स्वास्थ्य एवं
परिवार कल्याण मंत्रालय
MINISTRY OF
HEALTH AND
FAMILY WELFARE

सत्यमेव जयते

केंद्र शासित प्रदेश लद्दाख
UNION TERRITORY OF
LADAKH

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LADAKH

STATE ACTION PLAN ON CLIMATE CHANGE AND HUMAN HEALTH







National Centre for
Disease Control
Government of India

National Programme
on Climate Change
and Human Health

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2022-27

National Centre for
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Executive Summary

Introduction

The State Action Plan on Climate Change and Human Health is a comprehensive strategy aimed at addressing the multifaceted impacts of climate change on public health within our state. Climate change poses significant threats to human health, including increased frequency and intensity of extreme weather events, air and water pollution, changes in vector- borne disease patterns, and impacts on mental health. This executive summary outlines key objectives, strategies, and initiatives proposed to mitigate these risks and safeguard public health.

Key Objectives

1. Risk Assessment and Surveillance

- Conduct comprehensive risk assessments to identify vulnerable populations and prioritize health threats.
- Enhance surveillance systems to monitor climate-related health impacts and facilitate timely responses.

2. Health Adaptation and Resilience

- Develop and implement adaptation strategies to strengthen healthcare infrastructure and enhance resilience to climate-related challenges.
- Promote community-based interventions to address climate-related health risks and build adaptive capacity.

3. Mitigation of Climate-Related Health Impacts

- Implement policies and regulations to reduce greenhouse gas emissions and mitigate climate change impacts on public health.
- Promote sustainable practices and renewable energy initiatives to improve air quality and reduce environmental health risks.

4. Public Awareness and Education

- Increase public awareness about the links between climate change and human health through targeted education campaigns and outreach efforts.

- Provide resources and tools to empower communities to take proactive measures to protect their health in a changing climate.

Key Strategies and Initiatives

1. Heat Adaptation and Emergency Response

- Develop heat action plans to minimize heat-related illnesses and deaths during extreme heat events.
- Enhance emergency response protocols to effectively manage heat emergencies and provide support to vulnerable populations.

2. Air Quality Improvement

- Implement measures to reduce air pollution and improve indoor and outdoor air quality.
- Strengthen monitoring systems to track air pollutants and their health impacts, particularly in urban areas.

3. Vector-borne Disease Control

- Implement vector control programs to mitigate the spread of vector-borne diseases such as malaria, dengue, and Lyme disease.
- Enhance surveillance and early warning systems to detect and respond to changes in disease transmission patterns.

4. Health Adaptation Plan for Extreme Weather Events & Disaster Management

- Risk Assessment and Preparedness
- Early Warning Systems
- Adaptive Infrastructure
- Community Resilience Programs
- Cross-Sector Collaboration

5. Action Plan – Prevention & Management of Cold Wave & Frost

- Early Warning and Risk Communication
- Protection of Vulnerable Populations
- Emergency Response and Relief
- Agricultural Resilience and Crop Protection
- Infrastructure Preparedness and Resilience
- Public Education and Outreach

6. Health Adaptation Plan for Green and Climate Resilient Healthcare Facilities

- Climate Risk Assessment and Vulnerability Mapping
- Green Infrastructure and Energy Efficiency
- Adaptive Health Systems and Emergency Preparedness
- Community Engagement and Stakeholder Collaboration

Conclusion

The State Action Plan on Climate Change and Human Health represents a proactive and collaborative approach to addressing the complex challenges posed by climate change to public health. By prioritizing risk assessment, adaptation, mitigation, and public education, we aim to build resilient communities and safeguard the health and well-being of all residents in the face of a changing climate. Implementation of this plan requires concerted efforts from government agencies, healthcare providers, community organizations, and stakeholders across various sectors to achieve meaningful and sustainable outcomes.

PART I

Climate Change and its Health Impacts

CHAPTER 1
Introduction

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

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

The *United Nations Framework Convention on Climate Change (UNFCCC)* came into force on 21st March 1994. Since then many steps have been initiated to reduce the effect of climate change at the global level including the "Rio Convention 1992", "Kyoto protocol 1997", the "Male' Declaration 1998", "Convention of Parties", the "Cancun Agreement 2010", "Durban Platform 2011", and the "Nationally Determined Contributions" (NDCs) at the Conference of Parties 21".

India is a signatory to the "Male' Declaration" highlighting the need for the strengthening of the health sector and achieving climate resilience. According to the "Male' Declaration", it is desired that healthcare facilities should be prepared to address human needs in face of climate change-induced vagaries and adopt climate-resilient practices, particularly to encourage that these can withstand any climatic event and that essential services such as water, sanitation, waste management, and electricity are functional during such events. To achieve climate resilience, the health department has to undertake measures to initiate the greening of the health sector by adopting environment-friendly technologies and using energy-efficient services.

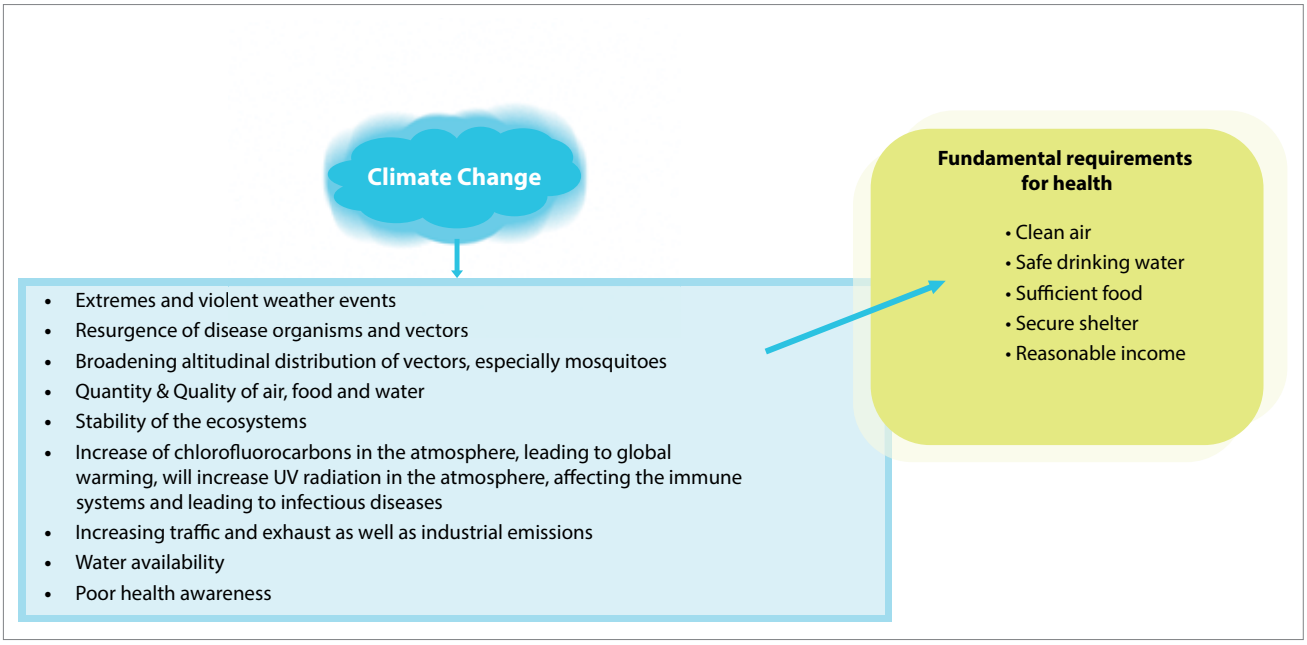
In this regard, initiatives undertaken by the Government of India include the identification of the Ministry of Environment, Forest & Climate Change (MoEF&CC) as the nodal ministry, the formulation of the National Environmental Policy 2006, and the formulation of the Prime Minister's Council on Climate Change for matters related to Climate Change. MoEF&CC has developed National Action Plan on Climate Change with eight missions. Later on, four new missions (including Health Mission) were identified. The Health Mission aims to reduce climate-sensitive illnesses through integration with other missions under National Action Plan for Climate Change (NAPCC) as well as through programmes run by various ministries. As a follow-up

action, the Ministry of Health and Family Welfare (MoHFW) constituted a National Expert Group on Climate Change & Health (NEGCCH) to prepare National Action Plan on Climate Change and Human

Health (NAPCCHH) and recommend strategies for indicators, mitigation, capacity building, etc. for the health sector to respond to the climate emergency.

National Centre for Diseases Control (NCDC) is identified as the 'technical nodal agency' by MoHFW for the National Mission on Health. The Centre for Environmental and Occupational Health, Climate Change & Health (CEOH&CCH), NCDC, is implementing the National Programme of Climate Change and Human Health (NPCCHH), as a part of which the State Action Plan on Climate Change and Human Health (SAPCCHH) has been prepared by Union Territory of Ladakh. SAPCCHH is a long-term vision and planning document prepared by the Department of Health & Family Welfare, Jammu, applicable up till 2027. Based on this document, district-specific action plans will also be prepared. The SAPCCHH highlights the current and future vulnerabilities to climate change in the state, the disease burden and the initiatives to be undertaken by the state to reduce the disease burden and develop a climate-responsive and sustainable healthcare ecosystem in the state.

Illustrating linkages between climate change and human health



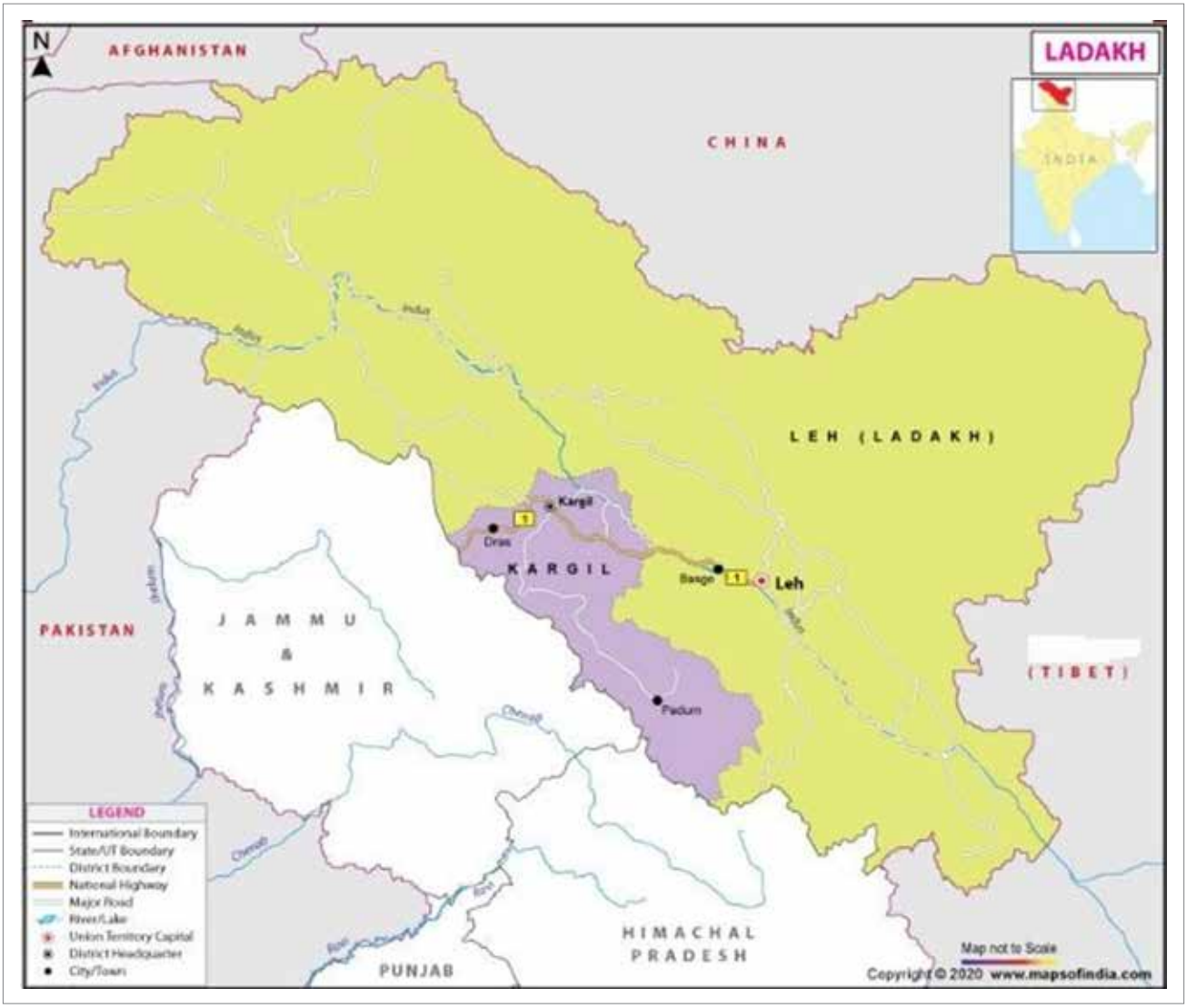
Union Territory of Ladakh - Geography and Demographics

The Union Territory of Ladakh shares its borders with the Tibet Autonomous Region to the east and Jammu and Kashmir, Pakistan and Afghanistan on the west. South part is connected with Himachal Pradesh. Ladakh became a Union Territory on 31st of October 2019. Ladakh is renowned for its remote mountain beauty and distinct culture. Ladakh is famous for its scenery, views, and travel-trekking, which provides Ladakh a destination of summer vacation to the people across the globe. The hospitality industry of Ladakh is the major revenue making segment where the livelihood is generated for the local population. It has a very tough terrain due to its high altitude and extremely cold climate. Drass, located in district Kargil has recorded the second lowest (coldest) temperature in the world after Siberia. After the restructuring of the State of

Jammu and Kashmir, Ladakh has been identified as a Union Territory from the year 2019. Since 2019, a sharp growth has been recorded in terms of development and number of tourists. In the year 2023, it is expected to have record number of tourists in the season.

Ladakh was established as a union territory of India on 31 October 2019, following the passage of the Jammu and Kashmir Reorganisation Act. Prior to that, it was part of the Jammu and Kashmir state. Ladakh is both the largest and the second least populous union territory of India.

The detailed map of the state along with population statistics of the districts is presented below:



Demography of District Leh

Leh is the largest district in the country in terms of area. It is one of the coldest and most elevated inhabited regions of the world having 112 inhabited and 1 uninhabited village. As per census 1991 population of the district is estimated as 0.895 lacs. Which is risen to 1.17 lacs during census 2001. Population growth rate of 29.97% has been recorded during the decade 1991-2001 in the district. As per 2001 census 75.57% population is residing in the rural area. The biggest ethnic group is Buddhist having 77.30% of population followed by Muslims with 13.78% and Hindus with 8.16%. The main working force account for 33.07% to the total population whereas marginal workers account for 16.50 % and non- workers 49.58%. The main

occupation engaging the working force is cultivation (37.92%), agriculture labour (4.28%), household industry (1.24%) and other works (56.56%).

As per Provisional population figures of 2011 Census, the total no of villages is 113. (Source of all information www.leh.nic.in)

Demography of District Kargil

District Kargil is extended over an area of 14036 sq km and comprises of 129 villages. As per Census-2011 population of the District was recorded as 1,40,802 souls. There was change of 18.02 percent in the population compared to population as per 2001. In the previous census of India 2001, Kargil District recorded increase of 33.55 percent to its population compared to 1991. According to Census 2011 The total Population of the district is 140802 out of this the Rural Population is 124464 & Urban Population is 16338 the decadal Growth rate is 19.67 %in Urban & 20.18% in Rural. The Sex ratio of the District is 883 per thousand males. Kargil is one of the two Districts of Ladakh region and is the second largest town of Ladakh and is situated roughly at equal distance(200KM) from Srinagar, Leh, Padum Zanskar and Skardo Baltistan. Kargil has always been an important trade centre in the past. The District again came in lime light during the Indo- Pak conflict in 1999 as it remained in the headlines of National and International media and some sites such as Tiger Hill, Tololing, Mushku valley and Batalik have become very popular since then.

Besides historical importance unique landscape and number of Heritage sites, Budha Statues, Forts Palaces, ancient Rock carvings (Petroglyphs), Mosques, Monasteries, Pilgrim places, war memorials are found all over the District.

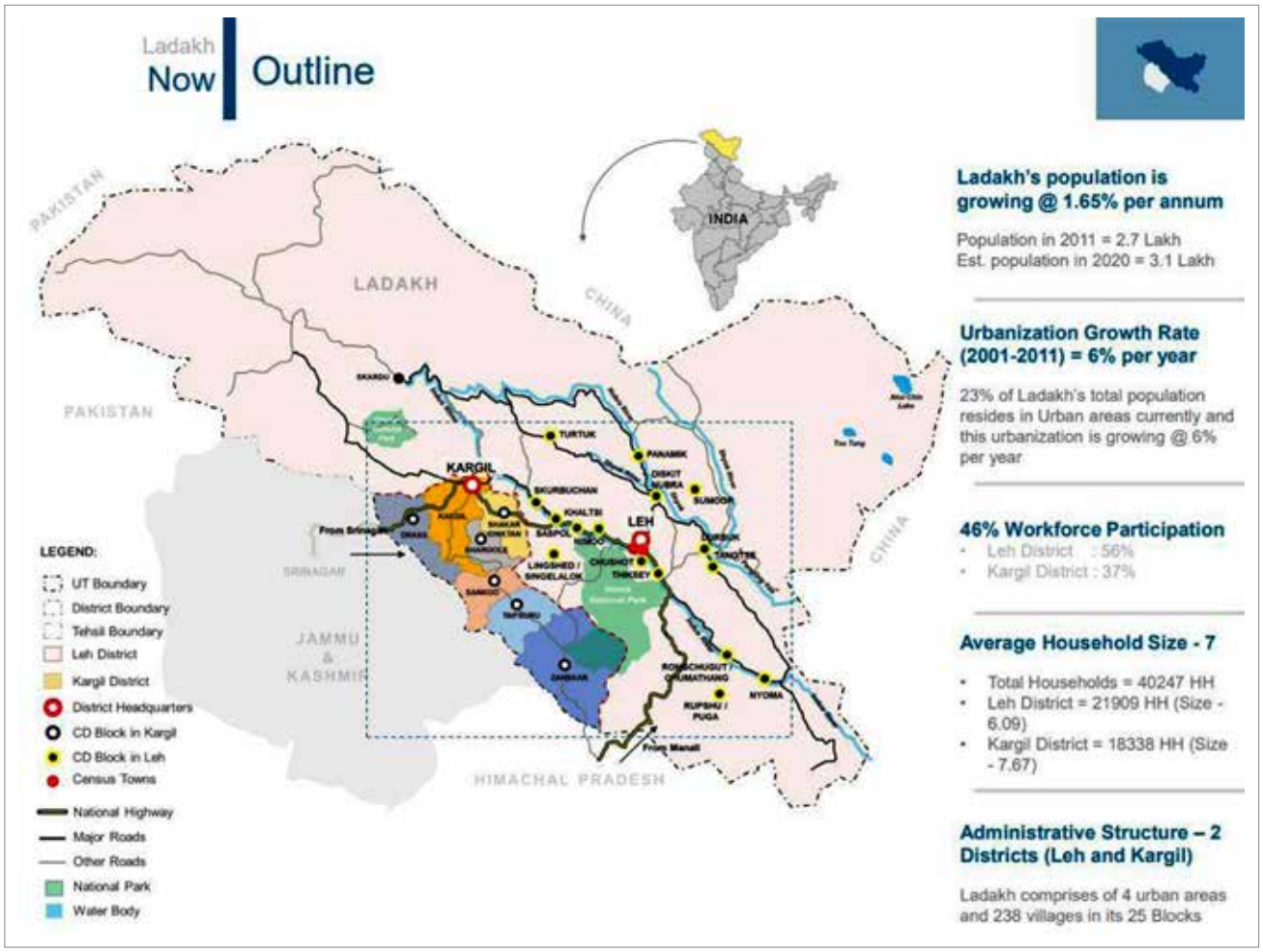
Administratively Kargil is divided into 12 Niabats, namely Drass, Kargil, Shargole, Chiktan, TSG, G.M.Pore, Sankoo, Taisuru, Padum, Lungnaq, Cha and Zangla. It has four Sub-Divisions viz Kargil, Zanskar, Sankoo and Shakar-Chiktan and Seven Tehsils namely, Drass, Kargil, Shargole, Shakar- Chiktan, Sankoo, Taisuru and Zanskar.

With the institution of the Ladakh Autonomous Hill Development Council in Kargil, the administrative set-up has become different as compared to other districts of the State. Hill Council was constituted in Kargil during the year 2003. The district was divided into 26 Council Constituencies.

Basic Statistics of Ladakh

Sl. No.	Particulars	Unit	Number
1	No. of Districts	Number	2
2	Tehsils	Number	15
3	(Population 2011)		
	Total Population	Lakhs	2.74
	Rural Population		2.12
4	% of Rural to Total Population	%	77%
5	Municipal Committees	Number	2
6	% of Urban to Total Population	%	23%
7	Population Density	People Per sq km	4.6

Sl. No.	Particulars	Kargil	Leh
1	Total Population (in Lakhs) 2011 Census	1.40	1.34
	Rural Population (in Lakhs) 2011 Census	1.24	0.88
	% of Rural to Total Population	86%	66%
2	Area (km^2)	14036 sq km	45100 sq km
3	Population Density	10 person/sq km	3 person/sq km
4	Households	18,338	21,909
5	Avg. Household Size	7.6	7.6
6	Irrigated Land Area	11,754 ha	10,358 ha



CHAPTER 2
Climate Vulnerability in the UT

Union Territory of Ladakh nestles in the fragile Himalayan Ecosystem and is exposed to natural fluctuations in climate and human-induced changes due to large-scale urbanization. Biodiversity loss and water stress owing to climate change are the greatest challenges for the state for a few decades. Climate change poses a serious threat to species diversity, habitats, forests, wildlife, fisheries, and water resources in the region. The numerous wetlands in UT Ladakh support a wide range of biodiversity in the region and are adversely affected. The rate of recession of glaciers is reportedly varying which is being attributed to winter precipitation climate warming and anthropogenic elements. Temperature, precipitation, and cold wave are most likely to significantly impact the agriculture sector and enhance its vulnerability. The deficit in food production is growing in recent times in Union Territory of Ladakh.

Ladakh is vulnerable to the impacts of climate change. Here are some of the climate vulnerabilities that Ladakh faces:

1. **Glacial Melting:** Ladakh's glaciers are a critical source of freshwater for the region, providing water for agriculture, domestic use, and hydropower generation. However, these glaciers are melting due to rising temperatures, which can lead to water scarcity during crucial times of the year.
2. **Water Scarcity:** The region is already arid and water-scarce, and climate change can exacerbate this problem. Changes in precipitation patterns and reduced snowfall can impact the availability of water for irrigation and drinking, potentially leading to conflicts over water resources.
3. **Livelihood and Agriculture:** Ladakh's economy is heavily dependent on agriculture and pastoralism. Changes in temperature and precipitation patterns can affect crop yields and livestock productivity. Unpredictable weather patterns, including untimely frosts or heavy rainfall, can damage crops and disrupt traditional farming practices.
4. **Ecosystem Disruption:** The unique biodiversity of Ladakh, adapted to its harsh climate, is at risk due to changing temperatures. Species that are specifically adapted to the cold and arid conditions may struggle to survive as temperatures rise, leading to shifts in ecosystems and potential loss of biodiversity.
5. **Infrastructure and Tourism:** Climate change can impact infrastructure, including roads and buildings, through events like landslides and flash floods. Additionally, the region's growing popularity as a tourist destination can contribute to environmental degradation and stress on local resources.
6. **Health and Well-being:** The health sector is highly vulnerable to the impacts of climate change. Changes in local climatic conditions majorly influence health issues in the state. Changing climate

patterns can affect the health and well-being of Ladakh's residents. Changes in temperature and precipitation can influence the prevalence of certain diseases, while extreme weather events can pose risks to human health and safety. Weather and climate variability have a profound influence on human health. The impact of climate change on human health is likely to be multifaceted involving the increased incidence of vector, water, and food-borne diseases, malnutrition and undernourishment, injuries and death caused by extreme hydrogeological events, and thermal stress. Temperature, precipitation, and humidity have a strong influence on the reproduction, survival, and biting rates of the mosquitoes that determine malaria and dengue fever, and temperature effects on the life-cycle of the infectious agents themselves. The same meteorological factors also influence the transmission of water and food-borne diseases such as cholera and other forms of diarrhoeal diseases. The vulnerability due to the incidence of diseases or hazards will however depend upon the level of exposure, sensitivity, and the coping capacity of the populace. Short-term impacts of climate change are likely to magnify the existing socio-economic threats due to rapid urbanization, population growth, poverty, health infrastructure, contamination of air and water, unplanned urbanization, and issues of solid and liquid waste management resulting in high morbidity and mortality. Long-term climate change impacts will exacerbate the existing stress while undermining growth and development.

7. **Cultural Impact:** The indigenous cultures and traditional ways of life in Ladakh are deeply connected to the region's unique environment. Climate change can disrupt these cultural practices and further marginalize vulnerable communities.

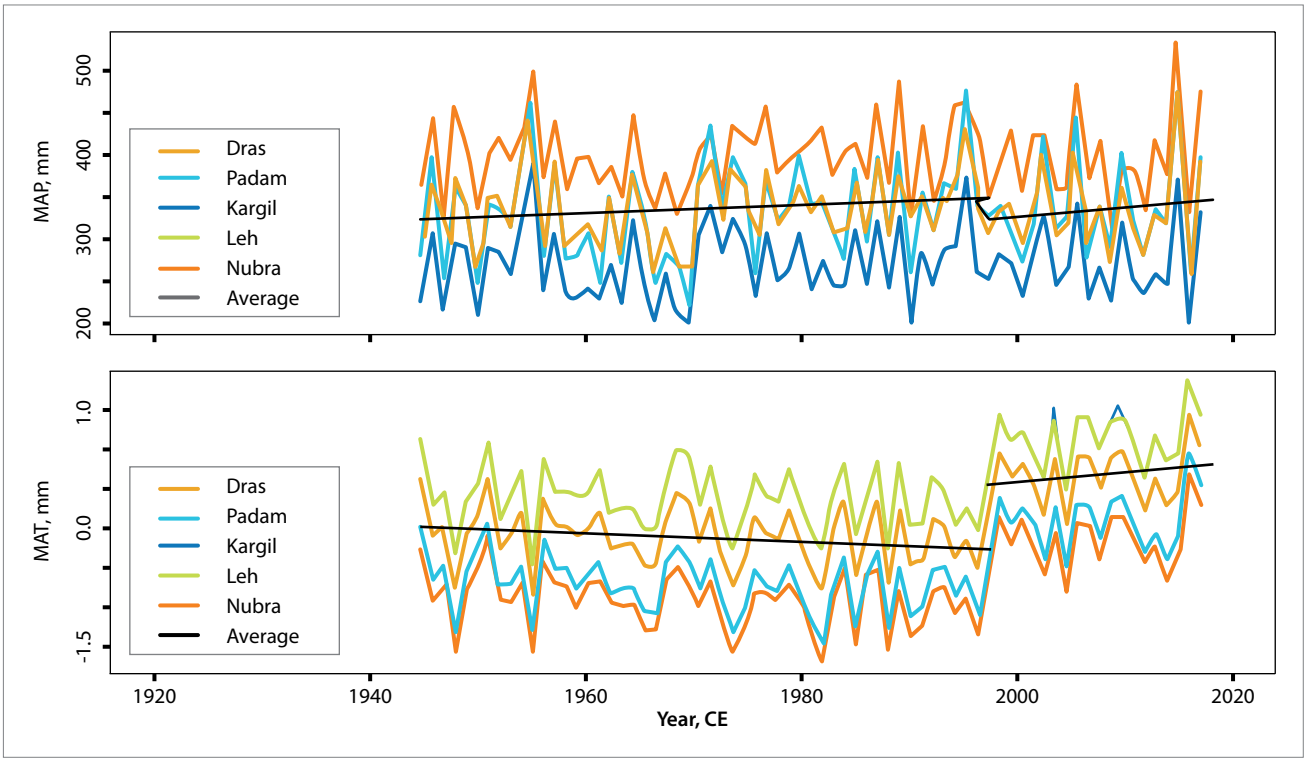
Climate & Temperature

The climate of Union Territory of Ladakh varies greatly owing to its rugged topography. Ladakh, a Union Territory nestled in the northern reaches of India, is a land of breath-taking landscapes and enchanting beauty. Its unique geographical location within the Himalayas gives rise to a climate that is distinct from the rest of the subcontinent. Spread across its diverse districts, Ladakh's climate, temperature, and rainfall patterns vary significantly, creating a tapestry of climatic diversity that is as captivating as the region itself. Ladakh's climate can be categorized as a cold desert climate or a high-altitude desert climate. The region experiences prolonged periods of cold temperatures and limited precipitation, making it a challenging environment for agriculture and habitation. Due to its elevation, Ladakh also receives intense sunlight, contributing to the daytime warmth despite the cold nights. The valley experiences a temperate climate. Summers are pleasant but winters are very cold and there is snowfall.

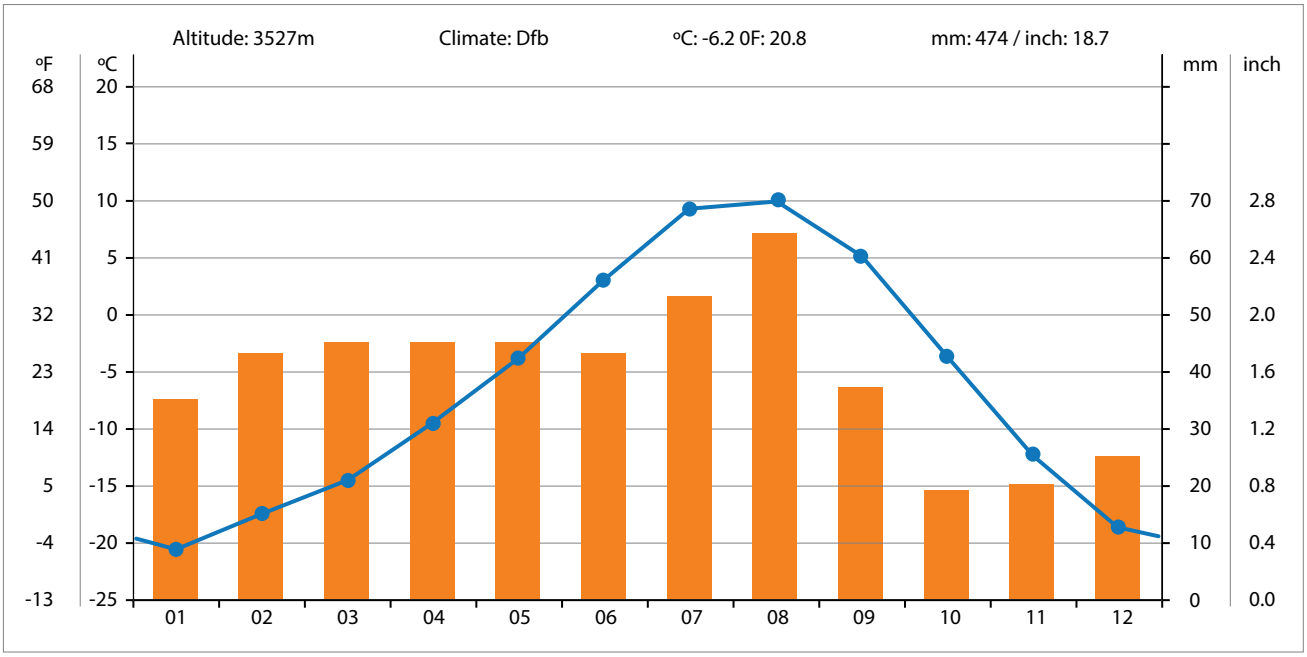
Temperature: Ladakh's temperature ranges are extreme due to its high altitude and geographical location. Winters are exceptionally cold, with temperatures often dropping well below freezing point. In some areas, temperatures can plummet to -30°C (-22°F) or even lower during the coldest months. Summers, on the other hand, are relatively mild, with daytime temperatures ranging from 20°C to 30°C (68°F to 86°F). The temperature variations between day and night can be substantial, with daytime warmth giving way to chilly nights.

Rainfall: Ladakh is situated in the rain shadow of the Himalayas, which means it receives very limited rainfall due to the barrier effect created by the mountains. The annual precipitation in Ladakh is extremely low, often ranging from 50 mm to 100 mm (2 to 4 inches) per year. This arid environment results in a stark desert landscape with scant vegetation. The monsoon rains that affect many parts of India have minimal impact on Ladakh, contributing little to its overall annual rainfall.

Mean Annual Precipition (MAP, mm) and Mean Annual Temperature (MAT, 0C) from 5 regions in the Independent India, as extracted from CRU TS 4.03 (see the text for more details)



Graph depicting month wise average temperature of Leh



Source: climate-data.org

Gradual and widespread climate changes with major impacts have occurred repeatedly in UT Ladakh in the recent past. Although climate changes can occur for many reasons, it is conceivable that human activities are forcing an increase in the probability of large, abrupt events. Such changes in climate conditions might have natural causes or could be triggered by humans. Interactions of global climate change, air pollution, and extreme weather conditions have visible repercussions on the ecosystem manifested through multiple sectors including health. From symptoms of normal flu to stomach problems, climate change has manifested

its impacts on human and livestock health. Human adaptability in many cases has failed to shape itself according to the drastic changes in climatic parameters due to the lack of livelihood facilities. Climate change in UT Ladakh has enhanced morbidity and mortality due to direct exposure to climatic adversities or indirectly through, scarcity of nutritious supplements, and degrading water quality. Interstate migration in search of livelihood has increased the infiltration of diseases in the UT/State. The UT Ladakh government is on a drive to ensure better health through institutional upgradation, infrastructural improvement, and ensuring easy access to health care facilities for all.

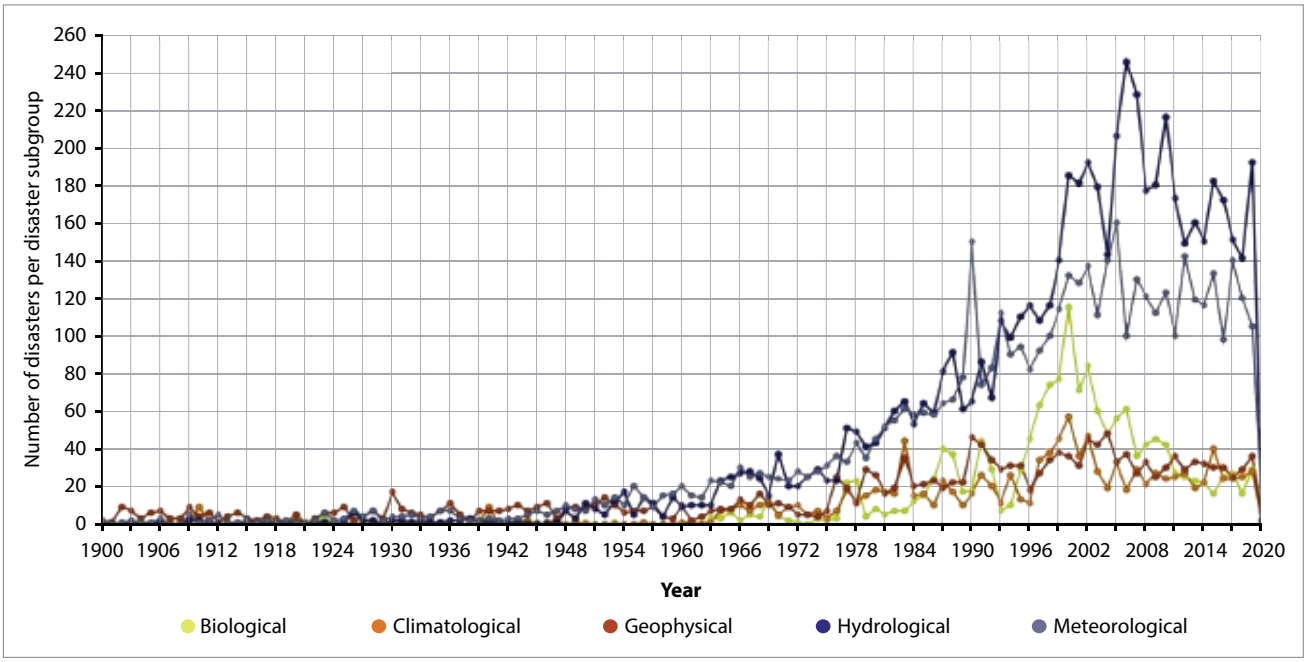
District-wise profile of government health institutions in Union Territory of Ladakh

Sl. No.	Name of District	Number of Medical college (Govt/Pvt)	Number of district/sub-district hospital	Number of CHC hospital	Number of PHCs	Number of UPHC	Number of Sub Centres
1	Leh	0	1	3	16	1	138
2	Kargil	0	1	4	16	0	150
	Total	**0**	**2**	**7**	**32**	**1**	**288**

Disaster has been defined as "a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts" by United Nations Office for Disaster Risk Reduction. Centre for Research on the Epidemiology of Disasters (Belgium) categorizes disasters into two main groups– (a) Natural, and (b) Technological. The following is description of Natural Disasters, their subgroups, and Main Types within each Subgroup.

Disaster Subgroups & Their Main Types	Definition of Sub-Group
Geophysical • Earthquake • Mass Movement (dry) • Volcanic activity	A hazard originating from solid earth. This term is used interchangeably with the term geological hazard.
Meteorological • Extreme Temperature • Fog • Storm	A hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that last from minutes to days.
Hydrological • Flood • Landslide • Wave action	A hazard caused by the occurrence, movement, and distribution of surface and subsurface freshwater and saltwater.
Climatological • Drought • Glacial Lake Outburst • Wildfire	A hazard caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multidecadal climate variability.
Biological • Epidemic • Insect infestation • Animal Accident	A hazard caused by the exposure to living organisms and their toxic substances (e.g. venom, mold) or vector- borne diseases that they may carry. Examples are venomous wildlife and insects, poisonous plants, and mosquitoes carrying pathogens and viruses.
Extra-Terrestrial • Impact • Space weather	A hazard caused by asteroids, meteoroids, and comets as they pass near-earth, enter the Earth's atmosphere, and/or strike the Earth, and by changes in interplanetary conditions that effect the Earth's magnetosphere, ionosphere, and thermosphere.

Globally, disaster events are increasing since recorded history of data (since 1900) where hydrological (flood, landslide, etc.) and meteorological disasters (extreme temperature, fog, etc.) are in much rise than the other types. Study on global fatal landslide, occurred between 2004 and 2016, indicates that Asia is more vulnerable (highest number of events; 75% of landslides) with substantial numbers of landslides in states in India along the Himalayan Arc, and neighboring countries (south-eastern China, Bangladesh, Myanmar, etc.)



Source: EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium.

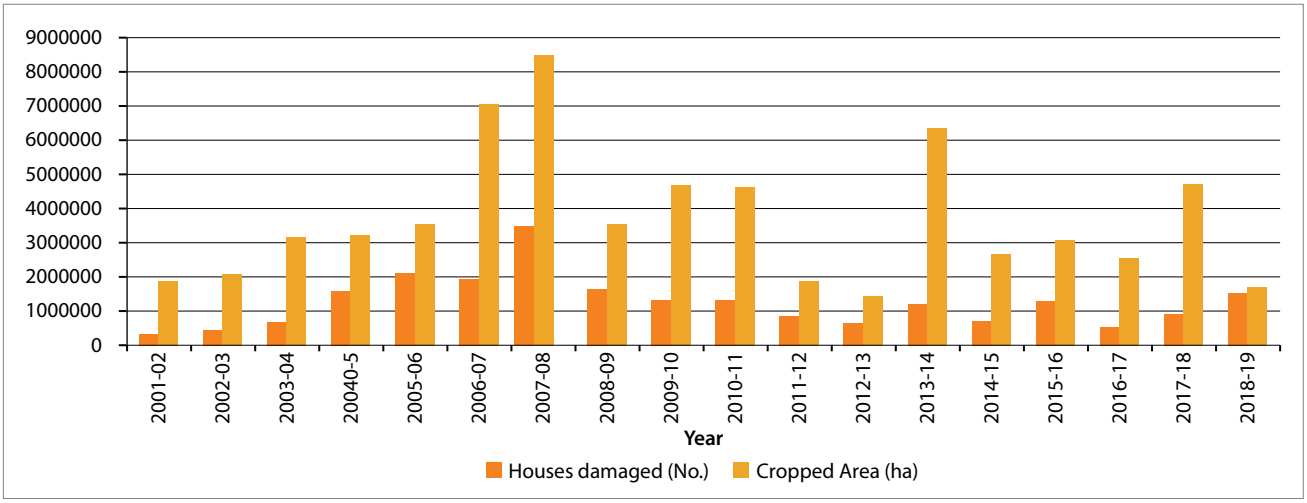
National Definition, Classification and Events

In national scenario disaster has been defined - "A disaster is a catastrophe, mishap, calamity in any area, arising from natural or manmade causes, which results in substantial loss of life or human suffering, damage destruction of property, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area", and Impacts of disasters are enumerated as: (i) loss of lives, (ii) loss of property and infrastructure, (iii) damage to livelihood, (iv) economic losses, (v) environmental damages- flora & fauna, (vi) sociological and psychological after effects, (vii) civil strife. India is affected by 33 different types of disasters, and the adopted national classification of disasters is as follows.

Sl. No.	Disaster Group	Types of Disaster
1	Water and Climate related Disasters	Droughts, Floods, Cloudburst, Cyclones, Tornadoes, Hailstorm, Thunder and Lightning, Heat- and cold Waves, Snow avalanches, Sea erosion, Tsunami
2	Geologically related Disasters	Earthquakes, Landslides and Mudflow, Dam failures/Dam Bursts, Mine Fires
3	Chemical, industrial and nuclear	Chemical and Industrial disasters, Nuclear disasters
4	Accident related Disasters	Forest fires, Urban fires, Village fire, Mine flooding, Oil spill, Major Building collapse, Serial bomb blasts, Festival related disaster, Electrical disaster and fires, Air, Road, and Rail accidents, Boat capsizing
5	Biologically related Disasters	Biological disasters and epidemics, Pest attacks, Cattle epidemics, Food poisoning

India has experienced most of these described disaster types or felt their threats in recent time history of recorded observations and has witnessed a significant growth in increasing number of natural disasters where frequency of natural disasters is increasing. For example, decadal analysis indicates that between 1991 and 2000 26 events of disastrous riverine floods occurred while between 2001 and 2010 this number increased to 79, and in present decade (2011 onward) 29 such events have been already registered. A remarkable damage to property (houses) and agriculture (cropped area) in last 20 years (2001-2019) has been experienced by the country due to extreme natural events figure below, which took a toll of nearly thirty nine thousand human lives and more than 14.7 lakh cattle.

Damage to important assets due to natural extreme events in India



Between 2001 and 2010, significant damaged in the country was caused due to floods, cyclonic storm, landslides, etc. (lives lost 21,975; cattle lost 9,79,677; house damaged 1,50,22,070; cropped area affected 424.69 lakh ha), however, since 1926, more than three hundred disastrous floods events occurred in India 7 those accounted for a death toll of more than 73 thousand lives of countrymen.

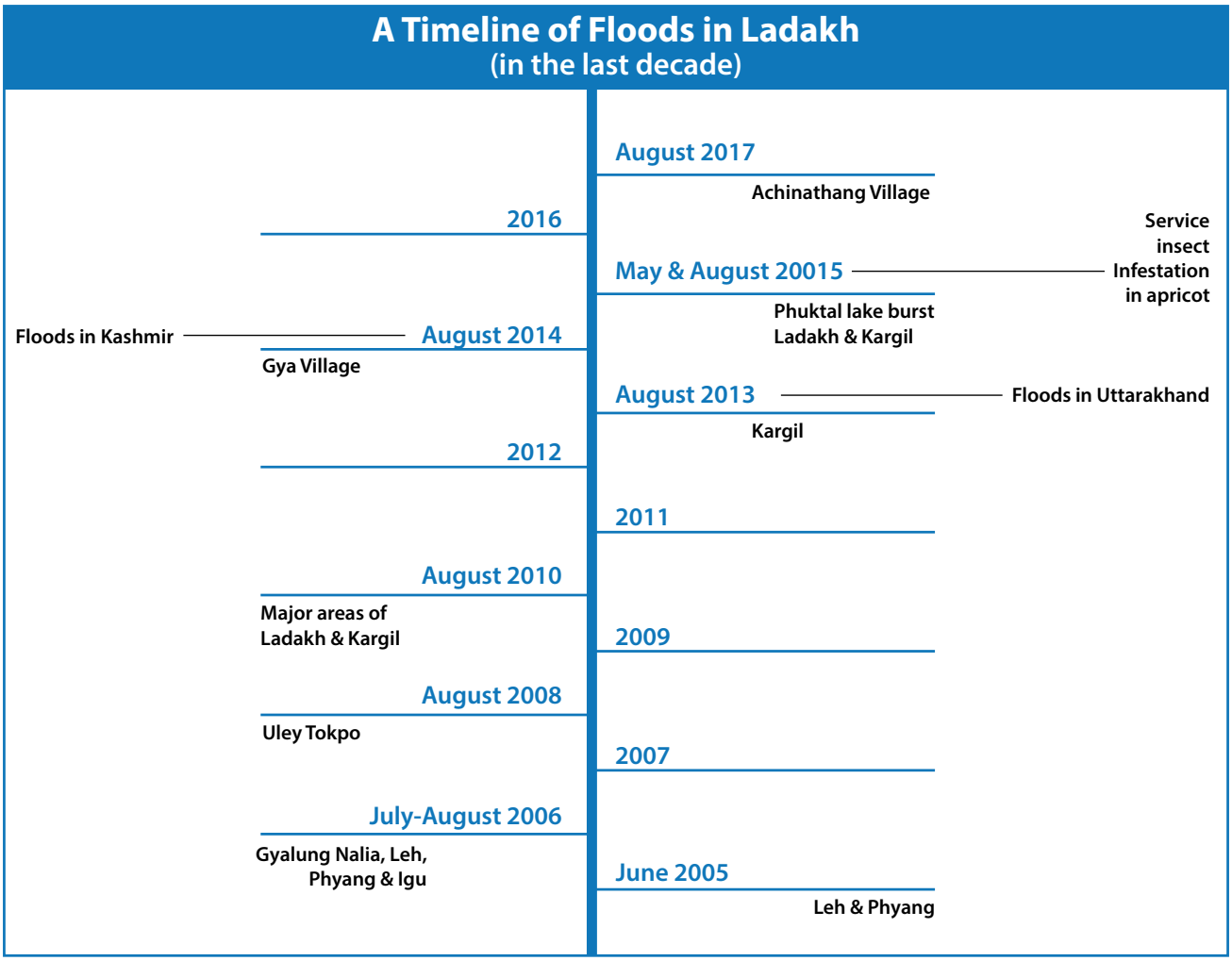
Vulnerability of Ladakh to Disasters

In India, mountainous regions are highly susceptible to landslides. Between 1948 and 2017, 49 disastrous events of landslide in the country took a toll of 5035 persons, while 536 were injured and more than 2 lakhs people were affected by these events. Among the sub-types of Landslide (main type), 10 disastrous events of avalanches (sub-type) happened in the Indian Himalayan region from 1986 to 2017. These events took a toll of 885 human lives while more than 250 were injured.

Ladakh is prone to disastrous events of snowfall. In 2016 several events of heavy intensity (64.5-115 cm in 24 hrs) happened leading to causalities of human lives. Some of the details for year 2013, and year 2016 are given.

Records of flash floods (sub-type) in the country (1968-2018) indicate that more than 32 hundred casualties occurred in 28 disastrous events and over 38 million people were affected. Events of disastrous riverine floods were 139 from 1926 to 2017. Timeline of flood occurrence in Ladakh shows occurrence of several events in recent times.

Ladakh: Flood timeline in recent years



Source: Preksha Sharma. 2018. Ladakh Floods: A Timeline of Disaster. https://thewire.in/environment/ladakh-floods

Sl. No.	Date	Intensity	Causalities, Cause, and Area
1	5 Feb 2013	Moderate	22,000 livestock perished in Leh
2	26 Apr 2013	Heavy	One person died and 6 others injured on Srinagar-Leh highway when 3 vehicles were hit by the avalanche
3	3 Jan 2016	Heavy	4 number due to Snow Avalanche (Southern Glacier)
4	3 Feb 2016	Heavy	10 number due to Snow Avalanche (Siachen)
5	19 Mar 2016	Heavy	1 number due to Snow Avalanche (Kargil)
6	25 Mar 2016	Heavy	2 number due to Snow Avalanche (Turtuk)

Threats of Climate Change in Ladakh

Vulnerability analysis for country on several disaster and hazard zonation done by national agencies places Jammu & Kashmir State (undivided state) in high risks zones, however data deficiency in landslide incidence map appears. Entire state of Jammu & Kashmir state has been placed in the category of annual rainfall between 1001- 2000 mm (Fig. 5) while large part of the undivided state was trans-Himalayan landscape represented by the present Union Territory of Ladakh which receives very less rainfall.

The present Union Territory of Ladakh is divided in two districts, and both differs in some climatological features. While Kargil district has wide range of climate from sub- tropical to temperate and even alpine in high elevated regions, Leh district has climatic condition of arctic and desert type, hence often refer as 'Cold Desert'. Total annual rainfall also varies in these two regions of Ladakh. The average annual rainfall in the Kargil district (3 stations, 12-16 years average) is 319.4 mm while it is 96.7 mm for Leh district (4 stations, 16-25 years).

Patterns of precipitation also varies between these regions of Ladakh. Rainfall of southwest monsoon season (June to September) contributes 24% of the annual rainfall in Kargil while it accounts large part in Leh district (45% of total). Pre-monsoon months (March to May) contributes more (33% of the annual) in Kargil region than in the Leh region (27% of total). The winter months (December to February) contribute rainfall for about 31% of the annual normal rainfall in Kargil region while it is about 21% in Leh region. Months having highest average of rainfall also differs in both the regions- March with an average of 44.2 mm in Kargil and July with an average of 15.6 mm in Leh. However, number of rainy days (i.e., days with rainfall of 2.5 mm or more) varies between stations, average rainy days in a year are more in Kargil district (27 days) than the Leh district (11 days). The average height of snowfall is about 200 to 500 cm in Kargil while it ranges from 200 to 400 cm in Leh district. In such dry condition floods are occurring in recent times in this cold desert area, and flood event of 2010 in Leh is recorded in top ten disastrous flood events in the country, which claimed more than 250 lives and huge loss of property and infrastructure. This, event was caused by a period of unusual intense precipitation which triggered debris flows and mudflows.

Statistical analysis of the climate over Leh using different datasets shows a slight but significant trend of change where a warming with reduced precipitation in the current decades is noticeable, and there is somewhat of an inverse relationship between temperature and precipitation. Comparison between different datasets indicate varied results some showing increasing and others showing decreasing trends, but significant increasing precipitation is seen in few datasets. There, is also some indication of decreasing

number of days having high precipitation though reported otherwise. This suggests that overall the region is receiving more rainfall than the arid region is used to. This study indicates a rapid increase in temperature and varied precipitation patterns in recent decades foreshadows a further changing climate with a higher probability of unexpected events in the coming years. Such changes in climatic pattern may have irreversible impacts leading to devastating consequences which are sometime part of the global climate. For example, disastrous event of 2010 is attributed to complex system and wave energy transport of the jet stream where southerly and easterly winds prevailed with higher surface air pressure which corresponded to easterly winds turning around the south of the Tibetan High located in the northern part of the Tibetan Plateau bringing moisture into Ladakh from the south part of the Tibetan Plateau. Southeasterly flow brought moisture to Ladakh and converged, resulting in the precipitation events of 4–7 August. Another school suggests that south-west monsoon of India contributed to this event which is contrary to general belief that this monsoon does not reach Ladakh. Report suggests that 40% of all the annual extreme rainfall events occurred during the monsoon months, and events of 5 August 2010 and 25 July 2011 were associated with westward moving cyclonic circulations in middle troposphere (~500 hPa) over the Tibet-Ladakh region, where orography (usually considered obstacle) may play a role by enhancing the rainfall associated with westward moving cyclone circulations in the middle troposphere. Thus, it can be concluded that whatever the reason it was, landscape of Ladakh is prone to global anomalies created on the face of climate change.

Long geological records also indicate that Indus River valley region is susceptible to mass movements, catastrophic land sliding, outburst floods and tectonic activity, such events occurred after the Last Glacial maximum (LGM) and Holocene warming; Four large landslides (debris volume more than 10 million m3) in Holocene period were attributed to an increase in pore water pressure over a period of increased monsoon strength. Thus, historically landscape was vulnerable to climate changes related anomalies, and remains in present time too.

Hazard, Risk, Vulnerability

Leh district has generally faced the following disasters and it is vulnerable to some of the natural disaster given below.

a) Cloud burst and Flood:

b) Road Blockade due to landslides, cloud burst, Snow

c) Snow Avalanche

d) Earth Quake

e) Locust Menace/Agriculture Drought

Cloud burst and Flood

Cloudburst is an extreme weather event in which very heavy rainfall occurs over a highly localized area in a very short time span. Cloudbursts in India occur during monsoon season over mountain regions in the Himalayas, north-eastern states and the Western Ghats. The associated convective clouds can extend up to 15 km above the ground.

Ladakh is not known to be frequently affected by this type of phenomena but the expected period of occurrence is between June to September. Analysis by the India Metrological Department

http://www.imd.gov.in/ of satellite images for 4th–6th August 2010 indicate that an intense convective system developed in the easterly current which is associated with the monsoon conditions over the region. The convective cloud band extended from the southeast to the northwest over Nepal and India during the afternoon of 5th August. It gradually intensified and moved west- northwest towards the Ladakh region. An intense convective cloud cluster developed to the east of Leh by 21:30 IST on 5th August.

Geologically, the region around Leh is made up of granites and loose sediments. The mountain slopes around Leh are covered in loose, unconsolidated deposits. Large fans of loose sediment, which are the product of several million years of erosion, can be observed in many locations along the banks of the Indus River. These sediments become dislodged and move rapidly when the surface layer becomes heavily saturated. The very heavy rainfall over Nimoo-Basgo and Leh on 4th–6th August saturated the loose sediment, setting off mudslides and sand flows which travelled down- slope towards the Indus River. The destruction at locations throughout Leh district was due to the rapid movement of huge volumes of water charged with mud, boulders, trees, building debris and other objects swept up in the flow. At Choglamsar (among the worst affected areas), the debris flow travelled approximately 10km from the epicenter of the cloudburst (near Saboo), spreading up to 2 km. In Leh, the debris flow travelled about 3 km, from an elevation of 3800 m to 3410 m, confined to the catchments of Shaksaling stream. The flow destroyed settlements, the Bus Stand and the BSNL mobile communications hub, and damaged the Sonam Norboo Memorial Hospital and the radio station. The worst affected areas including Leh town are Choglamsar village, Tashi Gyatsal area of Choglamsar, Saboo village, Taru, Nimoo, Basgoo, Stakna, Shey, Arzoo. Thiksay Kungam, Anlay, Nidder, Achinathang, Lungba, Skurbuchan. Rezong. Ulley, Tia, Temisgam, Tyakshi in Turtuk area about 233 human life were lost 424 people injure and about 79 people are still missing.

Vulnerable places: As per past records and present study, the following villages/places are most vulnerable from cloud burst and flash flood.

1. **Leh:** from Gabglies to Spituk along both side of Leh Nallah.
2. **Saboo Village:** From Saboo Phoo to Choglamsar both side of Saboo Nallah.
3. **Igoo-Village:** Khaspang village to Igoo Dhoo along both side of Igoo Nallah.
4. **Phyang:** Phulung Phyang to Phey along both side of Phyang nallah.
5. **Taru:** From head to tail of Taru Nallah.
6. **Nimoo:** Along both side from Head to tail of Nimoo Nallah.
7. **Ney/Basgoo:** Form Ney to Basgoo along both side of Ney Nallah.
8. **Tia/Temisgam:** Both side along the Nallah.
9. **Shila Wanla:** Along both side of Shila/Wanla Nallah.
10. **Kungam:** Along both side of Kungam Nallah.
11. **Anlay:** Along both side of Anlay Nallah.
12. **Tingang:** Along both side of Tingang Nallah Diskit.
13. **Trishi:** Along both side of Trishi Nallah Nobra.
14. **Chamshen:** Along both side of chamshen Nallah.
15. **Tyakshi:** Along both side of Tyakshi Nallah.
16. **Bogdang:** Bogdang Nallah Phoo to Dhoo.

17. **Diskit:** Along both side of Diskit Nallah at tail end.
18. **Turtuk:** Along both side of Turtuk Nallah.
19. **Hunder:** Along both side of Nallah.
20. **Lungdo:** Along both side of Nallah.
21. **Taksha:** Along both side of Taksha.
22. Nungstate/Along both side of Nallah Murgi.

Road Blockade due to landslides

Landslides are simply defined as the mass movement of rock, debris or earth down a slope and have come to include a broad range of motions whereby falling, sliding and flowing under the influence of gravity dislodges earth material. They often take place in conjunction with earthquakes, floods and volcanoes. At times, prolonged rainfall causing heavy block the flow or river for quite some time. The formation of river blocks can cause havoc to the settlements downstream on its bursting.

In the hilly terrain of India including the Himalayas, landslides have been a major and widely spread natural disaster the often strike life and property and occupy a position of major concern.

The two regions most vulnerable to landslides are the Himalayas and the Western Ghats. The Himalayas mountain belt comprise of tectonically unstable younger geological formations subjected to severe seismic activity. The Western Ghats and nilgiris are geologically stable but have uplifted plateau margins influenced by neo- tectonic activity. Compared to Western Ghats region, the slides in the Himalayas region are huge and massive and in most cases the overburden along with the underlying litho logy is displaced during sliding particularly due to the seismic factor.

The major parameters that call for evaluation are as follows:

- Slope-Magnitude, length and Direction
- Soil thickness
- Relative relief
- Land use
- Drainage- pattern and density
- Landslide affected population

Causes of Landslides

Landslides can be caused by poor ground conditions, geomorphic phenomena, and natural physical forces and quite often due to heavy spells of rainfall coupled with impeded drainage.

A Checklist of Causes of Landslides Ground Causes:

- Weak, sensitivity, or weathered materials
- Adverse ground structure (joints, fissures etc.)
- Physical property variation (permeability, plasticity etc.)

Morphological Causes:

- Ground uplift (volcanic, tectonic etc.)
- Erosion (wind, water)
- Scour. Deposition loading in the slope crest. Vegetation removal (by forest fire, drought etc.)

Physical Causes

- Prolonged precipitation
- Rapid draw- down
- Earthquake
- Volcanic eruption
- Thawing
- Shrink and swell
- Artesian pressure

Snow Avalanche

Snow cover on a slope tends to slide down the slope because of gravity. Conditions affecting stability include the gravitational force component of the snow and resisting forces, such as the frictional resistance of the slope or the anchoring effect of shrubs. In general, avalanches are caused when this balance is lost and when the forces exceed the resistance. Avalanches are rarely observed closely since they normally occur during a short time period of one or two minutes.

Major Causes: Major causes of avalanches can be classified into fixed (prime factors) and variable factors (exciting factors), such as weather conditions and the weight of the snow cover, Avalanches occur when these factors are combined. The types and scale of avalanches can differ depending on the combination of these various factors and their scale. Major prime factors and exciting factors are shown in the following table.

Major Causes of Snow Avalanches

Item	Description	Factor
Prime factors	Topographic factors	• Inclination of slope • Shape of slope • Location (ridge line or toe of slope) • Orientation of slope
	Vegetation factors	• Vegetation cover and height of trees • Vegetation cover and its thickness
Exciting factor	Weather factors	• Depth of snow cover • Depth of snowfall • Wind velocity • Atmospheric and snow temperatures
	Other factors	• Increase in weight of snow cover because of snow dropping from cornices or snow covers • Vibrations such as earthquake or the sound of gunfire

Factors Used for classification of Avalanches

Classification Factor	Classification Factor	Definition
Type of occurrence	Loose snow avalanche	Avalanches that flow rapidly, spreading widely from a point normally small in scale
	Slab avalanche	Avalanches that start to move suddenly over wide areas, normally large in scale
Type of snow	Dry snow avalanche	Avalanches that contain no water
	Wet snow avalanche	Avalanches that contain water
Surface layer avalanche	Surface layer avalanche	Slip surface exists within the snow cover
	Full- depth avalanche	Slip surface occurs on the ground surface

Types of Damage

The following lists typical examples of damage to roads caused by avalanches. The scale of damage can differ depending on the scale and type of avalanche.

- Traffic blocked by snow deposited on road surface.
- Roads damaged by avalanches.
- Road structures, such as retaining walls, overturned.
- Structures damaged by an avalanche during construction of roads occur most frequently.

Types and Description of Avalanches

Dry, loose surface-layer snow avalanche	These often occur in low atmospheric temperature or during snowfalls. This type of avalanche is caused mainly by small masses of snow falling from snow cornices, tree branches or exposed rock. Dry snow moves down in loose layer.
Dry, slab surface-layer snow avalanche	These often occur when new snow with a depth of more than 10 cm falls over existing snow cover during low atmospheric temperatures. Avalanches flow rapidly, taking the form of loose snow powder and often reach several kilometers down the foot of the mountain, causing serious disasters.
Dry, slab full-depth snow avalanche	Avalanche occurring in areas with low temperatures can have different mechanisms. In regions of relatively high temperatures, this type of avalanche occurs extensively when the weight of large quantity of snow falls quickly over existing snow deposits on slope at low temperatures. In cold regions, snow layers near the ground tend to become collapsible and can slide in a full depth if severe cold weather has continued for a long time. The dry new surface snow layers tend to slide in the form of snow powder and often reaches further down the foot of the mountain.
Wet, loose surface layer snow avalanche	These can be caused when a 20 to 30 cm layer of new snow layer starts to move, takes a wedge-shaped from and reduces in width. This avalanche flows smoothly as it advances.
Wet, slab surface layer snow avalanche	These can occur when temperature rises in fair weather after a snowfall when the slab snow surface layer contains water. Avalanches do not take the from of snow powder but move in a smooth flow.
Wet, slab full-depth snow avalanche	These can be caused when snow starts to melt in the early spring season and can also result if temperatures rise the winter season. It can occur either on a rainy day or on a warm day. These will not take the from of snow powder, and move in a smooth flow. This type of avalanche often causes serious disasters.

Characteristic Feature of Avalanche Movement

Powder avalanche	This type avalanche often reaches a depth of several tens of meters, taking the from of snow powder moving at a high speed. These most often occur during snowfalls at low temperature.
Flow avalanche	This type of avalanche appears to move as a flow of water over the snow surface. These are seen as full- depth avalanche occurring when atmospheric temperature increases.
Mixed avalanche	Powder type and flow avalanches occurring in combination. This type avalanche can occur quickly when large quantity to snow falls over unstable snow cover.

Estimation of Hazardous Slopes

The following actions are appropriate when avalanche hazard prone slopes are identified:

- Advise residents of avalanche risk areas using published maps.
- Afforestation programmes for areas where there is risk of avalanches.
- Trap avalanches by control measures.
- Dispose avalanche potential snow packs by artificial triggering.
- Predict occurrence of avalanches through stability analysis and issue warnings as and when necessary.
- Guide residents to emergency evacuation shelters.

There are three types of snow avalanche zones:

Red Zone: The most dangerous zone where snow avalanches are most frequent and have an impact pressure of more than 3 tons per square meter.

Blue Zone: Where the avalanche force is less than 3 tons per square meter and where living and other activities may be permitted with connection of safe design but such areas may have to be vacated on warning.

Yellow Zone: Where snow avalanche occurs only occasionally.

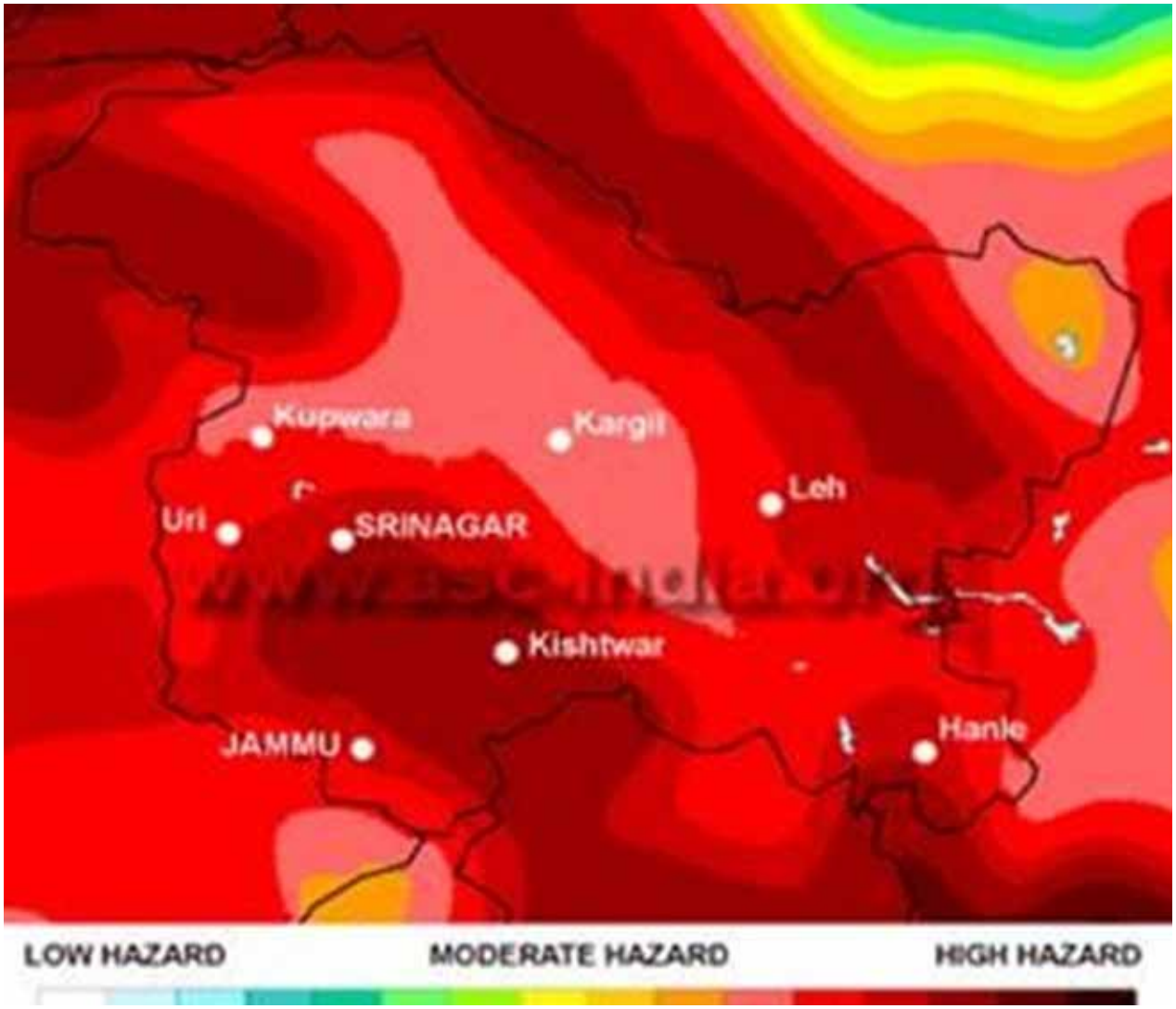
In case of Leh district there are several vulnerable areas for snow avalanche:

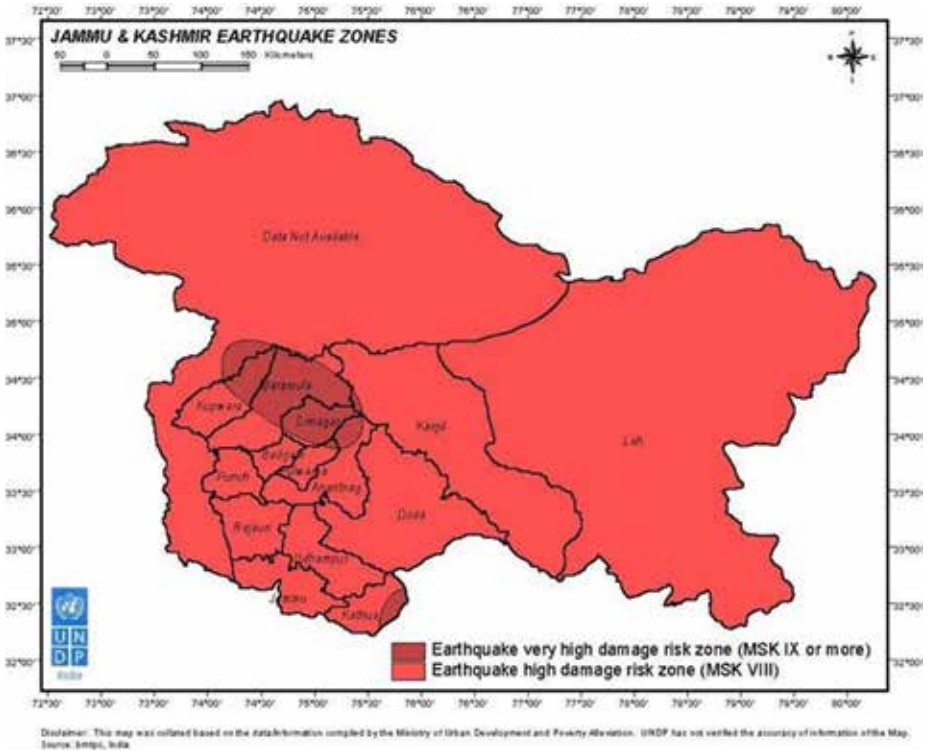
1. **Kardung La:** This zone is very vulnerable as lot of snow accumulates during winter. Lot of tourists visit Nubra via kardung La from April to October. Most of the tourists visit Kardung La as through this Pass, world's highest motorable road passes. Vulnerable Period – April to June.
2. **Chang La:** This pass is enroute to the most famous Pangong Tso lake. Lot of tourists visit pangong from spring to autumn. Vulnerable period - April to June.

There are other zones enroute to Manali as well as Srinagar.

Earth Quake

It comprises of Pir Panjal, Zanskar, Karakoram and Ladakh ranges. The Main Bounary Thrust (MBT) underlies the Pir Panjal range and is known as the Panjal thrust in the region. The Zanskar ranges which are part of the Great Himalayan range are underlaid by the Zanskar Thrust. Along the Zanskar and Ladakh ranges runs a NW-SE trending strike-slip fault, Leh district falls in zone IV (Damage Risk Zone). However, it must bestated that proximity to faults does not necessarily translate into a higher hazard as compared to areas located further away, as damage from earthquakes depends on numerous factors such as sub- surface geology as well as adherence to the building codes. Even though, earth quake didn't strike in that past in Leh district, since it is in zone IV all precautions are required to minimize the loss of life and property.


Kupwara
Kargil
Leh
Uri
SRINAGAR
Kishtwar
JAMMU
Hanle
LOW HAZARD
MODERATE HAZARD
HIGH HAZARD


JAMMU & KASHMIR EARTHQUAKE ZONES
Data Not Available
Earthquake very high damage risk zone (MSK IX or more)
Earthquake high damage risk zone (MSK VIII)

Drought and Locust Menace

Drought is a temporary reduction in water or moisture availability significantly below the normal or expected amount for a specific period. This condition occurs either due to inadequacy of rainfall, or lack of irrigation facilities, under exploitation or deficient availability for meeting the normal crop requirements in the context of the agro climatic conditions prevailing in particular area. This has been scientifically computed as Moisture Index (MI). Drought, in this context, can be defined as adverse MI or adverse water balance which may be attributable not only to a prolonged dry spell due to lack or sufficient rainfall but also due to such other factors as excessive evapo-transpiration losses, high temperature, low soil holding capacity etc. The inadequacy is with reference to the prevailing agro climatic conditions in any particular area.

Types of draught

There are three types of drought:

Meteorological Drought describes a situation where there is a reduction in rainfall for a specific period (days, months, season or year) below a specific amount (long term average for a specific time).

Hydrological Drought involves a reduction in water resources (stream flow, lake level, ground water, underground aquifers) below a specified level for a given period of time.

Agricultural Drought is the impact of meteorological/hydrological drought on crop yield. The three drought types are completely different and not synonymous.

Agricultural drought is the common phenomenon in Leh district. It is particularly very well noticed in changthang region. In case of changthang drought situation is also caused by Locust Menace moving across the border from china. It eats away all the green parts of a plant resulting in death of plant and stuntedness and multiple branching from the base in case of tree plantation.

Man Made Disasters Road Accident

Melas: There are lot of melas conducted in various monasteries of Leh district. Prominent are Hemis Mela, Spituk Mela, Thicksay Mela etc. at least one Mela is conducted in each of the various monasteries. People congregate in huge numbers. Even though no incident has taken place in the past, it is very essential that precautions are to be taken to prevent the catastrophe. Presently, in these monasteries, because of huge crowd gathering and limited place to assemble people even sit in the flat tops where there is no hold. There are chances for stampede in case in there is need for sudden exit. There is need to put railings.

Loss/Damage assessment during recent cloud burst/flood disaster 2010

Cloud burst disaster in the year 2010 and the damaged caused to life and property.

The cloud burst happened in the intervening night between 4th-5th August 2010 at Ney, Nimoo and Basgo and in the intervening night between 5th-6th August 2010, Leh, Choglamsar, Saboo and Phyang flash floods.

Sl. No.	Description	Numbers
1	Number of Districts Affected	01 (Leh)
	Number of Villages Affected in Leh District	71
	Population Affected	9000 persons
2	**LAND/AGRICULTURE DAMAGE**	
	Total Land Area Affected	687 ha
	Total Cropped Area Affected	660 ha
	Area where crop damage was more than 50%	
3	**ESTIMATED VALUES OF DAMAGE DUE TO FLOODS**	
	Estimated value of damage to public properties	133.00 Cores
4	**HOUSED DAMAGED IN THE FLOODS**	
	Fully damaged kutcha houses	664
	Partly Damaged houses (kutcha and Pucca)	783
	Number of huts damaged	458
	Total Number of Houses Damaged	1447
	Total Number of non-residential houses	458
	Estimated Value of Damages to Houses	
5	**LIVES LOST**	
	Civilian Lives Lost (inclusive of foreigners)	224
	Army Personnel Lives Lost	31
	Foreigners Lives Lost	06
	Unidentified Dead Bodies	17
	Missing Bodies	29
	Number of persons with grievous injuries	195
	Number of persons with minor injuries	15
6	**ANIMALS LOST**	
	Number of Large Animals Lost	91
	Number of Small Animals Lost	311

Cloudburst affected 64 villages of the Leh District over the period of 4th to 6th August 2010)

- Heavy Damages to households, Government infrastructure, over 200 lives lost in Leh, Choglamsar, Saboo, Phyang
- Worst Affected Area: Tashi Gatsal, Choglamsar; Worst Affected Localities in Leh: Manetselding and Skampari
- Choglamsar Bridge on the Leh-Manali highway washed away
- 7 bridges on the National Highway washed away due to floods
- Telecommunication cut-off (BSNL Telecom washed away), internal roads heavily damaged, Water Supply heavily damaged, transmission and distribution lines damaged in 40% of the Leh area
- Hundreds of tourists stranded on the Skiu-Markha trekking route, Wanla and Rumste areas

Sl. No.	Affected Area	Block/Area	Houses Damaged/Affected
1	Skara	Leh Locality	4
2	Norgyasling	Leh Locality	6
3	Lower Skara	Leh Locality	7
4	Mistik Chulung	Leh Locality	24
5	Maney Tsermo	Leh Locality	19
6	Maney-Tsel-Ting	Leh Locality	83
7	Upper Leh/Changspa	Leh Locality	6
8	Ibex Colony	Leh Locality	3
9	Housing Colony	Leh Locality	22
10	New Leh	Leh Locality	16
11	Targyasling	Leh Locality	4
12	Nurbooling	Leh Locality	1
13	Chubi	Leh Locality	1
14	Skampari	Leh Locality	18
15	Choglamsar Village	Leh Block	36
16	Sonamling (Choglamsar)	Leh Block	38
17	Tashi Gatsal	Leh Block	233
18	Saboo	Leh Block	34
19	Phyang	Leh Block	60
20	Umla	Leh Block	1
21	Stakmo	Leh Block	2
22	Shey	Leh Block	29
23	Thiksey	Leh Block	1
24	Gya	Leh Block	1
25	Miroo	Leh Block	6
26	Spituk	Leh Block	16
27	Spang Spituk (Devachan Hotel)	Leh Block	20
28	Basgo	Leh Block	4
29	Nyemo	Leh Block	18
30	Taru	Leh Block	28
31	Skyu Kaya	Leh Block	3
32	Sumda Chenmo	Leh Block	0
33	Sumda Chugun	Leh Block	2
34	Markha	Leh Block	0
35	Ney	Leh Block	13
36	Matho	Leh Block	2
37	Rumste	Leh Block	0
38	Igoo	Leh Block	49

Sl. No.	Affected Area	Block/Area	Houses Damaged/Affected
39	Photoksar	Khaltse Block	3
40	Urtsi	Khaltse Block	3
41	Skurbuchan	Khaltse Block	13
42	Bema	Khaltse Block	2
43	Hanu Yokma	Khaltse Block	2
44	Hanu Gongma	Khaltse Block	10
45	Kanji	Khaltse Block	7
46	Tia	Khaltse Block	9
47	Temisgam	Khaltse Block	2
48	Achinathang Longpa	Khaltse Block	10
49	Saspochey	Khaltse Block	3
50	Dipling	Khaltse Block	0
51	Hanu Patta	Khaltse Block	0
52	Lingshed	Khaltse Block	0
53	Nyiarags	Khaltse Block	0
54	Yulchung	Khaltse Block	0
55	Wanla	Khaltse Block	4
56	Skumbardo	Khaltse Block	11
57	Domkhar	Khaltse Block	8
58	Yangthang	Khaltse Block	3
59	Lamayuru	Khaltse Block	2
60	Waris-Sunudo	Nubra Block	4
61	Rongjuk-Khardong	Nubra Block	2
62	Tyakshi	Nubra Block	Property Damage
63	Turtuk	Nubra Block	Property Damage
64	Skuru	Nubra Block	Property Damage

Damage to roads and bridges

- Major flood damage to 26 different roadways inclusive of link roads, airport road and internal roads
- 688.80 km damaged out of 1722 km roads (about 40%)
- 622.34 km totally under flood water, heavy sludge, slips/slides accompanied with heavy boulders
- Breaches at stretches of roads: 66.46 km
- 3 major link roads under PMGSY damaged
- 29 bridges damaged out of which 10 have been completely washed away
- 6 Bailey bridges to be installed/launched at vulnerable sites on an emergency basis (Yurtung and Phyang Bridges have been installed)

Damage to irrigation systems

- Headworks of most Zamindari Khuls/Canals have been destroyed
- Heavy damages to irrigation khuls and footbridges under Rural Development Department
- Protection works on the banks of the Indus, Siachen, and Shayok Rivers are damaged
- Medium Irrigation Igoo-Phey Canal – sludge and boulders at stretches as well as damages at various sections
- Temporary restoration has been carried out, however funds are needed for permanent restoration

Damage to hospital and healthcare facilities

- Damages to Operation Theatre, Surgical Ward No. 1 and 2, Gynaecology Ward, Blood Bank, Medical Wards 1 and 2, Labour Room, OPD and CT Scan at Sonam Norboo Memorial, Leh
- Heating system at Sonam Norboo Memorial Hospital destroyed
- DG (power) set destroyed
- Restoration of Health Department Buildings in villages and completion of E-Block at the SNM Hospital is urgently needed
- Cost of restoration of F-Block and completion of E-block estimated at Rs. 8.91 crore
- Works being carried out by the PWD on a credit basis

Non-Governmental Organizations who assisted with post-flood relief operations in Ladakh

1. Indian Red Cross
2. CII
3. Ladakh Ecological Development Group (LEDEG)
4. Ladakh Environment and Health Organization (LEHO)
5. Save the Children India
6. AIDMI
7. WWF India
8. Bond
9. CASA Mountain Forum Himalayas
10. Oxfam India and Rural Development and You
11. Medecins Sans Frontieres
12. Care Today
13. CENSFOOD
14. Centre for Environment and Education
15. EFICOR
16. Gaden Relief
17. GERES

18 Handicap International

19. Himalayan Cultural Heritage Foundation

20. INTACH

21. Ladakh Arts and Media Organization

22. Ladakh Relief

23. Lutheran World Relief Service

24. PAGIR

25. People's Action Group for Inclusion and Rights

26. Pragya

27. SAMARPAN Foundation

28. SECMOL

29. SEEDS India

30. Snow Leopard Conservancy India Trust

31. Tibet Heritage Fund

32. Welthungerhilfe – Mahabodi International Meditation Centre

Additionally, CORDAID, Christian Aid, Plan India, World Vision, DCA, CRS and CARITAS – awaiting detailed assessments from partner agencies before intervention action.

Prevention and Mitigation, Recovery and Reconstruction Strategy for Different Hazards

Prevention and Control Measures to be adopted for various disasters.

A. Cloud Burst/Flash Flood

- Early warning: Collaboration with IMD for early forecasting
- Evacuation of the people living in low lying areas to high reaches
- Construction of Check-dams/other structures
- Nallah training
- Not allowing plantations in the nallah bed, near nallah etc.

B. Road Block

Mitigatory Measures

In general, the chief mitigatory measures to be adopted for such areas are:

- Drainage correction,
- Proper land use measures,
- Reforestation for the areas occupied by degraded vegetation and
- Creation of awareness among local population.

The most important triggering mechanism for mass movements is the water infiltrating into the overburden during heavy rains and consequent increase in pore pressure within the overburden. When this happens in steep slopes the safety factor of the slope material gets considerably reduced causing it to move down. Hence the natural way of preventing this situation is by reducing infiltration and allowing excess water to move down without hindrance. As such, the first and foremost mitigation measure is drainage correction. This involves maintenance of natural drainage channels both micro and macro in vulnerable slopes.

C. Snow Avalanche

Control Measures

Types of control Measures

Avalanche control measures can roughly be classified into hardware and software types. Hardware measures are for the purpose of preventing avalanches or for blocking or deflecting avalanches with protective structures. Software measures provide safety by eliminating the probability of avalanches by removing snow deposits on slope with blasting and by predicting the occurrence of avalanches and recommending evacuation from hazardous areas.

Avalanche Control Structures

Avalanche control structures can be divided into two major types:

- Prevention Structures
- Protection Structures

Prevention Structures

Prevention structures are provided to prevent the occurrence of avalanches.

Major types are described below:

- Planting (Avalanche prevention Forest).
- **Stepped Terraces:** Stepped terraces are provided for stabilizing the snow cover on slope by reducing or dividing the sliding of the snow cover with steps cut into the slopes. Steps are easy to construct at a reasonable cost but are not effective in controlling surface layer avalanches.
- **Avalanche Control Piles:** Avalanche Control Piles are assemblies of single piles driven into slopes in avalanche zones to control surface layer avalanches. The type of snow should determine the spacing of piles or topographic features and an average spacing of 5 meters is normally used from past experience.
- **Avalanche Control Fence:** Avalanche Control Fence is installed on slopes of avalanche zones to prevent full depth or surface layer avalanches.
- **Suspended Fences:** These are used in steep slopes or in areas where foundations cannot be properly installed because of poor ground conditions and useful in small area.
- **Snow Cornice Control Structures:** These structures are installed at tops of mountain areas to prevent the development of snow cornices that can cause avalanches. There are two methods of prevention: one is a collector snow fence, which collects snow on the windward side of the top of the mountain, and the other is blower snow fence which controls the development of snow cornice by blocking winds on the ridge.

D. Earth Quake

Measures for Earthquake Risk Reduction

Long term measures

Various activities taken up as long-term measures for earthquake disaster mitigation may include:

- RE-framing the building codes, guidelines, manuals and bye-laws and their proper implementation.
- Stricter legislation for highly seismic areas, in the regard.
- In high risk areas, all building should incorporate earthquake resistant features.
- Public utilities like water supply system, communication network, electricity lines etc. must be earthquake proof to reduce damages to the infrastructure facilities, alternative arrangement for the same must be developed.
- Community buildings and buildings used for gathering of large number of persons, like school, dharamshalas, hospitals, prayer halls, etc must be made earthquake resistant in seismic zones of moderate to high intensities.
- Supporting R&D in various aspects of disaster mitigation, preparedness and prevention and post disaster management.
- Improving educational curricula in architecture and engineering institutions and
- Technical training in polytechnics and schools to include disaster related topics.

Medium term measures

The medium-term measures for earthquake disaster mitigation may be listed as follows:

- Retrofitting of the weak structures in the highly seismic zones.
- Preparation of literature in local languages with do's and don'ts for the building constructions.
- Getting community involved in the process of disaster mitigation by providing them proper education and awareness. Supporting local technical institutions/colleges/school to organize research and to organize exhibitions etc. for public awareness.
- Networking of local NGOs working in the area of disaster management.

Post disaster Preventive Measures

Short term measures-The urgent measures to be undertaken in the aftermath of a damaging earthquake will include the following:

- Maintenance of law and order, prevention of trespassing, looting etc.
- Evacuation of people.
- Recovery of dead bodies and their disposal.
- Medical care for injured.
- Supply of food and drinking water.
- Temporary shelters like tents, metal sheds etc.
- Restoring lines of communication and information.

- Restoring transport routes.
- Quick assessment of damage and demarcation of damaged areas according to grade of damage.
- Cordoning off severely damaged structures that are liable to collapse during aftershocks.
- Co-ordination between various agencies involved in rescue and relief work is extremely important for success in avoiding gaps and duplication. Pre-disaster preparedness needs to be based on preparing likely damage scenario in probable earthquake occurrences and the estimate of extent of efforts required.

The following preparedness actions will be useful:

- Community should be trained in search, rescue and relief at the time of disaster in high-risk areas.
- An extensive programme of mass drills may be very helpful in high-risk areas for earthquake damage reduction.
- Local NGOs should be trained and their capacity and capabilities should be strengthened.
- Introducing earthquake disaster safety do's and don'ts and drills in schools.
- To organize training to field personnel of the states in the science and art of carrying out post disaster damage surveys, (a) for urgent relief purposes, (b) for repair, reconstruction and retrofitting purposes.

Consolidation and reconstruction

- An effort needs to be made in the emergency phase, to involve the affected people to the maximum extent so as to create a feeling of self-reliance. They need to be started as quickly as possible so that the period of relief is minimized.
- Detailed survey of building for assessment of damage and decision regarding repair, reconstruction and strengthening or demolition.
- Repair, reconstruction and seismic strengthening or demolition.
- Selection of sites for new settlements, if required.
- Execution of the reconstruction programme.
- Review of the existing seismic zoning maps and risk maps.
- Training of personnel, engineers, architects, builders and masons.
- Statistical studies regarding the earth quake in the district needs to be initiated.

E. Drought, Locust Menace

Strategies

- Close monitoring of the emerging drought scenario so as to develop an advance warning system.
- Relief measures required for providing immediate succor to the affected population and the upkeep of the cattle wealth, and if possible integrate it with long term objectives.
- Hammering out an alternative crop strategy for maximum possible retrieval of the Kharif crop and a better ensuing Rabi crop.

Health & Public Health Measures

- The nutritional requirement of all the children, expectant mothers and nursing mothers should be taken care of.

- Care has to be taken to disinfect drinking water sources to prevent the spread of water-borne diseases and plans need to be drawn up to cope with likely epidemics.
- There is need for constant surveillance of public health measures including immunization to be undertaken.

Cattle care

The cattle are the worst effected during a drought situation. Where it is not possible to supply fodder or take medical care of cattle, cattle camps are to be opened to take complete care of the cattle population. The following is a checklist of points for monitoring the fodder requirement in the difficult drought situation.

- Assessment of fodder requirement in drought affected districts and locate areas where shortages are likely to occur and arrange for supplies from outside.
- Monitoring the prices of fodder in selected places/markets.
- Arrange to procure fodder in selected outlets.
- Fodder cultivation to be encouraged wherever feasible.
- Ensure supply from molasses to cattle feed plants.
- Obtaining from premixed feed and urea-molasses bricks to the extent

CHAPTER 3

Climate Sensitive Diseases in Union Territory of Ladakh

Human health has always been influenced by weather and climate. Changes in climate and climate variability, particularly changes in weather extremes, affect the environment that provides us with clean air, food, water, shelter, and security. Climate change together with other natural and human-made health stressors threaten human health and well-being in numerous ways. In the summer months, between May to August, there is a surge in water borne outbreaks which include acute diarrhoeal diseases (ADD), cases of jaundice (which on laboratory confirmation get confirmed as Hepatitis A, Hepatitis E), cholera, and enteric fever.

During the winter months i.e. December to April, there is an increase in Acute respiratory infections (ARIs), Influenza-like illnesses (ILI) (Influenza A H1N1), especially in patients with co-morbid conditions like diabetes, hypertension, malignancies, and patients on anti-malignancy drugs. UT Ladakh, being situated at a higher altitude is protected against vector-borne diseases (malaria, dengue, chikungunya) as the vector responsible for these diseases does not survive at lower temperatures as the peak temperature does not cross above 35^{o}C during summer months. UT Ladakh being a tourist place gets imported cases of malaria and dengue. In the near future, due to climate change, the vector is moving to higher altitudes, with increased possibilities of these diseases. Regarding heat-related illnesses, the UT Ladakh does not face these illnesses during the summer months. But during winter months, as the temperature goes below 0^{o}C to minus 25-35^{o}C in both the district of UT Ladakh, these districts experience cases of frost bites and apprehension of avalanches/ snow storms.

Following are the major climate-sensitive diseases prevalent in UT Ladakh:

- Acute Respiratory Illnesses attributed to Air Pollution
- Water Borne Diseases

Acute Respiratory Infection/Influenza-like illness and Influenza

Acute respiratory infections (ARIs) are classified as upper respiratory tract infections (URIs) or lower respiratory tract infections (LRIs). ARIs are not confined to the respiratory tract and have systemic effects because of the possible extension of infection or microbial toxins, inflammation, and reduced lung function. The district-wise ARI cases registered in the state between 2021 and 2023 include.

Sl. No.	District	Acute Respiratory Infection/Influenza Like Illness		
		2021	2022	2023
1	Leh	1484	7894	11838
2	Kargil	1435	4278	3134

Vector-borne Diseases

In the state, vector-borne Diseases (VBDs) were restricted to the spread of malaria and dengue for the past two decades, but now, these diseases have widened their geographical reach. These VBDs are a threat to thousands of people in the state as they cause huge mortality and morbidity in extreme cases. There are no localized cases of Malaria & Dengue in both the districts of UT Ladakh. All the cases reported are from Migrant peoples as they have got infected in other parts of the country and they have travelled to Ladakh.

District Wise Detail of Vector-borne Diseases in UT Ladakh 2021

Sl. No.	Name of the District	Year: 2021 (Number of cases)					
		Malaria	Dengue	Chikungunya	Kala Azar	JE	Filaria
1	Leh	1	0	0	0	0	0
2	Kargil	0	0	0	0	0	0

District Wise Detail of Vector-borne Diseases in UT Ladakh 2022

Sl. No.	Name of the District	Year: 2022 (Number of cases)					
		Malaria	Dengue	Chikungunya	Kala Azar	JE	Filaria
1	Leh	0	2	0	0	0	0
2	Kargil	2	2	0	0	0	0

District Wise Detail of Vector-borne Diseases in UT Ladakh 2023

Sl. No.	Name of the District	Year: 2023 (Number of cases)					
		Malaria	Dengue	Chikungunya	Kala Azar	JE	Filaria
1	Leh	5	0	0	0	0	0
2	Kargil	6	0	0	0	0	0

Water Borne Diseases

Waterborne diseases such as typhoid, hepatitis, dysentery, and others are caused by micro-organisms such as Vibrio vulnificus and Vibrio cholera, E.Coli, Campylobacter, Salmonella, Cryptosporidium, Giardia, Yersinia, Legionella are some climate-dependant infectious diseases. The increase in temperature is seen to be associated with increased survival and abundance of microorganisms. The decreased precipitation and drought results in decreased availability of safe-water reuse of wastewater, contamination of water sources, and transmission from vertebrate to human or human to human, etc. Flooding causes contamination of water sources as well as disruption of the sewage disposal system, further contributors are population displacement, overcrowding, poor sanitation and hygiene, subsequent faeco-oral contamination, and the spread of pathogens, etc. The details of water-borne cases registered in the state are presented below:

Sl. No.	District	ADD			Bacillary Dysentery			Enteric Fever		
		2021	2022	2023	2021	2022	2023	2021	2022	2023
1	Leh	1380	2168	1656	2	17	14	18	3	45
2	Kargil	1222	1449	1245	14	28	37	4	8	56

CHAPTER 4

High Altitude Illness

Epidemiology

Mountains cover one-fifth of the earth's surface; 140 million people live permanently at altitudes ≥2500 m, and 100 million people travel to high-altitude locations each year. Skiers in the Alps or Aspen; tourists to La Paz, Ladakh, or Lahsa; religious pilgrims to Kailash Manasarovar or Gosainkunda; trekkers and climbers to Kilimanjaro, Aconcagua, or Everest; miners working in high-altitude sites in South America; and military personnel deployed to high-altitude locations are all at risk of developing acute mountain sickness (AMS), high altitude cerebral oedema (HACE), high-altitude pulmonary oedema (HAPE), and other altitude-related problems. AMS is the benign form of altitude illness, whereas HACE and HAPE are life-threatening. Altitude illness is likely to occur above 2500 m but has been documented even at 1500–2500 m. In the Mount Everest region of Nepal, ~50% of trekkers who walk to altitudes >4000 m over ≥5 days develop AMS, as do 84% of people who fly directly to 3860 m. The incidences of HACE and HAPE are much lower than that of AMS, with estimates in the range of 0.1–4%. Finally, re-entry HAPE, which in the past was generally limited to highlanders (long-term residents of altitudes >2500 m) in the Americas, is now being seen in Himalayan and Tibetan highlanders—and often misdiagnosed as a viral illness—as a result of recent rapid air, train, and motorable-road access to high-altitude settlements.

Physiology

Ascent to a high altitude subjects the body to a decrease in barometric pressure that results in a decreased partial pressure of oxygen in the inspired gas in the lungs. This change leads in turn to less pressure, driving oxygen diffusion from the alveoli and throughout the oxygen cascade. A normal initial "struggle response" to such an ascent includes increased ventilation—the cornerstone of acclimatization—mediated by the carotid bodies. Hyperventilation may cause respiratory alkalosis and dehydration. Respiratory alkalosis may be extreme, with an arterial blood pH of >7.7 (e.g., at the summit of Everest). Alkalosis may depress the ventilatory drive during sleep, with consequent periodic breathing and hypoxemia. During early acclimatization, renal suppression of carbonic anhydrase and excretion of dilute alkaline urine combat alkalosis and tend to bring the pH of the blood to normal. Other physiologic changes during normal acclimatization include increased sympathetic tone; increased erythropoietin levels, leading to increased haemoglobin levels and red blood cell mass; increased tissue capillary density and mitochondrial numbers; and higher levels of 2,3-bisphosphoglycerate, enhancing oxygen utilization. Even with normal acclimatization, however, ascent to a high altitude decreases maximal exercise capacity (by ~1% for every 100 m gained above 1500 m) and

increases susceptibility to cold injury due to peripheral vasoconstriction. If the ascent is made faster than the body can adapt to the stress of hypobaric hypoxemia, altitude-related disease states can result.

Genetics

Hypoxia-inducible factor, which acts as a master switch in high-altitude adaptation, controls transcriptional responses to hypoxia throughout the body and is involved in the release of vascular endothelial growth factor (VEGF) in the brain, erythropoiesis, and other pulmonary and cardiac functions at high altitudes. In particular, the gene EPAS1, which codes for transcriptional regulator hypoxia-inducible factor 2α, appears to play an important role in the adaptation of Tibetans living at high altitude, resulting in lower haemoglobin concentrations than are found in Han Chinese or South American highlanders. Other genes implicated include EGLN1 and PPARA, which are also associated with haemoglobin concentration. Some evidence indicates that these genetic changes occurred within the past 3000 years, which is very fast in evolutionary terms. An intriguing question is whether the Sherpas' well-known mountain-climbing ability is partially attributable to their Tibetan ancestry, with overrepresentation of variants of EPAS. A striking recent finding is that some of these genetic characteristics may stem from those of Denisovan hominids who were contemporaries of the Neanderthals. For acute altitude illness, a single gene variant is unlikely to be found, but differences in the susceptibility of individuals and populations, familial clustering of cases, and a positive association of some genetic variants all clearly support a role for genetics.

Acute Mountain Sickness and High-Altitude Cerebral Edema

AMS is a neurologic syndrome characterized by nonspecific symptoms (headache, nausea, fatigue, and dizziness), with a paucity of physical findings, developing 6–12 h after ascent to a high altitude. AMS is a clinical diagnosis. For uniformity in research studies, the Lake Louise Scoring System, created at the 1991 International Hypoxia Symposium, is generally used without the sleep disturbance score. AMS must be distinguished from exhaustion, dehydration, hypothermia, alcoholic hangover, and hyponatremia. AMS and HACE are thought to represent opposite ends of a continuum of altitude-related neurologic disorders. HACE (but not AMS) is an encephalopathy whose hallmarks are ataxia and altered consciousness with diffuse cerebral involvement but generally without focal neurologic deficits. Progression to these signal manifestations can be rapid. Papilledema and, more commonly, retinal haemorrhages may develop. In fact, retinal haemorrhages occur frequently at ≥5000 m, even in individuals without clinical symptoms of AMS or HACE.

Risk Factors

The most important risk factors for the development of altitude illness are the rate of ascent and a prior history of high altitude illness. Exertion is a risk factor, but lack of physical fitness is not. An attractive but still speculative hypothesis proposes that AMS develops in people who have inadequate cerebrospinal capacity to buffer the brain swelling that occurs at high altitude. Children and adults seem to be equally affected, but people >50 years of age may be less likely to develop AMS than younger people. In general, there is no gender difference in AMS incidence. Sleep desaturation—a common phenomenon at high altitude—is associated with AMS. Debilitating fatigue consistent with severe AMS on descent from a summit is an important risk factor for death in mountaineers. A prospective study involving trekkers and climbers who ascended to altitudes between 4000 and 8848 m showed that high oxygen desaturation and low ventilatory response to hypoxia during exercise are independent predictors of severe altitude illness. However, because

there may be a large overlap between groups of susceptible and non-susceptible individuals, accurate cut-off values are hard to define. Prediction is made more difficult because the pre-test probabilities of HAPE and HACE are low. Neck irradiation or surgery damaging the carotid bodies, respiratory tract infections, and dehydration appear to be other potential risk factors for altitude illness. Unless guided by clinical signs and symptoms, pulse oximeter readings alone on a trek should not be used to predict AMS.

Pathophysiology

Hypobaric hypoxia is the main trigger for altitude illness. In established AMS, raised intracranial pressure, increased sympathetic activity, relative hypoventilation, fluid retention and redistribution, and impaired gas exchange have all been well noted; these factors may play an important role in the pathophysiology of AMS. Severe hypoxemia can lead to a greater than normal increase in cerebral blood flow. However, the exact mechanisms underlying AMS and HACE are unknown. Evidence points to a central nervous system process. MRI studies have suggested that vasogenic (interstitial) cerebral oedema is a component of the pathophysiology of HACE. The pathophysiology of the most common and prominent symptom of AMS—headache—remains unclear because the brain itself is an insensate organ; only the meninges contain trigeminal sensory nerve fibres. The cause of high-altitude headache is multifactorial. Various chemicals and mechanical factors activate a final common pathway, the trigeminovascular system. In the genesis of high-altitude headache, the response to nonsteroidal anti-inflammatory drugs and glucocorticoids provides indirect evidence for involvement of the arachidonic acid pathway and inflammation.

Prevention and Treatment

Gradual ascent, with adequate time for acclimatization, is the best method for the prevention of altitude illness. Even though there may be individual variation in the rate of acclimatization, a conservative approach would be a graded ascent of ≤300 m from the previous day's sleeping altitude above 3000 m, and taking every third day of gain in sleeping altitude as an extra day for acclimatization is helpful. Spending one night at an intermediate altitude before proceeding to a higher altitude may enhance acclimatization and attenuate the risk of AMS. Another protective factor in AMS is high-altitude exposure during the preceding 2 months; for example, the incidence and severity of AMS at 4300 m are reduced by 50% with an ascent after 1 week at an altitude ≥2000 m rather than with an ascent from sea level. However, regarding the benefits of acclimatization, clear-cut randomized studies are lacking. Repeated exposure at low altitudes to hypobaric or normobaric hypoxia is termed pre-acclimatization. Pre-acclimatization is gaining popularity. For example, many Everest climbers in the spring of 2019 claimed to use commercially available "tents" at home with a hypoxic environment for weeks to months in preparation for the climb. However, the optimal method based on robust studies for pre-acclimatization is yet to be determined.

Management of Altitude Illness

Condition	Management
Acute mountain sickness (AMS), mild[a]	• Discontinuation of ascent • Treatment with acetazolamide (250 mg q12h) • Descent[b]
AMS, moderate[a]	• Immediate descent for worsening symptoms • Use of low-flow oxygen if available • Treatment with acetazolamide (250 mg q12h) and/or dexamethasone (4 mg q6h)[c] • Hyperbaric therapy[d]

Condition	Management
High-altitude cerebral edema (HACE)	• Immediate descent or evacuation • Administration of oxygen (2-4 L/min) • Treatment with dexamethasone (8 mg PO/IM/IV; then 4 mg q6h) • Hyperbaric therapy if descent is not possible
High- altitude pulmonary edema (HAPE)	• Immediate descent or evacuation • Minimization of exertion while patient is kept warm • Administration of oxygen (4-6 L/min) to bring O_2 saturation to >90% • Adjunctive therapy with nifedipine[e] (30 mg, extended-release, q12h) • Hyperbaric therapy if descent is not possible

a. Categorization of cases as mild or moderate is a subjective judgment based on the severity of headache and the presence and severity of other manifestations (nausea, fatigue, dizziness).

b. No fixed altitude is specified; the patient should descend to a point below that at which symptoms developed.

c. Acetazolamide treats and dexamethasone masks symptoms. For prevention (as opposed to treatment) of AMS, 125 mg of acetazolamide q12h or (when acetazolamide is contraindicated- e.g., in people with a history of sulfa anaphylaxis) 4 mg of dexamethasone q12h may be used.

d. In hyperbaric therapy, the patent is placed in a portable altitude chamber or bag to simulate descent.

e. Nifedipine at this dose is also effective for the prevention of HAPE, as are tadalafil (10 mg twice daily), sildenafil (50 mg three times per day), and dexamethasone (8 mg twice daily). Preventative therapy should be continued for about 3 days after arriving at the target altitude. If prompt descent follows arrival at target altitude, continuation of preventative therapy is unnecessary.

Clearly, a flexible itinerary that permits additional rest days will be helpful. Sojourners to high-altitude locations must be aware of the symptoms of altitude illness and should be encouraged not to ascend further if these symptoms develop. Any hint of HAPE (see below) or HACE mandates descent. Proper hydration (but not overhydration) in high-altitude trekking and climbing, aimed at countering fluid loss due to hyperventilation and sweating, may play a role in avoiding AMS.

Pharmacologic prophylaxis at the time of travel to high altitudes is warranted for people with a history of AMS or when a graded ascent and acclimatization are not possible—e.g., when rapid ascent is necessary for rescue purposes or when flight to a high-altitude location is required.

Acetazolamide is the drug of choice for AMS prevention. It inhibits renal carbonic anhydrase, causing prompt bicarbonate diuresis that leads to metabolic acidosis and hyperventilation. Acetazolamide (125 mg twice daily), administered for 1 day before ascent and continued for about 3 days at the same altitude, is effective. Treatment can be restarted if symptoms return after discontinuation of the drug. Higher doses are not required.

A meta-analysis limited to randomized controlled trials revealed that 125 mg of acetazolamide twice daily was effective in the prevention of AMS, with a relative-risk reduction of ~48% from values obtained with placebo. Even lower doses (62.5 mg twice daily) have been reported to be effective. Paraesthesia and a tingling sensation are common side effects of acetazolamide. Some other uncommon side effects are myopia and drowsiness. This drug is a nonantibiotic sulfonamide that has low-level cross-reactivity with sulfa antibiotics; as a result, severe reactions are rare.

Dexamethasone (8 mg/d in divided doses) is also effective. A large scale, randomized, double-blind, placebo-controlled trial in partially acclimatized trekkers clearly showed that Ginkgo biloba is ineffective in the prevention of AMS. In randomized studies, ibuprofen (600 mg three times daily) has been shown to be beneficial in the prevention of AMS. Recently, acetaminophen (1 g three times daily) was as effective as ibuprofen at the above dosage in a randomized, double-blind study, which did not have a placebo arm. However, more definitive studies and (for ibuprofen) a proper gastrointestinal bleeding risk assessment

need to be conducted before these drugs can be routinely recommended for AMS prevention. Many drugs, including spironolactone, medroxyprogesterone, magnesium, calcium channel blockers, and antacids, confer no benefit in the prevention of AMS. Starkly conflicting results from a number of trials of inhaled budesonide for the prevention of AMS have recently been published, but, in all likelihood, the drug is ineffective. Similarly, no efficacy studies are available for coca leaves (a weak form of cocaine), which are offered to high-altitude travellers in the Andes, or for soroche pills, which contain aspirin, caffeine, and acetaminophen and are sold over the counter in Bolivia and Peru. Finally, a word of caution applies in the pharmacologic prevention of altitude illness. A fast-growing population of climbers in pursuit of a summit are injudiciously using prophylactic drugs such as glucocorticoids in an attempt to improve their performance; the outcome can be tragic because of potentially severe side effects of these drugs, especially if taken for a long duration.

For the treatment of mild AMS, rest alone with analgesic use may be adequate. Descent and the use of acetazolamide and (if available) oxygen are sufficient to treat most cases of moderate AMS. Even a minor descent (400–500 m) may be adequate for symptom relief. For moderate AMS or early HACE, dexamethasone (4 mg orally or parenterally) is highly effective. For HACE, immediate descent is mandatory. When descent is not possible because of poor weather conditions or darkness, a simulation of descent in a portable hyperbaric chamber can be very effective. Pressurization in the bag for 1–2 h often leads to spectacular improvement and, like dexamethasone administration, "buys time." Thus, in certain high-altitude locations (e.g., remote pilgrimage sites), the decision to bring along the lightweight hyperbaric chamber may prove lifesaving. Like nifedipine, phosphodiesterase-5 inhibitors have no role in the treatment of AMS or HACE. Finally, short-term oxygen inhalation using small cannisters of oxygen or by visiting oxygen bars is unhelpful in the prevention of AMS.

High-Altitude Pulmonary Edema

Risk Factors and Manifestations Unlike HACE (a neurologic disorder), HAPE is primarily a pulmonary problem and therefore is not necessarily preceded by AMS. HAPE develops within 2–4 days after arrival at high altitude; it rarely occurs after >4 or 5 days at the same altitude, probably because of remodelling and adaptation that render the pulmonary vasculature less susceptible to the effects of hypoxia. A rapid rate of ascent, a history of HAPE, respiratory tract infections, and cold environmental temperatures are risk factors. Men are more susceptible than women. People with abnormalities of the cardiopulmonary circulation leading to pulmonary hypertension— e.g., mitral stenosis, primary pulmonary hypertension, and unilateral absence of the pulmonary artery—may be at increased risk of HAPE, even at moderate altitudes. Although patent foramen ovale, a common condition, is four times more common among HAPE-susceptible individuals than in the general population, there is no compelling evidence to suggest causal effect. Echocardiography is recommended when HAPE develops at relatively low altitudes <3000 m) and whenever cardiopulmonary abnormalities predisposing to HAPE are suspected. The differential diagnosis of HAPE includes anxiety attack, pneumonia, pneumothorax, and pulmonary embolism.

The initial manifestation of HAPE may be a reduction in exercise tolerance greater than that expected at the given altitude. Although a dry, persistent cough may presage HAPE and may be followed by the production of blood-tinged sputum, cough in the mountains is almost universal and the mechanism is poorly understood. Tachypnoea and tachycardia, even at rest, are important markers as illness progresses. Crackles may be heard on auscultation but are not diagnostic. HAPE may be accompanied by signs of HACE. Patchy or localized opacities or streaky interstitial oedema may be noted on chest radiography. In the past, HAPE was mistaken for pneumonia due to the cold or for heart failure due to hypoxia and exertion. Kerley B lines or a

bat-wing appearance are not seen on radiography. Electrocardiography may reveal right ventricular strain or even hypertrophy. Hypoxemia and respiratory alkalosis are consistently present unless the patient is taking acetazolamide, in which case metabolic acidosis may supervene. Assessment of arterial blood gases is not necessary in the evaluation of HAPE; an oxygen saturation reading with a pulse oximeter is generally adequate. The existence of a subclinical form of HAPE has been suggested by an increased alveolar-arterial oxygen gradient in Everest climbers near the summit, but hard evidence correlating this abnormality with the development of clinically relevant HAPE is lacking. Comet-tail scoring—an ultrasound technique initially validated in cardiogenic pulmonary oedema—has been used for evaluation of extravascular lung water at high altitude and has proven to be useful in detecting HAPE (clinical or subclinical) and even in ascertaining whether the presence of extravascular lung water is a harbinger of HAPE in patients with AMS.

Pathophysiology

HAPE is a noncardiogenic pulmonary oedema with normal pulmonary artery wedge pressure. It is characterized by patchy pulmonary hypoxic vasoconstriction that leads to overperfusion in some areas. This abnormality leads in turn to increased pulmonary capillary pressure (>18 mmHg) and capillary "stress" failure. The exact mechanism for this hypoxic vasoconstriction is unknown. Endothelial dysfunction due to hypoxia may play a role by impairing the release of nitric oxide, an endothelium-derived vasodilator. At high altitude, HAPE-prone persons have reduced levels of exhaled nitric oxide. The effectiveness of phosphodiesterase-5 inhibitors in alleviating altitude induced pulmonary hypertension, decreased exercise tolerance, and hypoxemia supports the role of nitric oxide in the pathogenesis of HAPE. One study demonstrated that prophylactic use of tadalafil, a phosphodiesterase-5 inhibitor, decreases the risk of HAPE by 65%. In contrast, the endothelium also synthesizes endothelin-1, a potent vasoconstrictor whose concentrations are higher than average in HAPE-prone mountaineers.

Exercise and cold lead to increased pulmonary intravascular pressure and may predispose to HAPE. In addition, hypoxia triggered increases in sympathetic drive may lead to pulmonary venoconstriction and extravasation into the alveoli from the pulmonary capillaries. Consistent with this concept, phentolamine, which elicits α-adrenergic blockade, improves hemodynamic and oxygenation in HAPE more than do other vasodilators. The study of tadalafil cited above also investigated dexamethasone in the prevention of HAPE. Surprisingly, dexamethasone reduced the incidence of HAPE by 78%—a greater decrease than with tadalafil. Besides possibly increasing the availability of endothelial nitric oxide, dexamethasone may have altered the excessive sympathetic activity associated with HAPE: the heart rate of participants in the dexamethasone arm of the study was significantly lowered. Finally, people susceptible to HAPE also display enhanced sympathetic activity during short-term hypoxic breathing at low altitudes.

Because many patients with HAPE have fever, peripheral leucocytosis, and an increased erythrocyte sedimentation rate, inflammation has been considered an etiologic factor in HAPE. However, strong evidence suggests that inflammation in HAPE is an epiphenomenon rather than the primary cause. Nevertheless, inflammatory processes (e.g., those elicited by viral respiratory tract infections) do predispose persons to HAPE—even those who are constitutionally resistant to its development.

Another proposed mechanism for HAPE is impaired transepithelial clearance of sodium and water from the alveoli. β-Adrenergic agonists upregulate the clearance of alveolar fluid in animal models. In a single double-blind, randomized, placebo controlled study of HAPE-susceptible mountaineers, prophylactic inhalation of the β-adrenergic agonist salmeterol reduced the incidence of HAPE by 50%. However, the dosage of salmeterol (125 µg twice daily) used was very high, which could result in excessive tachycardia and tremors.

Other effects of β agonists may also contribute to the prevention of HAPE, and these findings are in keeping with the concept that alveolar fluid clearance may play a pathogenic role in this illness.

Prevention and Treatment

Allowing sufficient time for acclimatization by ascending gradually (as discussed above for AMS and HACE) is the best way to prevent HAPE. Sustained-release nifedipine (30 mg), given twice daily, prevents HAPE in people who must ascend rapidly or who have a history of HAPE. Other drugs for the prevention of HAPE. Although dexamethasone is listed for prevention, its adverse effect profile requires close monitoring. Acetazolamide has been shown to blunt hypoxic pulmonary vasoconstriction in animal models, and this observation warrants further study in HAPE prevention. However, one large study failed to show a decrease in pulmonary vasoconstriction in partially acclimatized individuals given acetazolamide. Inhaled salmeterol is not recommended as clinical experience with this drug is limited at high altitude. Finally, potent diuretics like furosemide should be avoided in the treatment of HAPE. Early recognition is paramount in the treatment of HAPE, especially when it is not preceded by the AMS symptoms of headache and nausea. Fatigue and dyspnoea at rest may be the only initial manifestations. Descent and the use of supplementary oxygen (aimed at bringing oxygen saturation to >90%) are the most effective therapeutic interventions. Exertion should be kept to a minimum, and the patient should be kept warm. Hyperbaric therapy in a portable altitude chamber may be lifesaving, especially if descent is not possible and oxygen is not available. Oral sustained-release nifedipine (30 mg twice daily) can be used as adjunctive therapy. No studies have investigated phosphodiesterases inhibitors in the treatment of HAPE, but reports have described their use in clinical practice. The mainstays of treatment remain descent and (if available) oxygen.

In AMS, if symptoms abate (with or without acetazolamide), the patient may reascend gradually to a higher altitude. Unlike that in acute respiratory distress syndrome (another non cardiogenic pulmonary oedema), the architecture of the lung in HAPE is usually well preserved, with rapid reversibility of abnormalities. This fact has allowed some people with HAPE to reascend slowly after a few days of descent and rest. In HACE, reascent after a few days may not be advisable during the same trip.

Other High-Altitude Problems

Sleep Impairment The mechanisms underlying sleep problems, which are among the most common adverse reactions to high altitude, include increased periodic breathing; changes in sleep architecture, with increased time in lighter sleep stages; and changes in rapid eye movement sleep. Sojourners should be reassured that sleep quality improves with acclimatization. In cases where drugs do need to be used, acetazolamide (125 mg before bedtime) is especially useful because this agent decreases hypoxemic episodes and alleviates sleeping disruptions caused by excessive periodic breathing. Whether combining acetazolamide with temazepam or zolpidem is more effective than administering acetazolamide alone is unknown. In combinations, the doses of temazepam and zolpidem should not be increased by >10 mg at high altitudes. Limited evidence suggests that diazepam causes hypoventilation at high altitudes and therefore is contraindicated. For trekkers with obstructive sleep apnoea who are using a continuous positive airway pressure (CPAP) machine, the addition of acetazolamide, which will decrease centrally mediated sleep apnoea, may be helpful. There is evidence to show that obstructive sleep apnoea at high altitude may decrease and "convert" to central sleep apnoea.

Gastrointestinal Issues: High-altitude exposure may be associated with increased gastric and duodenal bleeding, but further studies are required to determine whether there is a causal effect. Because of

decreased atmospheric pressure and consequent intestinal gas expansion at high altitudes, many sojourners experience abdominal bloating and distension as well as excessive flatus expulsion. In the absence of diarrhoea, these phenomena are normal, if sometimes uncomfortable. Accompanying diarrhoea, however, may indicate the involvement of bacteria or Giardia parasites, which are common at many high-altitude locations in the developing world. Prompt treatment with fluids and empirical antibiotics may be required to combat dehydration in the mountains. Haemorrhoids are common on high-altitude treks; treatment includes hot soaks, application of hydrocortisone ointment, and measures to avoid constipation.

High-Altitude Cough: High-altitude cough can be debilitating and is sometimes severe enough to cause rib fracture, especially at >5000 m. The etiology of this common problem is probably multifactorial. Although high-altitude cough has been attributed to inspiration of cold dry air, this explanation appears not to be sufficient by itself; in long-duration studies in hypobaric chambers, cough has occurred despite controlled temperature and humidity. The implication is that hypoxia also plays a role. Exercise can precipitate cough at high altitudes, possibly because of water loss from the respiratory tract. In general, infection does not seem to be a common etiology. Many trekkers find it useful to wear a balaclava to trap some moisture and heat. In most situations, cough resolves upon descent.

High-Altitude Neurologic Events Unrelated to "Altitude Illness": Transient ischemic attacks (TIAs) and strokes have been well described in high-altitude sojourners outside the setting of altitude sickness. However, these descriptions are not based on cause (hypoxia) and effect. In general, symptoms of AMS present gradually, whereas many of these neurologic events happen suddenly. The population that suffers strokes and TIAs at sea level is generally an older age group with other risk factors, whereas those so afflicted at high altitudes are generally younger and probably have fewer risk factors for atherosclerotic vascular disease. Other mechanisms (e.g., migraine, vasospasm, focal oedema, hypocapneic vasoconstriction, hypoxia in the watershed zones of minimal cerebral blood flow, or cardiac right-to-left shunt) may be operative in TIAs and strokes at high altitude.

Subarachnoid haemorrhage, transient global amnesia, delirium, and cranial nerve palsies (e.g., lateral rectus palsy) occurring at high altitudes but outside the setting of altitude sickness have been well described. Syncope is common at moderately high altitudes, generally occurs shortly after ascent, usually resolves without descent, and appears to be a vasovagal event related to hypoxemia. Seizures occur rarely with HACE, but hypoxemia and hypocapnia, which are prevalent at high altitudes, are well-known triggers that may contribute to new or breakthrough seizures in predisposed individuals. Nevertheless, the consensus among experts is that sojourners with well-controlled seizure disorders can ascend to high altitudes.

Finally, persons with hypercoagulable conditions (e.g., antiphospholipid syndrome, protein C deficiency) who are asymptomatic at sea level may experience cerebral venous thrombosis (possibly due to enhanced blood viscosity triggered by polycythaemia and dehydration) at high altitudes. Proper history taking, examination, and prompt investigations where possible will help define these conditions as entities separate from altitude sickness. Administration of oxygen (where available) and prompt descent are the cornerstones of treatment of most of these neurologic conditions.

Ocular Problems: Ocular issues are common in sojourners to high altitudes. Hypoxemia induced by altitude leads to increased retinal blood flow, which can be visible as engorged retinal veins on ophthalmoscopic examination. Both high flow and hypoxemic vascular damage causing permeability have been implicated in a breakdown of the blood-retina barrier and the formation of retinal haemorrhages. Blot, dot, flame, and white-centered haemorrhages can be observed. These haemorrhages usually resolve spontaneously with

descent, with only mild symptoms and no lasting visual damage in most healthy eyes. The exception is haemorrhage in the macular area. Macular haemorrhages can cause devastating initial visual loss, particularly if bilateral, and have been reported to cause permanently decreased vision in a few cases.

Stroke syndromes such as retinal vein occlusion, retinal artery occlusion, ischemic optic neuropathy, and cortical visual loss have all been reported. With unilateral vision loss, it is always important to check for a relative afferent pupillary defect. Increased haematocrit combined with dehydration may contribute to these maladies. Glaucomatous optic nerve damage may progress with hypoxemia of altitude. Acetazolamide is helpful both in combating the respiratory alkalosis that comes with increased ventilation at high altitude and in lowering the interocular pressure; its use should be considered in patients with stable controlled glaucoma. Macular degeneration and diabetic eye disease are not directly exacerbated by ascent to high altitude. Dry eye and solar damage to the cornea, known as "snow blindness," are common. Wearing of high-quality UV- blocking sunglasses, even on cloudy days, and attention to protecting and supplementing the tear film with artificial tear drops can greatly improve comfort and vision. Although modern refractive surgeries, such as photorefractive keratectomy (PRK) and laser in situ keratomileusis (LASIK), are stable at high altitude, patients who have undergone radial keratotomy should be cautioned that hypoxemia to the cornea can lead to swelling that shifts the refraction during ascent.

Psychological/Psychiatric Problems: Delirium characterized by a sudden change in mental status, a short attention span, disorganized thinking, and an agitated state during the period of confusion has been well described in mountain climbers and trekkers without a prior history. In addition, anxiety attacks, often triggered at night by excessive periodic breathing, are well documented. The contribution of hypoxia to these conditions is unknown. Expedition medical kits need to include antipsychotic injectable drugs to control psychosis in patients in remote high-altitude locations.

Preexisting Medical Issues

Because travel to high altitudes is increasingly popular, common conditions such as hypertension, coronary artery disease, and diabetes are more frequently encountered among high-altitude sojourners. This situation is of particular concern for the millions of elderly pilgrims with medical problems who visit high-altitude sacred areas (e.g., in the Himalayas) each year. In recent years, high altitude travel has attracted intrepid trekkers who are taking immunosuppressive medications (e.g., kidney transplant recipients or patients undergoing chemotherapy). Recommended vaccinations and other precautions (e.g., hand washing) may be especially important for this group. Although most of these medical conditions do not appear to influence susceptibility to altitude illness, they may be exacerbated by ascent to altitude, exertion in cold conditions, and hypoxemia. Advice regarding the advisability of high-altitude travel and the impact of high-altitude hypoxia on these pre-existing conditions is becoming increasingly relevant, but there are no evidence-based guidelines. In addition, recommendations made for relatively low altitudes (~3000 m) may not hold true for higher altitudes (>4000 m), where hypoxic stress is greater. Personal risks and benefits must be clearly thought through before ascent.

Hypertension: At high altitudes, enhanced sympathetic activity may lead to a transient rise in blood pressure. Occasionally, non-hypertensive, healthy, asymptomatic trekkers have pathologically high blood pressure at high altitude that rapidly normalizes without medicines on descent. Sojourners should continue to take their antihypertensive medications at high altitudes. Importantly, hypertensive patients are not more likely than others to develop altitude illness. Because the probable mechanism of high-altitude hypertension is α-adrenergic activity, anti-α-adrenergic drugs such as prazosin have been suggested

for symptomatic patients and those with labile hypertension. It is best to start taking the drug several weeks before the trip and to carry a sphygmomanometer if a trekker has labile hypertension. Sustained-release nifedipine may also be useful. A recent observational cohort study of 672 hypertensive and non-hypertensive trekkers in the Himalayas showed that most travellers, including those with well-controlled hypertension, can be reassured that their blood pressure will remain relatively stable at high altitude. Although blood pressure may be extremely elevated at high altitude in normotensive and hypertensive people, it is unlikely to cause symptoms.

Coronary Artery Disease: Myocardial oxygen demand and maximal heart rate are reduced at high altitudes because the VO2 max (maximal oxygen consumption) decreases with increasing altitude. This effect may explain why signs of cardiac ischemia or dysfunction usually are not seen in healthy persons at high altitudes. Asymptomatic, fit individuals with no risk factors need not undergo any tests for coronary artery disease before ascent. For persons with ischemic heart disease, previous myocardial infarction, angioplasty, and/or bypass surgery, an exercise treadmill test is indicated. A strongly positive treadmill test is a contraindication for high-altitude trips. Patients with poorly controlled arrhythmias should avoid high altitude travel, but patients with arrhythmias that are well controlled with antiarrhythmic medications do not seem to be at increased risk. Sudden cardiac deaths are not noted with a greater frequency in the Alps than at lower altitudes; although sudden cardiac deaths are encountered every trekking season in the higher Himalayan range, accurate documentation is lacking.

Cerebrovascular Disease: Patients with TIAs should avoid travel to high altitude for at least 3 months. Patients with known cerebral aneurysm should also avoid high-altitude travel because of possible rupture of the aneurysm due to increased cerebral blood flow at high altitude.

Migraine: Trekkers with a history of migraine may have an increased likelihood of suffering from AMS and may also be predisposed to headaches including altered character of their migraine presenting with focal neurologic deficits. Oxygen inhalation may reduce AMS triggered headache, whereas a migraine headache usually persists even after 10–15 min of oxygen inhalation.

Asthma: Although cold air and exercise may provoke acute bronchoconstriction, asthmatic patients usually have fewer problems at high than at low altitudes, possibly because of decreased allergen levels and increased circulating catecholamine levels. Nevertheless, asthmatic individuals should carry all their medications, including oral glucocorticoids, with proper instructions for use in case of an exacerbation. Severely asthmatic persons should be cautioned against ascending to high altitudes.

Pregnancy: In general, low-risk pregnant women ascending to 3000 m are not at special risk except for the relative unavailability of medical care in many high-altitude locations, especially in developing countries. Despite the lack of firm data on this point, venturing higher than 3000 m to altitudes at which oxygen saturation drops steeply seems unadvisable for pregnant women.

Obesity: Although living at a high altitude has been suggested as a means of controlling obesity, obesity has also been reported to be a risk factor for AMS, probably because nocturnal hypoxemia is more pronounced in obese individuals. Hypoxemia may also lead to greater pulmonary hypertension, thus possibly predisposing the trekker to HAPE.

Sickle Cell Disease: High altitude is one of the rare environmental exposures that occasionally provokes a crisis in persons with sickle cell anaemia. Even when traversing mountain passes as low as 2500 m, people with sickle cell anaemia have been known to have a vaso-occlusive crisis. Patients with known sickle cell

anaemia who need to travel to high altitudes should use supplemental oxygen and travel with caution. Thalassemia has not been known to cause problems at high altitude.

Diabetes Mellitus: Well-controlled diabetes is not a contraindication for travel to high altitude. Most of the high-altitude diabetes advice is based on patients with type 1 diabetes and not type 2 diabetic patients with comorbidities. An eye examination before travel may be useful. Insulin pumps are increasingly used, but bubble formation in the system may need to be closely monitored. Diabetic patients need to carry a reliable glucometer. Ready access to sweets is also essential. It is important for companions of diabetic trekkers to be fully aware of potential problems like hypoglycaemia. Dexamethasone, as far as possible, should be avoided in the prevention or treatment of altitude illness in a diabetic patient.

Chronic Lung Disease: Depending on disease severity and access to medical care, pre-existing lung disease may not always preclude high-altitude travel. A proper pretravel evaluation must be conducted. Supplemental oxygen may be required if the predicted PaO_2 for the altitude is <50–55 mmHg. Pre-existing pulmonary hypertension may also need to be assessed in these patients. If the result is positive, patients should be discouraged from ascending to high altitudes; if such travel is necessary, treatment with sustained release nifedipine (20 mg twice a day) should be considered. Small scale studies have revealed that when patients with bullous disease reach ~5000 m, bullous expansion and pneumothorax are not noted. Compared with information on chronic obstructive pulmonary disease, fewer data exist about the safety of travel to high altitude for people with pulmonary fibrosis, but acute exacerbation of pulmonary fibrosis has been seen at high altitude. A handheld pulse oximeter can be useful to check for oxygen saturation.

Chronic Kidney Disease: Patients with chronic kidney disease can tolerate short-term stays at high altitudes, but theoretical concern persists about progression to end-stage renal disease. Acetazolamide, the drug most commonly used for altitude sickness, should be avoided by anyone with pre-existing metabolic acidosis, which can be exacerbated by this drug. In addition, the acetazolamide dosage should be adjusted when the glomerular filtration rate falls to <10 mL/min.

Cirrhosis: patients with cirrhosis, 16% may have Porto pulmonary arterial hypertension, and 32% may have hepatopulmonary syndrome; these conditions may be detrimental at high altitude as they may cause exaggerated hypoxemia. Thus, screening for these problems is important in cirrhotic patients planning a high-altitude trip. In addition, acetazolamide may be inadvisable in these patients as the drug may increase the risk of hepatic encephalopathy.

Dental Problems: Air resulting from decay in the root system could expand on ascent and lead to increasing pain. A good dental check-up before a trekking or climbing trip may be prudent.

Chronic Mountain Sickness and High-Altitude Pulmonary Hypertension in Highlanders

The largest populations of highlanders live in the South American Andes, the Tibetan Plateau, and parts of Ethiopia. Chronic mountain sickness (Monge's disease) is a disease in highlanders that is characterized by excessive erythrocytosis with moderate to severe pulmonary hypertension leading to cor pulmonale. This condition was originally described in South America and has also been documented in Colorado and in the Han Chinese population in Tibet; it is much less common in Tibetans or in Ethiopian highlanders. Migration to a low altitude results in the resolution of chronic mountain illness. Venesection and acetazolamide are helpful. High-altitude pulmonary hypertension is also a subacute disease of long-term high-altitude

residents. Unlike Monge's disease, this syndrome is characterized primarily by pulmonary hypertension (not erythrocytosis) leading to heart failure. Indian soldiers living at extreme altitudes for prolonged periods and Han Chinese infants born in Tibet have presented with the adult and infantile forms, respectively. High-altitude pulmonary hypertension bears a striking pathophysiologic resemblance to brisket disease in cattle. Descent to a lower altitude is curative.

Hypothermia and Peripheral Cold Injuries

Hypothermia

Accidental hypothermia occurs when there is an unintentional drop in the body's core temperature below 35°C (95°F). At this temperature, many of the compensatory physiologic mechanisms that conserve heat begin to fail. Primary accidental hypothermia is a result of the direct exposure of a previously healthy individual to the cold. The mortality rate is much higher for patients who develop secondary hypothermia as a complication of a serious systemic disorder or injury.

Causes

Primary accidental hypothermia is geographically and seasonally pervasive. Although most cases occur in the winter months and in colder climates, this condition is surprisingly common in warmer regions as well. Multiple variables render individuals at the extremes of age—both the elderly and neonates—particularly vulnerable to hypothermia. The elderly has diminished thermal perception and are more susceptible to immobility, malnutrition, and systemic illnesses that interfere with heat generation or conservation. Dementia, psychiatric illness, and socioeconomic factors often compound these problems. Neonates have high rates of heat loss because of their increased surface-to-mass ratio and their lack of effective shivering and adaptive behavioural responses. At all ages, malnutrition can contribute to heat loss because of diminished subcutaneous fat and as a result of depleted energy stores used for thermogenesis.

Risk Factors for Hypothermia

Age extremes
- Elderly
- Neonates

Environmental exposure
- Occupational
- Sports-related
- Inadequate clothing
- Immersion

Toxicologic and pharmacologic
- Ethanol
- Phenothiazines
- Barbiturates
- Anesthetics
- Neuromuscular blockers
- Antidepressants

Insufficient fuel
- Malnutrition
- Marasmus
- Kwashiorkor

Endocrine
- Diabetes mellitus
- Hypoglycemia
- Hypothyroidism
- Adrenal insufficiency
- Hypopituitarism

Neurologic
- Cerebrovascular accident
- Hypothalamic disorders
- Parkinson's disease
- Spinal cord injury

Multisystem
- Trauma
- Sepsis
- Shock
- Hepatic or renal failure

Burns and exfoliative dermatologic disorders immobility or debilitation

Individuals whose occupations or hobbies entail extensive exposure to cold weather are at increased risk for hypothermia. Military history is replete with hypothermic tragedies. Hunters, sailors, skiers, and climbers also are at great risk of exposure, whether it involves injury, changes in weather, or lack of preparedness.

Ethanol causes vasodilation (which increases heat loss), reduces thermogenesis and gluconeogenesis, and may impair judgment or lead to obtundation. Some antipsychotics, antidepressants, anxiolytics, benzodiazepines, and other medications reduce centrally mediated vasoconstriction. Many hypothermic patients are admitted to intensive care because of drug overdose. Anaesthetics can block shivering responses; these effects are compounded when patients are not insulated adequately in the operating or recovery units.

Several types of endocrine dysfunction cause hypothermia. Hypothyroidism—particularly when extreme, as in myxoedema coma —reduces the metabolic rate and impairs thermogenesis and behavioural responses. Adrenal insufficiency and hypopituitarism also increase susceptibility to hypothermia. Hypoglycaemia, most commonly caused by insulin or oral hypoglycaemic agents, is associated with hypothermia, in part because of neuroglycopenic effects on hypothalamic function. Increased osmolality and metabolic derangements associated with uremia, diabetic ketoacidosis, and lactic acidosis can lead to altered hypothalamic thermoregulation.

Neurologic injury from trauma, cerebrovascular accident, subarachnoid haemorrhage, and a hypothalamic lesion increases susceptibility to hypothermia. Agenesis of the corpus callosum (Shapiro's syndrome) is one cause of episodic hypothermia. In this syndrome, profuse perspiration is followed by a rapid fall in temperature. Acute spinal cord injury disrupts the autonomic pathways that lead to shivering and will prevent cold-induced reflex vasoconstrictive responses.

Hypothermia associated with sepsis is a poor prognostic sign. Hepatic failure causes decreased glycogen storage and gluconeogenesis as well as a diminished shivering response. In acute myocardial infarction associated with low cardiac output, hypothermia may be reversed after adequate resuscitation. With extensive burns, psoriasis, erythrodermas, and other skin diseases, increased peripheral-blood flow leads to excessive heat loss.

Thermoregulation

Heat loss occurs through five mechanisms: radiation (55–65% of heat loss), conduction (10–15% of heat loss, increased in cold water), convection (increased in the wind), respiration, and evaporation; both of the latter two mechanisms are affected by the ambient temperature and the relative humidity. The preoptic anterior hypothalamus normally orchestrates thermoregulation. The immediate defence of thermoneutrality is via the autonomic nervous system, whereas delayed control is mediated by the endocrine system. Autonomic nervous system responses include the release of norepinephrine, increased muscle tone, and shivering, leading to thermogenesis and an increase in the basal metabolic rate. Cutaneous cold thermo reception causes direct reflex vasoconstriction to conserve heat. Prolonged exposure to cold also stimulates the thyroid axis, leading to an increased metabolic rate.

Clinical Presentation

In most cases of hypothermia, the history of exposure to environmental factors (e.g., prolonged exposure to the outdoors without adequate clothing) makes the diagnosis straightforward. In urban settings, however, the presentation is often more subtle and other disease processes, toxin exposures, or psychiatric

diagnoses should be considered. Predicting the core temperature based on the clinical presentation is very difficult.

After initial stimulation by hypothermia, there is progressive depression of all organ systems. The timing of the appearance of these clinical manifestations varies widely. Without knowing the core temperature, it can be difficult to interpret other vital signs. For example, tachycardia disproportionate to the core temperature suggests secondary hypothermia resulting from hypoglycaemia, hypovolemia, or a toxin overdose. Because carbon dioxide production declines progressively, the respiratory rate should be low; persistent hyperventilation suggests a central nervous system (CNS) lesion or an organic acidosis. A markedly depressed level of consciousness in a patient with mild hypothermia suggests an overdose or CNS dysfunction due to infection or trauma.

Severity	Body Temperature	Central Nervous System	Cardiovascular	Respiratory	Renal and Endocrine	Neuromuscular
Mild	35°C (95°F)-32.2°C (90°F)	Linear depression of cerebral metabolism; amnesia; apathy; dysarthria; impaired judgment; maladaptive behavior	Tachycardia, then progressive bradycardia; cardiac cycle prolongation; vasoconstriction; increase in cardiac output and blood pressure	Tachypnea, then progressive decrease in respiratory minute volume; declining oxygen consumption; bronchorrhea; bronchospasm	Diuresis; increase in catecholamines, adrenal steroids, triiodothyronine, and thyroxine; increase in metabolism with shivering	Increased preshivering muscle tone, then fatiguing
Moderate	<32.2°C (90°F)-28°C (82.4°F)	EEG abnormalities; progressive depression of level of consciousness; pupillary dilation; paradoxical undressing; hallucinations	Progressive decrease in pulse and cardiac output; increased atrial and ventricular arrhythmias; suggestive (J-wave) ECG changes	Hypoventilation; 50% decrease in carbon dioxide production per 8°C (17.6°F) drop in temperature; absence of protective airway reflexes	50% increase in renal blood flow; renal autoregulation intact; impaired insulin action	Hyporeflexia; diminishing shivering-induced thermogenesis; rigidity
Severe	<28°C (<82.4°F)	Loss of cerebrovascular autoregulation; decline in cerebral blood flow; coma; loss of ocular reflexes; progressive decrease in EEG abnormalities	Progressive decrease in blood pressure, heart rate, and cardiac output; reentrant dysrhythmias; maximal risk of ventricular fibrillation; asystole	Pulmonic congestion and edema; 75% decrease in oxygen consumption; apnea	Decrease in renal blood flow that parallels decrease in cardiac output; extreme oliguria; poikilothermia; 80% decrease in basal metabolism	No motion; decreased nerve-conduction velocity; peripheral areflexia; no corneal or oculocephalic reflexes

Abbreviations: ECG, electrocardiogram; EEG, electroencephalogram.

Source: From DF Danzl, RS Pozos: Accidental hypothermia. N Engl J Med 331:1756, 1994. Copyright © 1994 Massachusetts Medical Society. Reprinted with permission from Massachusetts Medical Society.

Physical examination findings will also be altered by hypothermia. For instance, the assumption that areflexia is solely attributable to hypothermia can obscure the diagnosis of a spinal cord lesion. Patients

with hypothermia may be confused or combative; these symptoms abate more rapidly with rewarming than with chemical or physical restraint. A classic example of maladaptive behaviour in patients with hypothermia is paradoxical undressing, which involves the inappropriate removal of clothing in response to a cold stress. The cold-induced ileus and abdominal rectus spasm can mimic or mask the presentation of an acute abdomen.

When a patient in hypothermic cardiac arrest is first discovered, cardiopulmonary resuscitation (CPR) is indicated unless (1) a do not-resuscitate status is verified, (2) obviously lethal injuries are identified, or (3) the depression of a frozen chest wall is not possible. Continuous CPR is normally recommended, and interruptions should be avoided if possible. In the field, when the core temperature is <28°C, intermittent CPR may also be effective.

As the resuscitation proceeds, the prognosis is grave if there is evidence of widespread cell lysis, as reflected by potassium levels >10–12 mmol/L (10–12 meq/L). Other findings that may preclude continuing resuscitation include a core temperature <10–12°C (<50–54°F), a pH <6.5, and evidence of intravascular thrombosis with a fibrinogen value <0.5 g/L (<50 mg/dL). The decision to terminate resuscitation before rewarming the patient past 33°C (91°F) should be predicated on the type and severity of the precipitants of hypothermia. Survival has occurred with a cardiac arrest time over 7 h. There is an ongoing search for validated prognostic indicators for recovery from hypothermia. The Swiss grading system considers core body temperature and the clinical findings. Other scoring systems also consider age, albumin, and lactate levels. A history of asphyxia, as in an avalanche, with secondary cooling is the most important negative predictor of survival.

Diagnosis and Stabilization

Hypothermia is confirmed by measurement of the core temperature, preferably at two sites. Rectal probes should be placed to a depth of 15 cm and not adjacent to cold faeces. A simultaneous oesophageal probe can be placed 24 cm below the larynx; it may read falsely high during heated inhalation therapy. Relying solely on infrared tympanic thermography is not advisable.

After a diagnosis of hypothermia is established, cardiac monitoring should be instituted, along with attempts to limit further heat loss. If the patient is in ventricular fibrillation, it is unclear at what core temperature ventricular defibrillation (2 J/kg) should first be attempted. One biphasic attempt below 30°C is warranted. Further defibrillation attempts should usually be deferred until some rewarming (1°–2°C) is achieved and ventricular fibrillation is coarser. Although cardiac pacing for hypothermic brady dysrhythmias is rarely indicated, the transthoracic technique is preferable. The J or Osborn wave at the junction of the QRS complex and ST segment suggests the diagnosis. Obvious J waves are routinely misdiagnosed by automated readings as injury current.

Supplemental oxygenation is always warranted, since tissue oxygenation is affected adversely by the leftward shift of the oxyhaemoglobin dissociation curve. Pulse oximetry is often unreliable in patients with vasoconstriction. If protective airway reflexes are absent, gentle endotracheal intubation should be performed. Adequate preoxygenation will prevent ventricular arrhythmias.

Insertion of a gastric tube prevents dilation secondary to decreased bowel motility. Indwelling bladder catheters facilitate monitoring of cold-induced diuresis and can provide an ancillary approach for temperature monitoring. Dehydration is encountered commonly with chronic hypothermia, and most

patients benefit from an intravenous or intraosseous crystalloid bolus. Normal saline is preferable to lactated Ringer's solution, as the liver in hypothermic patients inefficiently metabolizes lactate. The placement of a pulmonary artery catheter can cause perforation of the less compliant pulmonary artery. Insertion of a central venous catheter deeply into the cold right atrium should be avoided since this procedure, similar to transvenous pacing, can precipitate refractory arrhythmias.

Arterial blood gases should not be corrected for temperature. An uncorrected pH of 7.42 and a PCO_2 of 40 mmHg reflect appropriate alveolar ventilation and acid-base balance at any core temperature. Acid-base imbalances should be corrected gradually, since the bicarbonate buffering system is inefficient. A common error is overzealous hyperventilation in the setting of depressed CO_2 production. When the PCO_2 decreases by 10 mmHg at 28°C (82°F), it doubles the pH increase of 0.08 that occurs at 37°C (99°F).

The severity of anaemia may be underestimated because the haematocrit increases 2% for each 1°C drop in temperature. White blood cell sequestration and bone marrow suppression are common, potentially masking an infection. Although hypokalaemia is more common in chronic hypothermia, hyperkalaemia also occurs; the expected electrocardiographic changes are often obscured by hypothermia. Patients with renal insufficiency, metabolic acidosis, or rhabdomyolysis are at greatest risk for electrolyte disturbances.

Coagulopathies are common because cold inhibits the enzymatic reactions required for activation of the intrinsic cascade. In addition, thromboxane B2 production by platelets is temperature dependent, and platelet function is impaired. The administration of platelets and fresh-frozen plasma is therefore not effective. Coagulation studies can be deceptively normal and contrast with the observed in vivo coagulopathy. This contradiction occurs because all coagulation tests are routinely performed at 37°C (99°F), and the enzymes are thus rewarmed.

Rewarming Strategies

The key initial decision is whether to rewarm the patient passively or actively. Passive external rewarming simply involves covering and insulating the patient in a warm environment. With the head also covered, the rate of rewarming is usually 0.5°–2°C (1.10°–4.4°F) per hour. This technique is ideal for previously healthy patients who develop acute, mild primary accidental hypothermia. The patient must have sufficient glycogen to support endogenous thermogenesis.

The application of heat directly to the extremities of patients with chronic severe hypothermia should be avoided because it can induce peripheral vasodilation and precipitate core temperature "after drop," a response characterized by a continual decline in the core temperature after removal of the patient from the cold. Truncal heat application reduces the risk of after drop.

Active rewarming is necessary under the following circumstances: core temperature <32°C (<90°F) (poikilothermia), cardiovascular instability, age extremes, CNS dysfunction, hormone insufficiency, and suspicion of secondary hypothermia. Active external rewarming is best accomplished with forced-air heating blankets. Other options include devices that circulate water through external heat exchange pads, radiant heat sources, and hot packs. Monitoring a patient with hypothermia in a heated tub is extremely difficult. Electric blankets should be avoided because vasoconstricted skin is easily burned.

There are numerous widely available options for active core rewarming. Airway rewarming with heated humidified oxygen (40°– 45°C [104°–113°F]) via mask or endotracheal tube is a convenient option. Although airway rewarming provides less heat than do some other forms of active core rewarming, it eliminates

respiratory heat loss and adds 1°–2°C (2.2°–4.4°F) to the overall rewarming rate. Crystalloids should be heated to 40°–42°C (104°–108°F), but the quantity of heat provided is significant only during massive volume resuscitation. The most efficient method for heating and delivering fluid or blood is with a counter current in-line heat exchanger. Heated irrigation of the gastrointestinal tract or bladder transfers minimal heat because of the limited available surface area. These methods should be reserved for patients in cardiac arrest and then used in combination with all available active rewarming techniques.

Closed thoracic lavage is far more efficient in severely hypothermic patients with cardiac arrest. The hemithorax's are irrigated through two inserted large-bore thoracostomy tubes. Thoracostomy tubes should not be placed in the left chest of a spontaneously perfusing patient for purposes of rewarming. Peritoneal lavage with the dialysate at 40°–45°C (104°–113°F) efficiently transfers heat when delivered through two catheters with outflow suction. Like peritoneal dialysis, standard haemodialysis is especially useful for patients with electrolyte abnormalities, rhabdomyolysis, or toxin ingestion. Another option involves the use of endovascular temperature control catheters.

Extracorporeal blood rewarming options should be considered in severely hypothermic patients, especially those with primary accidental hypothermia. Extracorporeal life support, including bypass, should be considered in non-perfusing patients without documented contraindications to resuscitation. Circulatory support may be the only effective option in patients with completely frozen extremities or those with significant tissue destruction coupled with rhabdomyolysis. There is no evidence that extremely rapid rewarming improves survival in perfusing patients.

Options for Extracorporeal Blood Rewarming

Extracorporeal Rewarming Technique	Considerations
Continuous venovenous (CVV) rewarming	• Circuit: CV catheter to CV, dual-lumen CV, or peripheral catheter • No oxygenator/circulatory support • Flow rates 150-400 mL/min • ROR 2°-3°C (4.4°-6.6°F)/h
Hemodialysis	• Circuit: single- or dual-vessel cannulation • Stabilizes electrolyte or toxicologic abnormalities • Exchange cycle volumes 200-500 mL/min • ROR 2°-3°C (4.4°-6.6°F)/h
Continuous arteriovenous rewarming (CAVR)	• Circuit: percutaneous 8.5-Fr femoral catheters • Requires systolic blood pressure of 60 mmHg • No perfusionist/pump/anticoagulation • Flow rates 225-375 mL/min • ROR 3°-4°C (6.6°-8.8°F)/h
Cardiopulmonary bypass (CPB)	• Circuit: full circulatory support with pump and oxygenator • Perfusate-temperature gradient 5°-10°C (11°-22°F) • Flow rates 2-7 L/min (average 3-4 L/min) • ROR up to 9.5°C (20.9°F)/h
Venoarterial extracorporeal membrane oxygenation (VA-ECMO)	• Decreased risk of post-rewarming cardiorespiratory failure • Improved neurologic outcome

Abbreviation: CV, central venous; ROR, rate of rewarming.

Treatment

Hypothermia

When a patient is hypothermic, target organs and the cardiovascular system respond minimally to most medications. Generally, medications are withheld below 30°C (86°F). In contrast to antiarrhythmics, low-dose vasopressor medications may improve the intra-arrest rates of return of spontaneous circulation. Because of increased binding of drugs to proteins as well as impaired metabolism and excretion, either a lower dose or a longer interval between doses should be used to avoid toxicity. As an example, the administration of repeated doses of digoxin or insulin would be ineffective while the patient is hypothermic, but the residual drugs would be potentially toxic during rewarming.

Achieving a mean arterial pressure of at least 60 mmHg should be an early objective. If the hypotension is disproportionate for temperature and does not respond to crystalloid/colloid infusion and rewarming, low-dose dopamine support (2–5 µg/kg per min) should be considered. Perfusion of the vasoconstricted cardiovascular system also may improve with low-dose IV nitro-glycerine.

Atrial arrhythmias should be monitored initially without intervention, as the ventricular response should be slow and, unless pre-existent, most will convert spontaneously during rewarming. The role of prophylaxis and treatment of ventricular arrhythmias is complex. Pre-existing ventricular ectopy may be suppressed by hypothermia and reappear during rewarming. None of the class I agents is proven to be safe and efficacious.

Initiating empirical therapy for adrenal insufficiency usually is not warranted unless the history suggests steroid dependence or hypoadrenalism or efforts to rewarm with standard therapy fail. The administration of parenteral levothyroxine to euthyroid patients with hypothermia, however, is potentially hazardous. Because laboratory results can be delayed and confounded by the presence of the sick euthyroid syndrome historic clues or physical findings suggestive of hypothyroidism should be sought. When myxoedema is the cause of hypothermia, the relaxation phase of the Achilles reflex is prolonged more than is the contraction phase.

Hypothermia obscures most of the symptoms and signs of infection, notably fever and leucocytosis. Shaking rigors from infection may be mistaken for shivering. Except in mild cases, extensive cultures and repeated physical examinations are essential. Unless an infectious source is identified, empirical antibiotic prophylaxis is most warranted in the elderly, neonates, and immunocompromised patients.

Frostbite

Peripheral cold injuries include both freezing and non-freezing injuries to tissue. Tissue freezes quickly when in contact with thermal conductors such as metal and volatile solutions. Other predisposing factors include constrictive clothing or boots, immobility, and vasoconstrictive medications. Frostbite occurs when the tissue temperature drops below 0°C (32°F). Ice-crystal formation subsequently distorts and destroys the cellular architecture. Once the vascular endothelium is damaged, stasis progresses rapidly to microvascular thrombosis. After the tissue thaws, there is progressive dermal ischemia. The microvasculature begins to collapse, arteriovenous shunting increases tissue pressures, and oedema forms. Finally, thrombosis, ischemia, and superficial necrosis appear. The development of mummification and demarcation may take weeks to months.

Clinical Presentation

The initial presentation of frostbite can be deceptively benign. The symptoms always include a sensory deficiency affecting light touch, pain, or temperature perception. The acral areas and distal extremities are the most common insensate areas. Some patients describe a clumsy or "chunk of wood" sensation in the extremity.

Deep frostbitten tissue can appear waxy, mottled, yellow, or violaceous-white. Favourable presenting signs include some warmth or sensation with normal colour. The injury is often superficial if the subcutaneous tissue is pliable or if the dermis can be rolled over bony prominences.

Clinically, frostbite is superficial or deep. Superficial frostbite does not entail tissue loss but rather causes only anaesthesia and erythema. The appearance of vesiculation surrounded by oedema and erythema implies deeper involvement. Haemorrhagic vesicles reflect a serious injury to the microvasculature and indicate severe frostbite. Damages in subcuticular, muscular, or osseous tissues may result in amputation. An alternative classification establishes grades based on the location of presenting cyanosis; that is grade 1, absence of cyanosis; grade 2, cyanosis on the distal phalanx; grade 3, cyanosis up to the metacarpophalangeal (MP) joint; and grade 4 cyanosis proximal to the MP joint.

The two most common non-freezing peripheral cold injuries are chilblain (pernio) and immersion (trench) foot. Chilblain results from neuronal and endothelial damage induced by repetitive exposure to damp cold above the freezing point. Young females, particularly those with a history of Raynaud's phenomenon, are at greatest risk. Persistent vasospasticity and vasculitis can cause erythema, mild oedema, and pruritus. Eventually plaques, blue nodules, and ulcerations develop. These lesions typically involve the dorsa of the hands and feet. In contrast, immersion foot results from repetitive exposure to wet cold above the freezing point. The feet initially appear cyanotic, cold, and oedematous. The subsequent development of bullae is often indistinguishable from frostbite. This vesiculation rapidly progresses to ulceration and liquefaction gangrene. Patients with milder cases report hyperhidrosis, cold sensitivity, and painful ambulation for many years.

Treatment

Peripheral Cold Injuries

When frostbite accompanies hypothermia, hydration may improve vascular stasis. Frozen tissue should be thawed rapidly and completely by immersion in circulating water at 37°–40°C (99°– 104°F) for 30–60 min and not by using hot air. Rapid rewarming often produces an initial hyperaemia. The early formation of large clear distal blebs is more favourable than that of smaller proximal dark haemorrhagic blebs. A common error is the premature termination of thawing, since the reestablishment of perfusion is intensely painful. Parenteral narcotics will be necessary with deep frostbite. If cyanosis persists after rewarming, the tissue compartment pressures should be monitored carefully. Many antithrombotic and vasodilatory treatment regimens have been evaluated. The prostacyclin analogue iloprost given within 48 h after rewarming is an option. There is no conclusive evidence that sympathectomy, steroids, calcium channel blockers, or hyperbaric oxygen salvages tissue. Patients who have deep frostbite injuries with the potential for significant morbidity should be considered for intravenous or intraarterial thrombolytic therapy. Angiography or pyrophosphate scanning may help evaluate the injury and monitor the progress of tissue plasminogen activator therapy (rt-PA). Heparin is recommended as adjunctive therapy. Intraarterial thrombolysis may reduce the need

for digital and more proximal amputations when administered within 24 h of severe injuries. A treatment protocol for frostbite is summarized.

Treatment for Frostbite

Before Thawing	During Thawing	After Thawing
Remove from environment	Consider parenteral analgesia and ketorolac.	Gently dry and protect part: Elevate; place pledgets between toes, if macerated
Prevent partial thawing and refreezing	Administer ibuprofen (400 mg PO)	If clear vesicles are intact, aspirate sterilely; if broken, debride and dress with antibiotic or sterile aloe vera ointment
Stabilize core temperature and treat hypothermia	Immerse part in 37-40°C (99°–104°F) (thermometer-monitored circulating water containing an antiseptic soap until distal flush (10–45 min)	Leave hemorrhagic vesicles intact to prevent desiccation and infection
Protect frozen part–no friction or massage	Encourage patient to gently move part	Continue ibuprofen (400-600 mg PO [12 mg/kg per day] q8 to 12h)
Address medical or surgical conditions	If pain is refractory, reduce water temperature to 35°–37°C (95o–99°F) and administer parenteral narcotics	Consider tetanus and streptococcal prophylaxis; elevate part. Administer hydrotherapy at 37°C (99°F) Consider dextran or phenoxybenzamine or, in severe cases, thrombolysis rt-PA (IV or intra arterial).

Abbreviation: rt-PA, recombinant tissue plasminogen activatio.

Unless infection develops, any decision regarding debridement or amputation should generally be deferred. Angiography or technetium-99 bone scan may assist in the determination of surgical margins. Magnetic resonance angiography may also demonstrate the line of demarcation earlier than does clinical demarcation. The most common symptomatic sequelae reflect neuronal injury and persistently abnormal sympathetic tone, including paraesthesia, thermal misperception, and hyperhidrosis. Delayed findings include nail deformities, cutaneous carcinomas, and epiphyseal damage in children. Management of the chilblain syndrome is usually supportive. With refractory perniosis, alternatives include nifedipine, steroids, and limaprost, a prostaglandin E1 analogue.

CHAPTER 5

Vision, Goal and Objectives

Vision: Strengthening of healthcare services for all the citizens of the state especially vulnerable groups like children, women, elderly, tribal, and marginalized populations against climate-sensitive illnesses.

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

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

Specific Objectives

Objective 1: To create awareness amongst the general population (vulnerable community), healthcare providers, and policy makers regarding the impacts of climate change on human health.

Objective 2: To strengthen the capacity of the healthcare system to reduce illnesses/diseases due to variability in climate.

Objective 3: To strengthen health preparedness and response by performing situational analysis at state/district/below district levels.

Objective 4: To develop partnerships and create synchrony/synergy with other missions and ensure that health is adequately represented in the climate change agenda in the state in coordination with the Ministry of Health & Family Welfare.

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

CHAPTER 6
Organisational Structure

ORGANISATIONAL STRUCTURE

NATIONAL LEVEL

Key Nodal Agency
Head, NPCCHH
(NCDC, MoHFW)

- Prime Minister's Council on Climate Change
- Health Mission
- Ministry of Health and Family Welfare (MoHFW), Govt of India

STATE LEVEL

Key Nodal Point
(SNO-NPCCHH)

- State Governing Body - Environmental Health
- State Level Task Force - Environmental Health
- State Environmental Health Cell

DISTRICT LEVEL

Key Nodal Point
(DNO-NPCCHH)

- District Task Force - Environmental Health
- District Environmental Health Cell

A. State/UT Level - Governing Body

The UT level governing body for policy-level decision shall be working under the Chairpersonship of Administrative Secretary (H&ME). The other members may be as follows: Vide Govt Order No. 18 (H&ME) UTL of 2023 dated: 22-08-2023.

Hon'ble Lieutenant Governor, UT Ladakh	Chairperson
Advisor to Hon'ble Lieutenant Governor, UT Ladakh	Vice Chairperson
Administrative Secretary, Health & Medical Education, UT Ladakh	Member
Administrative Secretary, Department of Forest, Ecology & Environment, UT Ladakh	Member
Administrative Secretary, Department of Revenue, UT Ladakh	Member
Administrative Secretary, Housing & Urban Development Department, UT Ladakh	Member
Administrative Secretary, Department of Social & Tribal Welfare, UT Ladakh	Member
Administrative Secretary. Power Development & Non-Renewable Energy Department, UT Ladakh	Member
Administrative Secretary, Department of Animal & Sheep Husbandry, UT Ladakh	Member
Administrative Secretary, Department of Transport, UT Ladakh	Member
Administrative Secretary, Department of Information & Technology, UT Ladakh	Member
Administrative Secretary, Department of Rural Development & Panchayati Raj, UT Ladakh	Member
Administrative Secretary, General Administrative Department, UT Ladakh	Member
Administrative Secretary, Department of Food Civil Supplies & Consumer Affairs, UT Ladakh	Member
Administrative Secretary, Department of Public Health Engineering, Irrigation & Flood Control, UT Ladakh	Member
Administrative Secretary, Public Work Department, UT Ladakh	Member
Administrative Secretary, Department of Agriculture, UT Ladakh	Member
Administrative Secretary, Department of Law, UT Ladakh	Member
Head NAPCCHH, CEOH & CCH Division, NCDC, New Delhi	Member
Director Health Services, UT Ladakh	Member
Mission Director, National Health Mission, UT Ladakh	Member Secretary
State Nodal Officer – Climate Change, UT Ladakh	Member

Terms of References

1. To take an Overview of work done by State/UT NPCCHH for the period since inception till date and therefore in subsequent meetings for the period since previous meeting.
2. To Take decision related to policy matters submitted for Governing Body by member secretary based on inputs received during previous State Task Force meeting & discussions with State Nodal Officer and his team in a State/UT.
3. Take an overview of work done by other sectors which may have a relationship on climate change mitigation & adaptation and identify matters of convergence for state health department.

B. State/UT Level Task Force

The State/UT Level Task Force has been constituted. This task force shall be working under the Chairpersonship of Principal Secretary, Health & Medical Education, UT Ladakh. It shall be directly overseeing the implementation of the State/UT Action Plan for Climate Change and Human Health (SAPCCHH). It shall be working through the Directorate of Health Services (DHS) of the state, which will be the implementing agency for SAPCCHH.

Vide Govt Order No. 10 of 2023 dated: 04-04-2023

Principal Secretary, Health & Medical Education, UT Ladakh	Chairperson
Mission Director, National Health Mission, UT Ladakh	Vice Chairperson
Director Health Services, UT Ladakh	Member Secretary
Chairperson, State Pollution Control Board, UT Ladakh	Member
Head -State Disaster Management Authority, UT Ladakh	Member
Head – NAPCCHH, CEOH & CCH Division, NCDC, MoHFW, New Delhi	Member
Director - Department of Agriculture, UT Ladakh	Member
Director - Department of Social & Tribal Welfare, UT Ladakh	Member
Director - Meteorological Department, UT Ladakh	Member
Director - Department of Animal & Sheep Husbandry, UT Ladakh	Member
Director - Department of Urban & Local Bodies, UT Ladakh	Member
Director – Department of School education. UT Ladakh	Member
Director – Department of Food, Civil Supplies & Consumer Affairs, UT Ladakh	Member
Director – Department of Finance, UT Ladakh	Member
Director/Chairperson – Department of Power Development & Non- Renewable Energy, UT Ladakh	Member
Director – Department of Rural Development & Panchayati Raj, UT Ladakh	Member
Regional Transport Officer – Department of Transport, UT Ladakh	Member
Under Secretary – Department of Disaster, UT Ladakh	Member
Under Secretary – Department of Revenue, UT Ladakh	Member
Chief Engineer –Public Work Department, UT Ladakh	Member
Chief Engineer – Department of Public Health Engineering, UT Ladakh	Member
Chief Conservator – Department of Forest, Ecology & Environment, UT Ladakh	Member
Environmental Engineer/Scientist from Ministry of Environment	Member
Assistant Legal Remembrance – Department of Law, UT Ladakh	Member
State Nodal Officer – Climate Change, UT Ladakh	Member
State Surveillance Officer, UT Ladakh	Member

Terms of References

1. The Task force of the State/UT's Environmental Health cell will coordinate with the Centre (MoHFW, NCDC) for execution of State/UT's SAPCCHH.

2. To oversee implementation of the UT Action Plan for Climate Change & Human Health (SAPCCHH)
3. To monitor the National Health Mission, UT Ladakh which will be the implementing agency for UT Action Plan for Climate Change & Human Health (SAPCCHH).
4. To supervise the UT's Environmental Health Cell which will coordinate for execution of UT Action Plan for Climate Change & Human Health (SAPCCHH).

C. Executive Member of State/UT Environmental Health Cell

State Nodal Officer- Climate Change, UT Ladakh	Chairperson
Director Health Services, UT Ladakh	Member
State Immunization Officer, UT Ladakh	Member
State Nodal Officer – NCD, UT Ladakh	Member
State Nodal Officer – Mental Health, UT Ladakh	Member
State Surveillance Officer – IDSP, UT Ladakh	Member
State Programme Officer – NHM, UT Ladakh	Member
State Epidemiologist – IDSP, UT Ladakh	Member
State Microbiologist – IDSP, UT Ladakh	Member
State IEC Consultant, NHM, UT Ladakh	Member
Representative from Department of Animal Husbandry, UT Ladakh	Member

Roles and Responsibilities of the State/UT Environmental Health Cell

- Preparation and implementation of State Action Plan for Climate Change and Human Health.
- Conduct Vulnerability assessment and risk mapping for commonly occurring climate-sensitive illnesses in the state/UT.
- Assessment of needs for health care professionals (like training, capacity building) and organise training, workshops, and meetings.
- Maintain State and District level data on physical, financial, and epidemiological profiles for climate-sensitive illnesses.
- Ensure convergence with NHM activities and other related programs in the state/district
- Monitor programme, review meetings, and field observations.
- Timely issue of warnings/alerts to health professionals and related stakeholders as well as the general public through a campaign or using mass media (electronic or printed),
- Social mobilization against preventive measures through the involvement of women's self-help groups, community leaders, NGOs, etc.
- Advocacy and public awareness through media (street plays, folk methods, wall paintings, hoardings, etc.)
- Conduction of operational research and evaluation studies for the climate change and its impact on human health.

PART II

Health Action Plans on Priority Climate Sensitive Health Issues

CHAPTER 7

Health Action Plan on Air Pollution Related Diseases

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

Two Major Types of Air Pollution

- Ambient (Outdoor) Air Pollution
- Household (Indoor) Air Pollution

Ambient (Outdoor) Air Pollution is a broader term used to describe air pollution in an outdoor environment.

Household (Indoor) Air Pollution is pollution from the in-efficient combustion of solid fuels (wood, charcoal, crop waste, cow dung) and kerosene oil.

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

Prominent causes of Ambient Air Pollution in UT Ladakh:

- Pollution by Automobiles
- Industrial Emission
- Solid fuel burning
- Smoke from bush fires

Prominent causes of Household Air Pollution in UT Ladakh:

- Use of biomass, kerosene as fuel for cooking & Heating.
- Burning of waste, cow dung, coal
- High temperature & humidity
- Inadequate ventilation, toxic products & use of dhoop/agarbatties.

Air Quality Index

Air Quality Index is a tool for effective communication of air quality status to people in terms, which are easy to understand. It transforms complex air quality data of various pollutants into a single number (index value), nomenclature, and colour.

Air Quality Index (AQI) Category	
Good	0-50
Satisfactory	51-100
Moderately Poor	101-200
Poor	201-300
Very Poor	301- 400
Severe	401-500

AQI Monitoring Stations within State

1. Central Pollution Control Board (CPCB) – No real-time ambient air Quality Monitoring station (CAA QMS) has been established in Leh & Kargil city.

Sl. No.	District	Acute Respiratory Infection/Influenza Like Illness		
		2021	2022	2023
1	Leh	3933	4341	4462
2	Kargil	38053	47468	66624

Health Adaptation Plan

Awareness Generation

Advertisement and promotion through IEC

i. Street plays in low-income communities

ii. Hoards, billboards, and other modes of advertisement

iii. Carry out mass media campaigns

iv. Promote a culture of risk prevention, mitigation, and better risk management

v. Promote attitude and behaviour change in the awareness campaigns linking air pollution and climate change.

vi Engage local and regional media (community radio, TV).

Public Health Advisories

Health advisories are issued to alert the population of the potentially harmful impact of air pollution. Advisories are issued at the central level and will be forwarded to all the districts through the state for public dissemination. The district is to ensure timely dissemination of health advisories and if required, translate in locally acceptable language.

IEC Dissemination Plan for 5 Years 2022-27

Sl. No.	IEC Content	Priority Districts	Dissemination Plan for 5 Years	Timeline	Budget (In Lakhs) for 5 Years				
					2022-23	2023-24	2024-25	2025-26	2026-27
1.	Posters	Entire State/UT	2 Posters for healthcare facilities in all districts	July-September	10.5	11.55	0.00	0.00	0.00
2.	Audio		Social Media (Facebook, Instagram, Twitter etc.)	August-October					
3.	Videos								
4.	GIF's								
5.	Public Health Advisories		1 in all the Healthcare facilities	September-October					

Capacity Building

i. Formulate and implement national training and capacity-building programmes.

ii. Ensure the availability of qualified and experienced trainers.

Training Plan at the District Level

Training Programme	Trainer	Participants	Training Content
Medical Officers (3 days)	DNO	MO (DH, CHC, PHC)	• Air pollution- health impact, prevention measures • Surveillance case identification, reporting, and analysis with AQI • Health facility preparedness
Community Health Care Workers (HWC) (2 days)	MO	Community Health Workers (MPHW, ASHA)	
Panchayati Raj Institutions (1 day)	MO, MLHP	Panchayati Raj Institutions, communities	

Schedule Plan for Training for 5 Years 2022-27

Sl. No.	Training programme	Timeline	Target	Priority Districts	Budget (in lakhs) for 5 years 15 % increase each year				
					2022-23	2023-24	2024-25	2025-26	2026-27
1	DNO	August	100%	Entire UT Ladakh	18.0	19.80	0.0	0.00	0.0
2	MO	September-October	100%						
3	Community Health Workers	October-November	100%						
4	Panchayati Raj Institutions	November	100%						

*There is no separate Training budget for heat-related illness. A cumulative budget for capacity building and training has been proposed for all climate-sensitive issues.

Sensitization/knowledge building workshops will be planned for seeking updates on various air pollution-related health issues between district officials, medical officers, and academic institutions working on climate change impact.

Surveillance

The objective of ARI surveillance is to identify the trend of air pollution-related illness in the context of outdoor air quality for an area and share the reported findings with all the relevant authorities including public health authorities to minimise the impact of air pollution by undertaking the timely intervention.

Activities undertaken and further proposed related to data collection and analysis, strengthening of surveillance related to air pollution.

ARI Surveillance from two identified Sentinel Hospitals.

- Govt. Hospital Leh,
- Govt. Hospital, Kargil

Roles and Responsibilities

State Climate Change & Human Health Cell

1. To coordinate with the state level task force meetings to develop a HAP on air pollution and health as part of the State Action Plan on Climate Change and Human Health (SAPCCHH)
2. To undertake situational analysis of health impacts in the context of air pollution in the State
3. Identification and capacity building of human resources like DNO-CC, Nodal officer-ARI surveillance and others
4. IEC development, translation, and dissemination planning
5. Development and dissemination of health advisories
5. Surveillance establishment in the context of air pollution
6. Hospital preparedness related to air pollution diseases
7. Timely issue of warnings to hotspot areas, health professionals, and vulnerable and general population
8. Overall periodic reviews, supervision, Monitoring and evaluation of the identified activities being carried out at all levels – State, Districts, Blocks, and Villages/wards

District Climate Change & Human Health Cell

1. To coordinate with the district level task force meetings to develop a HAP on air pollution and health as part of the District Action Plan on Climate Change and Human Health (SAPCCHH)
2. To undertake situational analysis of health impacts in the context of air pollution in the district
3. Identification and capacity building of human resources like Nodal officer-ARI surveillance, Medical Officers, Communities health officers, health care workers, and other departments like PRI, WCD etc.
4. IEC development, translation, and dissemination planning
5. Development and dissemination of health advisories
6. Surveillance and reporting in the context of air pollution to the state level
7. Hospital preparedness related to air pollution diseases
8. Timely issue of warnings to hotspot areas, health professionals and vulnerable and general population
9. Overall periodic reviews, supervision, Monitoring and evaluation of the identified activities being carried out at all level, districts, blocks, and villages/wards.

Block level CHC/PHC

1. Implementation of the identified activities on air pollution and health as per DAPCCHH
2. Capacity Building of Medical officers, Nursing officers, Pharmacists, Communities health officers, health care workers and other departments like PRI, WCD, etc.
3. IEC Dissemination for increasing awareness generation to public and officials
4. Health advisories dissemination and implementation
5. Hospital preparedness for public health emergencies related to air pollution
6. Supervision and monitoring of Surveillance activities if any sentinel hospitals are involved in the block area

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

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

1. Creating awareness at the healthcare facilities and at the community level
2. Capacity building, developing village level health adaptation plan related to air pollution
3. Management of outdoor cases of health problems, emergency services, and their referrals for cases in the context of air pollution

Community Health workers at the Village Level/Ward Level

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

ARI Surveillance Activity at State Level

City-wise list of Sentinel hospitals selected for ARI surveillance activity

Name of Hospital	Public or Private	Type of Hospital (Medical College, District Hosp, Rural Hosp, Pediatric Hosp, Respiratory Disease Hospital)	Name of Nodal (reporting) Officer of hospital	Contact Details of Nodal Officer of hospital (Mobile No.)	Email ID
Govt. Hospital Leh	Public	District	Yet to be decided		snmhospital2013@gmail.com
Govt. Hospital Kargil	Public	District	Yet to be decided		msdhk2014@gmail.com

CHAPTER 8
Health Action Plan on Heat Related Illnesses

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

Based on Departure from Normal

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

Based on Actual Maximum Temperature (for plains only)

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

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

National Disaster Management Authority (NDMA) prepared Guidelines for Preparation of Action Plan-prevention and management of Heat wave-2017, wherein the roles and responsibilities of various agencies were identified. Emergency Medical Relief (EMR), Ministry of Health and Family Welfare prepared detailed guidelines on the prevention and management of heat-related illnesses in 2015 wherein patho- physiology, risk factors, clinical manifestations, management, prevention and public health action plan for managing heat-related illnesses have been detailed.

Roles and responsibilities of health department, medical colleges & hospitals, health centres and link workers

Department	Season	Roles and responsibilities
Health Department	During **Pre-Heat** Season (Annually from March through April)	• Create a list of high-risk areas (heat-wise) of districts/blocks/cities • Update surveillance protocol and programs, including tracking daily heat-related data • Develop/revise and translate IEC in the local language • Make a communication plan for the dissemination of heat-related alerts or educational materials • Check inventories of medical supplies in health centers • Identify cooling centers and barriers to accessing cooling centers • Capacity building of healthcare personnel to detect and treat heat- related illnesses

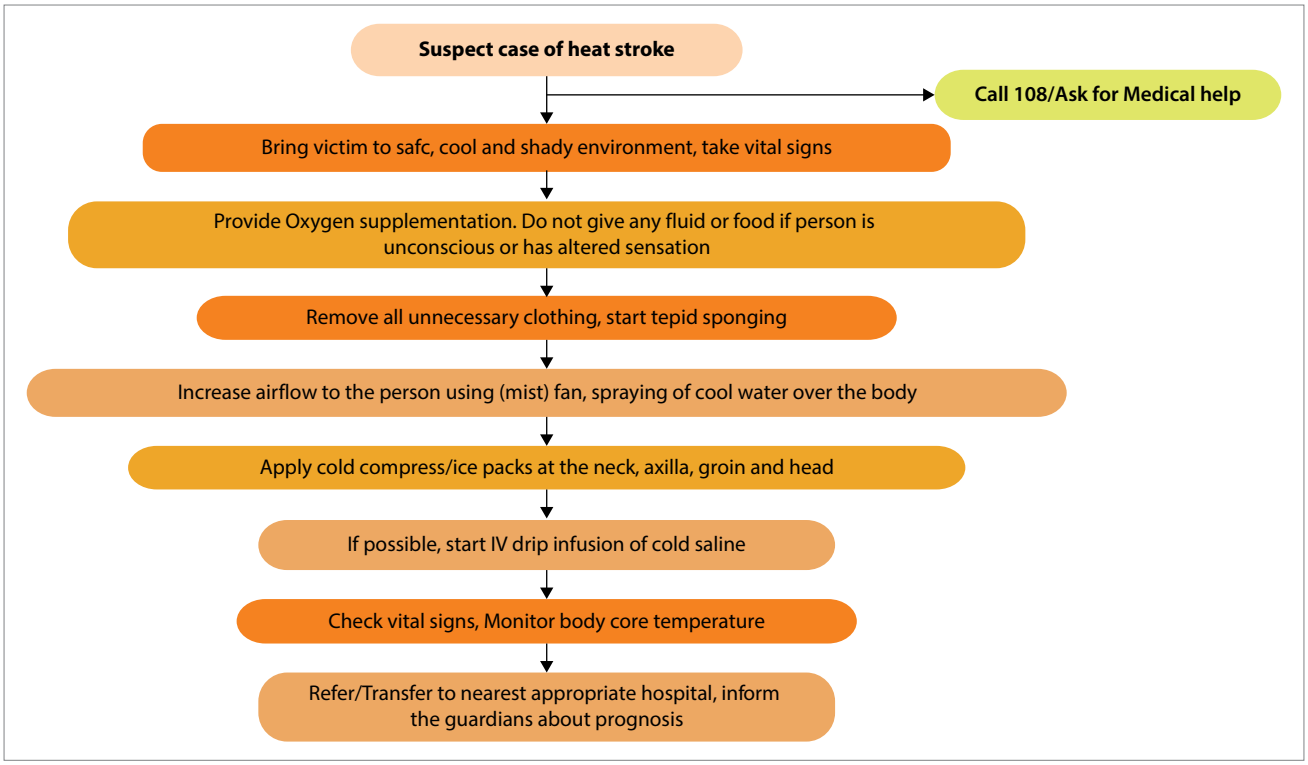
Department	Season	Roles and responsibilities
		• Community involvement for workers' and trainers' education • Issue health advisory to healthcare personnel based on IMD seasonal prediction or warning • Reassess 'Occupational Health Standards' for various types of Occupation. • Ensure Inter-sectoral convergence and coordination for improving the architecture, design, energy-efficient cooling, and heating facility, and increase in plantation i.e. Climate Resilient Green Building Design.
	During **Heat** Season (Annually from May through July)	• Ensure real-time surveillance and monitoring system in case of an extreme event. • Prepare rapid response team • Distribute "Dos and Don'ts" to the community • Effectively send a "Don't Panic!" message to the community • Ensure access to Medical Mobile Van in the Red Zone • Ensure additional medical vans are available • Ensure strict implementation of legislative/regulatory actions as per Occupational Health Standards. • Coordination with the meteorological department for analyzing cases and death data with meteorological variables like maximum temperature and relative humidity
	During **Post-Heat** Season (Annually from August through September)	• Participate in the annual evaluation of heat action plan • Review the revised heat action plan
Medical College and Hospitals	During **Pre-Heat** Season (Annually from March through April)	• Adopt heat-focused examination materials • Get additional hospitals and ambulances ready • Update surveillance protocols and programs, including tracking daily heat-related data • Establish more clinician education • Continue to train medical officers and paramedics
	During **Heat** Season (Annually from May through July)	• Adopt heat-illness-related treatment and prevention protocols • Equip hospitals with additional materials • Deploy all medical staff on duty • Keep the emergency ward ready • Keep stock of small reusable ice packs to apply to PULSE areas • Report heat stroke patients to DSU daily • Expedite recording of cause of death due to heat-related illnesses
For health centres and link workers	During **Pre-Heat** Season (Annually from March through April)	• Distribute pamphlets and other materials to the community • Sensitize link workers and community leaders • Develop and execute a school health program • Dissemination of materials in slum communities • Coordinate outreach efforts with other community groups, non- profits, and higher education
	During **Heat** Season (Annually from May through July)	• Recheck management stock • Modify worker hours to avoid the heat during the day • Visit at-risk populations for monitoring and prevention • Communicate information on tertiary care and 108 service

Department	Season	Roles and responsibilities
	During **Post-Heat** Season (Annually from August through September)	• Participate in the annual evaluation of heat action plan • Review the revised heat action plan

Activities further proposed in UT Ladakh to generate awareness, access weather data, and capacity building related to heat-related illness

Sl. No.	Key Activities			Details
1	Increasing public awareness on heat vulnerability	Assess and prioritize heat-vulnerable communities		
		Disseminated information on the health effects of heat	Distribute informational pamphlets	IEC campaigns including advisory of heat wave have been published in Newspapers & Aired in Electronic Media
			Launch a "heat line" call center	
			Develop heat health early action response strategies	
			Involve link workers in heat health campaigns	
		Disseminate public service announcements and health warnings		Issued by Directorate of Health services Jammu & District Headquarters.
		Form partnerships and heat health preparedness networks		
2	Improving access to Weather data and heat warnings	Increase communication channels between the Met Center, Municipal corporation and the health department.		Working on it
		Work with MC and state government to install displays for temperature and weather forecasts.		
		Revise the current heat wave advisory thresholds		State Pollution Control Board is sensitizing about it
3.	Building capacity in the health care infrastructure	Conduct heat vulnerability reduction trainings to Increase awareness and diagnosis of heat illnesses	Provide a train-the- trainers session for primary medical officers	Trainings to District Nodal Officers-CC as ToT's was completed & subsequent training to Primary Medical Officers have also been completed at District Headquarters.
			Create a training program or multiday workshop for health care providers, ward leaders, and paramedics	
			Conduct training programs for link workers	
			Increase heat stress outreach and education for women in maternity wards	
		Create and implement heat health guidelines		
		Adopt heat-focused examination procedures at local hospitals and Urban Health Centers.		

Management workflow of Suspected Heat Stroke victims at PHC level before Referral to Higher Centre



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

Primary triage - confirm heat stroke

Reassess airway, breathing and circulation, IV access, emergency investigations

Provide definitive airway protection if necessary

Institute active cooling measures:

1. Remove all clothing while protecting patient's dignity
2. Cover with thin wet cloth sheet/ spray cool water
3. Ice pack over head, neck, groin and axillary regions
4. Use mist fan / evaporative method
5. Tepid sponging / cool blankets if available
6. Make the child lie down; raise the feet slightly
7. Avoid Paracetamol or NSAIDS
8. Consider gastric lavage with cold saline

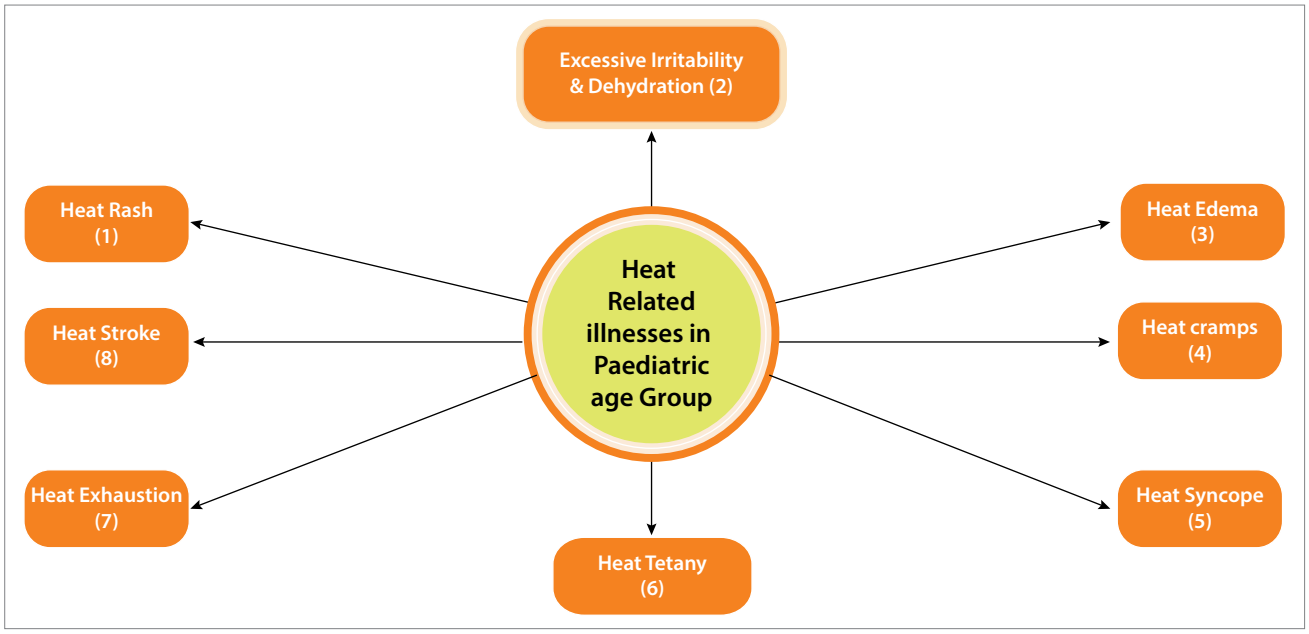
Administer Intravenous fluids judiciously (be cautious with patient's premorbid status)
Look out for pulmonary edema

Close monitoring of the following:

1. Temperature every 15-30 minutes (do not overcorrect to less than 38°C)
2. Vital signs (BP/HR///SpO_2), watch for altered cardiac rhythms (ECG), altered mental status (GCS)
3. Look out for complications of treatment :
   a. Acute pulmonary edema
   b. Hypothermia
4. Seizure (treat with benzodiazepines)
5. Prevent shivering (by paralyzing patient if intubated)
6. Look for signs of coagulopathy
7. Arterial Blood Gas (ABG) analysis regularly - look for metabolic acidosis
8. CT brain- to look for complications or rule out intracranial pathology
9. Co-management and referral to intensive care unit
10. Inform/communicate with next of kin regarding patient condition & prognosis

Heat related illnesses in Paediatric age group

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



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

1. Heat Rash/Milia Rubra/Prickly Heat

- Treatment:
  i. Place in cool environment
  ii. Remove excess clothing
  iii. Avoid application of lotions
- Prevention
  i. Use loose fitting clothing & remove excess cloth
  ii. Avoid direct sunlight
  iii. Avoid excessive heat
  iv. Frequent breast feeding/fluids

2. Excessive irritability & dehydration

- Treatment
  i. Place in cool environment
  ii. Remove excess clothing
  iii. Frequent breast feeding/fluids

3. Heat Oedema (more common in adults): swelling of feet/ankle/hands

- Treatment
  i. Remove from hot environment & place in cool environment
  ii. Elevate the affected extremity

4. Heat Cramps: common in young athletes

- Painful, involuntary, spontaneous contraction of muscle group of legs/calf/groin
- Treatment
  i. Remove from hot environment
  ii. Rehydration (frequent oral fluids), if persist then intravenous fluid may help

5. Heat Syncope

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

6. Heat Tetany

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

7. Heat Exhaustion

- After prolonged heat exposure, the body temperature rises up to 104 0 F and leads to dehydration, tachycardia, vomiting, fatigue and headache with normal mental status (sometimes mild confusion may present).
- It requires admission and specialist care
- Treatment
  i. Remove child from hot environment
  ii. Oral rehydration with salt containing fluid
  iii. Look for dyselectrolytemia
  iv. Intensive care monitoring and intravenous rehydration
  v. Rule out sepsis

8. Heat Stroke

- Prolonged exposure to heat leads to core body temperature rising to ≥40^{o}F
- Patient presents with stupor/coma/drowsiness/confusion/delirium/hallucination/seizures/ataxia
- Anhidrosis
- Coagulopathy
- Multi-organ dysfunction
- Treatment
  i. Admission
  ii. Check airway, breathing, circulation

iii. Give oxygen, intravenous fluid connection

iv. Do random blood sugar (RBS), arterial blood gas (ABG), electrolytes (Na/K/Ca), liver function test (LFT), renal function test (RFT), coagulation profile, neuroimaging to rule out CNS bleed, etc.

- Danger signs

i. Refusal to feed

ii. Excessive irritability

iii. Decreased urine output

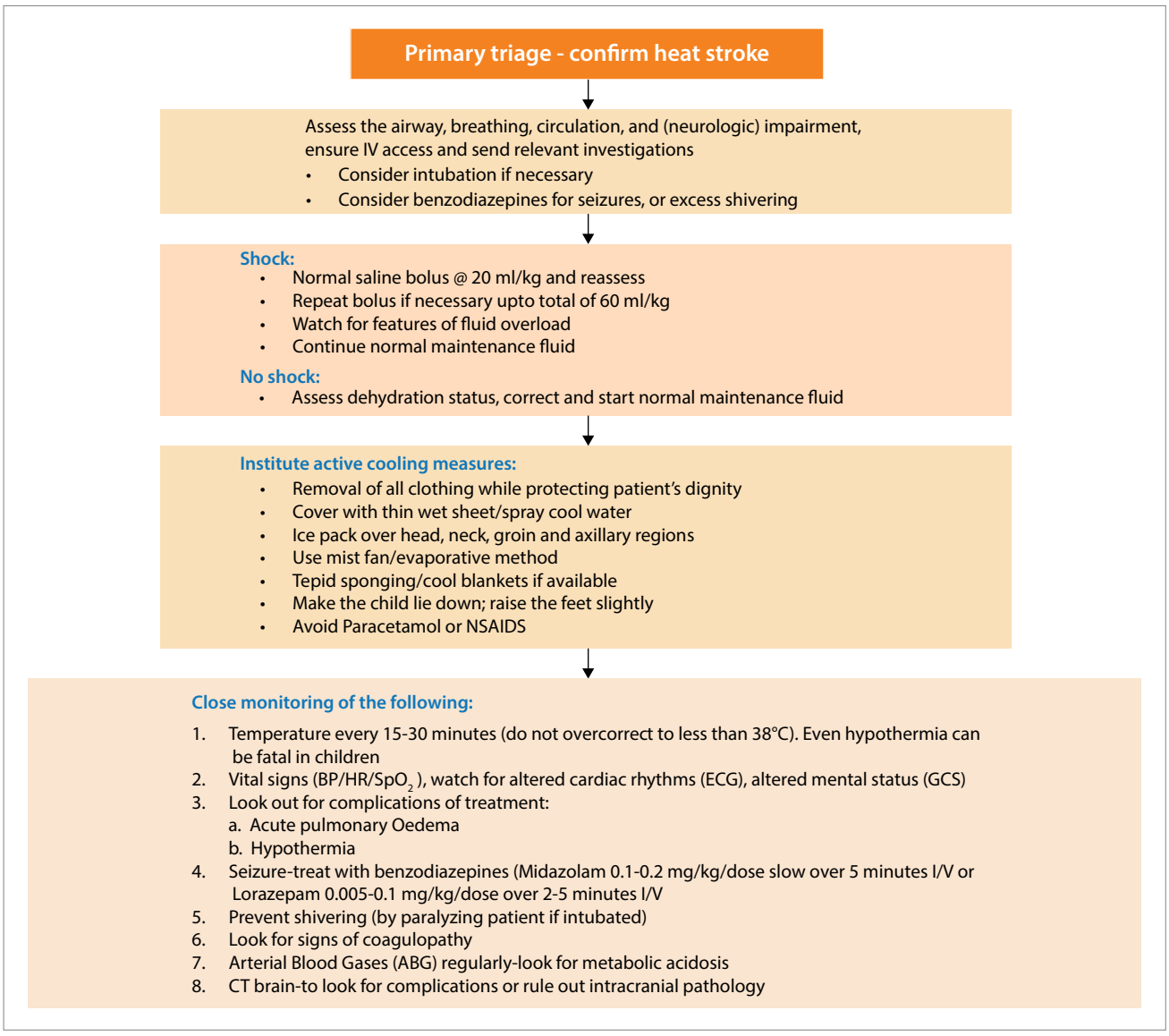
iv. Dry oral mucosa & absence of tear/sunken eyes

v. Lethargy/altered sensorium

vi. Seizures

vii. Bleeding from any site seek immediate medical help if danger signs are present

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



First Aid Instructions on Heat Exhaustion and Heat Stroke in Children

Symptoms of Heat Exhaustion	Symptoms of Heatstroke
• Increased thirst • Weakness and extreme tiredness • Fainting • Muscle cramps • Nausea and vomiting • Irritability • Headache • Increased sweating • Cool, clammy skin Body temperature rises, but less 105°F(40.5°C)	• Severe headache • Weakness, dizziness • Acts or talks confused • Fast breathing and rapid heartbeat • Hard to wake up or can't wakeup • Seizures • Flushed, hot, dry skin Body temperature rises to 105°F (40.5°C) or higher
Prevention • Lookout for weather warnings issued by India Meteorological Department • Teach kids to always drink plenty of liquids before and during any physical activity in hot, sunny weather even if they aren't thirsty • Make sure kids wear light-coloured, loose clothing in warm weather • Remind kids to look for shaded areas and rest often, while outside • Avoid activities during peak summer hour i.e., 12:00 noon to 03:00pm • Don't let kids participate in heavy activity outdoors during the hottest hours of the day • Teach kids to come indoors immediately whenever they feel over heated • Never leave a child alone, non- accompanied, inside a parked closed vehicle (look before you lock)	

If the child has symptoms of heatstroke Call for Ambulance 102/108 and take to the nearest hospital.

Health Adaptation Plan on Heat Related Illness

I. Awareness Generation

Under the programme, awareness generation amongst all the relevant stakeholders including the common population, vulnerable communities, healthcare providers, and policymakers around the impacts of heat-related illnesses along with the ways to address the same is imperative. Thereby, under the programme, UT Ladakh will conduct the following key activities:

a. Advertisement and promotion through IEC:
   i. Street plays
   ii. Hoardings, billboards, and other advertisement modes
   iii. Issue periodic Heat Wave advisory.

IEC dissemination plan

Sl. No.	IEC Content	Priority Districts	Dissemination Plan	Timeline	Budget (in lakhs) for 5 years with maximum 15% increasing each year*				
					2022-23	2023-24	2024-25	2025-26	2026-27
1	Posters	Entire J & K	1 Poster for each healthcare facility in all the districts	March- May	10.50	11.55	0.00	0.00	0.00
2	Audio		Social Media (Facebook, Instagram etc.)	March-May					
3	Videos								
4	GIF's								
5	Public Health Advisories		Health advisories to all the healthcare facilities	March-May					

II. Capacity Building

To strengthen the capacity of the healthcare system to adapt/address illnesses/diseases due to the impacts of heat, state and district-level meetings will be planned with the Task Force on Heat Action Plan before the summer season to ensure awareness and preparedness for responding to the heat wave scenario.

Training

- Formulate and implement national training and capacity-building programmes.
- Ensure the availability of qualified and experienced trainers
- Expanded training of doctors and associate staff
- Increased training of NGOs and Asha workers

Training Calendar for various health impacts of heat is as follows:

A. NPCCHH training plan at district level

Training Programme	Trainer	Participants	Training Content
Medical Officers (3 Days)	DNO	MO (DH, CHC, PHC)	Heat-related illness
Community Health Care Workers (HWC) (2 Days)	MO	Community Health Workers (MPHW, ASHA)	
Panchayati Raj Institutions (1 Day)	MO, MLHP	Panchayati Raj Institutions, communities	

B. Schedule plan for training for 5 years 2022-27

Sl. No.	Training programme	Timeline	Target	Priority Districts	Budget (in lakhs) for 5 years 15 % increasing each year				
					22 to 23	23 to 24	24 to 25	25 to 26	26 to 27
1	DNO	March	100%	Entire UT Ladakh	18.0	19.80	0.0	0.00	0.0
2	MO	March	100%						
3	Community Health Workers	April-May	100%						
4	Panchayati Raj Institutions	April-May	100%						

*There is no separate Training budget for heat-related illness. A cumulative budget for capacity building and training has been proposed for all climate-sensitive issues.

Roles and Responsibilities

The roles and responsibilities of the state staff to implement the action plan for heat-related illnesses is defined below:

Particular	Responsibilities
SNO	• Disseminate early warnings to the district level • Finalization of IEC material and dissemination plan • Liaison with IMD for weather alerts and its dissemination • Liaison with other departments for combined IEC campaigns, coordinated response and information sharing of health indicators for targeted action • Organize the IEC campaigns at the state level on the observance of important environment-health days • Organize training sessions for the district level and the surveillance nodal officers • Facilitate training of medical officers in clinical aspects of the heat-health impact • Ensure daily surveillance reporting from the district level • Ensure submission and analysis of heat-related death at the state and district level • Monitor daily health data with temperature and humidity levels to monitor trends and hotspots in the state • Review health facility preparedness and ambulance services to manage HRI • Identify health facilities at different levels that can have heat illness wards with necessary treatment/cooling facilities • Keep existing Rapid Response Teams under IDSP prepared to manage HRI if needed for an emergency response to extreme heat • Review implementation of the IEC and surveillance activities at all levels • Evaluate and update relevant sections of SAPCCHH with support from State Task Force • Create organizational support and strengthen the Environmental Health cell to implement NPCCHH's vision, goals, and objectives • Organize sensitization workshops for other stakeholders and line departments • Organize seminars and conferences to share knowledge and action under NPCCHH. • Collaborate with academic institute/s for support in updating SAPCCHH, Surveillance activity monitoring, training of health care professionals, vulnerability assessment, and applied research • Submit a report of activities on heat health under NPCCHH • Advocate for the reduction in source of greenhouse gas emissions
DNO	• Disseminate early warning to block and health facility level • Ensure IEC dissemination to the community level and facilitate community-level IEC activities • Liaison with IMD to receive daily observed temperature and relative humidity information • Liaison with other departments for combined IEC campaigns, coordinated response and information sharing of health indicators for targeted action • Conduct training for block health officers, and medical officers, with relevant training manuals • Conduct sensitization of vulnerable groups: police officers, outdoor workers, women, children etc. • Organize IEC campaigns at the district level on the observance of important environment-health days • Ensure daily reporting from health facilities and compile the data • Analyse daily health data with temperature and humidity levels to monitor trends and hotspots in the district

Particular	Responsibilities
	• Support timely suspected heatstroke death analysis and its reporting • Submit analysed weekly report to SNO, NPCCHH, Hq, and other departments for necessary action • Coordinate with other agencies for response • Update DAPCCHH with support from District Task Force • Submit a report of activities on heat health under NPCCHH • Advocate for the reduction in source of greenhouse gas emissions
Block Health Officer	• Conduct community-level IEC activities • Ensure training of medical officers • Organize PRI sensitization workshops and training for vulnerable groups • Implement heat mitigation efforts
City Health Department	• Support in the development and implementation of the city-specific heat- health action plan
Medical Officer	• Conduct health facility-based IEC activities • Support community-level IEC activities • Ensure necessary health facility preparedness in early diagnosis and management of cases
Panchayati Raj Institutions	• Conduct community-level IEC activities

CHAPTER 9

Health Action Plan on Extreme Weather Event-Related Health Issues

Adverse impacts of climate change increase disaster risk. The rising emissions and climate variability are projected to result in more frequent and intensive disasters with the most severe consequences on the infrastructure, food security, and livelihoods of natural resource-dependent vulnerable communities. Since both disaster risk (including climate-associated disaster risk) and climate-related vulnerabilities are likely to undermine economic sustain ability and development, it is therefore planned that disaster risk management strategies and climate change adaptation planning be integrated with the state's development strategy. UT Ladakh is a multi-hazard-prone region exposed to disasters like earthquakes, floods, landslides, avalanches, high-velocity winds, and snow storms, besides man made disasters including road accidents and fires, etc. Such incidents frequently occur, thereby disturbing the ecological balance in addition to leading to loss of human life as well as socio-economic damages.

UT Ladakh has recorded raised morbidity and mortality due to the effect of extreme weather conditions vide frequent, floods, droughts, and fires as a direct impact of climate variability and affecting the population at large. The hazard profile of the state is indicated:

Earthquakes

Cities Leh & Kargil lie in seismic zone IV. The geological structure of the state makes it vulnerable to earthquakes The Zanskar mountain ranges are underlain by Zanskar geological Thrust planes. These thrust planes are the largest strike-slip faults responsible for the occurrence of earthquakes and disasters in the region. Whereas, the rest of the state region including the whole of Ladakh region comes under the Seismic Zone IV.

Flood, Flash flood, and Cloud burst

Cloud bursts and flash floods are common disasters in the state which have caused loss of life and property in various regions. Glacial melting due to warming causes flash floods. The hilly area in the state is prone to cloud bursts.

Landslides

Large and small landslides occur every year in all three regions in the state. They are complex disaster phenomena caused by heavy rainfall, snowfall, earthquakes, and mining, etc. Soil creep and down- slide movements of rock masses occur to cause landslips and landslides. Landslides in Ladakh are caused by changes to slope stability which initiate debris flows and rock falls. A change in slope stability may be caused by a change to the slope angle, a change to the slope vegetation (cohesion) or a change in the saturation

(pore pressure) of sediment on the hillslopes. The weathering of the hillslopes in the Ladakh mountain range has formed loose regolith and sediment which is susceptible to land sliding. Rivers and glacial streams have incised the valleys forming steep sided slopes. Debris flows, rock falls and mudflow landslides are then triggered either naturally, by heavy precipitation and earthquakes, or unnaturally, by vibrations from heavy vehicles such as army trucks or where humans have modified the hillslopes. Debris flows are formed from a mixture of rock, mud and water which carries trees, boulders and debris. Rock falls occur on steep slopes which have been undercut by streams or by the construction of roads. Loose rocks and boulders that have become detached from the slope fall rapidly through the air, which is particularly hazardous on the mountain passes in Ladakh. Landslides may also form natural dams as they block the course of rivers in Ladakh. Behind these dam's lakes form which may flood the surrounding region when the dam breaches. Therefore, it is important that the stability of landslide dams in Ladakh is monitored so that hazardous flooding events can be prevented. In Ladakh the Kelang Serai, Patseo and Chilam landslide deposits were triggered during periods of increased monsoon strength. These historic deposits are examples of large landslides that have occurred in the region. The Darcha landslide (also an historic landslide) was caused by the structure (bedding and faulting) of the geology, which created lines of weakness along which the slope failed. In the last decade landslide events in Ladakh have been reported in the media and recorded by geological organisations such as the United States Geological Survey. These land sliding events have caused loss of life, injuries and road blockages. The most significant event to have occurred in recent history was the 2010 cloudburst event. This event was caused by a period of unusually intense precipitation on the hillslopes which triggered debris flows and mudflows. Over 200 people died in the event from multiple causes, including by drowning in the mudflows/floods or from head injuries caused by falling debris. The debris flows also destroyed homes, roads, bridges, the Leh hospital, drinking water canals, farmland and lines of communication.

Snow avalanches

Snow-avalanches are responsible for loss of life and damage to infrastructure in mountainous areas across the world. The present study aims to integrate traditional knowledge with Geographic Information System (GIS) for generation of snow-avalanche susceptibility map for Kargil- Ladakh Region of Trans-Himalayas. The avalanche susceptibility map has been generated using Analytical Hierarchal Process (AHP) method by combining avalanche inventory with avalanche influencing factors. The avalanche susceptibility map generated for the region reveals that around (60%) of area falls under low to very-low susceptibility classes, while as, around (21%) area falls in the moderate susceptibility zone. Approximately (19%) area is comprised of high and very-high susceptibility classes.

Drought

Most parts of the UT Ladakh are drought prone and are subjected to similar climate-related disasters.

Wind Storm

Occasional wind storms destroy crops, horticulture, and rooftops of houses.

Others

Several parts of the state face hazards like cloud bursts, forest fires, dam bursts, heavy snowing, human epidemics, and livestock epidemics, etc. from time to time; a few of which occasionally convert into situations like a disaster.

Climate change can result in more hot days, resulting in more periods of drought, dust storms, or 'heavy rains (precipitation), and even flooding. Human health gets directly affected due to injuries, hypothermia, hyperthermia, drowning, and indirectly through population dislocation, crowding, poor living conditions, faeco-oral transmission of gastro-intestinal pathogens causing water and food borne illnesses, respiratory illness, and other infectious diseases (e.g., leptospirosis, vector-borne disease, cholera, and also mental illnesses). The causes of different diseases prevalent during disasters in the state include:

1. Population displacement
2. Availability of safe water & sanitation facilities
3. The degree of crowding
4. Underling health status of the population
5. Availability of the healthcare services

Adaptation Plan

Awareness Generation

a) Under the programme, awareness generation efforts will be taken to reach out to all the relevant stakeholders including the common population, vulnerable communities, healthcare providers, and policymakers around the impacts of disaster events.

b) The districts are aimed to create awareness through Information, Education, and Communication Activities (IEC) through the development of locally and culturally more acceptable messages in posters, audio, video, organising public health events, and issuing advisories related to disaster management. The content for the IEC for disaster management will be provided by the NPCCHH division. The role of the districts is to utilize these materials, translate the required material, and disseminate them at all levels.

c) Sensitization of the health professionals/communities on emerging climate- sensitive health impacts and diseases.

Observance of important environment-health days

Day	Activities
• International Day for Disaster Risk Reduction	**IEC Campaigns** • Audio-video spots broadcasting • Targeted awareness sessions: women, children, occupational groups • Mock drill, disaster response exercise • Sports events • Competition: poster, poem/essay, **quiz Health facility-level activities** • Health facility-based patient awareness sessions • Conduct assessment of disaster vulnerability/energy/water conservation measures • Review of implementation of climate-resilient measures

Capacity Building

a) Refreshers training of the health professionals on diagnosis and treatment of Scrub Typhus/Snake Bites

b) Meeting the compensation process for the family for the death of the person due to lightening.

Training on disaster management is as follows:

NPCCHH Training Plan at District Level

Training Programme	Trainer	Participants	Training Content
Medical Officers (3 days)	DNO	MO (DH, CHC, PHC)	Disaster Management
Community Health Care Workers (HWC) (2 days)	MO	Community Health Workers (MPHW, ASHA)	
Panchayati Raj Institutions (1 day)	MO, MLHP	Panchayati Raj Institutions, communities	

Strengthening Health Sector Preparedness

i. Early warning

a) Dissemination of early warnings for the heat wave, cold waves, floods, cyclones, etc. to the health facility level and community level

ii. Surveillance

a) Monitoring of the cases in collaborative efforts with IDSP/Zoonotic Disease Department and State Disaster Management Authority

b) Post-disaster health impact assessment

iii. Health Facility Preparedness

- Vulnerability assessment of health facility in the context of climate change-extreme weather events
- Identify structural changes/retrofitting measures at the facility level to equip the healthcare facility
- Formalize disaster management plan and committee
- Emergency procurement arrangements and functioning of essential health services (safe water, immunization, maternal-child care, etc.)
- Post-disaster damage assessment and referral plan in case of health facility damage
- Ensure routine monitoring and maintenance of support functions (water quality, waste management)
- Establish Sustainable Procurement Committee

Roles and Responsibilities

Particulars	Responsibilities
SNO	• Disseminate early warnings to the district level • Finalization of IEC material and dissemination Plan • Formalize intersectoral coordination for disaster planning, management, and response with SDMA/IMD and other response departments • Organize training of district-level officers • Facilitate assessment and implementation of climate-resilient measures in health facilities • Review implementation of IEC, training, and surveillance activities at all levels • Evaluate and update relevant sections of SAPCCHH with support from State Task Force

Particulars	Responsibilities
	• Create organizational support and strengthen the Environmental Health cell to implement NPCCHH vision, goal, and objectives • Organize sensitization workshops for other stakeholders and line departments • Collaborate with academic institute/s for support in updating SAPCCHH, Surveillance activity monitoring, training of health care professionals, vulnerability assessment, and applied research • Submit reports of activities on EWE and health under NPCCHH
DNO	• Disseminate early warning to the block and health facility levels • Ensure IEC dissemination to the community level and facilitate community-level IEC activities • Organize training for block health officers and MO • Formalize intersectoral coordination for disaster planning, management, and response with SDMA/IMD and other response departments • Liaison with other departments for combined IEC campaigns, coordinated response and information sharing of health indicators for targeted action • Identification and communication of evacuation routes and relief camps • Support planning and management of health care services in relief camps • Provide necessary IEC on health and sanitation in relief camps • Training for block health officers, and medical officers, with relevant training manuals • Conduct sensitization of vulnerable groups, police officers, outdoor workers, women, children, etc. • Organize IEC campaigns at the district level on the observance of important environment-health days • Facilitate disaster vulnerability assessments in health facilities and maintain records of such assessments and health facility damage due to EWE • Update DAPCCHH with support from District Task Force • Submit reports of activities on EWE and health under NPCCHH
Block Health Officer	• Conduct community-level IEC activities • Ensure training of medical officers • Organize PRI sensitization workshops and training for vulnerable groups • Facilitate disaster vulnerability assessments in health facilities and maintain records of such assessments and health facility damage due to EWE
Medical Officer	• Conduct health facility-based IEC activities • Support community-level IEC activities • Preparation of Disaster Management Plans and hospital safety plan • Assessment of health facilities in the context of climate change-extreme weather events • Identifying structural changes/retrofitting measures at the facility level to equip the healthcare facility • Ensuring routine monitoring and maintenance of support functions (Water quality, waste management) • Health facility preparedness for seasonal events
Panchayati Raj Institutions	• Conduct community-level IEC activities • Community involvement in planning and demonstration of measures taken before, during, and after an EWE

CHAPTER 10

Health Action Plan on Vector-borne Illnesses in Context of Climate Change

Vector-borne diseases (VBD) are climate sensitive as the development of vectors is affected by environmental factors such as temperature, rainfall, and relative humidity (RH). At lower temperatures, the rate of development is slow while at higher temperatures, the life cycle of vectors gets completed in a shorter time. Rainfall helps in the creation of breeding grounds for mosquitoes, while the RH helps in the survival and longevity of vectors.

Malaria

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected mosquitoes. Malaria is preventable and curable. Non-immune travellers from malaria-free areas are very vulnerable to disease.

Dengue

Dengue is a mosquito-borne viral infection. The infection causes flu-like illness and occasionally develops into a potentially lethal complication called dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS).

Chikungunya

Chikungunya is a viral disease transmitted to humans by infected mosquitoes. It causes fever and severe joint pain. Other symptoms include muscle pain, headache, nausea, fatigue, and rash. The increased construction activity in the suburbs, growing population densities, and inadequate sanitation is creating fertile ground for mosquito breeding. The Aedes Aegypti mosquito which spreads dengue, chikungunya, yellow fever, and other diseases is a highly domesticated urban mosquito that prefers to live in the human habitat.

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

1. Programme Officer for National Programs for Control of Vector-borne diseases (NVBDCP) must consider climate variability as an important factor for the assessment of morbidity and mortality statistics and develop/adapt health micro-plan based on recent VBD diseases trend.
2. Map vulnerabilities: population at risk, geo-climatic conditions, seasonal variation, change in population demography, migration (in & out), available resources, healthcare infrastructure, laboratories, etc.
3. Strengthen/Develop active and passive surveillance and establish sentinel sites for vector-borne diseases.

4. Capacity building and increasing awareness for individuals, communities, and health care workers through the involvement of various media as well as campaigns and training workshops.
5. Develop or translate IEC on the effects of climate change on VBDs in the local language, and make a communication plan for dissemination of health-related alerts/education materials.
6. Ensure adequate logistic support, including equipment and other treatment modalities and supplies for case management at all levels of health care and also under an 'Emergency response Plan' in case of any disaster or an outbreak.
7. Vaccination of animals and animal handlers for vaccine-preventable diseases.
8. 'Environmental Health Impact Assessment' of new development projects.
9. Early warning system for vector-borne diseases.
10. Enforce legislation and regulations of vector-borne diseases.

Coordination with other sectors for reducing Zoonotic diseases

(As per the suggested sectors in the NVBDCP)

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

Intervention by a veterinary task force

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

Intervention by Community & Individual

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

Health Adaptation Plan on Vector-borne Diseases

IEC Campaign

- The districts are aimed to create awareness through Information Education and Communication Activities (IEC) through the development of locally and culturally acceptable messages in posters, audio, video, organising public health events, and issuing advisories related to vector-borne disease.
- The content for the IEC for vector-borne disease will be provided by the State NPCCHH division. The state will translate the content into the regional language if required and the role of the districts is to utilize these materials and disseminate at all levels.

- Advertisement and promotion through IEC: street plays, hoardings, billboards, and other advertisement modes.

IEC type	Material	Timeline	Mechanism
Posters	• Posters on VBD and climate change (English, Marathi) • Adopt posters made by state NVBDC	Pre-monsoon and Post monsoon	Collaborate with NVBDCP
Wall painting	• Wall painting malaria endemic Districts	Seasonal	Government schools, offices and Gram panchayat buildings
Hoardings		Seasonal	To be planned with hotspot Municipalities and District
Audio- Visual	• 3 Audio Jingles	Pre-monsoon and Post monsoon	Radio Channels
Digital display	• Available GIF • Above mentioned video messages	Seasonal	Display in health facilities Public digital display boards in major cities
Social medial	All the above material + Relevant activity updates	Seasonal	Facebook and Twitter handle of state NPCCHH, NHM WhatsApp groups (State DNO, Health facility group)

Observance of important environment-health days

Observance of the following days may be recommended for awareness on climate change and vector-borne diseases:

Day	Activities on VBD in the context of climate change
• World Malaria Day (April 25) • World Mosquito Day (August 20) • World Environmental Health Day (September 26)	**IEC Campaigns** • Targeted awareness sessions: urban slums, schools, women, children • Street plays and local cultural activities, Rallies • Clinical management training for Dengue • Dengue awareness week

Capacity Building

Refresher training of the Medical professionals:

- Expanded training of doctors and associate staff
- Increased training of NGOs and Asha workers

NPCCHH Training Plan at the District Level

Training Program	Trainer	Participants	Training Content
Medical Officers (3 Days)	DNO	MO (DH, CHC, PHC)	Vector-borne related illness
Community Health Care Worker (HWC) (2 Days)	MO	Community Health Workers (MPHW, ASHA)	
Panchayati Raj Institutions (1 Day)	MO, MLHP	Panchayati Raj Institutions, communities	

Sensitization/knowledge-building workshops should be planned for seeking updates on various air pollution-related health issues between district officials, medical officers, and academic institutions working on climate change impact.

Roles and Responsibilities

To address the current as well as future exposure of the state to vector-borne diseases due to changes in temperature and rainfall patterns, the following roles and responsibilities have been identified to be conducted by the departments at the state, district, block, and healthcare facility level.

NVBDCP	Overall guidance and policy formulation	Guide the state governments in the resurgence and containment of any VBD
State Nodal Officer, Climate Change	To support the state govt. in control of VBDs, particularly in climate- sensitive states	• Oversee vector control measures • Oversee health sector preparedness • Oversee VBD surveillance, and control in post-disaster situations in community and relief camps • Train DNO, DMO • Sensitization workshops to increase awareness on climate change and its impact on VBD
India Meteorological Department	To provide meteorological data as and when required	• To help the state govt. in building collaboration with any research institute, analysis of relationship between climatic factors, and a particular VBD to forewarn the impending outbreaks
NGO at the state and district level for reach to community	Heath education at community level	• Conduct workshops for IEC activities for different levels of staff in the identified areas in consultation with the state govt.
State Program Officer	Overall planning and execution of surveillance and intervention measures to control VBDs	• Supervise and guide the DNOs in control of VBDs
State Entomologist	To provide guidance in vector control	• Generate data on fortnightly fluctuations in the density of vector species to guide the state government in choosing the appropriate time of IRS activities. To generate data on susceptibility status of disease vectors for using appropriate insecticide for IRS/larvicide for vector control
Chief Medical Officer/ District Malaria Officer/Disease Surveillance officer	Execution of task assigned by the SPO	• Supervise and guide surveillance and intervention measures for the control of VBDs in the district.

CHAPTER 11

Action Plan for Green and Climate Resilient Health Care Facilities

"Climate-resilient and environmentally sustainable health care facilities anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stresses while minimizing negative impacts on the environment and leveraging opportunities to restore and improve it, to bring ongoing and sustained health care to their target population and protect the health and well- being of future generations. (WHO)".

As the climate continues to change, risks to health systems and facilities – including hospitals, clinics, and community care centers – are increasing, reducing the ability of health professionals to protect people from a range of climate hazards. Healthcare facilities are the first and last line of defence against climate change impacts as they can be responsible for large emissions of greenhouse gases (GHGs), and because they provide the needed services and care to people harmed by extreme weather and other long-term climate hazards.

Framework for building climate-resilient and environmentally sustainable HCF

Source: WHO Guidance for Climate-resilient and Environmentally Sustainable Health Care Facilities.

The first and last lines of defence against the causes of climate change's detrimental effects on human healthcare facilities (HCF). They must reduce their emissions of the greenhouse gases (GHGs) that cause climate change to offer the required services and care to the people affected by extreme weather events and long-term climate dangers (adaptation) (mitigation). The ability of health actors, institutions, and populations to anticipate crises, effectively respond to them, maintain key operations when a crisis arises, and, using the lessons learned, reorganize as necessary is referred to as healthcare system resilience. Building health facilities and systems that can endure climate change impacts is essential. Climate-smart health care should be used as an anchor approach to create more equal access to care, resulting in healthier, resilient communities.

Major factors in enhancing the HCF's ability to function with minimal detrimental effects on the environment and human health include resilience-building and supporting environmental sustainability. These elements have been outlined in line with the nation's international commitments to developing resilient infrastructure and healthcare facilities. To "significantly minimise catastrophic damage to essential infrastructure and interruption of fundamental services, among them health and educational facilities, particularly through increasing their resilience by 2030" is one of the seven worldwide aims of The Sendai Framework for Disaster Risk Reduction. SDG 9 (Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation) calls for the development of high-quality, dependable, sustainable, and resilient infrastructure as well as infrastructure upgrades and industry retrofitting to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and processes.

This includes the healthcare sector. The National Programme on Climate Change and Human Health (NPCCHH) focuses on five main goals, including the development of the health workforce's capacity and the adoption of environmentally friendly and climate-resilient infrastructure solutions, to address the health response to climate change. The following crucial elements have been recognised as part of the NPCCHH's Green & Resilient Infrastructure aim in order to be able to reduce the effects of climate change. Based on this, the state of Madhya Pradesh suggests an action plan to improve the current healthcare systems for the years 2022–2023. It is crucial to incorporate green design and concepts into the architecture of healthcare facilities because lighting, water heating, cooling, and ventilation account for 65% of the energy consumed in a healthcare institution.

The National Programme on Climate Change and Human Health (NPCCHH) is engaging critically with strengthening the healthcare services and facilities to adapt to as well as mitigate the impacts of climate change. The key components recognized under the programme include:

I. Environmentally Sustainable (Green) Measures at Health Care Facilities

a) Energy Auditing

b) Installation of LED lighting at Health Care Facilities

c) Installation of Solar panels

d) Water Conservation Measures – Rain water Harvesting

II. Climate Resilient Infrastructure at Health Care Facilities including Retro Fitting of Existing Health Care Facilities

1. Environmentally Sustainable (Green) Measures at Health Care Facilities

A. Energy auditing

As per the Energy Conservation Act, 2001, Energy Audit is defined as "the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption", which can be further evaluated with subsequent, annual energy audits to reach a goal of net-zero emissions. More information is available at https://beeindia.gov.in/sites/default/files/1Ch3.pdf

An energy audit identifies all energy end-uses within the building, estimates how much energy is used in each department, and determines the amount of energy used in relation to the desired values.

The guiding principles in this respect include:

- The HCFs would develop a plan for the energy audit to assess the level of energy consumption.
- The responsibility for the energy audit would be of the IPC committee of the facility. If the healthcare facility lacks qualified staff, then the energy audit would be conducted by the state health department as well.
- The energy audit would also consider load management, poor maintenance aspects, and extreme temperature to avoid fire-related accidents. Audit would be conducted in the facility biannually.
- Installing sub-meters in the facility premises would be useful in understanding how much energy is used across the healthcare facility

The work would be carried out in Collaboration with Chhattisgarh Renewal Energy Development Agency for solarization, water harvesting, energy-efficient equipment, and cool roof.

1. **Installing occupancy sensors:** Occupancy sensors light areas that are occupied by people, thereby reducing energy costs by reducing energy waste. The guiding principles in this respect include:
    1.1. The Occupancy sensor would be installed in those areas where people may not frequently be moving, such as doctor and administration offices, non-patient floors and hallways, office areas, toilets and washroom facilities, and storerooms in the HCFs.
2. **Energy-saving appliances:** ENERGY STAR-qualified office and imaging products consume 30-75 percent less energy than standard equipment. The guiding principles in this respect include:
    2.1. The healthcare facility would have the policy to purchase BEE labelled/ISI marked office equipment and appliances.

It would aim to use above three-star rating equipment such as computers, monitors, printers, scanners, external power adaptors, copiers, fax machines, digital duplicators, mailing machines, water coolers, room air conditioners, refrigerators, and lighting equipment.

B. Replace existing (non-LED) lighting with LED

Replacing the incandescent bulbs with LEDs leads to 75% less energy consumption. Each LED light saves approximately INR 700-1400 for a year.

The guiding principle in this respect would be:

- Healthcare facilities would have a policy on purchasing and using energy- efficient equipment and devices. The facilities would gradually phase out the incandescent bulbs with LEDs.

State and District Nodal Officers will coordinate with State/District level Bureau of Energy Efficiency representatives to conduct energy audits and energy conservation.

C. Installation of solar panels

Healthcare facilities both in urban and rural areas consume a lot of energy throughout the day as the electrical equipment used directly or indirectly to treat patients requires uninterrupted power.

The guiding principle in this area would be:

- The state would, in a phased manner, install PV solar panels in unused spaces like the roof of the facility. This would reduce grid-based electricity consumption and decrease the peak demand of a facility, which means the organization has lower operating costs, and hence these saved costs can be utilized for better patient care.

D. Water Conservation

In an HCF, sanitary fixtures consume 42 per cent of water while heating ventilation and air conditioning (HVAC) consumes 23 per cent of water, thus, major water-consuming area needs to be focused on reducing water consumption.

Rainwater harvesting for healthcare facilities has the potential to save thousands of liters of water every year. This in turn can result in substantial cost savings in addition to adopting climate-smart practices.

The guiding principles for water conservation in a HCF would be as follows:

- The healthcare facility would develop a strategy for the optimum usage of water.
- The HCFs would develop a plan for the conservation of water. e.g., water- efficient fixtures, dual flush mechanism, sensor-operated urinals, waterless urinals, rainwater harvesting.
- The HCFs would have a plan for wastewater treatment. e.g., sewage treatment plant and effluent treatment plant at sites of generation of contaminated grey water, like pathology.
- The HCFs would develop a program/plan for the conservation of water.
- The HCFs would have a water management program for the conservation of water by establishing a team, setting goals with timelines, conducting water audits, determining the cost of water, and preparing an action plan.
- The HCFs would have an ongoing educational program for the efficient usage and conservation of water for all the stakeholders (staff, patients and visitors).
- The HCFs would have the plan to train the staff on water savings techniques.
- The HCFs would develop a wide variety of methods to communicate through IEC materials, new and/or revised operating guides, and manuals.

2. Climate Resilient Infrastructure at Health Care Facilities Including Retro Fitting of Existing Health Care Facilities

It is essential that HCF planning and designing should be responsive to the local climate and hazard profile of the district. Strong focus should be given to designing all aspects of infrastructure and services as per relevant IS standards, building codes and local byelaws, and history of emergencies in the district to ensure patient safety and continuity of health service during emergencies. Few key interventions that would be undertaken to make the HCFs into green buildings would include:

New Buildings

a) Climate risk assessment at the time of planning and designing the building

b) Use of high-performance glass on windows, doors, and roofs to prevent the heat inside and allows sunlight and fresh air to enter the room

c) Use double glazing glass on windows; it provides thermal and optical properties to the building and reduce the noise level

d) Insulation of building from inside and outside in colder regions of the country

e) Ensure the plinth level is above the high flood level as known locally or storm surge level (in costal districts) and make the building accessible with ramps and railing to create a barrier free environment

f) Installation of Rainwater Harvesting System

g) Installation of alternative energy systems

h) Installation of STP & ETP

Existing Infrastructure

a) Introduction of electronic patient records in the facility to reduce the use of paper

b) Availability of 10-30 per cent area for the herbal garden in the facility

c) Floor and wall finishes are conducive for infection prevention control practices

d) Including services for climate sensitive diseases

e) Modifications in the critical care rooms to make them functional during disasters

f) Installation of Rainwater Harvesting System

g) Installation of alternative energy systems

h) Installation of STP & ETP

Implementation Arrangement

The implementation of clean and green guidelines will be the responsibility of the Infection and Prevention Control (IPC) Committee at the healthcare facility (HCF) level coordinated by a state- level IPC committee as per the mandate of the Kayakalp guideline. This committee will include representatives from all relevant disciplines or departments in the facility headed by an elected chairperson who is the HCF administrator or a person who has direct access to the head of the Healthcare Facility. The IPC Committee meetings would take place monthly for infection prevention and control in the health facility (including building, services, site, and the access road) while the agenda for clean and green facilities could be discussed quarterly and or as often as required.

Implementation Plan

1. Health sector preparedness for 5 years 2022-27

Objective	Activities	Priority districts	Identified Health facilities for 5 years for each	Timeline	Budget (in lakhs) for 5 years with 15% increasing each year					Target for 5 years 2022-27				
					2022-23	2023-24	2024-25	2025-26	2026-27	2022-23	2023-24	2024-25	2025-26	2026-27
Strengthening Healthcare System	Energy Audit	Entire State	32 PHC 7 CHC 2 DH	February-April	37.0	40.70	0.0	0.0	0.0	20%	35%	50%	75%	100%
										10%	20%	50%	80%	100%
	Led installation		32 PHC 7 CHC 2 DH	April-May						10%	20%	50%	80%	100%
	Solar Panels installation		32 PHC 7 CHC 2 DH	May-August						5%	10%	40%	70%	100%
	Retrofitting of Health care facilities		10 PHC	October-December						10%	20%	50%	80%	100%

2. Awareness generation

- Awareness and sensitization on Climate Change events on the Heat wave, flooding, air pollution events, and waste management.
- Sensitization workshop on Sustainable Procurement
- Awareness on energy efficient measures and water conservation measures

3. Capacity Building

- Training of ToTs, DNO-CC, and Medical officers on guidelines and operational framework of Green and Climate resilient measures in Health Care Facilities.

Roles and Responsibility

The table below highlights the roles and responsibilities of the associated staff to help support green climate and resilient infrastructure development to strengthen healthcare infrastructure.

Particulars	Responsibilities
SNO	• Finalization of IEC material and dissemination plan • Organize training sessions for the district-level officers and trainers • Identify health facilities for priority implementation based on disaster and health facility vulnerability • Identify relevant state-level nodal agencies and collaborate with them for assessment of health facilities for implementation of measures • Facilitate and monitor necessary assessments at the health facility level

Particulars	Responsibilities
	• Facilitate implementation of structural and functional measures at the health facility level • Monitor the implementation of the activities • Support districts to identify sources of funding • Advocate for a reduction in source of greenhouse gas emissions

DNO	• Conduct training for block health officers, and medical officers, with relevant training manuals
	• Support conduction for the following assessment at the health facility level
	  ▪ Energy audit
	  ▪ Water audit
	  ▪ Disaster-vulnerability assessment
	• Support the following functional measures at the health facility level
	  ▪ Water committee
	  ▪ Sustainable procurement committee
	  ▪ Operational measures to make health facilities function during disasters or power cut
	• Coordinate with other agencies for the assessment and implementation of identified structural and functional measures
	• Update DAPCCHH with support from District Task Force

Block Health Officer	• Ensure training of medical officers • Organize PRI sensitization workshop • Coordinate with other agencies for the assessment and implementation of identified structural and functional measures

Medical Officer	• Conduct health facility assessment
	  ▪ Energy audit
	  ▪ Water audit
	  ▪ Disaster-vulnerability assessment
	• Lead following functional measures
	  ▪ Water committee
	  ▪ Sustainable procurement committee
	  ▪ Operational measures to make health facility functioning during disasters or power cut
	• Support community level IEC activities
	• Identify local funding opportunities: e.g. CSR initiative, NGO funding

Panchayati Raj Instituti	• Support retrofitting and new health facilities with local funding source and community involvement

CHAPTER 12

Preparation of Action Plan – Prevention and Management of Cold Wave and Frost

Cold wave, heavy snowfall/rainfall, fog, snow storms etc. have emerged as one of the major weather hazards in recent years affecting different parts of the country. Cold wave is a localized seasonal phenomenon prevalent in the country except in southern India. The northern part of India, especially the hilly regions and the adjoining plain areas comprise of the Core Cold Wave Zone (CWZ), covers 17 states and accounts for a population of 90.90 crores. Out of this, 24.28 crore are either below 10 years or above 60 years of age (Rural 17.9 Cr. and Urban 6.38 Cr.), who are more vulnerable to cold waves.

In 2020, northern states of India were highly affected in terms of casualties from cold wave/frost. In India, cold wave has caused 4,712 deaths from 2001 to 2019 across various states. IITM data shows an increasing trend of cold waves in the last three decades (1991-2019). With effective planning and interventions, such loss of life could have been easily avoided.

As there are no guidelines and action plans on cold wave at the national level, it remains a challenge for disaster managers to take standardized preventive, preparedness, and mitigation measures. There is a need to prepare action plans to take timely actions for prevention, preparedness, mitigation and community outreach to safeguard human lives, livestock and wildlife.

Genesis

Occurrences of extremely low temperature in association with incursion of dry, cold winds from the north into the subcontinent are known as cold waves. The northern part of India, especially the hilly regions and the adjoining plains, are influenced by transient disturbances in the mid latitude westerlies which often have weak frontal characteristics. A cold wave or frost condition is a rapid fall in temperature within a 24- hour period requiring substantially increased protection for agriculture, health, livestock and other activities. As cold wave/frost is a localized disaster event, location-specific mitigation plans should be developed by the concerned State Governments/district administrations.

Given these past experiences there is a need to formulate "Preparation of Action Plan – Prevention and Management of Cold Wave" for improving the capacity of the States to deal with cold wave in a planned manner. The Action will help develop measures and strategies for assessment, forecast, preparedness and mitigation through coordinated efforts by multiple agencies and undertake long-term mitigation measures for addressing the issues at a broader level by the states/local authorities.

Objective

The aims to provide a broad framework for developing Cold Wave Action Plans (CWAPs) at the State level and district level; for implementation, inter-agency coordination and impact evaluation of cold wave response activities.

Introduction and Background

Cold wave, heavy snowfall/rainfall, fog, snow storms etc. have emerged as major weather hazards in recent years affecting different parts of the country. The World Meteorological Organization's (WMO) statements on global climate during the past few years indicate that the global temperatures are substantially unveiling variations during various seasons and have a large impact on environment, agriculture, health, livestock, livelihoods, socio-economy and other allied sectors. The management of cold wave remains a challenge with a large number of deaths each year especially in developing countries which lack proper heating systems. Around the world, many countries that experience cold wave as a recurrent hazard have developed institutional measures to prepare, mitigate, and respond to cold waves.

In recent years, occurrences of extreme low temperature in association with incursion of dry, cold winds from north into the sub-continent known as cold waves, cause discomfort, illnesses and even loss of lives. Cold wave occurs in the month of December-January every year and sometimes extended cold wave events occur from November to February and are limited mostly to northern India. The cold wave is marked by a well-defined and prolonged period of lower temperatures. The precise criterion for a cold wave is determined by the rate at which the temperature falls and the minimum to which it falls. This minimum temperature dependents on the geographical region and time of the year.

Cold wave is a localized seasonal phenomenon prevalent in the country except in southern India. The northern parts of India, specially the hilly regions (Ladakh, Jammu and Kashmir, Himachal Pradesh, Uttarakhand) and the adjoining plains are influenced by transient disturbances in the mid latitude westerlies which often have weak frontal characteristics. States like Punjab, Haryana, Rajasthan, Delhi, U.P., Bihar and Jharkhand are the highly affected. It also includes some met subdivisions of Marathawada, Vidharbha, Saurashtra and Madhya Maharashtra which are affected by cold waves. The extent of damage caused by a cold wave depends on the temperature, length of exposure, humidity levels, and the wind speed at freezing temperature. Indian Institute of Tropical Meteorology (IITM) data shows increasing trends of cold waves from the last three decades (1991-2021).

The total population is 90.90 crore reside in the core cold wave zones. Out of this, 24.28 crore are either below 10 years or above 60 years of age (Rural 17.9 crore and Urban 6.38 crore), who may be more vulnerable to cold waves (Census 2011). Cold waves have significant effect on health. In India, cold waves caused 4,712 deaths from 2001 to 2019 across various states. There was significant damage to crops, horticulture, forest, livestock, fisheries, water supply, power supply, transportation, tourism, economy and livelihood systems in these cold wave prone regions that led to economic losses of the state. Cold wave also leads to death of domestic and wild animals, birds, poultry, etc.

In 2019-20, Punjab, Haryana, Rajasthan, U.P. and Bihar were highly affected in terms of casualties from cold wave. This could have been avoided by proper planning and adequate shelters for the outdoor workers, farmers and livestock.

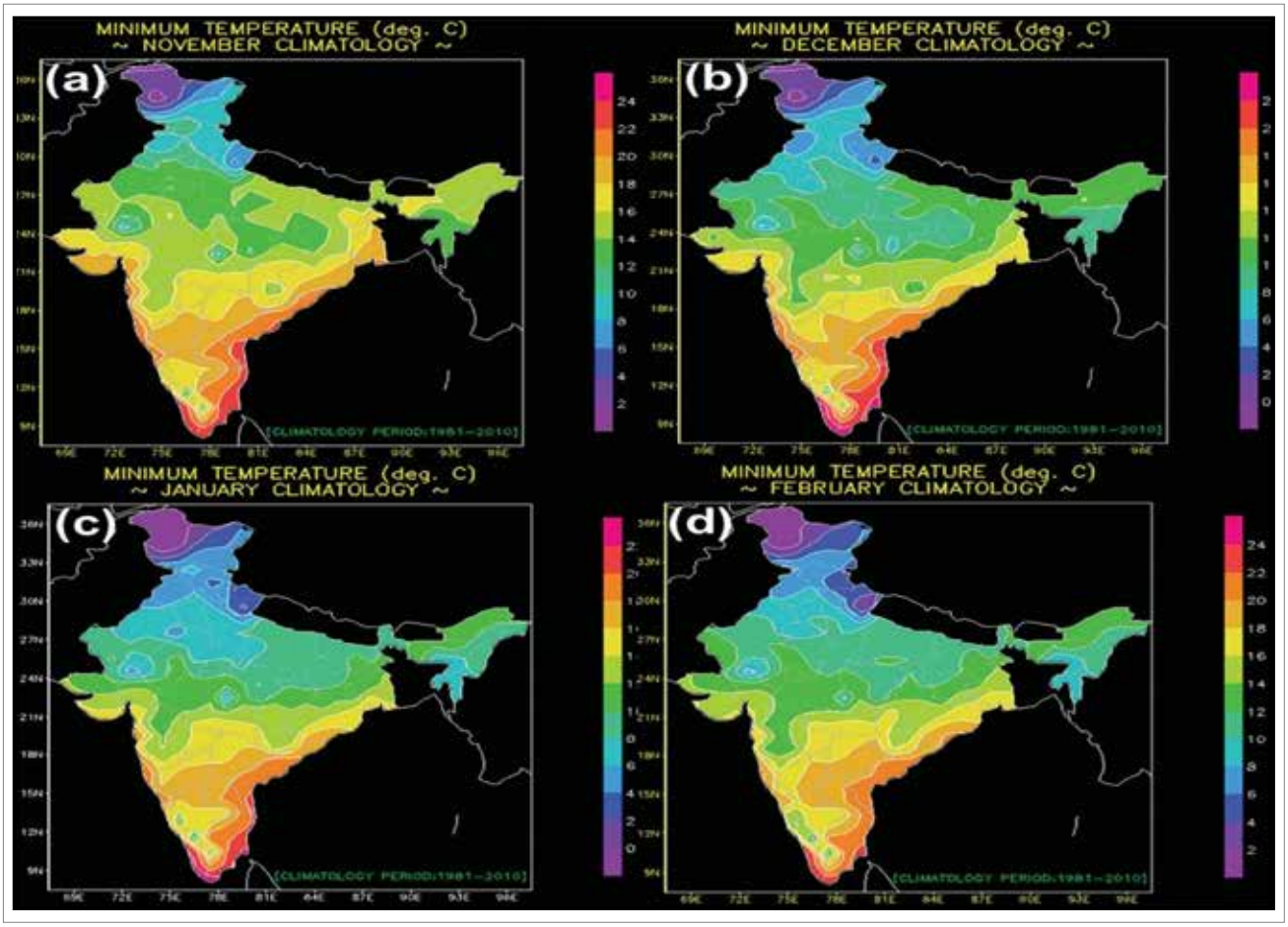
To deal with governance issues related to Disaster Risk Management for cold waves, there is a need for a multi-sectoral and multi-dimensional approach. Especially in the health sector, interventions can be made to address cold wave impacts. Early warnings can help in minimizing the loss of lives and economic impacts. An effective early warning system helps the communities to manage risk by generating public awareness, effectively disseminating warnings and ensuring a constant state of preparedness.

As there are no national guidelines for preparation of action plans for cold wave, it is a challenge for disaster managers to take standardized preventive, preparedness, and mitigation measures. There is a need to issue national guidelines to help preparation of action plans for preventive actions, preparedness, and mitigation measures.

Climatology and Cold Wave Season in India

The minimum temperatures (T.min) go down below 8^{0}C over many parts of northern India during November to February months (Figure a to d). However, December & January are the coldest months with T.min below 6^{o}C over most parts of northwest India and below 8^{o}C over the rest parts of northern India.

Normal T.min during November to February (1981-2010)



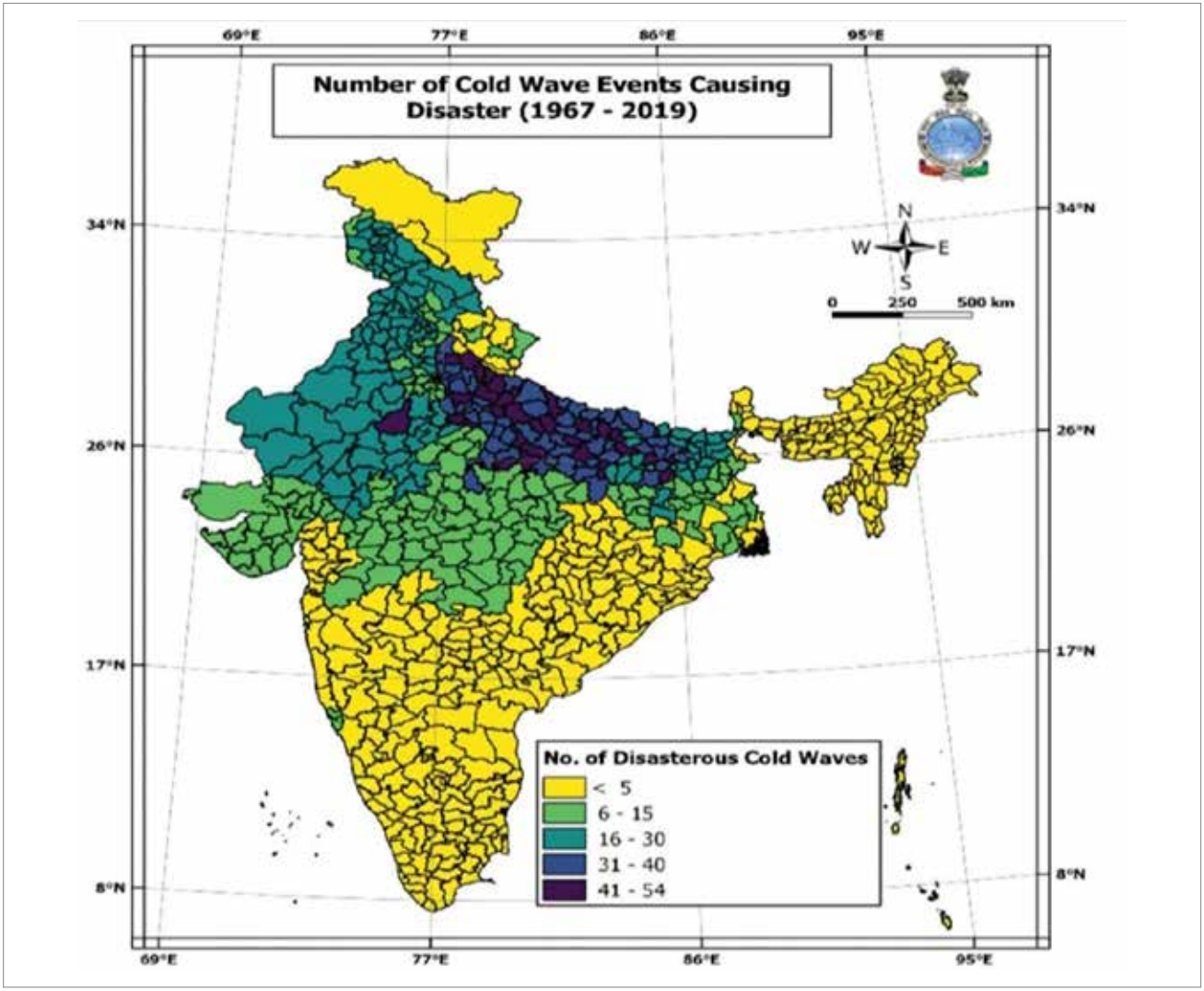
Source: https://www.imdpune.gov.in/

Cold waves are seasonal with more episodes observed from November to March and extreme events mostly experienced during the middle three-month period.

Normally, in the winter months, after the passage of western disturbances, dry cold northwesterly winds make way into north & central India. As a result, minimum temperatures drop over the regions and sometimes cause cold wave conditions. A cold wave is a meteorological event generally characterized by:

- Sharp drop of air temperature near the surface, leading to extremely low values;
- Steep rise of pressure;
- Strengthening of wind speed; or
- Associated with hazardous weather like frost and icing.

Number of Cold wave events causing disaster 1967-2019



Source: IMD, New Delhi.

The major factors for Cold Wave occurrence over India

- A build-up of a ridge (an extended area of relatively high atmospheric pressure) in the jet stream over northwest Asia;
- Formation of surface high-pressure over north & central India;
- Movement of cold air masses in response to steering by upper-level winds;

- Triggering mechanisms like a strong westerly wave approaching northwest India to enhance winds for transporting cold air southeastward; and
- Extensive snow covers over northwest Himalayas.

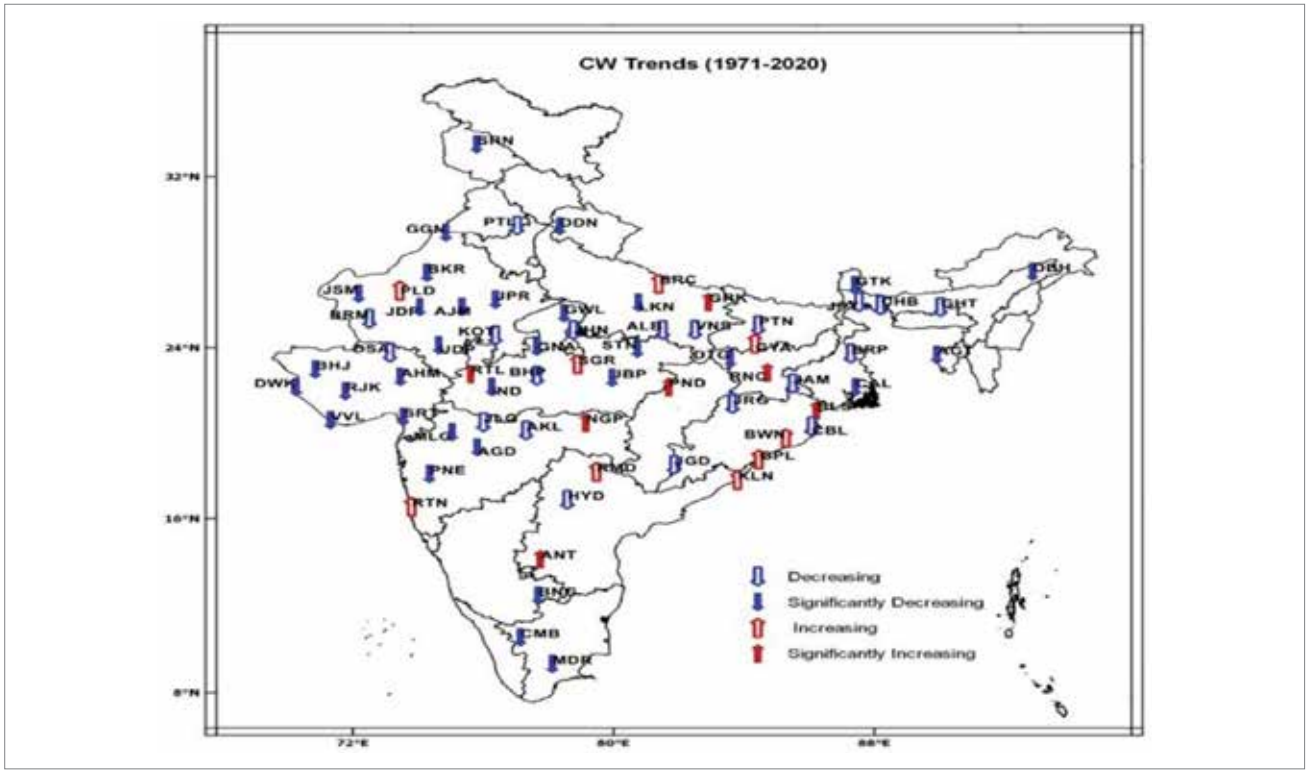
Cold Wave Trend in India

In general, scientists and policy makers across the globe are debating the issue of anthropogenic global warming which may lead to a decrease in the global occurrence of cold waves. However, instances of severe cold waves- in East Asia in 2016 or the recent cold wave in USA in 2021 gave rise to the discussion of cold waves occurring during the winter with the warmest recorded global mean Surface Air Temperature (SAT). While the East Asian cold wave is associated with atmospheric circulation regime, it mainly exhibited an extremely strong anomaly of the Ural Blocking High (UBH) and a record-breaking anomaly of the Surface Siberian High (SSH). However, because of the dynamic effect of Arctic amplification, anthropogenic global warming may increase the likelihood of extreme cold waves by shifting the responsible natural atmospheric circulation regime toward stronger amplitude. The probability of occurrence of extreme anomalies of UBH, SH, and East Asia mean SAT has been increased by 58%, 57%, and 32% respectively, as a consequence of anthropogenic global warming. During the cold-weather season (November to March), many stations from north, northwest, east and central.

India together named as Core Cold Wave Zone (CCZ) experienced the highest number of cold waves/severe cold waves with relatively higher frequency during December-January.

Over India, the trend of cold wave was observed across 86 weather stations during the December- January-February season for the period 1971- 2020 as shown in figure. It also shows falling/rising (blue/red arrows) trends in frequency of cold wave days in different parts of the country.

Map showing the increasing and decreasing trends of CW spell over India



Source: IMD, New Delhi.

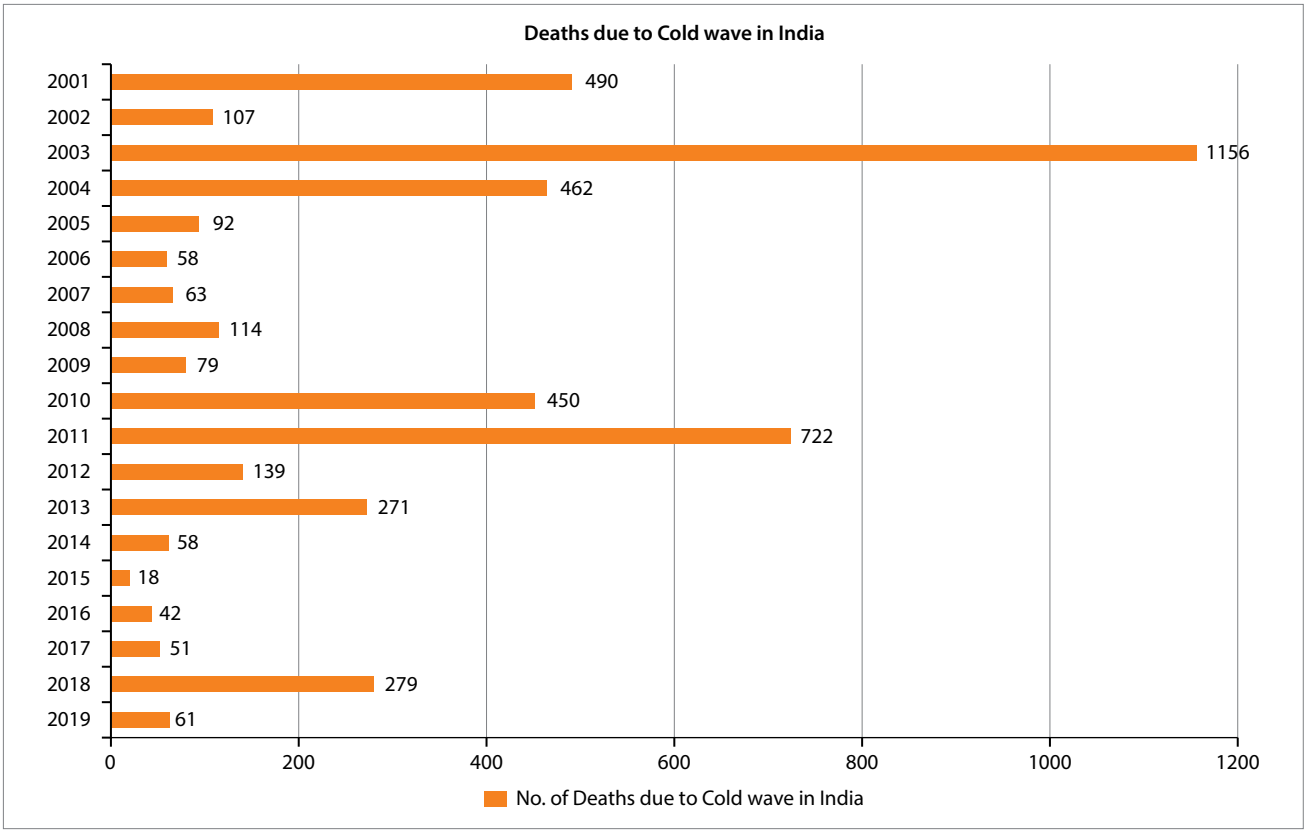
Impact of Cold Wave in India

Historically, cold wave was considered as 'cold weather' and treated as a mere seasonal change in India. As the occurrence of cold waves are limited to certain regions in the country, cold waves were more of a State responsibility and were treated as a local disaster that received less disaster preparedness or mitigation attention. Cold waves manifest on human health by increasing morbidity and death. This especially is severe in the homeless population. Cold wave also affects various service sectors including vegetable vendors, rickshaw pullers, daily wage workers, and roadside kiosk operators etc. Apart from impact on the population, it also affects many economic sectors. Details are given below.

Health

The impact of the cold wave on human beings can lead to death or injury. The mortality rates show a marked increase in areas with recurrent cold waves. Health issues are observed more commonly in the elderly and neonates. In India, cold wave caused 4,712 deaths from 2001 to 2019 across various states.

Showing deaths from 2001-2019 due to Cold wave in India



Source: EnviStats India 2020, Vol. 1 Statement 4.06 (MoSPI).

Agriculture

Cold wave and frost are a major factor that influences crop, horticultural plantations/orchard growth and productivity and has a significant impact on agriculture. As a result, the livelihood of people gets adversely affected. The extent of damage caused by a cold wave depends on temperature, length of exposure, humidity levels, and the speed at which freezing temperature is reached. Several crops and orchards in the north and northeastern regions of the country experienced the damaging effect of cold waves and frost.

Low temperatures cause two types of injuries to plants. The first is chilling injury that occurs between 2°C and 0°C. The second type of injury is freezing injury, which occurs when the external temperature drops below the freezing point of water.

Cold waves affect certain stages of growth and development in plants more sensitive to low temperature than other phases, with dormancy generally representing the most tolerant stage. Reproductive organs are comparatively more sensitive to chilling and freezing stress. Likewise, seedlings are more sensitive than adult plants. Both elongation and greening of leaves are affected by cold. Limits of freezing temperatures and plant injury in general are given below:

Light Frost/Freeze: -1.7°C to 0.1°C – tender plants killed, with little destructive effect on other vegetation.

Moderate Frost/Freeze: -3.9°C to 2.2°C – wide destructive effect on most vegetation with heavy damage to fruit blossoms, tender and semi-hardy plants.

Severe Frost/freeze: -4.4°C and less – severe damage to most plants. At these temperatures, the ground freezes solid, with the depth of the frozen ground dependent on the duration and severity of the freeze, soil moisture, and soil type.

Livestock

A cold wave can also cause death and injury to livestock. During a cold wave, animals require a higher intake of nutrition which affects the hormonal level and efficiency of production. Often, if a cold wave is accompanied by heavy and persistent snow, grazing animals are unable to graze, hence requiring more fodder to be provided indoors. If the food is inadequate and if there is exposure to low temperatures, animals may die of hypothermia or starvation. Similarly, wildlife also experiences challenges during winter for both shelter and food. Cold wave factors override genetic factors for determining the fertility patterns in buffaloes. The optimum breeding season for buffaloes under north Indian conditions is from October to February. Extreme variations in temperature as experienced during December and January may affect the fertility rate in cattle. Cold environment increases the body glucose turnover and glucose oxidation, thus resulting in less production of ketones.

Fisheries

Extreme climatic conditions particularly in winter months when air temperature drops to 2-4°C and water temperature is between 10-15°C, adversely affects the growth of Indian major carps. The effect on overall health of stocked fishes may be more when such conditions prevail for a longer duration.

Transport

Cold wave or extreme cold weather affects the transport sector such as airways, river & seaport, roadways, railways, local transport etc. Rivers and lakes also freeze during extreme cold conditions affecting waterways and the resulting dense fog that can sometimes also lead to huge traffic jams, major accidents and delay which may cause health related complications and loss of educational/employment opportunity.

Energy or power

Energy or power sector receives too much pressure during extreme winter or cold wave season. During the cold wave season, energy consumption rises significantly. In hilly regions, electricity is the main source

of heating in houses. Other energy sources like fuel, oil, coal is also in great demand during the cold wave season.

Water

Water sector is directly impacted by cold waves as it gets frozen due to extreme low temperature. Due to freezing, water supply may get disrupted. Other water dependent sectors can also be impacted if water supply gets disrupted. Other infrastructure is also impacted by cold wave conditions to varying degrees.

Tourism

Tourism sector bears both positive and negative impacts of cold weather. India receives a large number of tourists in the months of December and January, but extreme cold may also result in a smaller number of tourists as well as additional challenges for the State Government and local administration for their health and safety.

Small street vendors

Small street vendors are highly affected due to exposure to cold waves and frost. This may affects their livelihood at the same time increase their physical exposure to cold wave.

Definition of Cold Wave and Frost

As per the India Meteorological Department's criteria, Cold Wave and Cold Day conditions are defined as:

A. Cold Wave

It should be based on the actual minimum temperature of a station. Cold Wave is considered when the minimum temperature of a station is 10°C or less for plains and 0°C or less for hilly regions.

Based on Departure

i. Cold Wave (CW): Negative Departure from normal is 4.5°C to 6.4°C

ii. Severe Cold Wave (SCW): Negative Departure from normal is more than 6.4°C

Based on Actual Minimum Temperature (For plain stations only)

i. Cold Wave: When the minimum temperature is ≤ 04°C

ii. Severe Cold Wave: When the minimum temperature is ≤ 02°C

Cold Wave conditions for coastal stations - When minimum temperature departure is -4.5°C or less over a station, *"Cold Wave"* may be described if the minimum temperature is 15°C or less.

B. Cold Day

It should be considered when minimum temperature is 10°C or less for plains and 0°C or less for hilly regions.

i. Cold day: Maximum Temperature Departure is -4.5°C to -6.4°C

ii. Severe Cold day: Maximum Temperature Departure is < -6.4°C

Definition of Frost/Freeze Warnings

Freezing point: The constant temperature in which the solid and liquid forms of pure water are in equilibrium at Standard Atmospheric Pressure. (source- Glossary of IMD, Pune).

Warning	Wind Speed	Air Temperature
Frost	Below 16 kmph	Below 0°C
Frost/Freeze	Below 16 kmph	Below 0°C
Freeze	Above 16 kmph	Below 0°C

Source: Katharine B. Perry, 2002, North Caroline State University.

Hazard, Vulnerability & Risk Analysis

HVRA analysis includes three basic steps as the name itself indicates – hazard analysis, vulnerability analysis and risk assessment. Hazard analysis includes identification of all hazards (based on historic records and recall of elderly, sometimes based on hazard simulation), analyzing and estimating the possible intensity and the return period. Vulnerability analysis includes the vulnerability of various population groups, buildings (including private houses) and economic activities, etc. Risk is the product of the hazard and the vulnerability expressed in terms of 3-5 classes. However, there are approaches available using community in creation of vulnerability analysis.

HVRA analysis is useful to understand and demarcate the areas which are prone to higher risk. By understanding risk thoroughly, one can analyze if the higher risk is caused by hazard or vulnerability. With this knowledge, the authority can propose risk mitigation measures (RMM), targeting specific hazards or vulnerabilities.

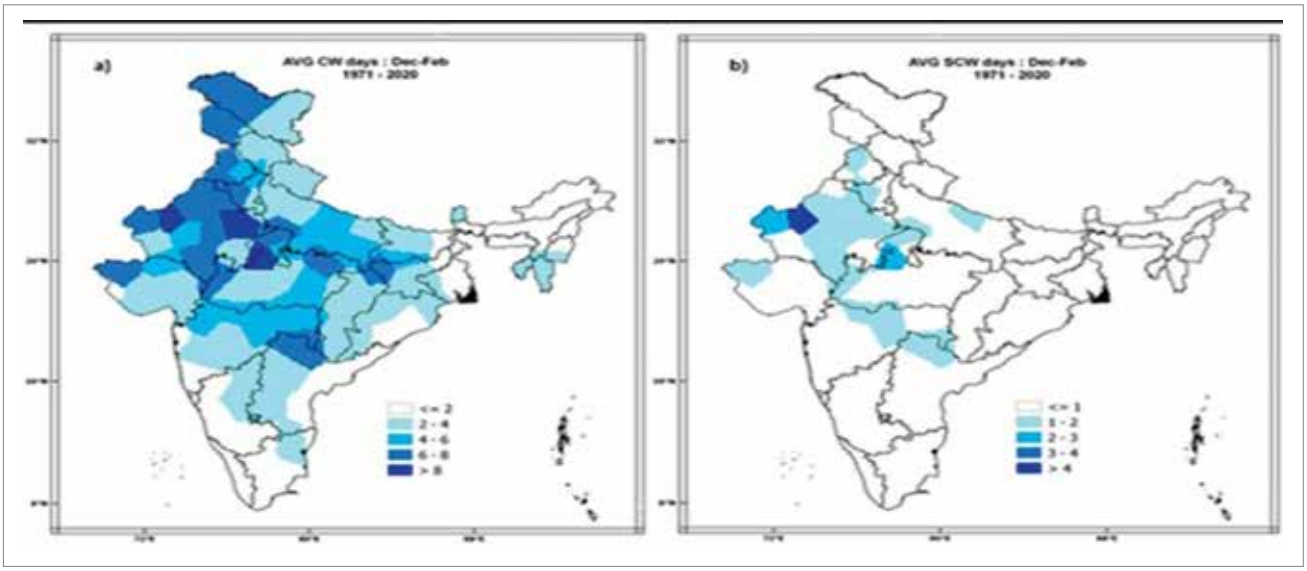
Hazard Analysis

Due to India's vast geographical area, it is exposed to various kinds of natural hazards, viz., earthquakes, landslides, tsunamis, avalanches, GLOFs, floods, cold waves, wildfires, cyclones, etc. Cold waves are prominent in the northern parts of the country, along the Himalayas and western desert areas. As per IMD, India's *'Core Cold Wave Zone'* covers 17 States/UTs covering Punjab, Himachal Pradesh, Uttarakhand, Jammu & Kashmir, Ladakh, Delhi, Haryana, Rajasthan, Uttar Pradesh, Gujarat, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, West Bengal, Odisha and Telangana. The figure shows the areas affected by CW and SCW. The maximum numbers of cold waves occur in Jammu and Kashmir followed by Himachal Pradesh, Punjab, Bihar, Haryana and Uttar Pradesh. These State authorities within the CCZ may analyze the cold wave/severe cold wave durations and prepare SOPs to mitigate cold wave related negative impacts. IMD issues forecasts and warnings before the cold wave season starts. If the State/District authority lacks the technical manpower to conduct HVRA analysis, they can request the IMD for a detailed analysis of their area.

Vulnerability Analysis

The impact of hazard events such as cold waves, extreme cold waves, rainfall, snowfall, is substantial and represents an increasing threat over India. The extent of vulnerability (mild, moderate or intensive) and the probable estimate of damages to agriculture including animal husbandry due to cold wave of varying

a) Average numbers of CW days over India during the DJF season computed using the CW information for the period of 1961–2020. b) same as a) for SCW



intensities must be included in the assessment report. Apart from the agriculture sector, many other sectors are affected by cold waves.

When it comes to economic sectors that are vulnerable to cold wave and related hazards; agriculture, animal husbandry and health are of primary importance. Human health is also vulnerable to the temperature drop. State Governments can identify the population in each district/village that are in the vulnerable groups. Population below 6 years and above 60 years can be considered vulnerable to cold wave and can be made beneficiaries to schemes designed for mitigating cold wave risk. Apart from the age groups, care needs to be taken to include people with disabilities, female-headed households, people under psycho-social care, people needing regular medication, etc. Workers who engage in economic activities in open areas need to be considered while disseminating the warnings. Similarly, sellers operating hand/push carts, open to sky shops/markets, also need to be included in the vulnerable groups.

Cold waves may also impact the efficiency and operation of other infrastructure like, Energy/(Power), IT/(Communications), Transportation, Banking & Finance, Government Services, Emergency Services, Water Supply/Management, Food production/security, etc. Assessment of each these sector's exposure to cold waves may be conducted. Action Plan and Standard Operating Procedures need to be prepared in order to minimize the impacts of cold waves and improve business continuity. Impact on each of these sectors will be different and SOPs need to be customized to suit the sector's needs. Transport sector in general and aviation sector in particular are prone to delays and stoppage due to low visibility caused by fog/smog.

Risk Analysis

With respect to a disaster, risk is specifically described using relative terms such as high-risk, average- risk and low-risk to indicate the degree of probability of the occurrence of the incident. Risk assessment includes an evaluation of all elements that are relevant to the understanding of the existing hazards and their effects on a specific environment. There are several steps involved in risk assessment based on the processes of hazard mapping and vulnerability analysis. They establish the nature, location and scale of risks to society and its assets. This information can assist decision makers in deciding what can and should be protected and up to which level.

Cold Wave Risk prone population can be assessed by counting the population in the vulnerable age groups, homeless, people with disabilities, etc., in the cold wave prone districts. Information from the Census of India can be considered for arriving at this number. Apart from this, people enlisted in the Below-Poverty-Line (BPL) population, beneficiaries of various other social schemes (both States and Centre) can also be considered as at-risk population. People engaged in vulnerable economic sectors need to be enlisted and provided information on remedial measures.

Special care needs to be taken to prevent fire accidents caused by heating pots within homes. This heating equipment, when unattended, may trigger fires, which may cause loss of life. These open fire pots may also contribute to carbon monoxide poisoning of the family members. There are many instances of lives lost because of carbon monoxide release in a confined space, as a closed room.

HVRA needs to be taken into consideration while preparing the action plan. Recommendations need to be worked out in consultation with each of the sector and responsible line departments.

Early Warning and Communication

Early Warnings and Forecast

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

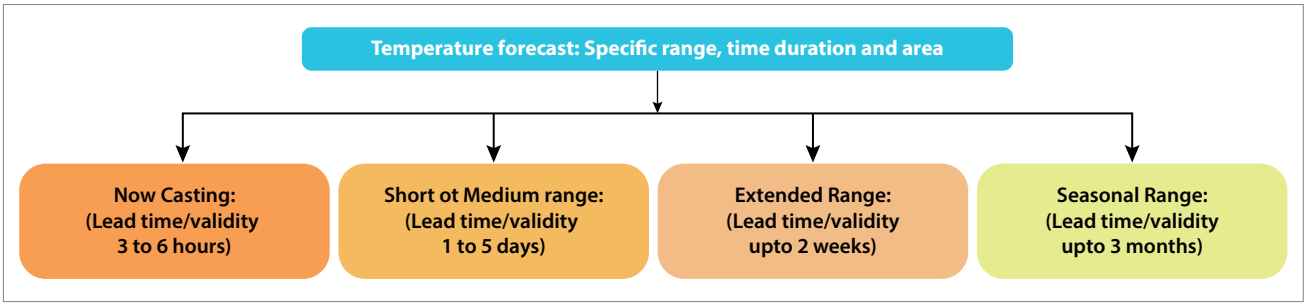
IMD issues forecasts & warnings for all weather-related hazards including agromet advisory for farmers at local level in short to medium range (valid for the next five days) every day as a part of its multi-hazard early warning system. IMD has developed various mobile applications to share forecast warnings. These warnings, updated four times a day, are available at https://mausam.imd.gov.in/.

In addition, IMD also provides real time Interactive Map for temperature and cold wave on GIS platform (http://imdgeospatial.imd.gov.in/Min_Temperature/#5/22.752/82.803). IMD issues special press releases whenever there is a possibility of severe cold wave conditions over any part of the country.

IMD initiated a multi-institutional initiative for cold wave/day monitoring & forecasting in collaboration with National Centre for Medium Range Weather Forecasting (NCMRWF), Noida, Indian Institute of Tropical Meteorology (IITM), Pune, Indian Space Research Organization (ISRO) and Indian Air Force (IAF) with effect from 2016. A very detailed report is prepared daily by 1700 hours IST during 1st December to 28th February, every year, which includes all meteorological & satellite observations related to minimum temperature, cold wave, cold day, frost, fog, heavy rainfall/snowfall and forecast & warning for next one week. The same is displayed on the IMD website and disseminated to all concerned.

A bulletin in extended range with outlook for the next two weeks (for all hazards including cold wave) is issued every Thursday (available at http://www.imd.gov.in/pages/extended.php).

In addition, Seasonal Outlook for 1-3 months ahead for sub-divisional levels for minimum temperatures & its departure are also issued. These seasonal outlooks are issued in the form of a press release on the IMD website, and through electronic and print media. These are also provided to all concerned Chief Secretaries, Disaster Managers and to the health sector through the India Medical Association (IMA). The operational system of weather forecasts and warnings is summarized in the chart below:



IMD utilises its resources to monitor round the clock forecast and warn against the adverse weather to the general public, disaster managers, media and other stakeholders. For monitoring the weather systems, IMD uses all types of synoptic charts, INSAT-3D Rapid half hourly imagery every 10 minutes, Doppler Weather Radar (DWR) produces for Srinagar, Patiala, Delhi, Lucknow, Jaipur and Bhopal to disseminate short to medium range forecast that indicates the potential areas at risk with the probability of occurrence of the phenomena. It also broadcast snow cast that provide specific information about the place and time of occurrence. Various Numerical Prediction Models like IMD GFS, WRF, ECMWF, NCMRWF, NCUM, GEFS and various international models are utilised for this purpose.

Impact Based Forecast - Warning for Cold Wave

As stated earlier, cold wave has adverse impact on many sectors like agriculture, energy, transportation, infrastructure, in addition to human health. IMD and NDMA have developed an impact-based early warning system using colour coding. IMD currently follows a single system of issuing forecasts & warnings for the entire country through the colour code system as given below. This system advises on the severity of an expected cold wave/cold day hazard and possible actions to be undertaken.

Color Code early warning

Color code	Alert	Warnings	Impact	Suggested Action
Green (No Action)	Normal day	Minimum temperatures are near normal	Comfortable temperature	No precautionary action required
Yellow Alert (Be Updated)	Cold Wave Alert	Cold wave conditions in isolated areas persist for two days.	• Moderate temperature. Chilly winds may aggravate cold at time. • Cold is tolerable but mild health concern for vulnerable people. (Infants, pregnant women, elderly, people with chronic diseases etc.)	• Avoid prolonged exposure to cold. • Wear several layers of loose fitting, light weight; warm woolen clothing rather than one layer of heavy cloth. • Cover your head, neck, hands and toes adequately as majority of heat loss occurs through these body parts.

Color code	Alert	Warnings	Impact	Suggested Action
Orange Alert (Be Prepared)	Severe Cold Wave Alert	(i) Severe cold wave conditions persist for two days. (ii) Though not severe, cold wave conditions persist for four days or more.	• An increased likelihood of various illnesses like flu, running/stuffynose or nosebleed, which usually set in or get aggravated due to prolonged exposure to cold. • Do not ignore shivering. It is the first sign that the body is losing heat. Get indoors. • Frostbite can occur due to prolonged exposure to cold. The skin turns pale, hard and numb and eventually black blisters appear on exposed body parts such as fingers, toes, nose and or earlobes. • Severe frostbite Needs immediate medical attention and treatment.	• Listen to radio; watch TV, read newspaper for weather updates/ forecasts. • Wear insulated/waterproof shoes. • Moisturize your skin regularly with oil, petroleum jelly or body cream. • Eat healthy fruits and vegetables rich in vitamin-C and drink lots of fluids to maintain adequate immunity. • Avoid or limit outdoor activities. • Keep dry, if wet, change clothes immediately to prevent loss of body heat. • Warm the affected area of the body slowly with lukewarm water; do not rub the skin vigorously. • If the affected skin area turns black, immediately consult a doctor. • Maintain ventilation while using heaters to avoid inhaling toxic fumes. • Take safety measures while using electrical and gas heating devices. • Don't drink alcohol. It reduces your body temperature. • Drink hot drinks regularly.
Red Alert (Take Action)		(i) Severe cold wave conditions persist for more than two days. (ii) Total number of cold wave/ severe cold wave/days exceeding six days.	• Severe exposure to cold wave can lead to Hypothermia; a decrease in body temperature which causes confusion, shivering, difficulty in speaking, sleepiness, stiff muscles, heavy breathing, weakness and/or loss of conscious- ness. Hypothermia is a medical emergency that needs immediate medical attention. • Frost and cold wave affect pulse crops and livestock.	• Along with suggested action for orange alert, extreme care needed for vulnerable people. • Regularly check on elderly neighbors, especially those who live alone. Stay indoors, if possible. Avoid unnecessary exertion. • Locate designated public shelter nearby. • In case of electricity or heating mechanism failure take the affected person to such designated shelters. • Seek medical attention as soon as possible for someone suffering from frostbite/Hypothermia. • Do not give the affected person any fluids unless fully alert.

Color code	Alert	Warnings	Impact	Suggested Action
				• Store adequate water as pipes may freeze. • Move pets indoors. Likewise, protect livestock or other big animals from cold weather by moving them to an enclosure.

Early Warning Dissemination and Communication Strategy

The early warning of an extreme weather event can lead to enhanced preparedness and response from the local authorities. The efficacy of the early warning systems rests on four key elements namely risk knowledge; an apex technical monitoring and warning service; communication and dissemination of warnings; and community response capability. In any given location the Risk is a combination of hazards and vulnerability. Early warning services relying on science are the mainstay of IMD in India which provides 24-hrs alerts by continuous monitoring of climate data.

In addition, it is equally crucial how the warnings are disseminated by various means to the end user. While popular media is one of the major means of dissemination of early warning, local governments may also innovate on how to disseminate warning. Community being the first responder to any disaster, it is necessary that programmes may be developed to build the capacity of the local community to interpret and act. Early warning/alert communication and dissemination strategy, capacity building, public awareness, community outreach and Information Education Communication (IEC) at various levels.

Dealing with Cold Wave and Preparing an Action Plan

"Disaster" is defined under section 2(d) of the Disaster Management Act, 2005 as a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, and is of such a nature or magnitude as to be beyond the coping capacity of the affected area.

Considering the importance of reducing the impact of cold wave, the Government of India notified 'cold wave' as a disaster and the Ministry of Agriculture as the nodal Ministry for cold wave/frost. The Government of India approved the inclusion of cold wave/frost O.M No. 32-3/2010-NDM-1 dated 13th August 2012 in the list of eligible natural calamities in the guidelines for assistance from SDRF and NDRF for damages in agriculture sector only. The following conditions/criterion will be taken into account while considering the assistance from SDRF/NDRF for the calamity of cold wave/frost:

A. Severe cold wave conditions would be said to prevail in an area:
   i. If minimum temperature is lower than 7°C in an area where normal minimum temperature is 10°C or above; and
   ii. If minimum temperature is lower than 5°C in an area where normal minimum temperature is less than 10°C.

B. Frost conditions would be said to prevail when temperature falls below 0°C in an area where it is an abnormal phenomenon during the kharif/rabi season.

C. For declaring a district affected by frost/cold wave conditions by the State Government concerned, the meteorological data on departure of normal minimum temperature in the affected area, as released by

the India Meteorological Department (IMD) shall be taken into consideration, for prevalence of frost/ cold wave conditions.

D. According to the existing norms, areas which suffer crop loss of 33% or more due to cold wave/frost conditions will be eligible for assistance from SDRF, as allowed in the case of damage due to drought, hailstorm, pest attack and other natural calamities. Similarly, animal husbandry, including the poultry sector, would get assistance from SDRF/NDRF in the wake of cold wave/frost.

The Inter-Ministerial Central Team (IMCT) needs to make a field visit for assessment of damage to agriculture and horticulture due to cold wave/frost and shall take into consideration of all factors such as crop cutting experiment, fall in normal production, Normalized Differential Vegetation Index (NDVI), status of crops in the affected area, crops sown in the area affected, the vulnerability of the cold wave/frost on standing agriculture/horticulture crops etc. in the guidelines.

Rationale for Cold Wave Action Plan (CWAP)

Cold wave especially affects the health sector; hence health systems and agriculture are required to be given more importance.

Cold waves can lead to injury or death. They also cause enormous financial and economic losses. The impact of cold wave has received immense attention in the media; but, the management aspect of cold wave has not been paid adequate attention. Concerted effort needs to be channeled into the management of cold wave.

Objectives of Guidelines

The guidelines for preparing the Cold Wave Action Plan aims to provide a broad framework for developing an action plan at the State level and local level. The guidelines draw upon on the Sendai Framework on Disaster Risk Reduction emphasizes on all aspects of disaster management like mitigation, preparedness, early warning and communication, IEC campaign, capacity building & training. With the focus on different sectors and defined roles and responsibilities, the cold wave guidelines will help the States to limit the mortality and economic loss due to cold wave.

Key Strategy for Cold Wave Management

Severe and extended cold wave can also cause disruption to general, social and economic service. As cold wave/frost is a localized disaster event, location-specific strategies are to be drawn up by the State Governments. Government agencies will have a critical role to play in preparing and responding to cold wave at the local level, working closely with agriculture, health, livestock and other related departments on a long-term strategic plan. The strategy for cold wave management comprises of:

i. Identification of cold wave risk and vulnerability assessment;
ii. Establishing qualitative early warning, forecasting and alerts dissemination;
iii. Develop inter-agency coordination at different levels;
iv. Preparedness at the local level;
v. Structural & non-structural measures including cold wave related programmes/schemes;
vi. Public awareness and community outreach;
vii. Capacity building and training programmes;

viii. Collaboration with private, non-government organizations and civil society;

ix. Research & Development;

x. Assessing the impact; and

xi. Receiving feedback for reviewing and updating the plan.

Acclimatization

Those who come from a hotter climate to a cooler climate, especially during the cold wave season, are at risk. Early warnings of minimize the impact of cold waves. An early warning message helps people to avoid moving out in open area and ensures preparedness, prevention and mitigation measures for cold waves. This helps the body get acclimatized to cold. Acclimatization is achieved by gradual exposure to the cold environment during a winter season.

Steps to Develop an Action Plan

Step 1: Government Engagement

Preparing a Cold Wave Action Plan requires participation from State and district governments, municipal health agencies, disaster management authorities and local partners. The State should constitute a dedicated cold wave committee chaired by the State Disaster Management Authority and will have representatives from all other relevant departments such as health, agriculture, animal husbandry etc.

Step 2: Appointing a State Nodal Agency and Officer

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

Step 3: Vulnerability Assessment and Mapping

It is important to identify vulnerable areas and populations in order to establish priorities for wave warning/ alerts and activities. The State should coordinate with the India Meteorological Department (IMD) to develop a local forecast warning and alert systems with the help of local government departments. Identifying local academic/research institutes like agriculture universities, medical colleges can provide additional useful partners for coordination.

Step 4: Drafting and Developing the Cold Wave Action Plan

The State Nodal Officer and Agency can coordinate with the local IMD office for receiving winter season forecasts from November to February and set up the early warning and daily alert system with colour codes based on predicted lower daily temperatures relative to different local normal temperatures.

Step 5: Team Preparation and Coordination

Governments should ensure that the State officials and agencies are well prepared for the winter season, key officials are well-trained and have information regarding pre, during and post cold wave (winter) season

activities. Team members have to develop a clearly defined interagency emergency response plan with roles and information flows clearly marked out.

Step 6: Implementation and Monitoring

While the government departments (and partners) are responsible for implementing many components of a Cold Wave Action Plan, the public should be made aware of how to prepare and respond to cold wave. Information, Education and Communication (IEC) plays an important role in widely disseminating key messages to communities in advance. Specific messages should be developed to cater to vulnerable groups such as elderly, young children, outdoor workers and slum residents. "Do's and Don'ts" during a cold wave should be available in local languages and disseminated through media, including social media and SMS in a manner that is easily accessible by vulnerable sections of the population.

Step 7: Evaluating and Updating the Plan

The approach towards severe cold wave risk reduction must be flexible and the plan should be frequently updated to deal with unintended consequences. There should be frequent evaluation to determine if the strategies to deal with cold wave are effective, such as traditional remedies for mitigating cold that includes eating hot food and drinking water. After every winter season, the State must assess the efficacy of the Cold Wave Action Plan, including the processes, outcomes, and impacts. Stakeholders should then identify changes and improvements needed for managing the next cold wave (winter) season. The plan should be revised and updated as required. The changes carried out should be brought to the notice of key officials and other stakeholders.

Step 8: Strategies for Reducing Cold Wave exposure and adapting to Climate Change

States should consider mitigation strategies to reduce the impact of cold wave, such as increasing the number of temporary shelters for homeless with adequate food, water, and medicine; advance planning and uninterrupted power supply; implement crop contingency plan; arrange sufficient food and shelter for animals, and effective traffic management during dense fog. Vulnerability assessment should also consider climate change scenarios wherever possible.

Prevention and Mitigation Measures

Knowledge of effective prevention and mitigation measures is crucial for survival and to contain damages caused by cold waves. The strategy envisages the development and implementation of a policy framework on disaster risk reduction from a holistic perspective, which emphasizes on prevention, mitigation and preparedness in pre-disaster phase. The guidelines would facilitate effective mitigation in tune with an ecosystem-based approach to disaster risk reduction.

The prevention and mitigation strategies need to be both structural and non-structural. While the former generally indicates investment made on physical constructions or other development works (such as engineering measures and construction of hazard resistant/protective structures), the latter refer to soft measures such as awareness creation and education, policies strengthening techno-legal systems and practices, training, capacity development etc.

Preventives Measures

It has been observed that the States affected by cold waves and frost have been taking necessary measures as per their understanding and experience. Hill States feel that they have a better understanding of local conditions and they are better prepared for cold waves than that of States in northern plains because hilly States know how to live with extreme cold conditions but States in plains face it for a short duration so they face more severe impact of cold waves.

Measures to manage cold wave have been in place by the local state/district level administration. Some of the general and prevailing measures adopted by cold wave prone states, which may be useful for other States too:

- Identification of vulnerable areas and preparation of Winter Action Plans covering all sectors;
- Timely dissemination of early warning to all concerned stakeholders;
- Regular and frequent meetings of administration at all levels;
- Ensure adequate quantity of supplies of food, drinking water, fuel, and medicines etc.;
- Well planned out and timely arrangements for day and night shelters for the homeless;
- Preparations for necessary medical facilities to handle cases of cold wave victims;
- Arrangements of Rescue Teams linked with CATs Ambulance to facilitate transportation of needy persons to hospitals;
- Creating and publicizing helpline numbers for people to contact authorities and get required help;
- Advance planning to ensure uninterrupted power supply;
- Preventing crops from cold waves and also promoting cold weather sustainable crops; and
- Issue of advisories for common people to help them keep safe from cold waves.

Mitigation Measures

It is important for both the hilly States and those in plains to prepare mitigation measures for cold waves and related issues; and develop time-bound strategies accordingly. Some of the important mitigation measures are listed below.

Agriculture Sector – Prevention and Mitigation Measures: Farmers are to provide light irrigation as per need, immediately prune damaged tips of branches or shoot, burn leaves/waste material in the orchard to create smoke and manage rejuvenation of damaged crops through pruning of dead material, application of extra doses of fertilizer through foliar sprays. Some important mitigation measures are:

- Thermal insulation by the application of locally available organic mulches will reduce the cooling rate of soil surface and keep the soil warm;
- Air mixing by running fans in orchards will help in breaking inversion layers and allow free mixing of cold air with warm air;
- Provision of heat through heaters/fire between the rows and creating an air blanket of smoke particularly in orchards by collecting and burning dried weeds/wood etc., shall trap the outgoing long- wave radiation and the fall in temperature is reduced to a great extent (greenhouse effect);
- Sprinkler irrigation to release latent heat of fusion by releasing heat into the surrounding air through condensation of water droplets;

- Cultivation of cold/frost resistant plants/crops/varieties in frost prone areas should be popularized to minimize crop loss;
- Application of growth regulators and chemicals to enhance resistance to cold stress may also prove helpful;
- Planting of wind breaks/shelter belts around orchards in cold wave prone areas. This will reduce the wind speeds and the wind chill effect in the leeward side besides minimizing the sensible heat losses from the protected crop;
- Mixed cropping of vegetables, viz., tomato, brinjal with a tall crop like mustard/pigeon pea will provide necessary shelter against cold winds; and
- Other agronomic practices such as raising nursery under partial shade of trees or in between tree rows, multi-storey/mixed plantations and pruning of undesirable twigs/branches for in-situ use as mulch. Providing plant cover shade will also give considerable protection (greenhouse effect).

Practices to Rejuvenate Frost Damaged Orchards

The package of practices for rejuvenating frost damaged plants includes:

- Prune the affected parts of the plants at the end of February or early March. While doing so, also cut a few centimeters of the living tissue of the limb/branch being pruned. Apply Bordeaux paste to the cut ends which are more than 2.5 cm in diameter;
- Spray these plants with Bordeaux mixture (2:2:250) or copper oxychloride @ 1.5 kg/550 liters of water after pruning so as to block infection of the wound;
- Irrigate the frost affected plants soon after pruning, if it is available;
- Apply nitrogenous fertilizer before irrigation to encourage new growth on the affected plants based on soil test results;
- Remove water sprouts from the main trunk of trees to encourage the fresh growth from the top;
- Application of P and K to soil to activate better rooting and sap flow in the plants; and
- Application of farmyard manure also helps in improving nutrient management besides improving soil thermal regime.

Health Sector – Prevention and Mitigation Measures

In order to minimize cold weather health impacts, high risk groups like senior citizens (>65 yrs)/young children (0 to 5 yrs), homeless citizens, persons with chronic illness (cardiac/respiratory), and psychiatrically debilitated should be given extra care. Also, extra effort needs to be given to the sick, injured, and wounded individuals as they are very susceptible to cold injuries. Director/In-charge of Hospitals CHCs and PHCs in all States/Districts should ensure that the following measures are in place:

- A detailed action plan to tackle cold wave illnesses well in advance of winter months;
- Operational framework - preparing specific health adaptation plan, development of guidelines and response plan for climate sensitive diseases (CSD);
- Need for updating cold wave health action plan, and issuing advisories 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;

- Standard Operating procedures to tackle all levels of cold-related illnesses;
- Develop a standard cold wave Treatment Protocol;
- Identify surge capacities and mark the beds dedicated to cold wave affected patients;
- Ensure adequate arrangements of staff, beds, essential medicines and equipment;
- Health centers must undertake awareness campaigns for neighborhood communities using different means of information dissemination;
- Primary health centers must refer the patients to the higher facility only after ensuring adequate stabilization and basic definitive care;
- Hospitals must ensure proper networking with nearby facilities and medical centers to share the patient load which exceeds their surge capacities; and
- All cases of cold-related illnesses (suspected or confirmed) should be reported to IDSP (Integrated Disease Surveillance Programme) unit of the district.

In case, someone is affected by cold wave, the victim may be covered with dry, insulating materials in a warm environment (blankets, sleeping bags, and space blankets). Block any source of cold wind and keep the victim dry. Also, hot water bags, warmed rocks or heat packs may be applied to high circulation areas. Immersing the victim in a hot water bath and sharing body heat from another person helps to manage cold weather-related health impact.

Animal Husbandry

Some of the preventive measures that can help reduce the impact of cold weather include:

- Improving livestock feeding practice and dietary additives;
- Selecting animal breeds especially fit for cold weather conditions;
- Use of high-quality forage or pastures;
- Fat supplementation in ratios;
- Construction of climate-smart sheds that allow maximum sunlight during winters and low radiation during summers;
- Covering the animals especially smaller ruminants during cold days; and
- Cover the animal habitat from all sides during the night to avoid direct exposure of animals to cold winds; and Using some bedding materials such as dry straw under animals during winters.

Veterinary infrastructure and expertise need to be arranged/upgraded by the States which may also include:

- Deployment of adequate number of veterinarians and para- veterinarians in cold prone areas
- Arrangement of mineral mixtures, lifesaving drugs, fluids and other medicines and equipment in veterinary hospitals at all times
- Activation of mobile veterinary units
- Conducting awareness programmes in respect of cold management of animals
- Identifying disposal sites for dead animals
- Liaison with other stakeholders/agencies wherever required.

Homeless and Urban Poor

The urban poor and migratory laborers who are homeless are especially vulnerable to cold waves. In that, the subgroups of aged, children, substance-abusers are especially vulnerable to cold wave spells. As the migration from rural to urban areas increases each year there is an overall deficit in housing and shelters for the urban poor. Following activities are undertaken to mitigate cold weather impacts on urban poor:

- To provide shelter to the homeless in Rain Baseras/Vishram Grah throughout the year
- To provide a comfortable stay with basic facilities for homeless residents
- To put up shelters at a strategic potential location for meeting the requirement of shelter-less
- To make additional arrangements during the winter season under "Winter Action Plan"
- To make arrangement to shift homeless from open area roadsides to nearest shelter during winter season under rescue program.

Preparedness and Response Measures

The primary focus is to enable the decision makers to find solutions on the availability of equipment and human resources required to combat any emergency situation that may arise. Following preventive and mitigation measures, and in order to address the residual risks of cold waves, various preparedness measures need to be put in place by disaster management authorities, followed by effective response in order to meet the challenges posed by cold wave and related threats. Respective agencies should be prepared to respond in their respective sectors.

India Disaster Resource Network (IDRN) is a web enabled data base that to collects and collate information on resources available in the country/State/District for emergency response and to enhance the decision-making capabilities of Government functionaries. IDRN is accessible to the Emergency Officers, District Collectors and other disaster managers at various levels of Government. The system gives the location of specific equipment/specialist resources as well as the controlling/owning authority for the resource so that it can be mobilized for response in the shortest possible time.

Disaster response measures should aim at rescuing those who are affected or likely to be affected by hazards. This involves minimizing the impact of injuries, loss of life and damage to agriculture and other economic activities and the environment. Usually, disaster response is carried amidst periods of heightened stress and often with constraints of time, information and resources. Apart from addressing the immediate needs and functions of search and rescue, it also involves the activation and coordination of various lifeline systems.

Effective preparedness and response require planned sectoral interventions. Following are the major areas of intervention with some broad action points towards preparedness and response.

- **Advisories and Early Warning:** Timely advisory and early warning in coordination with IMD can prevent likely loss of lives or damages due to cold waves.
- **Health and Medical Facilities:** Saving loss of lives and preventing cold wave related illnesses are top priorities; adequate health and medical facilities are necessary to deal with cold wave impacts.
- **Agriculture:** Impact of cold waves on Agriculture is huge and significant. Protection of crops and plants from cold wave/frosts is crucial.
- **Animals and Livestock:** Protection of animals and livestock is also important as they are part of livelihood for large number of households.

- **Energy:** Role of Power/Energy is vital in management of cold waves. Uninterrupted power supply helps in keeping the internal environment warm and it also helps in medical and health services.
- **Water Supply:** Prevention of water from freezing during extreme cold and to ensure normal water supply is very essential.
- **Transportation and Traffic Management:** Clearing of snow and taking safety measures during fog are some of the important measures to be taken for cold waves.
- **Tourism:** Tourism has both positive and negative impacts of the cold waves. It is important to ensure that positive impacts continue whereas the negative impacts are checked and controlled.

Community/Family preparedness during cold wave

Community/Family should be adequately prepared for meeting the challenges of cold wave. Community/ local level preparedness plan, and IEC activities to create awareness among the community members is essential. As part of the awareness or community & families special focus should be paid to the following do's and don'ts. A detailed list of Do's and Don'ts is in Annexure-1:

- Assess the risks where you live, work, study and (kids) play
- Assess individual capabilities and needs
- Keep emergency contact and health information available
- Know your building exit routes
- Make hazard-specific plans about whether to stay or go and where to shelter (applicable for other hazards as well). Learn the location of cold wave-shelters or temporary housing.
- Respond to early warnings issued by competent authority. Learn and participate in your community's early warning systems and practice regular emergency mock-drills
- Construct your home in a safe place in compliance with building regulations
- Take annual home maintenance measures to keep your home safe
- Know your building well and identify places that may fail due to snowfall or heavy precipitation
- As keeping hot-pots and other heating mechanisms is common during cold wave, practices home fire prevention methods
- Protect your domestic animals and livestock
- In case of power outage, take fire precautions
- After hazard impact, after making sure you're safe, help those around you.

Source: IFRC - Key Messages for All-Hazards Household and Family Disaster Prevention.

Information Education and Communication (IEC) - Strategy for Management of Cold Waves

Key Components of IEC Strategy

Cold Wave related Information Education and Communication should aim to reach the last person as soon as possible.

The Communication Strategy should be based on insights and needs of the local population while selecting the following:

- Messages
- Messenger/Medium/Media;
- Nature of the Receiver with specific messages for the most vulnerable
- It should aim at promoting a culture of DRR and behavioral change in public.
- It should focus on reaching out to the most vulnerable such as the poor, homeless, elderly, disabled, pregnant or lactating mothers, etc., with specific messages for these groups. In addition, the targeting may be further sub-categorized (if needed) such as Urban Poor and Rural Poor as they are living in different situations.
- Do's and Don'ts/safety tips should be specifically drafted for the first responders for identifying symptoms in affected persons & actions to be taken for different symptoms. Research Methodology, Rapid Appraisals and Communication Gap Analysis techniques should be used for better understanding of:
  - Vulnerable groups
  - Behavior patterns or tendencies
  - Media consumption
  - Local trends of the vulnerable population
  - Based on this, the IEC Campaign should identify optimal ways to reach out to the target groups.

IEC Activities and Awareness Campaigns

Communication plans should be prepared based on robust communication strategy and research insights. Following are the salient features of a communication plan:

- Target specific, and implementation oriented
- It should cover all the phases –research, development of concept, media planning, development of relevant IEC material such as short films, posters, print ads, social media posts, talking points for interpersonal communication, etc.
- The plan can be divided into pre- cold wave activities, during cold wave and post cold wave phases
- Since the main objective of the IEC Campaign is readiness and preparedness, the campaign should be planned in a way to start much before the commencement of the cold wave season. It should reinforce its messages during the cold-wave season and should have space for review after the cold wave season
- The scope of the IEC activities can be defined based on at what level viz; National, State or local, the campaign is organized.

Following are the activities for each of the levels. These activities are suggestive in nature and should be amended as per the need of the hour.

State Level

- If possible, all the stakeholders such as Disaster Management Authorities, departments and agencies of health, municipal administration, education, labor, police, etc., should co-opt a single campaign for consistency of messaging
- Prototypes of IEC materials of all forms may be shared with the State and local administrations for reproduction in local languages or as reference content for local IEC material

- Mass awareness campaigns involving print, TV, radio, social media, etc., reaching out to all the vulnerable areas/regions/States
- Separate list of Do's and Don'ts and safety tips should be targeting vulnerable sections of the society such as women, pregnant women and lactating mothers, children, poor, homeless, elderly, handicapped, outdoor workers, managers of night shelters, farmers etc. agriculture sector (field and horticulture crops), and livestock sector
- In case the campaign is to be endorsed, it should be by a nationally renowned eminent personality
- Carry out mass awareness campaigns in local languages
- Develop media and communication strategies and plans considering local socio-economic and behavioral factors
- Involve recognized artists of the state, such as folk singers, dancers, and other performers
- Conduct regular awareness programmes in all the districts
- Conduct regular training programmes for interpersonal communication activities
- Identification and first-aid of cold disorders in both human beings and animals need to be addressed under all campaigns and State programmes on cold waves.

District/Local Level

The local authorities, due to their proximity to the cold wave prone population are in the best position for caring out IEC activities and last mile delivery of messages. They may:

- Conduct regular training and awareness programmes including demonstrating the safety tips to the vulnerable population in their local language, using local customs, cultural aspects and behavior patterns. Local artists and art-forms may be utilized for entertainment-based education programmes
- IEC tools and materials (such as flyers, calendars, comic books, etc.) should be made available for field level functionaries for dissemination to local people
- Strengthen and involve local communities such as RWAs, Municipal bodies, NGOs, Civil Society Organizations, Panchayati Raj Institutions, Anganwadis, Gram Sabhas, Police, medical professionals and other local networks
- Closed group messaging services such as WhatsApp may be extensively used by these local community groups
- Give special emphasis to dissemination in locations of "closed homogeneous groups" such as schools, colleges, offices, cinema houses, construction sites, agricultural markets etc.
- Carry out special awareness programmes for specific occupations (farmers, horticulturists, livestock rearers, construction & other outdoor workers, etc.) and vulnerable groups making them aware of impacts and the preventive and curative measures to be adopted in the event of a cold wave.

Dissemination of Warning Messages

In addition to the IEC awareness campaign, activities towards wider dissemination of the early warning for severe cold waves should be undertaken with short, clear and action-oriented messages. Some of the points to consider with respect to Early Warning Messages are as follows:

a) Content of warning messages: The warning messages from agencies such as IMD should contain the safety direction to be followed along with generic suggested actions, for example, the messages for Severe Cold Wave may ask the public to remain indoors, use hot beverages etc.

b) Dissemination of warning messages: Target audience specific actions should be undertaken by the Health/Municipal/Labor/Police/Education department, Disaster Management agencies based on severity/duration of the warnings for vulnerable groups such elderly, women, children, farmers, outdoor workers etc.

c) Multiple mediums should be used for dissemination of the warning messages.

Capacity Building

Capacity Building and Training Programmes

Capacity building is an on-going process that equips officials, stakeholders and the communities to perform their functions in a better manner during a crisis/disaster. It includes human resource development, i.e., individual training, organizational development for improving the functioning of groups and organizations and institutional development.

As cold wave/frost is a localized phenomenon, the State Governments must draw up location specific training and capacity building plans, focus on sector specific stakeholders/target groups including senior/middle level officers/staff, media personnel and respective District Disaster Management Authorities (DDMAs), local authorities (PRIs and ULBs) and NGOs. The State under the guidance of SDMA at state level will also organize training of concerned officials and stakeholders.

Locally generated, owned and sustained capacity is essential for the effective management of cold wave and frost conditions. Sector-specific programmes for various stakeholders including medical officers, community health staff, health care professionals, agriculture officers, veterinary officers, NGOs, District Administration and Community needs to be developed and regular training needs to be imparted. Regular training is also required for Fire Departments, as it has been noticed that during the cold wave period incidences of fire break-out are very high.

Capacity building and training programme additional focus for health care professionals at local level to recognize and respond to cold-related illnesses, particularly during extreme cold events. These training programmes should focus on medical officers, paramedical staff and community health staff so that they can effectively prevent and manage cold-related medical issues to reduce mortality and morbidity.

The local authorities need to retain stock of essential items to tide over the lean period of supply. The dense fog associated with cold wave limits the movement of traffic, both road and air. Hence, particular attention needs to be provided for traffic management. With the onset of winter, disaster management authorities at the State and district level should issue advisories for better management of cold waves. All the institutions involved in cold wave management must document their lessons learned and draw upon them to refine the management this year. Hence, for cold wave management, both change management, as well as knowledge management, is important.

Cold waves are common in the plains of north India with foggy conditions that prevail during the winter season for several days or weeks at a stretch. It affects the day-to-day life of local people. During a cold wave, common issues like electricity failures, roadblocks and health issues are reported commonly in the media. A cold wave with heavy and persistent snowfall causes crop damage and a shortage of food for grazing animals. Fire incidences are also common during the winters.

Capacity Building and Training Measures

- Facilitate: Knowledge & Skills required for Cold wave management through short/medium Training Courses
- Integrate training sessions on Cold Wave management as part of other official training programmes for senior and mid-level government officials from various line departments
- Study ours and training programs for State/District officials
- Training for Shelter Management including arrangement of essential supplies and medicines for local administration
- Training of Fire Department for responding to fire situations
- Awareness campaigns
- Training of health workers under Integrated Disease Surveillance Programme (IDSP)
- Training programmes for farmers about measures for protecting their crops and livestock
- Develop Modules on related areas based on NDMA guidelines- enable in training sessions of government offices/states converting into School, College Syllabus, Curriculum etc.

Nodal Agency for Capacity Building and Training

NIDM has been assigned nodal responsibilities for human resource development, capacity building, training, research, documentation, and policy advocacy in the field of disaster management.

Sl. No.	Tasks/Activities	Central/State Agencies & Their Responsibilities			
		Centre	Responsibility	State/District	Responsibility
Understanding Risk					
1	Preparation of policy, guidelines and Action Plan	NDMA	Guidelines for preparation of Action Plan		
		Nodal Ministry – Ministry of Agriculture and Farmers Welfare (MoA&FW) and other concerned ministries	• Preparation of national action plan for cold wave • Preparation of DM plan of the ministry including coldwave hazard	State Governments/ SDMA/ Commissioner of Relief (COR)/ Dept. of Agriculture and other concerned departments	• Preparing State Action Plan for cold wave management and its implementation • Ensure preparation of detailed departmental SoPs by concerned departments
2	Hazards Risk and Vulnerability Assessment	MoA&FW*/MoES/ MoH&FW/MoAH&DF/ MoHUA/MoP/MoJS/ MoRTH/MoPR/MoR/ MoEF & CC/DST	• Identification of vulnerable areas and preparation of HVRA maps at district level	State Governments/ SDMA/DDMAs/ Dept. of Agriculture and all concerned departments	• Identification of vulnerable areas and preparation of HVRA maps for respective states up to sub district/village level

Sl. No.	Tasks/Activities	Central/State Agencies & Their Responsibilities			
		Centre	Responsibility	State/District	Responsibility
Inter-Agency Coordination					
3	Early Warning and Communication	**Nodal Agency** IMD (Ministry of Earth Science)	• Issue area specific impact-based warning/alerts and weather forecasts • Strengthening infrastructure for forecast/early warning	State Governments/ SDMA/DDMA/ District Adm.	• Early warning to be converted into advisories on necessary action and disseminate using different media including social media. • Create a network of community based early warning systems
		Disseminations 1. Ministry of Agriculture and Farmers Welfare and all concerned central ministries/ departments	• Issue warning and advisory to all the sub-ordinate offices/ agencies	State Governments/ SDMA/Dept. of Agriculture and all concerned departments	• Disseminate information received from IMD to public at large • Disseminate impact based colour code early warning at local level • Disseminate agro-met advisory,forecast/ warning and alert to farmers
		2. Ministry of Health & Family Welfare	• Disseminate early warning information to all State health department	State Governments/ SDMA/ State health department	• Disseminate early warning information to all health professional
		3. Ministry of Animal Husbandry & Dairying, Fisheries	• Disseminate early warning information to all State Animal • Husbandry department	State Governments/ Department of Animal Husbandry	• Disseminate early warning information to all veterinary offices/hospitals
		4. Ministry of Information and Broadcasting (PIB, AIR, Doordarshan)	Specific message and information, dissemination to public at large through print/ electronic and social media	State Governments Dept. of Public Relation in concerned States	• Ensure specific message and information, dissemination to public at large through print/ electronic/social and other mass media at local level

Sl. No.	Tasks/Activities	Central/State Agencies & Their Responsibilities			
		Centre	Responsibility	State/District	Responsibility
		5. Ministry of Power	Specific	State Governments/ SDMA/COR/Dept. Of Electricity	• Activate all concerned public/ private DISCOM offices/officers • To ensure uninterrupted power supply
		6. Department of Telecommunication	Issue necessary direction to its field and Telecom Service Provider (TSPs) for timely dissemination of alerts through various telecom network over Outbound Voice Messages, SMS and cell broadcast	State Governments	• Send warning message, preparedness through Bulk SMS to the likely impacted areas–based on IMD warning. • Ensure all TSPs to take necessary measures for ensuring business continuity duly extreme cold wave condition.
Relief & Response					
4	Relief & Response	1. MoA&FW (in Coordination with other concerned Ministries/Dept./ Agencies)	• Coordination • To ensure all necessary measures required for effective and timely relief and response • Issue advisory to save crops and plants from cold waves/frost	**Nodal Agency:** State Governments/ SDMAs/COR/ DDMAs. (with other concerned Department/ Agencies)	• Designate a nodal officer for emergency response • To ensure all administrative measures required for effective and timely relief and response. • Identify and establish Relief Centres/camps. • Arrange relief material and supplies. • Activate helpline number
			• To discuss in the Crop Weather Watch Group (CWWG) • Provide necessary relief for crops damage as per norms		• Coordinate with all stakeholders. • Initiate counter measures, such as shelter and other logistics necessary at relief centres. • Take necessary measures for saving crops • To provide necessary relief for crops damage as per norms

Sl. No.	Tasks/Activities	Central/State Agencies & Their Responsibilities			
		Centre	Responsibility	State/District	Responsibility
		2. Ministry of Health & Family Welfare	• Ensure adequate Hospital and medical facilities • Technical support and Advisory	**State Governments/ SDMAs/COR/ DDMAs Dept. of health**	• Additional hospital and medical facilities if needed for cold wave patient to be activated • Technical advisory and support • Hot room in hospital emergency ward for patient attendant
		3. Ministry of Animal Husbandry, & Dairying and Fisheries	• Issue advisories for the care and protection of animals. • Ensure supply of adequate and sufficient feed, fodder and veterinary medicine	**State Governments Department of a Husbandry**	• Issue advisories to veterinary hospitals/ professionals for the care and protection of animals. • Ensure supply of adequate and sufficient feed, fodder for livestock to avoid animal deaths. • Establish veterinary clinics to control of foot& mouth disease (FMD) • Involvement of NGOs working for animals
		4. Ministry of Housing and Urban Affairs	• Direction for shelter homes/ Rain Basera with essential service like medical facilities, power, food, water supply in urban areas • Ensure necessary measures of arising if any pandemic situation • Appropriate protocol and additional shelters to be ensured during concurrent disasters	**State Governments/ DDMAs/Urban local bodies (ULBs)**	• Ensure operational shelter homes/Rain Basera with essential service like medical facilities, power, food, water supply in urban areas. • Shift homeless/ affected people to shelter homes • Preparation and implementation of Snow Clearance Plan • If concurrent disaster like epidemic/pandemic appropriate social norms and additional shelters may be ensured

Sl. No.	Tasks/Activities	Central/State Agencies & Their Responsibilities			
		Centre	Responsibility	State/District	Responsibility
		5. Ministry of Road Transport and Highway 6. Ministry of Railway 7. Ministry of Civil Aviation	• Directives to effective traffic management during dense fog conditions • Technical support and advisory • Advise on use of advance safety measures during fog	**Public Works Department/ State police**	• Ensure traffic management during dense fog conditions • Apply advance safety measures during fog • Ensure clearing of snow using clearing machines and tools in areas of snow fall
		8. Ministry of Defence (Indian Army and ITBP in coordination with DGRE)	• SAR operation for trapped/ stranded persons in hilly/ mountainous region	**State Govt. (PWD)/District Authority**	• Clear road block due to snowfall in hilly/ mountainous terrain
		9. Border Road Organization/NHAI	• To ensure functional road under area of operation	State government/ PWD	• Assist BRO to ensure functional road
		10. Ministry of Tourism	• Issue Advisories to tourists/travel agencies/hotels etc.	State Governments/ State Tourism Department	• Issue Advisories to tourists/travel agencies/hotels etc. • Authorities to ensure the safety of tourists from any pandemic situation.
		11. Ministry of Home Affairs	• Support state government on request for maintenance of law & order which may arise due to situation like snow clearance, road clearance, fire service etc.	State Governments/ SDMAs/COR/ Department of Police/Civil Defence, and Home Guard	• Ensure maintenance of law & order. • To ensure necessary security arrangements for the emergency responders/relief teams who are working at Relief Centres and involved in distribution of relief.
		12. Ministry of Food and Consumer Affairs	• Ensure adequate stock of food and fuel due to additional demand during the cold wave	State Governments/ SDMA/COR Department of food and civil supply	• Ensure provision of basic food items in Relief Camps and in affected communities.

Sl. No.	Tasks/Activities	Central/State Agencies & Their Responsibilities			
		Centre	Responsibility	State/District	Responsibility
		13. Ministry of Commerce and Industry/MSME	• Issue advisory	State Government/ Department of Industry	• Issue advisory for commerce, industries, and social activities
Monitoring and Review					
5	Monitoring and Review	**Nodal Ministry:** • Ministry of Agriculture and Farmers Welfare • NDMA	• Implementation Periodic review/ updating of action plan	**State Government/ COR/SDMAs/ DDMAs Agriculture department and all concerned dept.**	• All concerned department/agencies to appoint a Nodal officer' to monitor the implementation of the State/District plan • Collect data/ information and plan for review/updating
Investing in DRR					
6	Prevention, Mitigation and Preparedness measures	**Nodal Ministry:** Ministry of Agriculture and Farmers Welfare	• Issue advisories • Give directives to concerned ministries/ departments and state governments. • Ensure cold wave crop safety measures included in the crop contingency plan • Standardize procedure of protection from cold/frost on the Rabi crops • Promote cold weather sustainable crops and plants • Construction safe crop storage shelters for farmers • R&D for cold wave risk reduction	**Nodal agency State Government/ COR SDMAs/ Agriculture/ Animal Husbandry/ Health and UD/ PRIs (with other concerned Department/ Agencies)**	• Undertake, preparedness and mitigation measures • Review and update precautionary measures and procedures • Construction arrangement of shelter homes • Strengthening techno-legal systems and practices etc. • Preparation and implementation of crop contingency plan • Ensure Power supply and Irrigation facilities for farmers • Protection of vegetable plants from freezing and absorbing the cold from surrounding air • Promotion of crop insurance • Formulation of active disaster management teams at panchayat level • R&D for cold wave risk reduction

Sl. No.	Tasks/Activities	Central/State Agencies & Their Responsibilities			
		Centre	Responsibility	State/District	Responsibility
		1. Ministry of Housing and Urban Affairs	• Disseminate information to public on mitigation measures • Ensure adequate number of shelter homes		
			• Issue advisories and direction for arrangements of well- equipped shelter homes with necessary medical facilities, power, food, water and medicine supplies. • Strengthening techno- legal regimes and practices etc.		
		2. Ministry of Panchayati Raj	• Strengthening techno- legal regimes and practices etc. • Issue advisories and direction for essential services and facilities		
		3. Ministry of Health & Family Welfare	• Issue directives for Hospital preparedness and mitigation measures including training of human resources • Create data base of health professionals and facilities	State Governments/ SDMA/COR/and concerned Dept. Of Health	• Ensure appropriate medical staff and facilities • Create data base of health professionals and facilities • Strengthen health centres with a network of paramedical professionals • Ensure stock piling of life- saving drugs, de-toxicants, anesthesia. Ensure availability of Halogen tablets in vulnerable areas

Sl. No.	Tasks/Activities	Central/State Agencies & Their Responsibilities			
		Centre	Responsibility	State/District	Responsibility
		4. Ministry of Animal Husbandry & Dairying and Fisheries	• Necessary advisory and support for the care and protection of animals. • Issue of Advisories with Do's and Don'ts to state governments	State Governments/ SDMA/COR/ and concerned Dept. Of Animal Husbandry	• Stocking of suitable feed or forage before cold wave to feed the livestock. • Avoiding exposure of animals to extreme cold. • Involvement of NGOs working for animals • Promotion of crop insurance and veterinary clinics
		5. Ministry of Power	• Advance planning to match with additional demands during cold weather	**State Governments/ SDMA/COR/and concerned Dept. of energy & power supply**	• To ensure adequate electricity supply in coordination with DISCOM (distribution company)
		6. Ministry of Road Transport and Highway/Ministry of Railways/Ministry of Civil Aviation	• Development • Issue advisories to ensure road connectivity and access to vulnerable areas	**State Governments/ SDMA/COR/ Public Works Dept. (PWD)/ Traffic Police/ Dept. of Road Transport**	• Ensure road connectivity and access to vulnerable areas • Pre-positioning of equipment for route clearance
		7. Ministry of Jal Shakti	• Issue instruction for ensuring availability of drinking water supply	**State Governments/ SDMA/COR/ PHED**	• Advance arrangements to ensure adequate water supply • Use protective measures to prevent water where the freezing point goes to below during extreme cold
		8. Ministry of Environment Forest and Climate Change/ Department Science Technology	• Promote • Ensure risk mitigation/ adaptation measures of cold wave in National Action Plan on climate Change	**State Governments/ Dept. of Forest**	• Ensure risk mitigation/ adaptation measures of cold wave in State Action Plan on Climate Change • Integrate adaptive measures towards climate change impacts in cold wave prone area

Sl. No.	Tasks/Activities	Central/State Agencies & Their Responsibilities			
		Centre	Responsibility	State/District	Responsibility
Capacity Development					
8	Capacity Building and Training	**Nodal agency:** NIDM	• Training programme for all concerned ministries/states • Inclusion of cold wave/frost in various training curriculums • Promoting	**Nodal agency: State Govt./COR/ SDMAs (with respective/DM institutes/ATIs) and NGOs**	• Training programme for all concerned department officials/ volunteers • Conduct training programmes for specific health care, livestock, traffic police etc. • Inclusion of cold wave/ frost and similar issue in various curriculum • Creating ToT teams for different trades relevant to cold wave protection in the construction of different types of housing and infrastructure • Engagement of academic institution for capacity building training and research • Capacity building for volunteers, NGOs, AASHA workers etc. • Conducting mock-drills
9	Public awareness, and Outreach and IEC activities	Ministry of Information and Broadcasting, NDMA and all concerned Ministries/Dept.	• Extensive IEC campaigns to create awareness through print, electronic and social media • Support public awareness of cold wave • Disseminate information to public on mitigation measures	**Nodal agency: State Govt./COR/ SDMAs (with Department of Information and Public Relations) and NGOs**	• Creation of public awareness materials and disseminations • Extensive IEC campaigns to generate public awareness through print, electronic and social media Carry out mass media campaigns in cold wave prone area • Disseminate Do's and Don'ts for general public and enable access to safe places. • Awareness genera-tion material in vernacular language

Sl. No.	Tasks/Activities	Central/State Agencies & Their Responsibilities			
		Centre	Responsibility	State/District	Responsibility
10	Record of data and Documentation	**Nodal Ministry:** Ministry of Agriculture and Farmers Welfare and all other concerned ministries/ departments	• Each concerned ministry to collect data and consolidated database to be maintained by Nodal Ministry • Develop a mechanism for documentation and best practices • Develop a data sharing strategy among all stakeholders	**Nodal agency: State Govt./ COR/SDMAs and Dept. of Agriculture**	• Collect data on deaths and injuries • Assessment of damage from cold wave and frost • Collecting pre, during and post cold wave data from field and reporting to State/National level authority • Prepare and share lessons learnt and best practices

Cold Wave/Frost Do's and Don'ts Before

- Listen to the radio, watch TV, read newspapers for local weather forecast to know if a cold wave is around the corner.
- Stock adequate winter clothing. Multiple layers of clothing are more helpful.
- Keep emergency supplies ready.
- An increased likelihood of various illnesses like flu, running/stuffy nose or nosebleed, which usually set in or get aggravated due to prolonged exposure to cold. Consult the doctor for symptoms like these.

During

- Follow weather information and emergency procedure information closely and act as advised.
- Stay indoors as much as possible and minimize travel to prevent exposure to cold wind.
- Wear multiple layers of loose fitting, lightweight, windproof warm woolen clothing rather than one layer of heavy clothing. Tight clothing reduces blood circulation.
- Keep yourself dry. If wet, then cover your head, neck, hands and toes adequately as the majority of heat loss occurs through these body parts.
- Prefer mittens over gloves. Mittens provide more warmth and insulation from cold, as fingers share their warmth and expose less surface area to the cold.
- Use hats and mufflers to prevent heat loss, Wear insulated/waterproof shoes.
- Eat healthy food to maintain the equilibrium of body temperature.
- Eat fruits and vegetables rich in Vitamin-C to maintain adequate immunity.
- Drink hot fluids regularly, as this will maintain body heat to fight cold.
- Moisture your skin regularly with oil, petroleum jelly or body cream.
- Take care of elderly people and children and check on neighbors who live alone, especially the elderly about their well-being.

- Store essential supply as per requirement. Store adequate water as pipes may freeze.
- Follow the guide on heat insulation for non-industrial buildings and take necessary preparedness measures.
- Watch out for symptoms of frostbite like numbness, white or pale appearance on fingers, toes, earlobes and the tip of the nose, while exposed to cold waves.
- Prolonged exposure to cold can turn skin to pale, hard and numb, and black blisters on exposed body parts such as fingers, toes, nose and/or earlobes. Immediately consult the Doctor.
- Treat the areas affected by frostbite in warm (not hot) water (the temperature should be comfortable to touch for unaffected parts of the body).
- Do not ignore shivering. It is an important first sign that the body is losing heat and is a signal to quickly return indoors.
- Seek medical attention as soon as possible for someone suffering from Frostbite/Hypothermia.
- Move pet-animals indoors. Likewise, protect livestock or domestic animals from cold weather.
- Severe exposure to cold wave can lead to Hypothermia – a decrease in body temperature which can cause shivering, difficulty in speaking, sleepiness, stiff muscles, heavy breathing, weakness and/or loss of consciousness. Hypothermia is a medical emergency that needs immediate medical attention.
- Consult doctor for symptoms like various illnesses, running/stuffy nose particularly during the period of COVID -19.
- Download NDMA's mobile application: First Aid for Students and Teachers (FAST) for information on first aid.

In the case of hypothermia

- Get the person into a warm place and change clothes.
- Warm the person's body with skin-to-skin contact, dry layers of blankets, clothes, towels, or sheets.
- Give warm drinks to help increase body temperature. Do not give alcohol.
- Seek medical attention if the condition worsens.

Don'ts

- Avoid prolonged exposure to cold,
- Don't drink alcohol. It reduces your body temperature, it actually narrows your blood vessels, particularly those in the hands, which can increase the risk of hypothermia.
- Do not massage the frostbitten area. This can cause more damage.
- Do not ignore shivering. It is the first sign that the body is losing heat - get indoors.
- Do not give the affected person any fluids unless fully alert.

Agriculture

Do's and Don'ts

Cold wave and frost damages crops by causing illnesses including diseases of black rust, white rust, late blight etc. Cold wave also causes a variety of physiological disruptions in germination, growth, flowering, yield and storage life.

Do's

- Undertake curative measures for cold illness/injury like spray with Bordeaux mixture or Copper Oxi- chloride, phosphorus (P) and potassium (K) to activate better root growth.
- Do light and frequent surface irrigations (high specific heat of water) during the cold wave wherever it is possible.
- Sprinkler irrigation (condensation-release heat into surrounding).
- Cultivate cold/frost resistant plants/crops/varieties.
- Use intercropping farming in horticulture and orchards.
- Mixed cropping of vegetables, viz., tomato, brinjal with a tall crop like mustard/pigeon pea will provide necessary shelter against cold winds (shelter against cold).
- Increase radiation absorption and provide warmer thermal regime through covering of nursery and young fruit plants during winter by plastic or by making thatches (jhuggies) of straw or sarkanda grass etc.
- Organic mulching (for thermal insulation).
- Planting of wind breaks/shelter belts (to reduce wind speed).

Animal Husbandry/Livestock

Do's and Don'ts

During Cold waves animals and livestock require more food for sustenance as the energy requirement goes up. Extreme variations in temperature may affect the fertility rate in animals during the optimum breeding season for buffaloes/cattle.

Do's

- Cover the animal habitat from all sides during night in order to avoid direct exposure of animals to cold winds.
- Cover the animals, especially smaller ones, during cold days.
- Protect livestock and poultry from cold weather by keeping them inside.
- Improving livestock feeding practice and dietary additives.
- Use of high-quality forage or pastures.
- Provide fat supplements - concentrate ratio on feed intake, feeding, and chewing behavior.
- Construction of climate smart sheds which allow maximum sunlight during winters and low radiation during summers.
- Selecting animal breeds especially fit for these conditions.
- Apply some bedding materials such as dry straw under animals during winters.

Don'ts

- Do not leave animals tied/roam in open area during cold wave.
- Avoid animal fares (pashumela) during cold wave.
- Avoid giving cold feed and cold water to the animals.

- Avoid dampness and smoke in animal shelter.
- Do not keep the animals in open during night and cold hours.
- Carcasses of dead animals should not be discarded on the regular grazing routes of the animals.

Cold wave Disorders: Symptoms and First Aid for Human beings

Disorder	Symptoms	Prevention	First Aid/Treatment
HYPOTHERMIA: Defined as a lowered core body temperature usually below 34.4°C.(94°F)			
1. Mild Hypothermia 2. Moderate Hypothermia: (82° to 89°F.) 3. Severe Hypothermia (less than 82 degree F.)	• Shivering • Dizzy, drowsy • Irritability • Confusion • Slowed, slurred speech • Altered vision	• Avoid exposure to cold. • Eat properly & often. • Warm liquids & water. • Wear uniform/ clothes properly & preferably in layers. • Wear cap and socks. • Keep active. • Us warming tents. • Get plenty of rest.	• Remove wet clothing. • Warm the centre of their body first followed by chest, neck, head and groin region using an electric blanket if available. • Use skin to skin contact under loose, dry layers of blankets, clothing, towels, or sheets. • Warm beverages may help increase the body temperature, but do not give alcoholic beverages. • **Do not give fluids orally if the person is unconscious.** • After their body temperature has increased, keeps the victim dry and wrapped in a warm blanket including the head and neck. • If victim has no pulse, begin Cardiopulmonary Resuscitation (CPR).
FROSTBITE: Frostbite is freezing of body tissue often accompanied with hypothermia. When ice crystal form between the cells of the skin and grow by extracting fluid from the cells, the circulation is obstructed, causing additional damage to the tissue affected. It commonly affects hands, feet, ears, nose and cheeks.			
Frostbite	• Initially manifests as redness in light coloured skin or greyish in dark coloured skin. • Tingling, stinging sensation. • Turns numb, yellowish, waxy or grey color. • Exposed body parts feel cold, stiff and woody	• Wear uniform/ clothes properly and in layers. • Keep socks, gloves and clothing dry. • Protect yourself from wind-chill. • Drink hot fluids and eat often. • Insulate yourself from • Prevent skin contact with super cooled metal or fuel. • Seek medical aid for suspected cases.	• Get into a warm room as soon as possible. • Unless absolutely necessary do not walk on frostbitten feet or toes as this increases the damage. • Immerse the affected area in warm but not hot water (the temperature should be comfortable for unaffected parts of the body). Ask an unaffected person to test the water temperature as patient may not be able to feel correct temperature due to numbness of body parts and end up getting burnt.

Disorder	Symptoms	Prevention	First Aid/Treatment
			• Warm the affected are using body heat; for example, the heat of an armpit can be used to warm frostbitten fingers. • Do not rub or massage the frostbitten area; doing so may cause more damage. • Do not use a heating pad, heat lamp or the heat of a stove, fireplace, or radiator for warming. Affected areas are usually numb and can be easily burnt.
CHILBLAINS: Caused due to exposure to cold, wet and humid conditions (between 32-60°F). Repeated, prolonged exposure of bare skin lead to development, only in a few hours. Ears, Nose, Cheeks, Fingers and toes are most commonly affected.			
Chilblains	• Skin is initially pale and colourless. • Worsens to achy, prickly sensation followed by numbness. • Red, swollen, hot, itchy, tender skin upon rewarming. • Blistering in severe cases	• Keep dry and warm. • Cover exposed skin. • Wear uniform/ clothes properly. • High risk during wet weather, in wet areas or sweat accumulated in boots or gloves.	• Prevent further exposure • Avoid scratching • Slowly warm the skin, Don't massage or rub • Use corticosteroid creams to relieve itching and swelling • Dry sterile dressing • Keep blisters and ulcers clean and covered • Seek medical aid
DEHYDRATION: Loss of body fluids to the point of slowing or preventing normal body functions. Dehydration increases chance of becoming a cold weather casualty.			
Dehydration	• Dark urine • Headache, Dizziness, nausea and Weakness • Dry mouth, tongue, throat, lips • Lack of appetite • Irritability • Stomach cramps • Increased or heartbeat	• Monitor urine color • Do not wait until you are thirsty • Drink hot liquids for warmth	• Drink water or other warm liquids • Avoid caffeinated liquids • Do not eat snow • Rest
CARBON MONOXIDE POISING (CMP): Carbon monoxide is a colourless, odourless, tasteless gas resulting from incomplete combustion of fuel from engines, stoves, heaters etc. In conditions of inadequate ventilation such as falling asleep in a motor with running engine in a closed garage, inhalation of excessive amount of carbon monoxide may lead to poisoning.			
	• Headache • Dizziness • Weakness • Ringing in ears • Nausea • Drowsiness • Bright red lips, eyelids	• Ensure proper ventilation. • Turn heaters off when not needed. • Never sleep in vehicle with engine run • Ensure heaters are regularly serviced.	• Move to fresh air immediately. • Provide mouth-to-mouth resuscitation if victim is not breathing. • Seek medical aid promptly.

Disorder	Symptoms	Prevention	First Aid/Treatment
SNOW BLINDNESS: Inflammation and sensitivity of the eyes caused by ultraviolet rays of the sun reflected by the snow or ice.			
SNOW BLINDNESS	• Gritty feeling in eyes • Redness and tearing • Eye movement will cause pain • Headache	• Eye protection. • Dark UV protective glasses. • Do not wait for discomfort to begin.	• Remove from direct sunlight. • Blindfold both eyes or cover with cool, bandages. • Recovery may take 2-3 days.
TRENCH FOOT: A painful condition of the feet caused by prolonged immersion in cold water or mud and marked by blackening and death of surface tissue.			
TRENCH FOOT	• Reddening of skin. • Numbness, leg cramps, swelling. • Tingling pain, Blisters or ulcers, bleeding under the skin, gangrene (the foot may turn dark purple, blue or grey).	• Thoroughly clean and dry your • Put on clean, dry socks daily.	• Remove shoes/boots and wet socks. • Dry their feet • Avoid walking on feet, as this may cause tissue damage. • Treat the affected part by applying warm packs or soaking in warm water (102° to 110° F) for approximately 5 minutes. • Obtain medical assistance as soon as possible.

केंद्र शासित प्रदेश लद्दाख का प्रशासन

मिशन निदेशक, राष्ट्रीय स्वास्थ्य मिशन, केंद्र शासित प्रदेश लद्दाख

सार्वजनिक स्वास्थ्य परामर्श: शीत लहर/ठंढ

शीत लहर क्या है?

शीत लहर एक मौसम संबंधी घटना है जो सतह के पास हवा के तापमान में तेज गिरावट की विशेषता है, जिसके कारण

- तापमान का बेहद कम मान
- वायुदाब में तीव्र वृद्धि
- हवा की गति को मजबूत करना या
- पाला और बर्फ जैसे खतरनाक मौसम से जुड़ा हुआ है

शीत लहरें आमतौर पर कब और कहाँ होती हैं?

- शीत लहर का मौसम: सर्दियों के दौरान (नवंबर -जनवरी में अधिक आवृत्ति
- शीत लहर की आशंका वाले क्षेत्र: उत्तर, उत्तर पश्चिम, पूर्व और मध्य भारत के 17 राज्य / केंद्र शासित प्रदेश 'कोर कोल्ड वेव जोन' में हैं और सबसे अधिक शीत । वे:

पंजाब, हिमाचल प्रदेश, उत्तराखंड, जम्मू और कश्मीर, लद्दाख, दिल्ली, हरियाणा, राजस्थान, उत्तर प्रदेश, गुजरात, मध्य प्रदेश, छतीसगढ़, बिहार, झारखंड,पश्चिम बंगाल, ओडिशा और तेलंगाना।

जम्मू और कश्मीर में सबसे अधिक शीत लहरें आती हैं, इसके बाद हिमाचल प्रदेश, पंजाब, बिहार, हरियाणा और उत्तर प्रदेश आते हैं।

शीत लहरों / ठंढ से कैसे अवगत रहें?

मौसम अद्यतन से अवगत रहें

- p gov.in/
- शीत लहर सहित तापमान का वास्तविक काल मानचित्र: http y

कौन संवेदनशील हैं?

बेघर, बुजुर्ग, आर्थिक रूप से वंचित, विकलांग, गर्भवती या स्तनपान कराने वाली माताएं, महिलाएं, बच्चे, बाहरी कर्मचारी, रैन बसेरों के प्रबंधक, किसान

शीत लहर को कैसे परिभाषित किया जाता है?

भारत मौसम विज्ञान विभाग के मानदंडों के अनुसार, शीत लहर और शीत दिवस की स्थिति को इस प्रकार परिभाषित किया गया है:

A. शीत लहर के लिए स्थितियां: जब किसी स्टेशन का न्यूनतम तापमान मैदानी इलाकों के लिए 10 डिग्री सेल्सियस या उससे कम और पहाड़ी क्षेत्रों के लिए 0 डिग्री हो और निम्नलिखित मानदंडों में से किसी . परा करता .

I) सामान्य से न्यूनतम तापमान के प्रस्थान के आधार पर	II) वास्तविक न्यूनतम तापमान के आधार पर (केवल सादे स्टेशनों के लिए)
शीत लहर: जब प्रस्थान -4.5°C से -6.4°C होता है	शीत लहर: जब न्यूनतम तापमान 4°C होता है
गंभीर शीत लहर: जब प्रस्थान > -6.4°C होता है	गंभीर शीत लहर: जब न्यूनतम तापमान 2°C होता है

III) तटीय स्टेशनों के लिए:

B. जब न्यूनतम तापमान का प्रस्थान -4.5 डिग्री सेल्सियस या उससे कम हो और न्यूनतम तापमान 15 डिग्री सेल्सियस या उससे कम हो।

शीत दिवस के लिए शर्तें: जब न्यूनतम तापमान मैदानी इलाकों के लिए 10 डिग्री सेल्सियस या उससे कम और

पहाड़ी क्षेत्रों के लिए 0 डिग्री सेल्सियस या उससे कम हो और निम्नलिखित मानदंडों को पूरा करता हो:

शीत दिवस: अधिकतम तापमान प्रस्थान -4.5 डिग्री सेल्सियस से -6.4 डिग्री सेल्सियस है

गंभीर शीत दिन: अधिकतम तापमान प्रस्थान <-6.4 डिग्री सेल्सियस है

National Programme on Climate Change and Human Health

शीत लहर का स्वास्थ्य पर प्रभाव

यदि एहतियाती उपाय नहीं किए गए तो अत्यधिक ठंड से चोट लग सकती है और मृत्यु हो सकती है। तीव्र ठंड के संपर्क में आने से हाइपोथर्मिया, फ्रॉस्टबाइट, और अन्य गैर-ठंड परिधीय ठंड की चोटें हो सकती हैं जैसे कि बिसर्जन (खाई) पैर और चिलब्लेन (पेर्निया)

हाइपोथर्मिया (Hypothermia)

• यह बहुत ठंडे तापमान में लंबे समय तक रहने के कारण होता है जहां आपके शरीर की गर्मी कम होने लगती है इसके उत्पादन की तुलना में तेज़। यह अंततः शरीर की संग्रहीत ऊर्जा का उपयोग करेगा जिससे शरीर का तापमान कम हो जाएगा।

• शरीर का बहुत कम तापमान मस्तिष्क को प्रभावित करता है, जिससे व्यक्ति स्पष्ट रूप से सोचने या अच्छी तरह से चलने में असमर्थ हो जाता है। यह हाइपोथर्मिया को विशेष रूप से खतरनाक बनाता है।

• कम ठंडे तापमान पर भी खतरनाक हाइपोथर्मिया हो सकता है यदि कोई व्यक्ति बारिश, पसीने या ठंडे पानी में डूबने से ठंडा हो जाता है।

हाइपोथर्मिया के प्रति संवेदनशील कौन हैं?

• वृद्ध वयस्क जिनके पास अपर्याप्त भोजन, कपड़े, या गर्म करने वाले उपकरण ना हो
• ठंडे बेडरूम में सो रहे बच्चे
• जो लोग लंबे समय तक बाहर रहते हैं—बेघर, पैदल यात्री, शिकारी आदि।
• जो लोग शराब पीते हैं या अवैध दवाओं का सेवन करते हैं।

हाइपोथर्मिया के संकेत और लक्षण

वयस्कों		शिशुओं
कांपना	स्मृति हानि	चमकदार लाल, ठंडी त्वचा
थकावट या बहुत थकान महसूस होना	आवाज स्पष्ट न निकलना	बहुत कम ऊर्जा
भ्रम की स्थिति (उलझन)	तंद्रा	
लड़खड़ाते हाथ		

हाइपोथर्मिया एक मेडिकल इमरजेंसी है। कार्रवाई करें!

यदि आप उपरोक्त में से किसी भी लक्षण वाले व्यक्ति को देखते हैं तो तुरंत चिकित्सा सहायता प्राप्त करें!

जब चिकित्सीय ध्यान देने की प्रतीक्षा हो, तो व्यक्ति को गर्म करने का प्रयास करें।

• व्यक्ति को गर्म कमरे या आश्रय में ले जाएं और कपड़े बदलें, गीले कपड़े हटा दें
• व्यक्ति के शरीर को त्वचा से त्वचा के संपर्क, कंबल, कपड़े, तौलिये या चादर की सूखी परतों से गर्म करें।
• शरीर के तापमान को बढ़ाने में मदद के लिए गर्म पेय दें, लेकिन मादक पेय न दें। बेहोश व्यक्ति को पेय पदार्थ देने की कोशिश न करें।
• शरीर का तापमान बढ़ने के बाद, व्यक्ति को सूखा रखें और उसके सिर और गर्दन सहित उसके शरीर को एक गर्म कंबल में लपेट दें।
• व्यक्ति को यथाशीघ्र उचित चिकित्सीय सहायता प्राप्त करें।

गंभीर हाइपोथर्मिया वाला व्यक्ति बेहोश हो सकता है और ऐसा लग सकता है कि उसे नाड़ी नहीं है या वह सांस नहीं ले रहा है। उस स्थिति में, व्यक्ति को धीरे से संभालें, और तुरंत आपातकालीन सहायता प्राप्त करें।

ठंडे मौसम के लिए तैयार रहें

यह स्वास्थ्य समस्याओं के विकास के जोखिम को कम करता है
ठंड के मौसम से संबंधित

National Programme on Climate Change and Human Health

शीतदंश (फ्रॉस्ट बाइट)

- यह जमने से होने वाली एक प्रकार की चोट है। इससे प्रभावित क्षेत्रों में भावना और रंग का नुकसान होता है,आमतौर पर नाक, कान, गाल, ठुड्डी, उंगलियां और पैर की उंगलियां।
- शीतदंश शरीर को स्थायी रूप से नुकसान पहुंचा सकता है, और गंभीर मामलों में विच्छेदन (शरीर के प्रभावित हिस्से को हटाना) हो सकता है।

शीतदंश के प्रति संवेदनशील कौन हैं?

खराब परिसंचरण वाले व्यक्ति
अत्यधिक ठंडे तापमान के लिए व्यक्ति ने ठीक से कपड़े नहीं पहने हैं

शीतदंश के संकेत और लक्षण

त्वचा की लाली या ठंड के मौसम में उजागर होने वाले क्षेत्र में दर्द या दर्द शीतदंश की शुरुआत हो सकता है।

शीतदंश इस प्रकार प्रस्तुत करता है:

- **सफेद या भूरे-पीले रंग का त्वचा क्षेत्र,**
- **त्वचा जो असामान्य रूप से दृढ़ या मोमी लगती है**
- **सुन्न होना**

एक व्यक्ति जिसे शीतदंश है, उसे तब तक पता नहीं चल सकता है जब तक कि कोई और उसे इंगित न करे क्योंकि उनके शरीर के जमे हुए हिस्से सुन्न हैं।

यदि कोई व्यक्ति हाइपोथर्मिया के बिना शीतदंश के लक्षण दिखाता है और तत्काल चिकित्सा देखभाल उपलब्ध नहीं है:

यदि आप अपने या किसी और पर शीतदंश के लक्षण देखते हैं, तो चिकित्सा देखभाल लें।

- व्यक्ति को यथाशीघ्र गर्म कमरे में ले जाएं।
- जब तक बिल्कुल आवश्यक न हो, पैरों या पैर की उंगलियों पर न चलें जो शीतदंश के लक्षण दिखाते हैं - इससे क्षति बढ़ जाती है।
- शीतदंश वाली जगह को बर्फ से न रगड़ें और न ही मालिश करें। इससे अधिक नुकसान हो सकता है।
- शीतदंश से प्रभावित क्षेत्रों को गर्म-गर्म नहीं-पानी में डालें (शरीर के अप्रभावित हिस्सों के लिए तापमान स्पर्श के लिए आरामदायक होना चाहिए)।
- यदि गर्म पानी उपलब्ध नहीं है, तो शरीर की गर्मी का उपयोग करके प्रभावित क्षेत्र को गर्म करें। उदाहरण के लिए, आप कांख की गर्मी का उपयोग ठंडी उंगलियों को गर्म करने के लिए कर सकते हैं।
- गर्म करने के लिए हीटिंग पैड, हीट लैंप या स्टोव, फायरप्लेस या रेडिएटर की गर्मी का उपयोग न करें। प्रभावित क्षेत्र सुन्न हो जाते हैं और आसानी से जल सकते हैं।
- शीतदंश की जांच स्वास्थ्य देखभाल प्रदाता द्वारा की जानी चाहिए

विसर्जन (खाई) पैर (IMMERSION (TRENCH) FOOT)

- यह तब होता है जब पैर लंबे समय तक गीले रहते हैं।
- संकेत और लक्षणों में शामिल हैं: झुनझुनी और/या खुजली की अनुभूति, दर्द, सूजन, ठंड और धब्बेदार त्वचा, सुन्नता और पैर में चुभन या भारीपन महसूस होना। गर्म होने के बाद पैर लाल, सूखा और दर्दनाक हो सकता है। फफोले बन सकते हैं, इसके बाद त्वचा और ऊतक मर जाते हैं और गिर जाते हैं। अगर इसका इलाज नहीं किया जाता है तो यह पैर की उंगलियों, एड़ी या पूरे पैर को नुकसान पहुंचा सकता है।
- अपने पैरों को हवा में सुखाने से रोकथाम और ऊपर उठाकर, और सूखे जूतों और जुराबों को बदलने से रोकथाम करें
- यदि कोई लक्षण और लक्षण दिखाई दें तो चिकित्सा सहायता लें
- यदि आपके पैर में घाव है, तो संक्रमण या लक्षणों के बिगड़ने के लिए अपने पैरों की दिन में कम से कम एक बार जांच करें.

चिलब्लेन (पेर्निओ) CHILBLAIN (PERNIO)

- यह आपकी त्वचा में छोटी रक्त वाहिकाओं की एक दर्दनाक सूजन है जो बार-बार होने की प्रतिक्रिया में होती हैठंड के संपर्क में लेकिन ठंडी हवा नहीं।
- संकेत और लक्षणों में शामिल हैं: खुजली, लाल धब्बे, सूजन, और आपके हाथों और पैरों पर छाले।
- ठंड के संपर्क को सीमित करके, गर्म कपड़े पहनकर, और उजागर त्वचा को ढककर रोकें
- यह आमतौर पर एक से तीन सप्ताह में सुधर जाता है, खासकर अगर मौसम गर्म हो जाता है
- संकेत और लक्षणों में सुधार न होने पर चिकित्सा देखभाल लें

National Programme on Climate Change and Human Health

शीत लहर / फ्रॉस्ट: क्या करें और क्या न करें

शीत लहर से पहले

- रेडियो सुनें, टीवी देखें, स्थानीय मौसम के पूर्वानुमान के लिए समाचार पत्र पढ़ें, यह जानने के लिए कि क्या शीत लहर आ रही है
- भारत मौसम विज्ञान विभाग द्वारा ट्रेक मौसम चेतावनी: http gov.in/
  tps://bit.ly
- पर्याप्त सर्दियों के कपड़े स्टॉक करें। कपड़ों की कई परतें अधिक सहायक होती हैं।
- अतिरिक्त भोजन, पीने का पानी, दवाएं, और अन्य आवश्यक सामान जैसी आपातकालीन आपूर्ति तैयार रखें।
- सर्दी के लंबे समय तक संपर्क में रहने से फ्लू, बहती नाक या नाक से खून आने जैसी विभिन्न बीमारियों की संभावना बढ़ जाती है, जो इस तरह के लक्षणों के लिए डॉक्टर से परामर्श करें।

शीत लहर के दौरान

क्या करें

- मौसम की जानकारी और आपातकालीन प्रक्रिया की जानकारी का बारीकी से पालन करें और सलाह के अनुसार कार्य करें।
- जितना हो सके घर के अंदर रहें और ठंडी हवा के संपर्क में आने से बचने और गर्मी से बचाने के लिए यात्रा कम से कम करें
- भारी कपड़ों की एक परत के बजाय ढीले ढाले, हल्के, वायुरोधी गर्म ऊनी कपड़ों की कई परतें पहनें। तंग कपड़े ब्लड सर्कुलेशन को कम करते हैं
- अपने आप को सूखा रखें। यदि गीला है, तो अपने सिर, गर्दन, हाथ और पैर की उंगलियों को पर्याप्त रूप से ढक लें क्योंकि अधिकांश गर्मी का नुकसान शरीर के इन हिस्सों से होता है।
- दस्तानों के बजाय निरंगुल दस्ताना को प्राथमिकता दें। निरंगुल दस्ताने ठंड से अधिक गर्मी और इन्सुलेशन प्रदान करते हैं, क्योंकि उंगलियां अपनी गर्मी साझा करती हैं और कम सतह क्षेत्र को ठंड में उजागर
  करती हैं।
- गर्मी के नुकसान को रोकने के लिए टोपी और मफलर का प्रयोग करें, इंसुलेटेड/वाटरप्रूफ जूते पहनें।

- शरीर के तापमान का संतुलन बनाए रखने के लिए स्वस्थ भोजन करें।
- पर्याप्त प्रतिरक्षा बनाए रखने के लिए विटामिन-सी से भरपूर फल और सब्जियां खाएं
- नियमित रूप से गर्म तरल पदार्थ पिएं, क्योंकि इससे सर्दी से लड़ने के लिए शरीर की गर्मी बनी रहेगी।
- अपनी त्वचा को नियमित रूप से तेल, पेट्रोलियम जेली या बॉडी क्रीम से मॉइस्चराइज करें
- बुजुर्गों और बच्चों का ख्याल रखें। पड़ोसियों की जाँच करें जो अकेले रहते हैं और उनकी भलाई के बारे में बुजुर्ग हैं।
- आवश्यकता के अनुसार आवश्यक वस्तुओं का भंडारण करें। पर्याप्त पानी स्टोर करें क्योंकि पाइप जम सकते हैं।
- गैर-औद्योगिक भवनों के लिए गर्मी रोधन पर मार्गदर्शिका का पालन करें और आवश्यक तैयारी के उपाय करें।
- सख्त और सुन्न हो सकती है, और शरीर के खुले हिस्सों जैसे उंगलियों, पैर की उंगलियों, नाक और/या कान के लोब पर काले
- क्षणों जैसे सुन्नता, उंगलियों, पैर की उंगलियों, कान की लोब और नाक की नोक पर सफेद या पीला दिखाई देने पर ध्यान दें। शीतदंश से प्रभावित क्षेत्रों को गर्म (गर्म नहीं) पानी में उपचारित करें (शरीर के अप्रभावित हिस्सों के लिए तापमान स्पर्श करने के लिए अप्रसादायक होना चाहिए)।
- शीत लहर के गंभीर संपर्क से हाइपोथर्मिया हो सकता है - शरीर के तापमान में कमी जो कंपकंपी, बोलने में कठिनाई, तंद्रा, मांसपेशियों में अकड़न, भारी श्वास, कमजोरी और/या चेतना की हानि का कारण बन सकती है। हाइपोथर्मिया एक चिकित्सा आपात स्थिति है जिसके लिए तत्काल चिकित्सा ध्यान देने की आवश्यकता होती है।
- ।
- :
- के लिए प्राथमिक चिकित्सा (फास्ट)
- । अंदर ले जाकर ठंड के मौसम से बचाएं।

क्या ना करें

- सर्दी के लंबे समय तक संपर्क से बचें
- कंपकंपी को नजरअंदाज न करें, यह पहला संकेत है कि शरीर गर्मी खो रहा है - घर के अंदर जाओ।
- एल्कोहॉल ना पिएं। यह आपके शरीर के तापमान को कम करता है और हाइपोथर्मिया के खतरे को बढ़ाता है।
- शीतदंश वाली जगह पर मालिश न करें। इससे अधिक नुकसान हो सकता है।
- प्रभावित व्यक्ति को तब तक कोई तरल पदार्थ न दें जब तक कि वह पूरी तरह से सतर्क न हो जाए।
- लावारिस आग न छोड़ें यह खतरनाक हो सकती है
- बंद, हवादार कमरों में मोमबत्तियां, लकड़ी आदि न जलाएं और कार्बन मोनोऑक्साइड (सीओ) विषाक्तता को रोकें

शीत लहर और पाला की रोकथाम और प्रबंधन पर राष्ट्रीय दिशानिर्देशों के बारे में अधिक जानकारी के लिए देखें:
https://ndma.g

शीत लहर यात्रा पर आईईसी के लिए: https: .gov.

National Programme on Climate Change and Human Health

གྲང་དར་ཅི་ཡིན?

རླུང་པོ་གྲང་མོ་རླུགས་པ་ནི་གནས་རྒྱུ་དང་འབྲེལ་བའི་གནས་སྐབས་ཤིག་ཡིན། གང་གིས་སའི་སྟེང་དུ་རླུང་པོའི་ཚ་རྩོད་ཡོལ་བཏུག་སྟེ།

- ཚ་རྩོད་མང་སྟེའང་ཉུང་དུན་འཕྲོ་བཏུག་པ།
- རླུང་པོའི་ཤུགས་རྒྱས་བཏུག་པ།
- རླུང་པོའི་རླུགས་ཚད་ཤུགས་ཆེ་རུ་གཏོང་བའམ་ཡང་ན།
- འཁྲུགས་ཟིལ་དང་བ་མོ་ལངས་པ་བཞིན་གནས་རྒྱུ་རྐྱབ་པོ་འགྱུར་བ།

ཐུམ་བཏང་དུས་དང་ས་གནས་གང་དུ་གྲང་དར་རླུགས?

- གྲང་དར་གྱི་དུས་སྐབས: དཀྱིལ་ནི་སྐབས(ནོ་ཝེམ་བར་ནས་མཐ་)རླུ་བའི་རིངས་ལ་དང་མང་ཆེ་བ་ཕྱི་རླུ་ཏེ་སེམ་གྱང་དང་རན་ཁ་རི་ཀྱིལ་ནི་ནང་ལ་རླུགས
- གྲང་དར་རླུགས་པའི་ཡུལ་ལྷོངས་གཙོ་ཆེ་བ: བྱང་ཕྱོགས། ནུབ་བྱང་། ཤར་དང་རྒྱ་གར་རི་གཞུང་འཁོར་རི་རྒྱལ་ཁབ/དབུས་གཞུང་མངའ་སྡེ་17,ནི་ནང་ང་གྲང་རླུང་ཤུགས་ཅན་རླུགས དེ་ཀྱིལ་ནི།

  བནྡ་རྣ་ཅིམྷ་ཅལ་ཐ་རིལ། ཨུཏྟ་ར་ཁཎྜ། རཔྟ་དང་ཀཤྨི་ར། འདྲས་དེཔྷི། ཉར་ཡ་ནཱ་ར་རཔྟན། ཨུཏྟ་ར་ཐ་རིལ། ཀུ་རུ་ཀྵེ་ཏྲ། མཉྫ་ཡ་ནཱ་དང་ཉེ་ལང་གཱ་ན།

  གྲང་མང་ཚད་རཔྟ་ཀཤྨི་ར་དང་དེའི་ཉེར་ན་ཅིམྷ་ཅལ་ཐ་རིལ། བནྡ་རཔ་བི་ཧར། ཉར་ཡ་ནཱ་དང་ཨུཏྟ་ར་ཐ་རིལ་ཀྱི་ནང་ལ་རླུགས་པ་ཡིན།

གྲུང་དར་གྱི་སྐོར་ལ་སྡུང་རྒྱས་ཅི་ལྟར་མཛད་?

གནས་རླུའི་སྐོར་ལ་ཞེས་རྟོགས་འབོར།

- གནམ་རྩ་དང་འབྲེལ་བའི་ཉེན་བརྡ་(warning) ཞག་དུང་དུས་ཚོད་ཅ་བར་ལ་ https:/mausam.imd.gov.in/བརྒྱུད་དེ་གཏོང་བ་ཡིན།
- ཐང་རྡེའི་ཚ་རྡོད་ཀྱི་དུས: https://bit.ly/IMDcoldwave

སུ་སུའང་གཏོད་སྐྱོན་སྐེས་སྲིད།

ནད་མེད་ཁང་མེད། ཆག་ཆོག། རྒྱ་ནོར་དེ་ཐོག་ན་ཉུག་གཅུག གཟུགས་གཞི་ཐང་ཡོ་མེད་གན། བན་བྱས་མ་ཀྱབ་དང་འོ་མ་འཐུན་མཁན་སྦུག་གྱི་ཨ་མ་ཀྱན། བུ་མོ་ཀྱན། སྦུག་ཀུ་ཀྱན།ཕྱི་འོག་ག་ལས་བཅོ་མཁན་ཀྱན།ཚན་ལ་སྐྱང་མཁན་དང་ཞིང་འབད་པ་ཀྱན།

ཐང་དར་གྱི་རྒྱུན་གྱི་ཚད་འཛིན་ག་ཐུག་ལ་བཅོ་ཡིན?

རྒྱ་གར་གྱི་གནམ་རྩིའི་འཚོ་འབྱུང་ལས་སྡེའི་ཚད་གཞི་ནང་བཞིན་ཐང་དར་དང་''ཐང་མོའི་ཞག་གི་གནམ་སྐྱབས་ཀྱན་གཤམ་གསལ་ལྟར་ཚད་འཛིན་བྱོས་ཏེ་ཡིན་ནོག

A) ཐང་དར་གྱི་དུས་སྐྱབས་སམ་གནམ་སྐྱབས། ནམ་ཞིག་ས་གནམ་ཤིག་གི་ཐང་རྡེའི་ཚད་ཨུང་མཐའ10°C དང་མ་ཚ་སྐྱེམས་པོར་དེ་ལས་ཨུང་བ་ཡོད་བཞམ་ཡང་ན་རི་ཡུལ་ཀུན་དུ་ཐང་རྡེའི་ཚད་0°C ཡོད་བཞམ་དེ་ལས་ཨུང་བ་ཡོད་ཅེད་གཤམ་གསལ་ལ་གྱི་ཚད་གཞི་ཀུན་སྐྱབ་པ་ཡོད་ན།

I) སྐྱིད་བཏང་ལས་ཚ་རྡོད་ཨུང་བ་ལ་གཞི་བཅོས་ཏེ། ཐང་རྒྱངས་ནམ་ཞིག་ཁྱད་པར་-4.5°C 2ནམ 6-4°C ཡོད་ན། ཐང་རྒྱང་22ཚབས་ཆེན། ནམ་ཞིག་ཁྱད་པར -6.4°C ཡོད་ན།	II) དངོས་གནམ་ཚ་རྡོད་ཨུང་དུ་ལ་གཞི་བཅོས་ཏེ། (ས་ཆ་སྐྱེམས་པོའི་ཐྱིར) ནམ་ཞིག་ཚ་རྡོད་ཨུངཤོས་ 4°C ཡོད་ན། ནམ་ཞིག་ཚ་རྡོད་ཨུངཤོས་ 2°C ཡོད་ན།

III) **རྒྱ་མཚོའི་མཐའ་འཁོར་དེ་ས་གནམ་ཀྱན་གྱི་ཐྱིངས**

ནམ་ཞིག་ཐང་རྡེའི་ཚད་ཨུངཤོས་ཀྱི་ཁྱད་པར་-4.5°C 2ལས་ཨུང་བ་དང་ཚ་རྡོད་ཨུངཤོས་15 °Cདང་དེ་ལས་ཨུང་བ་ཡོད་ན།

B) ཐང་དར་གྱི་དུས་སྐྱབས་སམ་གནམ་སྐྱབས། ནམ་ཞིག་ས་གནམ་ཤིག་གི་ཐང་རྡེའི་ཚད་ཨུང་མཐའ10°C དང་མ་ཚ་

སྟོན་པོར་དེ་ལས་ཉང་བ་ཡོད་པའམ་ཡང་ན་དེ་ཡུལ་ཀུན་དུ་ཐང་རྩེའི་ཚད་0°C ཡོད་པའམ་དེ་ལས་ཉང་བ་ཡོད་ཅིང་ གཡམ་གསལ་གྱི་ཚད་གཞི་ཀུན་སྐྱབ་པ་ཡོད་ན།

ཐང་མོའི་ཞགཔ: ནམ་ཞིག་ཚད་མདོག་ཀྱི་ཁད་པར་-4.5°C 3ནས 6-4°Cཡོད་ན།

ཐང་མོའི་ཞག་33ཚབས་ཆེན: ནམ་ཞིག་ཚད་མདོག་ཁད་པར-6.4°Cཡོད་ན།

ཐང་དར་ནས་ཁམས་བདེར་ཁྱད།

གལ་ཏེས་སྲོན་འགོག་གི་ཐབས་ལམ་ཀུན་ལག་ལེན་མ་མཛད་ན་ཐང་དར་ཤུགས་ཅན་ཀྱིས་རྨས་སྐྱོན་དང་ཤི་ཚད་ཆ་སྲིད།

ཐང་དར་དྲག་པོའི་ནང་ངས་ཞུགས་ན་དེ་ཡིས་"ཏེ་པོ་ཐེར་མི་འ། གངས་ཁྱེད་དང་གཞན་ཡང་ཁྲག་མིན་མཁན་གྱི་རྨ་སྐྱོན་དམེར་ན་ཤུར་འདོན་དང་འཁྲུགས་འབྲས(immersion (trench) foot chilblain(pernio)སོགས་ཐོན་སྲིད།

ཏེའེ་པོ་ཐར་མི་ཡ། (Hypothermai):

- ཐང་དར་ནང་དུས་མང་པོ་བཞུགས་པའི་ཆུན་གྱིས་ནམ་ཞིག་དེ་དང་གི་གཟུགས་པོའི་ནང་ངཚད་སྐྱེ་བ་ལས་མང་བ་ཚད་མེད་གན་ཆ་ན་ཏེ་པོ་ཐེར་མི་འཡོང་བ་ཡིན། དེ་ཡིས་གཟུགས་པོའི་ནང་ངབསགས་ཏེ་ཡོད་གན་ནུས་སྟོབས་བགོལ་ཏེ་ གཟུགས་པའི་ཚད་ཉུང་དུན་ཆ་བཙུག
- གཟུགས་པོའི་ཐང་རྩེའི་ཚད་མང་སྟེའང་ཉུང་དུན་ཆ་ན། དེ་ཡིས་ལྷད་པའི་ཀ་ཁྲད་སྟེབས་ནས་མི་དེ་ཚུལ་ནང་བཞིན་ བསམ་བློ་གཏང་མི་ཉན་མཁན་དང་འབྲལ་མི་ཉན་མཁན་འབྲུང་སྲིད།
- འཇིགས་ཚབས་ཅན་ཏེ་པོ་ཐེར་མི་འདེ་ཐང་མོའི་ཚད་ཉུང་དུན་ཡོད་ནའང་ཡོང་སྲིད། གལ་ཏེས་མི་ཞིག་ཆར་པ་དང་ ཚད་པ་འབིང་བའི་ཆུན་ཀྱིས་འཁྲུགས་འདང་ཡོང་ན་ཡང་ན་ཆུ་ཐང་མོའི་ནང་མང་པོ་བཞུགས་ན།

སུ་ཞིག་ག་ཏེ་པོ་ཐར་མི་ཡ་ལས་གཏོད་སྐྱོན་མང་བར་སྟེའ?

- མི་ཆན་ཆོན་ག་ཀུན་ལ་འདོན་ཐང་། གོན་ཆས་དང་རྩོན་མོའི་མཐུན་ཆུན་མེད།
- ནང་ཐང་མོའི་ནང་ངཉིད་གཏང་མཁན་སྤུག་གུ་ཆུང་ཆུང་ཀུན།

- ཐྲི་ལོག་ཏུ་གྲང་མེའི་ནང་དུས་མང་པོ་བཞུགས་མཁན་ནི་མི་ཀུན། དེས་ན་ནང་ཁང་མ་མེད་ཀན། ཤང་འགྱལ་མཛད་མཁན་དང་ལིང་ཐ་སོགས།
- ར་བཅེ་བའི་ཚང་རབ་དང་དུག་རྩྭ་རིགས་འདོན་མཁན་ཀུན།

ཉེ་པོ་ཐར་མི་ཡའི་ནད་ཀྱས།

ཆེ་མི་ཀུན་ལ།		སྐུ་གུ་ཀུན་ལ།
འཁྲུགས་འདུར།	བརྡེད་བྱས།	བཁས་པ་དམར་པོ་དང་གྲང་མོ་ཆ་བྱས།
ངལ་བྱས།	དེས་ར་ཁ་དག་པོ་མེད་པ།	གཟུགས་སྟོབས་ཆུང་དུ་འགྲོ་བ།
མགོ་ཐོམས་པ།	གཉེན་བཅེ་ཡོང་བ།	
ལག་ཆུལ་རྒྱབ་པ།		

རྟའི་པོ་ཐར་མི་ཡ་ནི་སྐན་སྟོང་ཀྱི་ཐོག་ན་ཇ་དྲག་ཞེག་ཡིན་པས། ལས་ཚིར་བྱོས།

གལ་ཏེས་དེ་རང་གིས་ཙོང་གི་ནད་ཀྱས་ཡོད་བའི་མི་ཞེག་གཟིགས་ན་ལེམ་སང་སྐན་སྟོང་ཆེད་སྐད་ཀྱས་མཛོད།

ནམ་ཞེག་སྐན་སྟོང་ཀྱི་གཟིགས་ཀྱོགས་འགོངས་ན། མི་དེ་རྟོན་མོ་བཅོ་ཐབས་ལ་འབོད།

- མི་དེ་ནང་རྟོན་མོའམ་ཡང་ན་ཐོག་གཡབ་ཞེག་གི་ནང་ལ་ཁྲེད།ཡང་གོན་ཆས་རྒྱོན་པ་ཀུན་སྟོས།
- མི་དེའི་གཟུགས་པོ་བགས་པ་བན་ཚུན་འཐུག་བཅུག་སྟེ་རྟོན་མོ་ཆ་བཅུག ཐལ་ཁེབ(blanket)གོན་ཆས། ལག་བྱིས་དང་ཅ་དང་ོ་མོགས་ཀྱིས་གཟུགས་པོ་བསྐམ་ཤུག
- གཟུགས་པོའི་ཚ་རྟོད་འཕེལ་བྱས་ལ་ཚན་ཏེ་རིགས་འཐུང་བཅུག ཡིན་ཀྱང་ཚང་རབ་གོགས་འཐུང་མ་བཅུག རྟན་ཤེས་མེད་མཁན་ཀུན་ལ་རྩུ་མ་ཡིན་པའི་གཞན་བཏུང་བའི་རིགས་མ་གཏང་།
- གཟུགས་པོའི་ཚ་རྟོད་རྒྱས་ཏེ་རྐེང་ན། མི་དེའི་གཟུགས་པོ་མགོ་དང་མཇེད་པ་ཀུན་མཐལ་ཁེབ་(blanket)རྟོན་མོ་ཞེག་ནང་བཏུམས་ཏེ་འབོད།

- ཅི་མཆོག་སྨན་སྦྱིད་མང་།
- རྟའི་ཡོར་ཅེ་མི་ཡ་དྲག་པོ་ལངས་པའི་མི་དེ་དྲན་ཤེས་མེད་ཀྱང་བས་རྒྱང་ཐང་དང་དབུགས་མ་འབྱལ་མཁན་ཡོགས་མཐོང་སྲིད། དེ་ཙུག་གནས་སྐབས་བྱང་ན་གད་དང་དང་མཉམ་པོ་ཅི་མཆོག་ང་ཟླ(Emergency) གི་རོགས་རམ་ལེན་དགོས།

གནམ་རླུ་གང་མེའི་ཐོག་ག་གལ་སྤྱིག་མང་དེ་བཞུགས།

དེ་ཡིས་གནམ་རླུ་གང་པོ་དང་འབྲེལ་ཁམས་བདེ་དཀའ་ལས་བྱང་བ་ཉུང་དུན་བྱེད།

Frostbite: གངས་ཐྱིད།འཁྱགས་ཅིད།

- འཁྱགས་ཐྱིད་ནི་འཁྱགས་པས་རྐྱེན་བྱས་ནས་བྱང་བའི་ཨ་སྨྱོན་གྱི་རིགས་ཤིག་ཡིན། འདི་ཡིས་གཟུགས་པོའི་ཁག་གང་ཡང་རུང་བར་ཁྲད་སྤེབས་ཏ་དང་དེར་ཚོར་བ་དང་མདོག་མེད་འགྱུར། སྤྱིར་བཏང་མང་ཆེ་བ་གཟུགས་པོའི་ཡན་ལག་དམེར་ན་སྐ་ཁྲང།ན་ཚོག ཞལ་མདོང།ཁོས་སྐྱེ།ལག་པ་དང་ཤུང་པའི་མཐུག་མོ་ཀུན་ལ་ཁྲད་སྤེབས།
- འཁྱགས་ཐྱིད་ཀྱིས་གཟུགས་པོར་གཏན་དུ་གཡོད་སྨྱོན་སྤེབས་སྲིད།ཡང་ཚབས་ཆེན་བྱང་ན་ཁྲད་སྤེབས་མཁན་གཟུགས་པོའི་ཡན་ལག་གམ་ཁག་ཏེ་བཅད་ཅིང་འཕེན་ཡང་སྲིད།

འཁྱགས་ཐྱིད་ནས་སུ་ཞིག་ལ་གནོད་སྨྱོན་མང་བ་སྤེབས?

ཁྲག་གི་འགོར་སྨྱོད་(blood circulation)རྒྱལ་ལ་མེད་མཁན་ཀུན།

ཀུང་མོའི་གནམ་རླུའི་རིངས་ལ་གོས་ཡང་ན་གོན་ཚས་རྡོན་མོ་མ་གོན་མཁན་ཀུན།

འཁྲུགས་ཐྲིད་ཀྱི་ནད་རྐྱེན།

གྲང་མོ་པོག་པའི་གཟུགས་པོའི་བཀས་པ་དམར་པོ་འགྱུར་ན་འཁྲུགས་ཐྲིད་ཀྱི་འགོ་ཟུག་ཡིན་ནོག འཁྲུགས་ཐྲིད་ཀྱིས།

- པགས་པའི་འཁོར་ལ་མདོག་དཀར་པོ་ཡང་ན་སྨུག་མེར་ཡོང་།
- དུས་རྒྱུན་ཚོགས་མིན་པར་པགས་པ་མཉེགས་པོའམ་སྐན་ཏེ་འགྱུར་བ།
- ཚོར་བ་མེད་པར་འགྱུར་བ།

འཁྲུགས་ཐྲིད་ཡོད་ཀན་མི་ཞེག་ག་ནམ་ཞེག་མི་གཞན་མ་ཞེག་གིས་འཁྲུགས་ཐྲིད་སོང་སྟེ་འདུག་ཟེར་ཏེ་མི་བསྟན།དེ་དེ་བར་དུ་རྒྱས་མི་ཆ། ཅི་ཐྲིར་ཞུ་ན་འཁྲུགས་ཐྲིད་ལ་སོང་མཁན་གཟུགས་པོའི་ཁག་པོ་ཚོར་བ་མེད་ཀན་འགྱུར་བ་ཡིན།

གལ་ཏེ་ཉེན་རང་ལ་འཁྲུགས་ཐྲིད་ཀྱི་རྐྱེན་ཡོད་བར་ཤེས་པའམ་གཞན་ཞེག་ལ་ནད་རྐྱེན་ཡོད་པར་གཟིགས་ན་ལེམ་སང་སྐན་སྐྱེད་མཛད།

གལ་ཏེ་སུ་ཞེག་གི་འཁྲུགས་ཐྲིད་ཀྱི་རྐྱེན་ཡོད་ཀྱང་རུའི་པོ་ཐང་མི་ཡར་སོང་མེད་ན། ལེམ་སང་སྐན་སྐྱེད་ཀྱི་ཐུལ་གྱིག་མེད་ནི།

- མི་དེ་ཅི་མཁོགས་ནང་རྔོན་མོ་ཞེག་ནང་ཞུར།
- ཁག་ཅན་མེད་ན་འཁྲུགས་ཐྲིད་ལ་སོང་བའི་ཤུང་ལག་ཀུན་བཙུགས་ཏེ་མ་འགྱལ། དེ་ཡིས་གནོད་སྐྱོན་བྱེད་སྲིད།
- འཁྲུགས་ཐྲིད་ལ་སོང་བའི་ཉེ་འཁོར་ཀུན་ཐུག་གིས་མཉེ་བར་མ་མཛད། དེ་ཡིས་གནོད་སྐྱོན་མང་བ་སྟེག
- འཁྲུགས་ཐྲིད་ལ་སོང་བའི་ཡན་ལག་དེ་ཆུ་དོན་འཇམ་ནང་བཙུག་ག་མཛད།
- གལ་ཏེམ་ཆུ་དོན་འཇམ་མེད་ན། གཟུགས་པོའི་ཁག་རེ་འགྲུག་བཙུག་སྟེ་དོས་སུ་བཙུག དབེན་ན་ལག་པའི་མཛུབ་མོ་ཀུན་འཁྲུགས་ཐྲིད་སོང་ཏེ་ཡོད་ན་ཚན་ཁུང་གི་འོག་ལ་མཛུབ་མོ་ཀུན་བོར་ཏེ་དོས་སུ་བཙུག
- དོན་མོ་བཅོ་ཅམ་ཀྱི་སྐྱོག་འོད། མེ་ཐབ་སོགས་བཀོལ་ཏེ་ཁྲག་ཐྲིད་ལ་སོང་བའི་ཡན་ལག་ཀུན་དོས་མ་བཙུག ཅི་ཐྲིར་ཞུ་ན་ཁྲག་ཐྲིད་སོང་བའི་ཡན་ལག་ཏུ་ཚོར་བ་མེད་པས་མེས་ཚེག་སྲིད།
- འཁྲུགས་ཐྲིད་དེ་ཁམས་བདེ་ཞབས་ཞུ་བར་བསྟན་དགོས།

Emersion (Trench) Foot:

- གལ་ཏེ་དུས་ཡུན་རིང་ཞིག་ཤང་ལ་རྟོན་ལ་ལུས་ན་.....
- ནད་ཀྲག་ཀྱི་སྡོད་དུཿ ཤང་ལ་སྦྲིད་ལ། ཟ་འཚྭག་གི་ཚོར་བ། རླུག་ཟེར། སྐྱངས་སྡོམ(swelling),ལགས་ལ་ཐང་མོ་དང་མདོག་དམར་སྐྱའམ་རྨ་ཅན་འགྱུར་བ།ཤང་བར་ཚོར་བ་མེད་ཅིང་ཕྱིན་ཅར་འགྱུར་བ། ཤང་ལ་རྩོམ་ལ་དང་མདོག་དམར་པོ།སྐམ་པོ་དང་ཟླག་ཟེར་ཅན་འགྱུར་བ། ལགས་ལ་དང་ཙ་ཀུན་སྐམ་ཤིང་བྱད་པའི་ཉིང་ན་ཆུ་ཕྱང་ཐོན། གལ་ཏེ་སྐན་སྡོད་ས་མཛད་ན། དེ་ཡི་བྱས་ཏེ་ཤང་མཚུབ།ཉིང་པའམ་ཡང་ན་ཤང་པོགས་མེད་ཀན་འགྱུར་སྲིད།
- **འགོག་ཐབས།** ཆུང་ཐོས་མི་སྐམ་པ། ཤང་ལ་མི་སྟེག་པ། ཤང་ལྷམ་དང་ཤང་ཤྲེབས་རྟོན་ལ་ཀུན་ཤང་ལྷམ་དང་ཤང་ཤྲེབས་སྐམ་པོ་དང་མི་བརྟེ་བ།
- གལ་ཏེ་ནད་ཀྲག་དེ་ཀུན་ཐོན་ན་སྐན་སྡོད་མཛད།
- གལ་ཏེ་ཤང་པར་ཆ་སྐྱོན་ཡོད་ན། ནད་ཁྲབ་ཅིང་འཛེལ་བའི་ཉེན་ཁ་འཛོམ་ཆེད་ཀྱི་མའི་ནང་ཐེབ་གཅིག་གར་མེད་གཅིག་མཛད།

Chilblain: འཁྲུགས་འབྲས། ཟ་འཚྭག་གི་ཚོར་བ།

- འདི་ནི་ཀྲང་མོའི་ནང་དུས་མང་པོ་བཤུགས་པ་ལ་བརྟེན་གཟུགས་པོའི་ཁག་གི་ཅ་སྤྱབས་སུ་ཡོང་བའི་གཉན་ཚད་(Inflammation)རླུག་ཟེར་ཅན་ཞིག་ཡིན།
- ནད་ཀྲགས། ཟ་འཚྭག དམར་ཐིག སྐྱངས་སྡོམ། ལག་ལ་དང་ཤང་པ་ཀུན་ལ་ཆུ་ཕྱང་(blistering)འབེབ་བ།
- **འགོག་ཐབས།** ཀྲང་མོའི་ནང་མང་པོ་མི་བཤུགས་བྱས། གོས་ལག་རྩོན་མོ་གོན་པ་དང་པགས་ཀུན་གོས་ལག་གིས་བཀབ་པ།
- གལ་ཏེ་ནད་ཀྲགས་ཀུན་མ་རྒྱལ་ན་སྐན་སྡོད་མཛད།

Cold Wave/ Frost: Do's and Don'ts ཀྲང་ཆྱང་རླུག་དུས་མཛད་དགོས་མི་དགོས།

གང་རུང་རྒྱུག་བའི་སྟོན་ལྟ།

- ས་གནས་''ཀྱི་གནས་རྟ་དང་གང་རུང་རྒྱུག་མེ་རྒྱུག་གི་སྐོར་ལ་རྒྱས་མཛད་པར་''རླངས་འཕྲིན་(Radio)ལ་ཉེན། རྒྱང་མཐོང་(T.V)དུ་གཟིགས། གསར་ཤོག་སིལ་བར་མཛད།
- རྒྱ་གར་གྱི་གནམ་རླུའི་ལས་ཁུངས་ཀྱི་ངྷ་རྒྱ https://mausam.gov.in/ བརྒྱུད་དེ་རྒྱས་མཛད།
- གྱན་དུས་ཀྱི་གོན་ཆས་ལྡངས་པ་གཉར་ར་མཛད། གོན་ཆས་མཐུག་མོ་ཡིས་བན་ཐོགས།
- དུས་སྐབས་རྒྱར་ཐོའི་རིངས་ལ་དགོས་པའི་ཁྱབ་རྒྱེན་དཔེར་ན་ཟ་འཐུང་གི་རིགས་སྐན་དང་གཞན་དགོས་རིགས་ཀྱི་ཅ་ལག་ཀུན་ཐེ་བ་ཚོར།
- གང་མོའི་ནང་མང་པོ་བཞུགས་བྱས་ན་88ཚམ་པ། སྐ་ཆུ། སྐ་ཁྲག་སོགས་ནད་སྐ་ཚོགས་ཤེག་རྒྱས་སྲིད། དེ་ཕྱག་ནད་རྐགས་རི་ཡོད་ན་སྐན་པ་དང་བསྟེན་ན་མཛད།

གང་དར་གྱི་རིངས་ལ།

(Do's)མཛད་དགོས་པ་ཀུན།

- གནམ་རླུ་དང་འབྲེལ་བའི་གནས་ཚུལ་ཀུན་དང་གནས་སྐབས་རྒྱར་ཐོའི་སྐབས་བྱེད་དགོས་པའི་ཞྭ་ལོན་ཀུན་སྐྲོབ་སྟོན་ནང་བཞེན་ལག་ལེན་མཛད།
- གང་རང་ནས་སྐྲོབ་ཅེས་ལ་ཙམ་ཉན་ནང་ལ་བཞུགས་ཡང་ཕྱི་ལོག་ཏུ་གང་མོའི་ནང་ཆ་ཡོང་མང་པོ་མ་མཛད།
- གོན་ཆས་བང་རིམ(layer) མང་པོ་ཅན་དང་ལྷུག་ལྷུག(loose) གོན། ཡང་མོ་དང་རྒྱང་པོ་འགོག་སྐབ་ལ་དང་བལ་གྱི་གོས་སོགས་མང་བ་གོན། གོན་ཆས་དམ་པོ(tight)གོན་ན་རྒྱང་ཁག་འཁོད་སྐྲོད་(blood circulation)བྲེད་པར་དཀའ་ལས་ཡོང་།
- རང་དང་རང་སྐམ་པོ་འབོར། གལ་ཏེམ་རྐྱོན་པ་ཡོད་ན་རང་གི་མགོ་མཇེད་པ་དང་ཤད་ལག་གི་མཐུབ་མོ་ཀུན་བཀག་པར་མཛད། དེ་ཀུན་བརྒྱུད་དེ་གཟུགས་པོའི་ཚ་དྲོད་ཀུན་མང་ཆེ་བ་ཡལ་བ་ཡིན།
- སྐྲིང་བཏང་''དེ་ལག་ཤྲབ་ལས་ལག་ཤྲབ་ཁྲག་གཉིས་ས(mitten) མང་བ་བགོ་ལ། ལག་ཤྲབ་ཁྲག་གཉིས་མས་དྲོད་མང་བ་གཏོང་། མཐྱ་ཀུ་ཀུན་ཀྱིས་བན་ཚུན་དྲོད་འབེལ་བཅུག

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- ཚ་རྟོད་ཉང་དུ་ཚ་བྱས་སྐག་བྱས་ལ་ཏེ་པི་དང་ཁ་སྐྱིས་སོགས་བཏགས་ཏེ། ཆུ་འགོག་ཐུབ་པའི་ཞབས་ལྷམ་གོན།
- གཟུགས་པོའི་ཚ་རྟོད་ཚ་སྟོམས་པར་འབོར་བྱས་ལ་འདོན་ཐང་རྒྱལ་ལ་འདོན།
- ཕེ་ཏ་མེན་སི་ཡོད་གན་ཁ་ཟས་དང་སྲོ་ཚོད་ཀུན་འདོན་ཏེ་གཟུགས་སྟོབས་རྒྱས་བཙུག
- གཤེར་ཁུ(fluids)རྟོན་མེའི་རིགས་ཡང་ཡང་འདོན། དེ་ཡིས་གྲང་མོ་ནས་སྐྱབ་ཅིང་གཟུགས་པོའི་ཚ་རྟོད་སྟོམས་པོ་འབོར།
- སྟྲས་རིགས་དེབེར་ན་petrolium jelly & body cream བཀྱས་ཏེ་པགས་པ་རྩོན་པ་བོར།
- ཤན་ཆོན་དང་ཐུག་གུ་ཀུན་ལ་སྐང་རྟགས་བོར། ཁྱིམ་མཚེས་ལ་སུ་ཞེག་གཅིག་པོ་བཞུགས་ས་ཡོད་ན་དེ་ཀུན་ལའང་སྐང་རྟགས་མཛད།
- དགོས་རིགས་ཀྱི་ཟ་འཐུང་གི་ཅ་ལག་ཀུན་སྲོན་ལ་གཉར་ཚགས་མཛད།ཆུའང་འགྲིག་ཟམ་བསག་ག་མཛད། ཆུའི་བུ་རེ་ཀུན་གྲང་མོས་འཁྱགས་སྲིད།
- བཙོ་ཐུའི་ཁང་པ་མེན་ན་རྩོན་མོ་བོར་བའི་སྐྱོབ་སྟོན་ཀུན་ལག་ལེན་མཛད།
- གྲང་མོའི་ནང་ང་བགས་པ་ཀུན་བསྐྱན་ཏེ་མང་པོ་བཞུགས་བྱས་ན་བགས་པ་མེར་པོ།སྐྱན་ཏེ་དང་ཚོར་བ་མེད་ཀུན་འགྱངས་སྲིད། དེ་བཞིན་དུ་གཟུགས་པོའི་ཡན་ལག་དེབེར་ན་ཤད་ལག་གི་མཛུབ་མོ་ཀུན།སྐ་ཁྲང་དང་རྣ་མཆོག་ཀུན་ལ་ཆུ་ཕྱང་འབེབ། དེ་ཐུག་ཚ་ན་མཁོགས་པ་ཇཀ་ཧར་དང་བསྐྱན་ན་མཛད།
- འཁྲགས་ཕྱིད་ཀྱིས་ཚོར་བ་མེད་ཀན་དང་མེར་པོ་ཆ་ཀན་ཞི་ཡན་ལག་དེབེར་ན་མཛུབ་མོ་ཀུན་དང་རྣ་མཆོག་དང་སྐའི་མགོ་ཀུན་ལ་སྐང་རྟགས་མཛད། ཡང་ཁྲད་སྟེབས་ཀན་ཁག་ཀུན་ཆུ་རྩོན་འཛམ་མཉམ་པོ་སྐན་སྤྲོད་མཛད། གྲང་རྩེའི་ཚད་སྟོམས་པོ་ཡོང་དགོས།
- གྲང་དར་ཀྱི་ཆྱང་རྩྭབ་ནང་དུས་མང་པོ་ཞེག་བཞུགས་ན། དེ་ཡིས་ཏའི་པོ་ཐེར་མི་ཡ་ཡོང་སྲིད། ཡང་དེ་ཡིས་འཁྲགས་འདར།དེབེ་ར་གཏོང་བར་དཀའ་ལས།ཉིད་མི་ཡོང་བྱས།རྒྱས་ལ་ཀུན་ཐོང་པོ།དབྱགས་ཐུང་། སྟོབས་མེད་དང་བྱན་ཤེས་མེད་ཀན་འགྱངས་སྲིད།

- ཆའི་པ་ཐེར་མེ་ཡའི་ནད་པ་སྐན་སྦྱད་ཀྱི་ཐོག་ན་ཇ་དང་ཅན་ཞེག་ཡིན་པས། དེ་ལ་ཅི་མཆོག་སྐན་སྦྱད་མཛད་དགོས།
- སུ་ཞེག་ག་འཁྲག་ཕྱིད་དང་ཆའི་པ་ཐེར་མེ་ཡའི་ནད་ཀྱིས་བཏབ་ན་ཅི་ཉམ་མཆོག་ལ་སྐན་སྦྱིད་མཛད།
- དམེག་བསལ་དུ་ཀོ་ཁིད་༡༥་ནད་ཡམས་ཀྱི་རིངས་ལ་སུ་ཞེག་ན་སྐ་ཆུ་དང་དབུག་ཚུལ་སོག་ཡོང་ན་ཇཀ་ཏར་ལ་བསྐན་ན་མཛད།

- NDMA mobile Application download མཛད་ཐ་ནད་དང་སྐོབ་སྦྱག་ཀུན་ཀྱི་ཆེད་འགོ་མའི་སྐན་བཅོས་བསྐོར།
- སྐལ་སྐྱོང་བཅོ་ཀན་སེམས་ཅན་དང་དུད་འཚོ་སྐོ་སྦྱག་ཀུན་ཀྱང་མོ་ནས་སྐྱོབ་ཕྱིར་ནང་ངོས་ལ་ཞུར།

མཛད་མི་དགོས་རིག་ས།(Don'ts)

- ཀྱང་མོའི་ནང་མང་པོ་མ་བཞུག་ས།
- འཁྲག་འདང་ཡོང་ན་སྐད་མེད་མ་མཛད། འདི་ནི་གཟུག་ཚོའི་ཚ་རྩོད་ཡལ་བའི་ཐོག་མའི་ནད་ཏུག་ས་ཡིན། དེ་ཕྱིར་ནང་དུ་བཞུག་ས།
- ཚང་རབ་སོག་མ་འདོན། དེ་ཡིས་གཟུག་ས་ཚོའི་ཀྱང་རྩོའི་ཚད་ཉམས་བཅུག་ཡང་ཆའི་པ་ཐེར་མེ་ཡ་རྒྱས་བཅུག
- འཁྲག་ཕྱིད་ལ་སོང་མཁན་གཟུག་བའི་ཡན་ལག་ཀུན་མཉེ་བ་མ་མཛད། དེ་ཐུག་མཛད་ཅེས་ན་གནོད་སྐྱོན་མང་བ་སྟེ།
- ཁྲད་སྟེབས་མཁན་ནད་བར་གཤེར་ཁྲའི་རིགས་འཐུང་མ་བཅུག
- མེ་ལ་སྐད་མེད་མ་མཛད། གནོད་སྐྱོན་ཅན་འགྱར་སྲིད།
- ཆུང་པ་ཆ་ཡོང་གཏང་མ་མེད་བའི་ནང་དུ་ཡང་ལྷ(candle)ཡི་ཆྱོང་ཅེ་དང་སྐར་ག་དང་ཤེང་བཏབ་ནས་མེ་མ་གཏང་། ཡང་དུག་ཆུང་(carbon monoxide)འགོག

ཀྱང་དར་དང་འཁྲག་ཕྱིད་དང་འབྲེལ་ཀྱལ་སྐྱིག་དང་འགོག་ཐབས་ཀྱི་སྐོར་ལ་ཞིབ་གསལ་ཤེས་འདོད་ཡོད་ན། ད་ཆུ་ https://mausam.gov.in/བརྒྱད་དེ་སྤྱས་ཆུས་མཛད།

ཡང་IECཀྱང་དར་ཀྱི་ཆེད། ད་ཆུ་https://indma.gov.in/

The Administration of Union Territory of Ladakh.
MISSION DIRECTOR, NATIONAL HEALTH MISSION, UT LADAKH

PUBLIC HEALTH ADVISORY: COLD WAVE/ FROST

WHAT IS A COLD WAVE?

A cold wave is a weather-related event characterized by sharp drop of air temperature near the surface, leading to

- extremely low values of temperatures
- steep rise of air pressure
- strengthening of windspeed or
- associated with hazardous weather like frost and icing

WHEN AND WHERE DO COLD WAVES OCCUR COMMONLY?

- **Cold wave Season:** during winter (November to March), more frequent in December-January.
- **Cold wave prone regions:** 17 States/UTs from north, northwest, east, and central India are in 'Core Cold Wave Zone' and experience the highest number of cold waves/severe cold waves. They are:

Punjab, Himachal Pradesh, Uttarakhand, Jammu & Kashmir, Ladakh, Delhi, Haryana, Rajasthan, Uttar Pradesh, Gujarat, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, West Bengal, Odisha, and Telangana.

The maximum numbers of cold waves occur in **Jammu and Kashmir** followed by **Himachal Pradesh, Punjab, Bihar, Haryana, and Uttar Pradesh**.

HOW TO BE AWARE OF COLD WAVES/FROST?

Be aware of weather updates

- Weather Warnings (regional/district-wise) updated every 4hrs on: https://mausam.imd.gov.in/
- Real-time map of temperature including cold wave: https://bit.ly/IMDcoldwave

WHO ARE VULNERABLE?

Homeless, elderly, economically disadvantaged, disabled, pregnant or lactating mothers, women, children, outdoor workers, managers of night shelters, farmers

HOW IS THE COLDWAVE DEFINED?

As per the India Meteorological Department's criteria, **Cold Wave and Cold Day** conditions are defined as:

A. Conditions for Cold Wave: When minimum temperature of a station is 10°C or less for plains and 0°C or less for Hilly regions and fulfils any of the following criteria:

I) Based on Departure of Minimum Temperatures from Normal	II) Based on Actual Minimum Temperature (For plain stations only)
Cold Wave: When the Departure is -4.5°C to -6.4°C	Cold Wave: When minimum temperature is ≤ 4°C
Severe Cold Wave: When the Departure is > -6.4°C	Severe Cold Wave: When minimum temperature is ≤ 2°C

III) For coastal stations:

When the Departure of Minimum Temperature is -4.5°C or less and Minimum Temperature is 15°C or less.

B. Conditions for Cold Day: When minimum temperature is 10°C or less for plains and 0°C or less for Hilly regions and fulfils following criteria:

Cold day: Maximum Temperature Departure is -4.5°C to -6.4°C

Severe Cold day: Maximum Temperature Departure is < -6.4°C

National Programme on Climate Change and Human Health

HEALTH IMPACT OF COLD WAVE

Extreme cold may lead to injuries and death if precautionary measures are not taken. Exposure to intense cold may lead to **Hypothermia, Frostbite,** and other non-freezing peripheral cold injuries like immersion (trench) foot and chilblain (pernio).

HYPOTHERMIA

- It is caused by prolonged exposures to very cold temperatures where your body begins to lose heat faster than it's produced. It will eventually use up the body's stored energy leading to lower body temperature.
- Very low body temperature affects the brain, making the person unable to think clearly or move well. This makes hypothermia especially dangerous.
- Dangerous hypothermia can occur even at less cold temperatures if a person becomes chilled from rain, sweat, or submersion in cold water.

WHO ARE VULNERABLE TO HYPOTHERMIA?

- Older adults with inadequate food, clothing, or heating
- Babies sleeping in cold bedrooms
- People who remain outdoors for long periods—the homeless, hikers, hunters, etc.
- People who drink alcohol or use illicit drugs.

SIGNS AND SYMPTOMS OF HYPOTHERMIA

Adults		Babies
Shivering	Memory loss	Bright red, cold skin
Exhaustion or feeling very tired	Slurred speech	Very low energy
Confusion	Drowsiness	
Fumbling hands		

Hypothermia is a medical emergency. Take ACTION!

If you see a person with any of the above signs get medical attention immediately!

WHEN MEDICAL ATTENTION IS AWAITED, TRY TO WARM THE PERSON UP.

- Get the person into a warm room or shelter and change clothes, remove any wet clothing
- Warm the person's body with skin-to-skin contact, dry layers of blankets, clothes, towels, or sheets.
- Give warm drinks to help increase body temperature, but do not give alcoholic drinks. Do not try to give beverages to an unconscious person.
- After body temperature has increased, keep the person dry and wrap their body, including their head and neck, in a warm blanket.
- Get the person proper medical attention as soon as possible.

A person with severe hypothermia may be unconscious and may not seem to have a pulse or to be breathing. In that case, handle the person gently, and get emergency assistance immediately.

BE PREPARED FOR COLD WEATHER

IT REDUCES THE RISK OF DEVELOPING HEALTH PROBLEMS RELATED TO COLD WEATHER

National Programme on Climate Change and Human Health

FROSTBITE

- It is a type of injury caused by freezing. It leads to a loss of feeling and colour in the areas it affects, usually extremities such as the nose, ears, cheeks, chin, fingers, and toes.
- Frostbite can permanently damage the body, and in severe cases can lead to amputation (removing the affected body part).

WHO ARE VULNERABLE TO FROSTBITE?

Individuals with poor circulation

Individual not dressed properly for extreme cold temperature

SIGNS AND SYMPTOMS OF FROSTBITE

Redness of skin or pain in an area that is exposed/unexposed in cold weather may be a beginning of frostbite.

Frostbite presents as:

- A white or grayish-yellow skin area,
- Skin that feels unusually firm or waxy
- Numbness

A person who has frostbite may not know they have it until someone else points it out because the frozen parts of their body are numb.

If you notice signs of frostbite on you or someone else, seek medical care.

IF A PERSON SHOWS SIGNS OF FROSTBITE WITHOUT HYPOTHERMIA AND IMMEDIATE MEDICAL CARE IS NOT AVAILABLE:

- Get the person into a warm room as soon as possible.
- Unless absolutely necessary, do not walk on feet or toes that show signs of frostbite—this increases the damage.
- Do not rub the frostbitten area with snow or massage it at all. This can cause more damage.
- Put the areas affected by frostbite in warm—not hot—water (the temperature should be comfortable to the touch for unaffected parts of the body).
- If warm water is not available, warm the affected area using body heat. For example, you can use the heat of an armpit to warm frostbitten fingers.
- Do not use a heating pad, heat lamp, or the heat of a stove, fireplace, or radiator for warming. Affected areas are numb and can easily burn.
- Frostbite should be checked by a health care provider.

IMMERSION (TRENCH) FOOT

- It occurs when the feet are wet for long periods of time.
- **Sign and symptoms include**: tingling and/or itching sensation, pain, swelling, cold and blotchy skin, numbness, and a prickly or heavy feeling in the foot. The foot may be red, dry, and painful after it becomes warm. Blisters may form, followed by skin and tissue dying and falling off. If untreated it may lead to loss of toes, heel, or the entire foot.
- **Prevention by** air-drying and elevating your feet, and exchanging wet shoes and socks for dry ones
- **Seek medical care if any signs and symptoms appear**
- If you have a foot wound, check your feet at least once a day for infections or worsening of symptoms.

CHILBLAIN (PERNIO)

- It is a painful inflammation of small blood vessels in your skin that occur in response to repeated exposure to cold but not freezing air.
- **Sign and symptoms include**: itching, red patches, swelling, and blistering on your hands and feet.
- **Prevent by** limiting your exposure to cold, dressing warmly, and covering exposed skin
- It usually improves in one to three weeks, especially if the weather gets warmer
- **Seek medical care if signs and symptoms do not improve**

Cold Wave/ Frost: Do's and Don'ts

BEFORE COLD WAVE

- Listen to the radio, watch TV, read newspapers for the local weather forecasts to know if a cold wave is approaching
- Track weather warning by India Meteorological Department: https://mausam.imd.gov.in/
  Realtime temperature update: https://bit.ly/IMDcoldwave
- Stock adequate winter clothing. Multiple layers of clothing are more helpful.
- Keep emergency supplies like extra food, drinking water, medicines, and other essentials ready.
- Prolong exposure to cold increases likelihood of various illnesses like flu, running/stuffy nose or nosebleed, which Consult the doctor for symptoms like these.

DURING COLD WAVE

Do's

- Follow weather information and emergency procedure information closely and act as advised.
- Stay indoors as much as possible and minimize travel to prevent exposure to cold wind and conserve heat
- Wear multiple layers of loose fitting, lightweight, windproof warm woolen clothing rather than one layer of heavy clothing. Tight clothing reduces blood circulation.
- Keep yourself dry. If wet, then cover your head, neck, hands and toes adequately as the majority of heat loss occurs through these body parts.
- Prefer mittens over gloves. Mittens provide more warmth and insulation from cold, as fingers share their warmth and expose less surface area to the cold.
- Use hats and mufflers to prevent heat loss, Wear insulated/waterproof shoes.
- Eat healthy food to maintain the equilibrium of body temperature.
- Eat fruits and vegetables rich in Vitamin- C to maintain adequate immunity.
- Drink hot fluids regularly, as this will maintain body heat to fight cold.
- Moisture your skin regularly with oil, petroleum jelly or body cream
- Take care of elderly people and children. Check on neighbor's who live alone and are elderly about their well-being.
- Store essential supplies as per requirement. Store adequate water as pipes may freeze.
- Follow the guide on heat insulation for non-industrial buildings and take necessary preparedness measures.
- Prolonged exposure to cold can turn skin to pale, hard and numb, and black blisters on exposed body parts such as fingers, toes, nose and/ or earlobes. Immediately consult the doctor.
- Watch out for symptoms of frostbite like numbness, white or pale appearance on fingers, toes, ear lobes and the tip of the nose, while exposed to cold waves. Treat the areas affected by frostbite in warm (not hot) water (the temperature should be comfortable to touch for unaffected parts of the body).
- Severe exposure to cold wave can lead to Hypothermia – a decrease in body temperature which can cause shivering, difficulty in speaking, sleepiness, stiff muscles, heavy breathing, weakness and/or loss of consciousness. Hypothermia is a medical emergency that needs immediate medical attention.
- Seek medical attention as soon as possible for someone suffering from Hypothermia/Frostbite.
- Consult a doctor for symptoms of running/stuffy nose particularly during of COVID-19 pandemic
- Download NDMA's mobile application: First Aid for Students and Teachers (FAST) for information on first aid.
- Move pet-animals indoors. Protect livestock or domestic animals from cold weather by moving them inside.

Don't s

- Avoid prolonged exposure to cold
- Do not ignore shivering. It is the first sign that the body is losing heat - get indoors.
- Do not drink alcohol. It reduces your body temperature and increases the risk of hypothermia.
- Do not massage the frostbitten area. This can cause more damage.
- Do not give the affected person any fluids unless fully alert.
- Do not leave a fire unattended it can be hazardous
- Do not burn candles, woods, etc. in closed, unventilated rooms and prevent carbon monoxide (CO) poisoning

For more information on National Guidelines on Prevention and Management of Cold Wave and Frost visit:
https://ndma.gov.in/Governance/Guidelines
For IEC on cold wave visit: https://ndma.gov.in/Resources/awareness/Cold_Wave

National Programme on Climate Change and Human Health

PART III

Budget

CHAPTER 13
Budget

SAPCCHH: Budget (PIP for The Year 2022-23) UT Ladakh

			Proposal for 2022-23		Approval for 2022-23	
New FMR	Particulars	Unit Cost (Rs)	Quantity/ Target	Budget (Rs. lakhs)	GoI Remarks	Budget (Rs. in lakhs)
3	**Community Interventions**			0.00		0.00
5	**Infrastructure**	500000	2	10.00	Approved	10.00
9	**Training and Capacity Building**					
9.2.4.9	**Trainings of Medical Officers, Health Workers and Programme officers under NPCCHH**					
	Any other (please specify)		As per PIP	22.00	Approved	22.00
10	**Reviews, Research, Surveys and Surveillance**		As per PIP	2.10	Approved	2.10
11	**IEC/BCC**		As per PIP	10.50	Approved	10.50

			Proposal for 2022-23		Approval for 2022-23	
New FMR	Particulars	Unit Cost (Rs)	Quantity/ Target	Budget (Rs. lakhs)	GoI Remarks	Budget (Rs. in lakhs)
11.4.7	**IEC on Climate Sensitive Diseases at Block, District and State level– Air pollution, Heat and other relevant Climate Sensitive diseases**					
12	**Printing**					
12.4.7	**Printing activities for NPCCHH**					
16	**Programme Management**		As per PIP	9.40	Approved	9.40

Budget

The table below presents an overview of the proposed activities and the respective budget to be implemented under the climate change and human health programme between 2022-2027 in J & K. The detailed activities and the corresponding budgetary amount are enlisted in the table below:

Sl. No.	Activities	Indicator	Budget (in lakhs) for 5 years					Target for five years 2022-27				
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
Programme Management												
1	Task force meeting to draft health sector plan for heat and air pollution	• % State Task Force Quarterly Meetings conducted in a year										
		• % Districts conducted quarterly District Task Force Meetings in a year						50	100	100	100	100
2	Sensitization workshop/ meeting of the state programme Officers and District level Health Officers.							100%	100%	100%	100%	100%
General Awareness												
3	Development of IEC material, campaigns, Innovative IEC/ BCC Strategies	• % of implemented IEC on all climate sensitive issues	10.50	11.55	0.00	0.00	0.00	100%	100%	100%	100%	100%
Capacity Building												
4	Orientation/ Training/capacity Building of healthcare staffs	• % of Medical Officers/DNO/ SN trained in Districts	22.00	24.20	0.00	0.00	0.00	10%	20%	30%	40%	50%
		• % of targeted sensitization trainings planned for vulnerable population in district (PRI Training)										

Sl. No.	Activities	Indicator	Budget (in lakhs) for 5 years					Target for five years 2022-27				
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
Strengthening of the Health System												
5	Adoption of Green/ Environment Friendly Measures in Health facilities	*Energy Audit:* • % of healthcare facilities per district per year that have conducted energy audit.	0.0	81.8	100.00	100.00	100.00	50	100	100	100	100
		LED lighting: • % of healthcare facilities per year that installed solar panel						50	100	100	100	100
		Solar Panel: • % of healthcare facilities per district per year that installed solar panel						50	100	100	100	100

Note: Year 1 = FY 2022-23; Year 2 = FY 2023-24; Year 3 = FY 2024-25; Year 4 = FY 2025-26; Year 5 = FY 2026-27.

The Activities which have been done under NPCCHH for the last two years as under:

1. Constitution of UT level Governing Body for NPCCHH was done Vide Govt. Order No:-18 (HME) UTL of 2023 Dated:-22-08-2023. (above Attached).
2. Constitution of State Task Force/Environmental Health cells for implementation of NPCCHH & action plan for climate change and human health (UTAPCCHH) was done vide Govt. Order No. 10 of 2023 Dated: 04-04-2023.
3. Chief Medical Officers of both the districts of UT Ladakh have been directed for the preparation for District Action Plan as per template.
4. The Advisories & IEC's regarding Air Pollution & Heat have edited & prepared for which all the District Nodal Officers have been directed for its implementation at all the Health Institutions and the community level.
5. Awareness of Health care workers on hazards of Air Pollution on international day of clean air for blue skies has been done in both the districts of UT Ladakh. International day of clean air & blue skies was celebrated across UT Ladakh on 7th September 2022 & 2023. Similarly, World Health Day was celebrated on 7th April 2023.
6. All the training modules have been disseminated in all the districts & time to time on line trainings has been conducted. The trainings at UT level & Divisional Level have been conducted for ToTs (District Health Officers as District Nodal Officers for NPCCHH) Trainings at District level for primary medical officers were completed in January 2022.
7. PIP for two years 2022-23 & 2023-24 has been proposed to NCDC-NPCCHH-MoHFW with requirement of one consultant for NPCCHH at State/UT level.
8. Acute Respiratory Infections (ARI) surveillance to be started soon in two sentinel Hospitals of Both the districts.

Annexures

संघ राज्य प्रशासन, लद्दाख
यूटी सचिवालय, लद्दाख
ई-मेल/email: commrsecy-ladakh@gov.in

THE ADMINISTRATION OF
UNION TERRITORY OF LADAKH
HEALTH & MEDICAL EDUCATION
DEPARTMENT

फोन/फैक्स नं Phone No: 01982 - 257561, Fax No 257435

यूटी सचिवालय, लेह/ UT Secretariat, Leh

Subject: - Constitution of State Level Governing Body -Environmental Health.

ORDER No.18 (H&ME) UTL of 2023
DATED: 22 .08.2023

Sanction is hereby accorded to the constitution of State/ UT Level Governing Body-Environmental Health for implementation of National Programme for Climate Change and Human Health (NPCCHH) and for Policy Level Decision under the chairmanship of Hon'ble Lieutenant Governor, UT Ladakh with the composition of following Members:

1	Advisor to Hon'ble Lieutenant Governor, UT Ladakh.	Vice Chairman
2	Administrative Secretary, Health & Medical Education, UT Ladakh.	Member
3	Administrative Secretary, Department of Forest, Ecology & Environment, UT Ladakh.	Member
4	Administrative Secretary, Department of Revenue, UT Ladakh.	Member
5	Administrative Secretary, Housing & Urban Development Department, UT Ladakh	Member
6	Administrative Secretary, Department of Social & Tribal Welfare, UT Ladakh.	Member
7	Administrative Secretary, Power Development & Non- Renewable Energy Department, UT Ladakh.	Member
8	Administrative Secretary, Department of Animal & Sheep Husbandry, UT Ladakh.	Member
9	Administrative Secretary, Department of Transport, UT Ladakh.	Member
10	Administrative Secretary, Department of Information Technology, UT Ladakh.	Member
11	Administrative Secretary, Department of Rural Development & Panchayati Raj, UT Ladakh.	Member
12	Administrative Secretary, General Administrative Department, UT Ladakh.	Member
13	Administrative Secretary, Department of Food, Civil Supplies & Consumer Affairs, UT Ladakh.	Member
14	Administrative Secretary, Department of Public Health Engineering, Irrigation & Flood control, UT Ladakh	Member
15	Administrative Secretary, Public Works Department, UT Ladakh.	Member
16	Administrative Secretary, Department of Agriculture, UT Ladakh.	Member
17	Administrative Secretary, Department of Law, UT Ladakh.	Member
18	Head – NAPCCHH, CEOH & CCH Division, NCDC.	Member
19	Director Health Services, UT Ladakh.	Member
20	Mission Director-National Health Mission, UT Ladakh.	Member Secretary
21	State Nodal Officer- Climate Change, UT Ladakh	Member

22.08.23

Terms of References:

1. To take on overview of work done by State/UT NPCCHH for the period since inception till date and therefore in subsequent meetings for the period since previous meeting.

2. To Take decision related to policy matters submitted for Governing Body by member secretary based on inputs received during previous State Task Force meeting & discussions with State Nodal Officer and his team in a State/UT.

3. Take an overview of work done by other sectors which may have a relationship on climate change mitigation & adaptation and identify matters of convergence for state health department

By order of Hon'ble Lt. Governor, UT of Ladakh.

Sd/-
(Dr. Pawan Kotwal, IAS)
Advisor & Secretary, H&ME Department.

No. M-13/29/2023-OFFICE OF SNO (NPCCHH)/ 1448-55 Dated: 22.08.2023

Copy to the: -

1. All concerned Administrative Secretaries, UT Ladakh.
2. Dr. Aakash Shrivastava, Additional Director & HoD - CEOH & CCHH, NCDC, Ministry of Health & Family Welfare, Govt. of India, New Delhi.
3. Director Health Services, UT Ladakh.
4. Mission Director, National Health Mission, UT Ladakh.
5. State Nodal Officer – Climate Change, UT Ladakh.
6. OSD to Hon'ble Lieutenant Governor, UT Ladakh for kind information of the Hon'ble Lieutenant Governor.
7. P.S. to Advisor, UT Ladakh for kind information of the Advisor to Hon'ble Lieutenant Governor.
8. Office Order file.

22.08.23
(Mohd Shabir)
OSD with Administrative Secretary.

THE ADMINISTRATION OF UNION TERRITORY OF LADAKH
OFFICE OF THE MISSION DIRECTOR, NATIONAL HEALTH MISSION

www.nhmladakh.ine-mail: mdnhmladakh@gmail.com

eFile No. M13/29/2023/-Office of SNO (NPCCHH) **Dated: 29/03/2023**

Subject:-Constitution of State/UT Level Task Force- Environmental Health/Executive Member of Environmental Health Cell for implementation of National Programme for Climate Change and Human Health (NPCCHH)/UT Action Plan for Climate Change and Human Health (UTAPCCHH).

Order No: 10 of 2023 Dated: 04-04-2023

Sanction is hereby accorded to the constitution of State/UT Level Task Force-Environmental Health/ Executive Member of Environmental Health Cell , comprising the following, for implementation of the National Programme for Climate Change and Human Health (NPCCHH)/Union territory Action Plan for Climate Change and Human Health (UTAPCCHH),

A) State Level Task Force - Environmental Health:
This task force shall be working under the guidance of Principal Secretary (Health) of the state. It shall be directly overseeing the implementation of the State Action Plan for Climate Change and Human Health (SAPCCHH) in the UT Ladakh. It shall be working through Mission Director, NHM of the state, which will be the implementing agency for SAPCCHH.

The State level Task Force shall have inter-Departmental members which are as follows:

Principal Secretary – Health & Medical Education, UT Ladakh	Chairperson
Mission Director-National Health Mission, UT Ladakh.	Vice Chairman
Director Health Services, UT Ladakh.	Member Secretary
Chairman, State Pollution Control Board, UT Ladakh.	Member
Head - State Disaster Management Authority, UT Ladakh	Member
Director - Department of Agriculture, UT Ladakh.	Member
Director - Department of Social & Tribal Welfare, UT Ladakh.	Member
Director, Meteorological Department, UT Ladakh	Member
Director - Department of Animal & Sheep Husbandry, UT Ladakh.	Member
Director – Department of Urban & Local Bodies, UT Ladakh.	Member
Director - Department of School Education, UT Ladakh.	Member
Director - Department of Food, Civil Supplies & Consumer Affair, UT Ladakh.	Member
Director- Department of Finance, UT Ladakh	Member
Director/ Chairman - Department of Power Development & Non- Renewable Energy, UT Ladakh	Member
Director - Department of Rural Development & Panchayati Raj, UT Ladakh.	Member
Regional Transport Officer - Department of Transport, UT Ladakh.	Member
Under Secretary– Department of Disaster, UT Ladakh.	Member
Under Secretary - Department of Revenue, UT Ladakh.	Member
Chief Engineer - Department of Public Works Department, UT Ladakh.	Member
Chief Engineer - Department of Public Health Engineering, UT Ladakh.	Member
Chief Conservator Department of Forest, Ecology & Environment, UT Ladakh.	Member
Environmental Engineer/ Scientist from Ministry of Environment	Member
Assistant Legal Remembrance - Department of Law, UT Ladakh.	Member
State Nodal Officer- Climate Change, UT Ladakh	Member
State Surveillance Officer, UT Ladakh	Member
Head – NAPCCHH, CEOH&CCH Division, NCDC, MoHFW	Member

Terms of References:

1. The Task force of the State/ UT's Environmental Health Cell will coordinate with the Centre (MoHFW, NCDC) for execution of state/ UTs SAPCCHH.
2. To oversee implementation of the UT Action Plan for Climate Change and Human Health (SAPCCHH).
3. To monitor the National Health Mission, UT Ladakh which will be the implementing agency for UT Action Plan for Climate Change and Human Health (SAPCCHH).
4. To supervise the UT's Environmental Health Cell which will coordinate for execution of UT Action Plan for Climate Change and Human Health (SAPCCHH)

Executive Members of EHC(Environmental Health Cell)

State Nodal Officer- Climate Change, UT Ladakh.	Chairman
State Program Manager/Officer – NHM, UT Ladakh.	Member
State Nodal Officer- NCD, UT Ladakh.	Member
Director Health Services, UT Ladakh.	Member
State Immunization Officer, UT Ladakh.	Member
State Nodal Officer- (Mental Health), UT Ladakh.	Member
State Surveillance Officer – IDSP, UT Ladakh.	Member
State IEC Consultant, UT Ladakh.	Member
State Epidemiologist, IDSP, UT Ladakh	Member
Representative from Department of Animal Husbandry, UT Ladakh.	Member
State Microbiologist, IDSP, UT Ladakh	Member

Roles and Responsibilities of the State/ UT Environmental Health Cell

1. Preparation and Implementation of State Action Plan for Climate Change and Human Health
2. Conduct Vulnerability assessment and risk mapping for commonly occurring climate sensitive illnesses in the state/ UT.
3. Assessment of needs for health care professionals (like training, capacity building) and organise training, workshop and meetings.
4. Maintain State and District level data on physical, financial, epidemiological profile for climate sensitive illnesses.
5. Ensure Convergence with NHM activities and other related programs in the State / District
6. Monitor programme, Review meetings, Field observations.
7. Timely issue of warning/ alerts to health professionals and related stakeholders as well as general public through campaign or using mass media (Electronic or printed),
8. Social mobilization against preventive measures through involvement of women's self-help groups, community leaders, NGOs etc.
9. Advocacy and public awareness through media (Street Plays, folk methods, wall paintings, hoardings etc.

10. Conduction of operational research and evaluation studies for the Climate change and its impact on human health.

By order of Competent Authority

Sd/-

Dr. Pawan Kotwal (IAS)
Principal Secretary,
Health & Medical Education,
UT Ladakh

No:SHS/UTL/MD /NHM/2023/5910 – 43 Dated:04.04.2023

Copy to the:

1. Mission Director, National Health Mission, UT Ladakh.
2. Director Health Services, UT Ladakh
3. Chairman State Pollution Control Board/ Committee, UT Ladakh.
4. Head State Disaster Management Authority, UT Ladakh.
5. Director - Department of Agriculture, UT Ladakh.
6. Director - Department of Social & Tribal Welfare, UT Ladakh.
7. Director, Meteorological Department, UT Ladakh.
8. Director - Department of Animal & Sheep Husbandry, UT Ladakh.
9. Director – Department of Urban & Local Bodies, UT Ladakh.
10. Director - Department of School Education, UT Ladakh.
11. Director - Department of Food, Civil Supplies & Consumer Affair, UT Ladakh.
12. Director- Department of Finance, UT Ladakh.
13. Director/ Chairman - Department of Power Development & Non- Renewable Energy, UT Ladakh.
14. Director - Department of Rural Development & Panchayati Raj, UT Ladakh.
15. Regional Transport Officer - Department of Transport, UT Ladakh.
16. Under Secretary– Department of Disaster, UT Ladakh.
17. Under Secretary - Department of Revenue, UT Ladakh.
18. Chief Engineer - Department of Public Works Department, UT Ladakh.
19. Chief Engineer - Department of Public Health Engineering, UT Ladakh.
20. Chief Conservator of Forest - Department of Forest, Ecology & Environment, UT Ladakh.
21. Head – NAPCCHH, CEOH&CCH Division, NCDC, MoHFW.
22. Environmental Engineer/ Scientist from Ministry of Environment, India.
23. Assistant Legal Remembrance - Department of Law, UT Ladakh.
24. State Nodal Officer- Climate Change & Human Health, UT Ladakh
25. State Surveillance Officer-IDSP, UT Ladakh.
26. State Immunization Officer, UT Ladakh
27. State Nodal Officer- (Mental Health), UT Ladakh.
28. State Epidemiologist, IDSP, UT Ladakh
29. State Nodal Officer- NCD, UT Ladakh.
30. State Program Manager/Officer – NHM, UT Ladakh.
31. State Microbiologist, IDSP, UT Ladakh
32. Representative from Department of Animal Husbandry, UT Ladakh.
33. District Informatics Officer, NIC Ladakh for Uploading on UT website.
34. Private Secretary to Advisor to Hon'ble Lt. Governor for information of Advisor to Lt. Governor, UT Ladakh.

04/04/2023

Dr. Iftakhar Ahmed Chowdhry (IRS)
Mission Director,
National Health Mission
Union Territory of Ladakh.

As per Order No. 20/2023-24/SHS/UTL/NHM/6131-49, dated: 19-04-2023, Mission Director, NHM had nominated Dr. Sunil Kumar Ahirwar, State Nodal Officer – NPCCHH, for UT Ladakh.