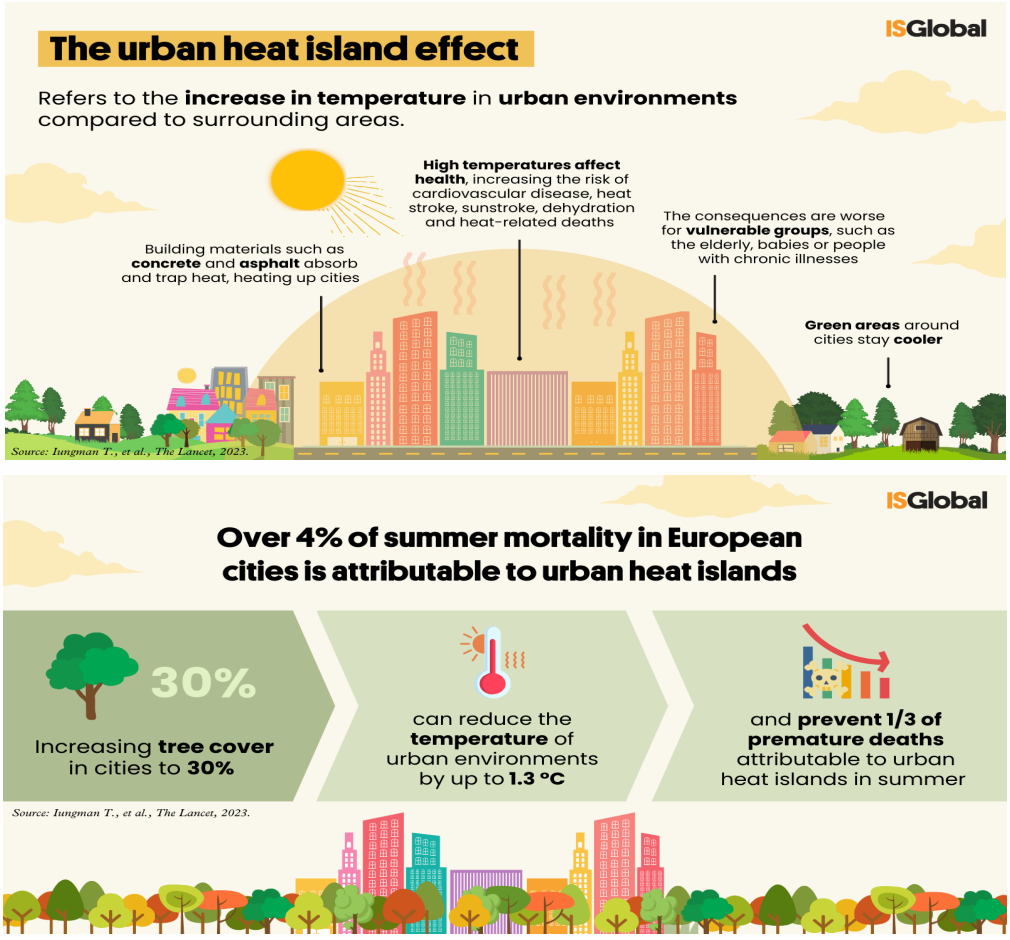

Figure 21: The Urban Heat Island Effect and impact of Tree Cover on Mortality

Urban Forests and Green Spaces: The strategic planting of trees, with careful consideration of species selection to maximize shelter and evapotranspiration, is of paramount importance. Parks, green corridors, and lesser green spaces strategically distributed throughout the urban environment can substantially mitigate temperatures and enhance air quality.

Green roofs and walls: These vegetated surfaces contribute to the reduction of building temperatures, enhance insulation, and facilitate the management of stormwater discharge. Green roofs, in particular, provide significant cooling benefits.

Urban Agriculture and Community Gardens: The incorporation of agricultural spaces within urban environments not only facilitates food production but also enhances cooling through the processes of evapotranspiration and the provision of shade.

7.4 Heat-Resilient Health Facilities (Long-term Measures)

Green and Climate Resilient Measures (Adaptation/Mitigation) (*Figure 17*)

- Energy conservation
- Solarisation
- Cool/green roof
- Rainwater harvesting, water conservation
- IPHS standards updated to include climate-resilient measures

Solarization of Health Centre, Chhattisgarh

Tiled Cool Roof & Solar Panels, UPHC, Ahmedabad

Rainwater harvesting, District Hospital Chikkaballapura, Karnataka

Source: NPCCHH, NCDC, NDMA National Workshop Presentation Available on NDMA Website

Figure 22: Climate Resilient Health Facilities

7.5 Data Analysis for understanding impact of heat (NDMA, 2019)

In order to prepare for and take necessary mitigative action against heat wave, we need data on age group, sex and occupation of 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, 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 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 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 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 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 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.

Many cities around the world are using new ways to reduce heat in urban areas. Here are some important examples that show different methods:

New York City is using different strategies to improve its environment, including green infrastructure, cool sidewalks, and involving the community. Their plans include:

Million Trees NYC is a big tree-planting program designed to plant more trees in the city. This will help lower temps and make the air cleaner.

Cool Roofs Program: Encouraging the use of cool roofs on buildings by offering tax credits and refunds.

NYC Parks is working to reduce heat in certain areas by planting trees in neighborhoods that need help and adding more green places.

Community projects that teach people about the dangers of extreme heat and encourage safe actions.

Singapore: Singapore, known for its tropical environment, focuses its strategy on integrating nature into the urban landscape.

Extensive green spaces and parks: Developing a large number of parks and green spaces to reduce heat and provide recreational opportunities.

Super trees are iconic vertical gardens that provide shade and enhance air quality.

Skyrise greenery: Using greenery in the architecture of high rise structures to reduce heat absorption.

Water features are strategically used to offer evaporative cooling, such as fountains and bodies of water.

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ANNEXURES

Annexure-1

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

Name of the state: Year: Reporting periods:

Date of Reporting:

District		Location						Occupation					Economy		
		Urban		Rural		Total		Farmer	Labour	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 enclosed 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)

Sr. no	Name and Address	Age Sex (M/F)	Occupation	Place of death	Date and time of death	Max Temp recorded (Rectal and oral)	Death reported during heat wave period or not	List of chronic disease present (Ask the family members)	Date and time of post mortem (If conducted)	Cause of death	Remark	
											Related to post-mortem	Related to joint enquiry
1												

Annexure-2

Format A

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

S. No	Village	PHC	Block/city	Name and 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 periods	Cumulative no of cause 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						
TOTAL						

Annexure-3

HOSPITAL PREPAREDNESS CHART-PRE HEAT SEASON

<table>
<tr><th colspan="3">INFRASTRUCTURE AND LOGISTICS</th><th colspan="3">LOGISTICS CAPACITY BUILDING</th><th colspan="3">IEC/AWARENESS</th></tr>
<tr><th>PHC</th><th>CHC</th><th>DH/MC</th><th>PHC (MOs, nursing staff, paramedics, ASHA, ANM)</th><th>CHC (MOs, nursing staff, paramedics, ASHA, ANM, MPHW)</th><th>DH/MC (MOs, nursing staff, paramedics, MPHW)</th><th>PHC</th><th>CHC</th><th>DH/MC</th></tr>
<tr><td colspan="3" rowspan="2">• Check inventories for basic equipment and medicines required
• Ensure adequate arrangement of staff,
• Explore creation of Ice pack dispensaries to increase access to vulnerable communities,
• Adopt long-term measures such as cool roofs and improving green coverage of health facility.
• Identify Rapid Response Team (RRT) to respond to any exigency call outside the hospitals
• May try to establish outreach clinics at various locations easily accessible to the vulnerable population</td><td colspan="3">• A detailed action plan to tackle HRI (update annually)
• Fresh/Refresher targeted training course -Maintaining hospital records, improve expedience of recording of cause of death, heat-focused examination procedures
• Community involvement of trained staff to create awareness.</td><td colspan="3" rowspan="2">• Preparation of Targeted IEC-hoardings, banner, poster, leaflets, factsheets, information cards, media, rallies, song/drama activities, street plays
• Planning of dissemination as per assessment of vulnerable area/communities
• Conduct sensitization meetings
• Prepare handouts for health staff about heat illness
• Ensure the availability of funds for above activities</td></tr>
<tr><td>• Mapping of susceptible villages (identify areas/population that are vulnerable)</td><td>• Mapping of susceptible PHCs (identify areas/population that are vulnerable)</td><td>• Mapping of susceptible blocks (identify areas/population s that are vulnerable)</td></tr>
</table>

HOSPITAL PREPAREDNESS CHART- HEAT SEASON

<table>
<tr><th colspan="3">INFRASTRUCTURE AND LOGISTICS</th><th colspan="3">LOGISTICS CAPACITY BUILDING</th><th colspan="3">IEC/AWARENESS</th></tr>
<tr><th>PHC</th><th>CHC</th><th>DH/MC</th><th>PHC (MOs, nursing staff, paramedics, ASHA, ANM)</th><th>CHC (MOs, nursing staff, paramedics, ASHA, ANM, MPHW)</th><th>DH/MC (MOs, nursing staff, paramedics, MPHW)</th><th>PHC</th><th>CHC</th><th>DH/MC</th></tr>
<tr><td colspan="3" rowspan="2">• Ensure adequate medical supplies available • Identify surge capacities and mark the beds dedicated to treat the heat stroke victims and enhance emergency department preparedness to handle more patients</td><td colspan="3">• Ensure reporting of HRI cases on daily basis
• Adopt HRI treatment and prevention protocols
• Expedite recording of cause of death due to heat related illnesses</td><td colspan="3" rowspan="2">• Ensure IEC dissemination
• Target the vulnerable area/communities followed by other areas.
• Plan activities as per the Heat Wave alert issued by IMD</td></tr>
<tr><td>• Referral of patients to the higher facility only after ensuring adequate stabilization and basic definitive care (cooling and hydration)</td><td>• Prepare weekly reports of health impact for nodal officer
• Conduct case review during heat season</td><td>• Prepare weekly reports of health impact for nodal officer
• Conduct case review during heat season</td></tr>
<tr><td>• Increase ASHA/ANM</td><td>• Increase ASHA/ANM/MP</td><td>• Increase MPHW outreach in at-risk blocks</td><td colspan="6"></td></tr>
</table>

/MPHW outreach in at-risk villages during a heat alert, if feasible.	HW outreach in at risk PHC during a heat alert, if feasible. • Ensure dedicated bed availability • Ensure ambulance availability	during a heat alert, if feasible • Ensure dedicated bed availability • Ensure ambulance availability • Dedicated heat corners • Increase staffing at DH/MCs to attend to the influx of patients during a heat alert, if feasible. • Have DNO-CC/SNO-CC visit CHCs to confirm proper preparation has been made for heat related illness and conduct case audits during heat season.	

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

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