सत्यमेव जयते
Government of India
Ministry of Health and Family Welfare

Azadi Ka Amrit Mahotsav

TRAINING MANUAL for MEDICAL OFFICERS on PREVENTION AND MANAGEMENT of HEAT-RELATED ILLNESSES

National Programme on Climate Change and Human Health

Ministry of Health and Family Welfare
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Contents

List of Abbreviations

ASHA	Accredited Social Health Activist
ACE	Angiotensin-converting-enzyme
ADH	Antidiuretic Hormone
DIC	Disseminated Intravascular Coagulation
IEC	Information, Education, and Communication
IMD	India Meteorological Department
GoI	Government of India
HAP	Heat Action Plan
HSAP	Heat Stress Action Plan
NDMA	National Disaster Management Authority
ORS	Oral Rehydration Salt
STGs	Standard Treatment Guidelines
UHC	Urban Health Center
ULB	Urban Local Body
UTI	Urinary Tract Infections
WMO	World Meteorological Organization

1. CLIMATE CHANGE, HEAT WAVES, AND HEAT ALERTS

Climate distortion and warming as a result of CO_2 emissions is a large threat to humans and other life on earth. The deleterious effects of climate change are no longer a futuristic warning but are seen in the many natural disasters witnessed every year across the world. The increasing frequency and intensity of these extreme climate events have a catastrophic impact on the availability of water, agriculture, and by extension food security, and the emergence of new and old diseases that have been greatly reduced or eliminated (Dutta, Golechha, and Mavalankar 2021). These effects are particularly visible in South Asian nations such as India due to the multifold risk posed by poverty, extremely high population density, underdeveloped and weak systems particularly healthcare, a double epidemiological burden, and the tropical geographical location where warming effects are severe. It is estimated that the extreme heat events will increase in frequency and strength in this region (Golechha, et al. 2021).
In the last two decades, it has been observed that mortality due to extreme heat has increased by more than 50% among the elderly, and in 2018, this number reached 296,000. In 2019, nearly half a billion heat wave events were observed that affected the vulnerable communities, causing excess premature death and morbidity. More than a quarter million deaths associated with climate change are expected to occur in the next three decades according to the WHO, from a variety of causes including large-scale natural disasters, several infectious diseases, malnutrition due to food insecurity, worsening chronic conditions, and the direct effects of extreme heat (Watts et al. 2021).

Therefore, it is essential to configure health systems in accordance with these changes and incorporate more aspects of environmental and especially heat protection in healthcare operations. There is a need for proper revival and treatment protocols and an evaluation of the heat interactions with the existing treatment lines for a gamut of health conditions. In addition, it will be imperative to put in place preventive measures that are focused on minimizing the adverse health impacts of intense heat and conduct periodic evaluations of the same to ensure compliance with shifting environmental and systemic realities. Interestingly, the shocks experienced by health systems as a result of the COVID-19 pandemic, and the preparedness measures put in place have a high degree of alignment with adaptations that will be required to address a surge in climate-related ill-health. These include surveillance measures to identify population sub-groups at the highest risk, capacity assessments, and capacity-building measures, not only for the healthcare system but across the governance board, and large investments in emergency preparedness, efforts to curb health inequity, and building resilience from the grassroots up to the global levels.

The IMD, identifies it to be a Heatwave condition, if the maximum temperature of a station reaches at least 40°C or more for plains, 37°C or more for the coastal stations, and at least 30°C or more for the hilly regions. The specifications are as follows:

1. Based on the Departure from the Normal Heat Wave
    a. Heat Wave: departure from the normal is 4.5°C to 6.4°C
    b. Severe Heat Wave: departure from the normal is >6.4°C
2. Based on the Actual Maximum Temperature (for plains only)
    a. Heat Wave: when the actual maximum temperature ≥ 45°C

b. Severe Heat Wave: when the 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 and the heat wave will be declared on the second day.

When actual maximum temperature remains 45°C or more irrespective of normal maximum temperature, heat wave should be declared.

2. VULNERABLE AREAS & GROUPS

Vulnerable Areas

Extreme heat affects different areas differently. For instance, areas that are subject to the Urban Heat Island Effect or those that have poor infrastructure and distribution of utilities such as power and water, represent environments that subject the people to higher levels of heat stress, and therefore, increased risk of heat-related illness. Vulnerable areas include:

1. **Slums** – These are characterised by housing that is often makeshift and composed of materials like tin sheets that absorb a large quantity of heat. Further, since slums are unplanned and unsanctioned, the access to utilities such as appropriate water and sanitation is either very poor or absent. As a result, people living in slums are subjected to worsened health during extreme heat.

2. **Low-income neighbourhoods** – In low-income neighbourhoods while dwellings may be built, the quality of construction may be poor, providing limited insulation, in particular for the flats on the higher floors of high-density apartment buildings. Similar to the slums, they are likely to have poor access to facilities including healthcare, thus increasing the risk of adverse health events due to heat.

3. **Hotspots** – These include areas identified in heatwave assessments conducted as public health measures, such as areas with no tree cover or surface water reservoirs, areas subject to the urban heat island effect, and areas with a very high index of air pollution.

Vulnerable Population Groups

Certain population groups are also more vulnerable to heat-related illnesses. These include-

1. **Infants** – They are particularly sensitive to heat due to different metabolism and poor ability to adjust to the changes in the temperatures. The infants sweat less, which considerably decreases their ability to cool their bodies. Infants are more susceptible to heat related deaths due to their high metabolism rate and inability to remove sheets or clothing.

2. **Children** – They are physiologically more vulnerable to heat stress unlike adults. The heat-related illnesses are associated with their physical activity, production of more metabolic heat/ kilogram, in comparison to body weight, dehydration, and lower cardiac output.

3. **Pregnant Woman** – The ability to thermoregulate is compromised in pregnancy and heat-related illnesses and are also liable to cause developmental defects in the fetus.

4. **Older Adults** – Ageing leads to a considerable reduction in the cardiac output and capacity to circulate blood to skin, intestinal, and renal circulatory beds, in addition to a reduced efficiency of heat dissipation.

5. **Workers** – The capacity to thermoregulate is affected due to continued exposure to heat and inability to regularly hydrate, leading to a variety of heat-related illnesses. Further, protective clothing required for certain jobs may further cause heating of the body.

6. **Economically Weaker Sections**– The lack of material and social resources including access to basic services such as power, water, adequately protective housing, and healthcare exposes individuals and communities to increased health risks. Low levels of education also point toward low heat-health awareness and knowledge of appropriate protective practices.

7. **People with Disabilities** – Spinal cord injury inhibits sweating and therefore cooling. People with disabilities are also subject to several psychosocial risks and there is evidence that awareness messaging may not be designed or delivered in a disability-friendly manner.

8. **Chronic Disease Patients** – Medication for several chronic diseases interferes with the body's ability to thermoregulate, and exacerbates the effects of heat. Persons with cardiovascular disease, endocrine disorders, and obesity are at the higher risk of heat-related illnesses or worsening of their existing chronic condition.

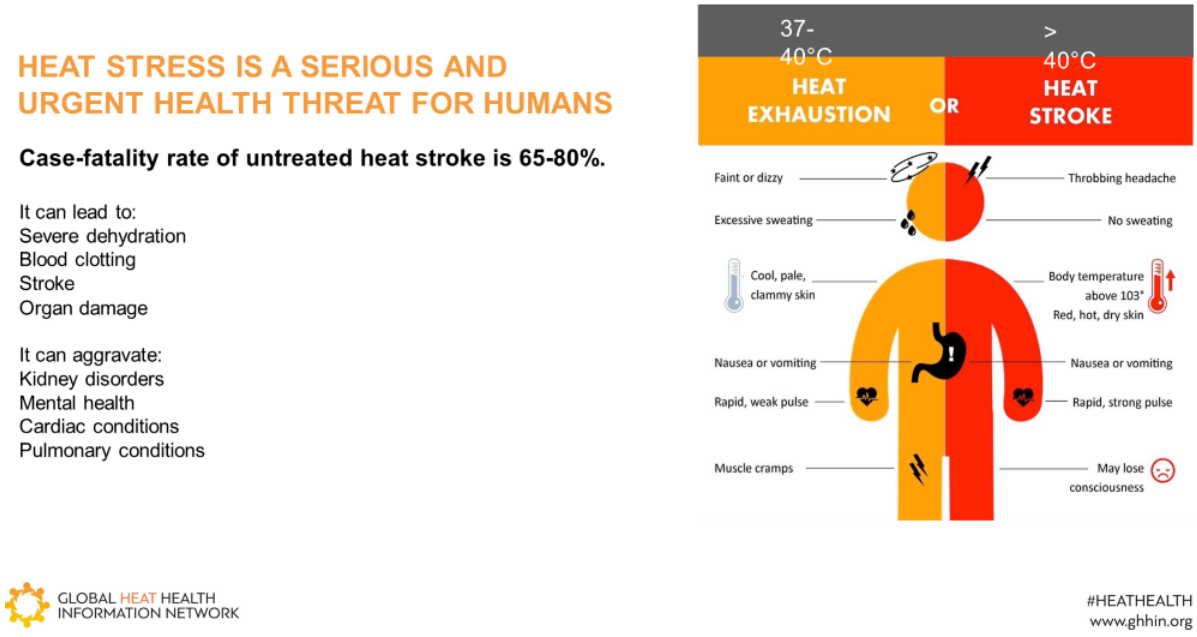
Below enlisted are the risk factors leading to increased exposure to heat-related illnesses-

S. No.	Risk factors for Heat Related Illnesses
1	Age < 15 years and > 65 years
2	Cognitive impairment
3	Heart and lung diseases
4	Limited access to air conditioning
5	Mental illness
6	Obesity
7	Physical disabilities
8	Poor fitness level
9	Sickle cell trait
10	Strenuous outdoor activity during the hottest day time hours
11	Urban residence or living on higher floors
12	Alcoholism
13	Uncontrolled diabetes
14	Medications contributing to heat related illness

3. CLASSIFICATION OF HEAT STRESS - CLINICAL SYMPTOMS AND TREATMENT

Heat-related stress ranges from minor to life-threatening, depending upon the health status of the individual (physiological condition) and the exposure (intensity, frequency and duration). Heat stress can manifest into the following five kinds of concerns-

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



Heat Rash – Heat rash is a skin irritation caused by excessive sweating during hot and humid weather. Usually appears on the neck, upper chest, groin, under the breasts, and in elbow creases.

Signs: Diffuse, pruritic, maculopapular or vesicular rash in the setting of heat exposure, often with insulating clothing or swaddling.
Symptoms: Itchy rash with small red bumps at pores in setting of heat exposure. Bumps can sometimes be filled with clear or white fluid.
Prognosis: Full recovery with the elimination of exposure and supportive care.
Treatment: Treatment for heat rash is to avoid hot and humid environment and to try to remain in cooler, less humid conditions. Try to keep the affected area dry, and wear light, loose clothing. Dusting powder may be used to increase comfort but avoid using ointments or creams as they keep the skin warm and moist and may make the condition worse. Treating heat rash is simple and usually does not require medical assistance.

Heat Cramps – Heat cramps are painful muscle cramps, which occur due to low-salt level in the muscles. Excessive sweating and dehydration results in this condition of low-salt levels.

Signs: Painful contractions of frequently used muscle groups in the setting of heat exposure, often with exertion.
Symptoms: Uncomfortable appearance, may have difficulty fully extending affected limbs /joints with pain.
Prognosis: Full recovery with elimination of exposure and supportive care.
Treatment: Stop physical activity and move to a cool place. Drink plenty of water with ORS (Oral Rehydration Salts). Gently massage on the contracted muscle. Use analgesic medicines if the pain is severe and persistent.

Heat Exhaustion – Heat exhaustion is the body's response to excessive water and salt loss through excessive sweating due to heavy physical exertion in the hot environment.

Signs: Sweaty/diaphoretic, flushed skin, hot skin, normal core temperature, +/- dazed, +/- generalized weakness, slight disorientation
Symptoms: Feeling overheated, lightheaded, exhausted and weak, unsteady, nauseated, sweaty and thirsty, inability to continue activities. A normal or mildly elevated body temperature, heavy sweating, pallor (paleness), muscle cramps and muscle pain, fatigue, weakness, dizziness and lightheadedness, headache, and nausea.
Prognosis: Full recovery with elimination of exposure and supportive care, progression in case of continued exposure.
Treatment: Move to a cool place, loosen your clothes, put cool, wet clothes on your body or take a cold bath, sip plenty of water with ORS.

Heat Syncope – Syncope means fainting or dizziness. Heat syncope is a fainting episode that occurs in the heat, either during prolonged standing or exercise, or when rapidly standing from a lying or a sitting position. It typically occurs in the individuals who are not acclimatized to the heat. Dehydration can also contribute to this condition.

Signs: Brief generalized loss of consciousness in a hot setting, short period of disorientation.
Symptoms: Feeling hot and weak, light-headedness followed by brief loss of consciousness, dizziness or lightheadedness, and fainting.
Prognosis: Full recovery with elimination of exposure and supportive care, progression if continued exposure.
Treatment: Sit and rest in a cool place. The affected individual may also lie down and elevate the legs above the level of the heart. Drink water or a sports beverage. Seek immediate medical attention for repeated episodes of fainting, or if the individual experiences chest pain, seizures, or confusion.

Heat Stroke – Heat stroke is the most severe form of heat-related illness which can sometimes lead to death or permanent disability if not treated at the proper time. It is a medical emergency and requires immediate hospitalization. When heat stroke occurs, the body temperature can rise to 106°F or higher within 10-15 minutes. Heat stroke occurs when the thermoregulatory mechanisms fail.

Signs: Flushed dry skin (not always), core temperature ≥ 40°C, (103°F or higher), altered mental status with disorientation, possibly delirium, coma, seizures, tachycardia, +/- hypotension.

Symptoms: Severe overheating, profound weakness, disorientation, obtundation, seizures or other altered mental status. High body temperature, hot red dry or damp skin, fast strong pulse, headache, dizziness, nausea, confusion, lack of sweat in armpits, losing consciousness (passing out). The classic symptoms of heat stroke are high fever, lack of sweat, and loss of consciousness.

Prognosis: 25-50% mortality even with aggressive care, significant morbidity if survives treatment: immediate hospitalization, plenty of IV fluids, sponging with ice packs and cold water, if possible patient should be in an air conditioned room. Treatment to be carried out according to the existing complications. Details regarding the required treatment is given in following section.

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

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

4. HEAT EXHAUSTION

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

Differential Diagnosis

1. Presenting with suggestive symptoms and signs (see table 3)
2. Patient has one or more of the following risk factors:
    a. Extremes of age (infants, elderly)
    b. Debilitation/physical deconditioning, overweight or obese
    c. Lack of acclimatization to environmental heat (recent arrival, early in summer season)
    d. Any significant underlying chronic disease, including psychiatric, cardiovascular, neurologic, hematologic, obesity, pulmonary, renal, and respiratory disease
    e. Taking one or more of the following:
        i. Sympathomimetic drugs
        ii. Anticholinergic drugs
        iii. Barbiturates
        iv. Diuretics
        v. Alcohol
        vi. Beta blockers

Treatment Protocol

1. Remove from the environmental heat exposure and stop physical activity
2. Initiate passive cooling procedures
    a. Cool-wet towels or ice packs to axillae, groin, and around neck. If patient is stable, may take a cool shower, but evaluate the risk of such activity against gain and availability of other cooling measures
    b. Spray cool water or blot cool water onto skin
    c. Use fan to blow cool air onto the moist skin
3. If temperature is lower than 104 °F, repeat assessment every 5 minutes. If improving, attempt to orally hydrate (clear liquids, ORS can be used but not necessary, cool liquids better than cold) and observe.
4. If temperature is 104 °F or above, initiate IV rehydration and immediately transport to the emergency department for stabilization.

5. HEAT STROKE

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

Diagnosis

1. It's usually apparent to doctors if you have heat stroke, but laboratory tests can confirm the diagnosis, rule out the other causes for symptoms and assess organ damage. These tests include rectal temperature to check your core body temperature.
2. A rectal temperature is the most accurate way of determining your core body temperature and is more accurate than mouth or forehead temperatures.
3. A blood test to check blood sodium or potassium and the content of gases in the blood to see if there's been a damage to the central nervous system.
4. A urine test to check the color of urine, because it's usually darker if one has had a heat-related condition, and to check the kidney function, which can be affected by heat stroke.
5. Muscle function tests to check for serious damage to the muscle tissue (rhabdomyolysis). X-rays and other imaging tests to check for damage on the internal organs.

Treatment

1. Immediate hospitalization, plenty of IV fluids, sponging with ice packs and cold water, if possible, patient should be placed in an air conditioned room.
2. Treatment to be conducted according to the complications. Early effective treatment is the key to determining the prognosis. The crucial points in effective treatment are rapid lowering of the core temperature, blood purification, and disseminated intravascular coagulation (DIC) prevention.
3. Specific treatment measures are "nine early and one ban," that is, early cooling, early expansion, early blood purification, early sedation, early intubation, early correction of coagulation dysfunction, early resistance to infection, early enteral nutrition, early immune regulation, and a ban on surgical operations during the period of coagulation dysfunction.
4. Cooling: Rapid cooling is the most important treatment measure. The case fatality rate is closely related to the hyperthermia and its duration. If cooling is delayed, the fatality rate increases significantly. As soon as a patient is removed from the hot environment, immediately begin cooling and continue to monitor core temperature. Cooling targets are

to quickly cool the core temperature to 39 °C or below within 10–40 min and to 38.5 °C or below within 2 hrs.

a. On-site cooling

i. Quickly move the patient from a hot and humid environment to a shady and breezy place, make the patient lie down, and remove all the clothing
ii. Use a cold water spray or wet towels to wipe the entire body
iii. Use fanning to accelerate evaporation and convection cooling
iv. Continue to monitor the body temperature

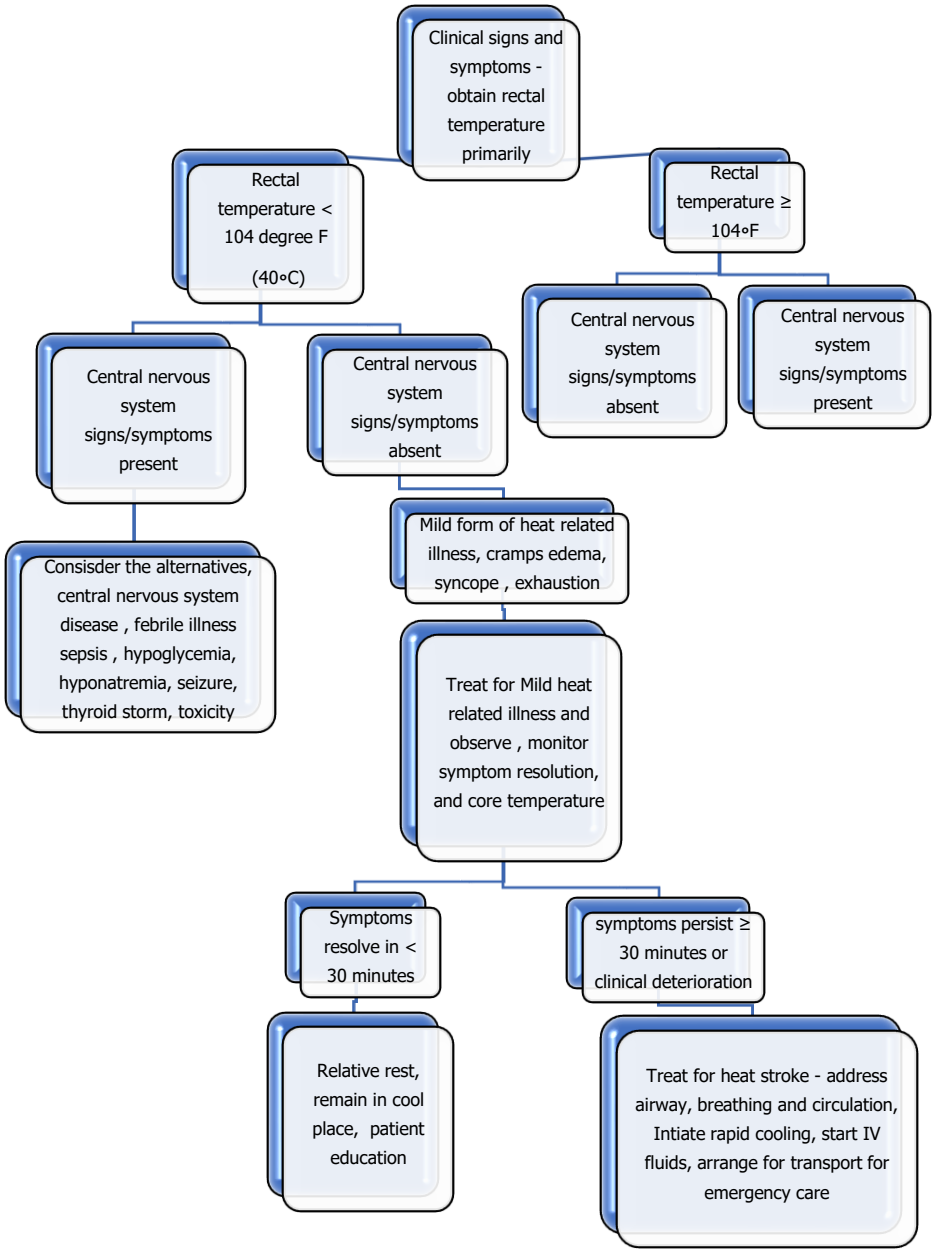
b. Cooling enroots

i. Turn on the air conditioning in the ambulance or open the windows
ii. Use cold water to wipe the entire body
iii. Administer an intravenous infusion. Continue to monitor body temperature

c. Cooling in the sickroom

i. Adjust the room temperature to 20°C–24 °C
ii. Administer an intravenous infusion quickly
iii. Use cooling blankets
iv. Place ice cubes on areas that dissipate heat faster (on either side of the neck, groin, and armpits)
v. Use 200–500 ml of 4 °C saline to perform gastric lavage and/or rectal enema
vi. Purify the blood
vii. Use a lytic cocktail in combination
viii. If conditions allow, use an intravascular cooling apparatus or immerse the patient in a cold water bath (water temperature at 15°C–20 °C)

Table -4 Algorithm for the initial evaluation of a patient with suspected heat related illness-



6. MANAGEMENT OF HEAT ILLNESS IN VULNERABLE GROUPS

Vulnerable groups include those who are at more risks of getting heat-related illnesses than the other community members. Heat waves and extreme hot weather can cause death and also aggravate existing health conditions. Health effects of heat waves can appear in all age and social groups and as a result of a wide range of factors, however, some people are more at risk of heat-related illness and death than others. We should consider the following risk factors for identification of vulnerable groups-

- Individual risk factors (age and sex, existing illness, use of medication, being overweight, dehydration, reduced ability for acclimatization, and pregnancy)
- Living environment risk factors (housing, urban heat island effect, internal cooling capacity, air pollution, working environment, and work place conditions)
- Social risk factors (loneliness, lack of access to information systems, and emergency services)

The manifestation of heat-related illness differs in different groups and requires differing modalities for prevention and treatment.

Pregnant Women

Why at risk?

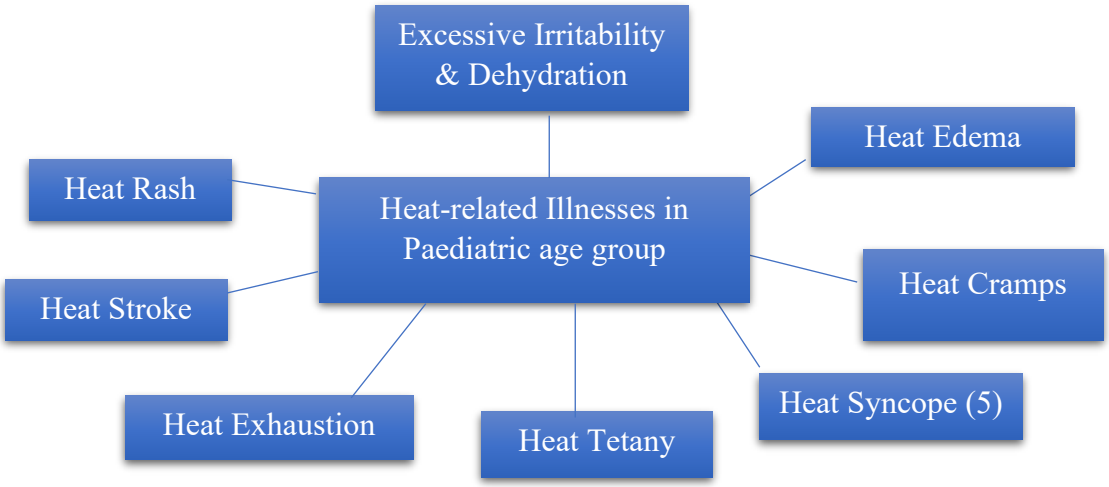
1. During pregnancy and in extreme heat, body works to cool both mother and the baby.
2. Heat causes the mother's blood vessels to contract in order to cool down, which then reduces the amount of nutrients that reach the foetus.
3. Blood volume greatly increases during pregnancy, which makes it more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

What are the risks involved?

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

Children

Heat-related illnesses (HRI) in paediatric age group encompass the following entire spectrum of disorders-



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

1. Heat rash/Milia Rubra/Prickly heat
   a. Treatment:
      i. Place in cool environment
      ii. Remove excess clothing
      iii. Avoid lotions
   b. 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
   a. Treatment
      i. Place in cool environment
      ii. Remove excess clothing
      iii. Frequent breast feeding/fluids
3. Heat Edema (more common in adults): swelling of feet/ankle/hands
   a. Treatment
      i. Remove from hot environment & place in cool environment
      ii. Elevate the extremity
4. Heat cramps: common in young athletes
   a. Painful, involuntary, spontaneous contraction of muscle group of legs/calf/groin
   b. Treatment
      i. Remove from hot environment
      ii. Rehydration (frequent oral fluids), if persist then intravenous fluid may help
5. Heat syncope

a. It is seen due to prolonged standing in the 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.
b. Remove the child from hot environment
c. Oral rehydration with salt containing fluids (ORS/lassi/nimbu pani/sattu, etc.)

6. Heat tetany
   a. It can be differentiated from heat cramps by the fact that there is very little pain or cramps in the muscle.
   b. Treatment
      i. Remove the child from hot environment
      ii. Calm the child to decrease hyperventilation
      iii. Intravenous calcium after admission
7. Heat exhaustion
   a. After prolonged heat exposure, the body temperature rises up to 104 ^{o}F and leads to dehydration, tachycardia, vomiting, fatigue, and headache with normal mental status (sometimes mild confusion may present).
   b. It requires admission and specialist care
   c. Treatment
      i. Remove child from the 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
   a. Prolonged exposure to heat leading to core body temperature rising to ≥40^{o}C
   b. Patient present with stupor/coma/drowsy/confusion/delirioum/hallucination/seizures/ataxia
   c. Anhydrosis
   d. Coagulopathy
   e. Multi-organ dysfunction
   f. Treatment
      i. Admission
      ii. Check airway, breathing, circulation
      iii. Give oxygen, intravenous fluid connection
      iv. Do random blood sugar (RBS), arterial blood gas, electrolytes (Na/K/Ca), liver function test (LFT), renal function test (RFT), coagulation profile, and neuroimaging to rule out the CNS bleed.

Danger signs

- Refusal to feed
- Excessive irritability
- Decreased urine output
- Dry oral mucosa & absence of tear/sunken eyes
- Lethargy/altered sensorium→seek medical help

Emergency Management

Primary triage – confirm heat stroke

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Assess the airway, breathing, circulation, and (neurologic) disability, IV access and send relevant investigations

- Consider intubation if necessary
- Consider benzodiazepines for seizures or excess shivering

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- **Shock:**
  - Normal saline bolus @ 20 ml/kg and reassess
  - Repeat bolus if necessary up to total of 60 ml/kg
  - Watch for features of fluid overload
  - Continue normal maintenance fluid
- **No shock:** Assess dehydration status, correct and start normal maintenance fluid

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Institute active cooling measures:
1.Removal of all clothing / protect patient dignity
2.Cover with thin sheet / spray cool water
3.Ice pack at head, neck, groin and axillary regions
4.Use mist fan / evaporative method
5.Tepid sponging / cool blankets if available
6.Avoid Paracetamol or NSAIDS
7.Consider lavage with cold saline

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Close monitoring of the following:
1. Temperature every 15-30 minutes (do not overcorrect to less than 38°C)
2. Vital signs (BP/HR/ECG/GCS/SpO2)
3. Look out for complications of treatment: -
   a. Acute Pulmonary Oedema
   b. Hypothermia
4. Seizure – treat with benzodiazepines
5. Prevent shivering by paralyzing patient if intubated and close monitoring of temperature
6. Look for signs of coagulopathy
7. Arterial Blood Gases regularly – look for metabolic acidosis
8. CT brain – to look for complications or rule out intracranial pathology
9. Continue management and referral to intensive care unit
10. Inform / communicate with next of kin regarding patient condition

Older Adults

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

Chronic disease and medication

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

Outdoor and manual labour workers

- Educate laborers and workers regarding heat stress
- Encourage hydration by drinking water and other non-sugary, non-caffeinated, electrolyte restoring drinks
- Encourage workers to seek medical attention if any discomfort
- Change in shift time and working hours
- Encouragement of wear light clothing's and self-protecting instruments
- Labor Law Enforcement and Coordination
- Cooling Incentives for local/outdoor businesses

Low Socio-economic status

- Accessibility to pure potable water
- Public access to cool places
- Availability and accessibility of health care services
- Cool-roofs wherever possible
- Health education and promotion regarding Heat stress and preventive measures

7. EMERGENCY PREPAREDNESS FOR HEALTH FACILITIES

Phase 1 – Pre-summer

- **INFRASTRUCTURE AND LOGISTICS**
  - Ensure adequate arrangement of staff
  - Dedicated bed in cooler area of hospital, Thermometer, ORS packets, ice pack
  - BP apparatus
  - Silver -sulphadiazine cream, Calamine lotion
  - Cold IV Normal saline (0.9%), Dextrose 50% in water solution (D50W)
  - Glucometer and strip
  - ECG equipment: ECG machine, Gel, electrodes, ECG paper
  - Cooling equipment: AC, Cooler, Fan as per requirement
  - Water cooler
  - Benzodiazpine: Lorazepam, diazepam
  - Barbiturate
  - Ambulance with ice packs and cold water
  - Ice pack dispensaries
  - Adopting cool roofs and improving green coverage
- **CAPACITY BUILDING**
  - A detailed action plan to tackle HRI
  - Targeted training – Maintaining hospital records, improve expedience of recording of cause of death, heat-focused examination procedures
  - Mapping of susceptible villages
  - Identify Rapid Response Team (RRT)
  - **IEC & AWARENESS**
    - Targeted IEC-banner, poster, vehicle mounted loud speaker for audio dissemination
    - Sensitization meetings

Phase 2 – During Summer

a. **INFRASTRUCTURE AND LOGISTICS**
   a. Ensure adequate medical supplies and increase ASHA/ANM/MPHW outreach in the catchment area with a special focus on at-risk populations and areas
   b. <u>Specific Preparedness</u>
      i. CHC – Ensure availability of ambulance and dedicated beds at the facility
      ii. DH/MC – Dedicated heat corners, increased staffing, and Nodal Officer visits to CHCs for HRI preparedness review and HRI case audits

b. CAPACITY BUILDING –
   a. Ensure daily HRI case reporting
   b. Adopt HRI treatment and prevention protocols
   c. Expedite recording of cause of death due to heat-related illnesses
   d. <u>Specific Preparedness</u>
      i. Referral of patients to the higher facility only after ensuring adequate stabilization and basic definitive care (cooling and hydration)

c. IEC & AWARENESS – Ensure IEC dissemination

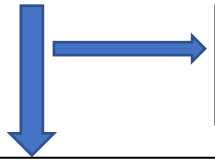
Phase 3 – Post-summer

1. Review to assess/identify gaps-if any
2. Enlist/document the lessons learnt for the next season

First Aid Instructions for Heat Exhaustion and Heatstroke in Children

The symptoms **may develop after exposure to** high temperatures **(such as heat wave) or** after hard work **or** sports during the hot weather

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**	• Severe headache • Weakness, dizziness • Acts or talk confused • Fast breathing and heartbeat • Hard to wake up or can't wake up • Seizures • Flushed, hot, dry skin • Body temperature rises to 105°F (40.5°C) or higher



If the child has symptoms of a heatstroke, **Call for an ambulance and take to the**

For cases of **heat exhaustion** or **while awaiting help** for a child with possible heatstroke:

- Bring the child indoors or into the shade immediately
- Remove the clothing of the child while maintaining the dignity of child
- Have the child lie down; raise the feet slightly
- Increase airflow to child using fan
- Spray with normal tap water or do tepid sponging
- If the child is alert and awake, give frequent sips of cool, clear fluids
- If the child is vomiting, turn onto his or her side to prevent choking
- If child is unconscious, don't give him anything to drink/ eat

Prevention:

- Lookout for weather warnings issued by India Meteorological Department
- Teach kids to always drink plenty of liquids before and during any activity in hot, sunny weather even if they aren't thirsty
- Make sure kids wear light-colored, 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 03:00 pm
- 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 overheated
- Never leave a child alone, nor accompanied, inside a parked closed vehicle (look before we lock).

- **Body temperature rises, but less than 105°F (40.5°C)**

8. MONITORING AND SURVEILLANCE

Format 1 (A): Health Facility Format

Daily line List of Suspected Heatstroke CASES[#] at Health Facility

(From Medicine, Paediatrics, and Casualty/Emergency department)

(To be kept at the health facility for record)

Name of health facility:_____ Block:_____ District:_____							Date of reporting: _-_/_-_/_-_				
Type of health facility (Circle the applicable):1. PHC 2. CHC 3. Taluka/Rural Hospital/Block Hospital 4. Sub-district 5. District Hospital/Civil Hospital 6. Medical College & Hospital 7. Private hospitals with emergency facility 8. Other……											
(A). Total no. of patients in department (Casualty/Emergency of Medicine + Paediatrics):											
Daily line List of Suspected Heatstroke CASES# at Health Facility											
S. No	**Hospital Regist-ration No.**	**Name**	**Age***	**Sex (M/F)**	**Address**		**Outcome within date of reporting (tick the box)**				**Re-marks**
					Block	**District**	**Admitted**	**Died**	**Referred**	**Reco-vered**	
Total											

**Age in completed years*

Name of person filling the form: Name of Facility In-Charge:

Designation: Signature of Facility In-Charge:

Signature: Date:

[#]**Suspected Heatstroke**: Altered mental status (including disorientation, delirium, seizure, obtundation) with elevated core body temperature ≥ 40°C/≥104°F, without signs of stroke, history of infection, or signs of medication overdose or altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals, i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose *(definition is applicable during the heatwave season, i.e., March to July)*

Standard Operating Procedures: Format 1(A)

1. **Format 1 (A)** is a daily line list format of **suspected heatstroke cases** to be filled at the health facility
2. It will be kept at health facility for records
3. It will be **used to compile line list Format 1(B) and daily reporting Format 2**
4. **Suspected heatstroke (case definition):**Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40**°F**C/≥104**°F**,** without signs of stroke, history of infection, or signs of medication overdose **or** altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose *(definition is applicable during the heatwave season i.e., March to July)*
5. **Institutes and departments who will compile suspected heatstroke cases**
    a. All public hospitals with casualty/emergency
    b. All private hospitals with casualty/emergency
    c. Reporting departments will be responsible for casualty/emergency of medicine and paediatrics.
6. **Data collection period**: It will be from **01st March to 31st July, every year**. Further direction will be communicated at the start of the year if required.
7. **Case identification**:
    a. **Person who will diagnose**: A qualified medical doctor will diagnose the HRI case, as per case definition
    b. **Where will the data be recorded**: A qualified medical practitioner will write the provisional diagnosis in the casualty/emergency register as suspected heat stroke
    c. **Data collecting person:** Pharmacist, multipurpose health worker-male (MPHW-M), staff nurse -either of the employee will collect the data of suspected heatstroke cases that were diagnosed on the previous day from emergency/casualty of medicine and paediatrics departments every day.
    d. **Day of diagnosis and recording:** The date of diagnosis will be considered as day zero. Cases diagnosed on day zero should be recorded on the following day, i.e., Day One in FORMAT 1 (A). Example: Cases diagnosed on Sunday (Day Zero) will be recorded on Monday (Day One).
8. **Data compilation:** A hard copy of each completed and signed **Format 1(A)** should be stored in a file **daily** in proper order. A soft copy of the line list should be maintained as a single excel sheet which should be updated **weekly** to include all the heat stroke cases. It should be ready to be submitted to DSU or SSU as per request.
9. **Reporting after a holiday:** A report which should have been prepared on a holiday (e.g. Sunday or gazette holiday) must be compiled and filed on the next working day.

For example, cases diagnosed on Saturday (Day Zero), must be recorded on **Format 1 (A)** on Monday (Day Two) along with a separate daily **Format 1 (A)** report of cases diagnosed on Sunday (Day One).

Nil reporting is mandatory in the prescribed format. No columns will be left blank; in case of nil reporting, **"0"** should be written.

Format 1 (B): Health Facility Format

Daily line List of Suspected Heatstroke DEATHS[#] and Confirmed CVD DEATHS*

(From Medicine, Paediatrics and Casualty/Emergency department)
(To be kept at the health facility for records)

Name of health facility:_____ Block:_____ District:_____							Date of reporting: _-_/_-_/_-_	
Type of health facility (Circle the applicable): 1. PHC 2. CHC 3. Taluka/Rural Hospital/Block Hospital 4. Sub-district 5. District Hospital/Civil Hospital 6. Medical College & Hospital 7. Private hospitals with emergency facility 8. Other……								
(A). Total no. of all-cause deaths in health facility (Casualty/emergency of Medicine and Paediatrics):								
Daily line List of Suspected Heatstroke DEATHS and Confirmed CVD DEATHS								
S.No	Registration number	Name	Age	Sex (M/F)	Address		Deaths (tick the box)	
					Block	District	Suspected Heatstroke death##	Confirmed CVD death
Total								

Name of person filling the form: Name of Facility In-Charge:

Designation: Signature of Facility In-Charge:

Signature: Date:

[#]**Suspected Heatstroke:** Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40**°C/**≥104**°F**,** without signs of stroke, history of infection, or signs of medication overdose **or** altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals, i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose *(definition is applicable during the heat wave season, i.e., March to July)*

[##]**Suspected Heatstroke Death**: This is death on account of a suspected heatstroke.

*__Cardiovascular Death__ includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV haemorrhage or death due to other CV causes.

Standard Operating Procedures: Format 1 (B)

1. **Format 1 (B)**is a daily line list of **suspected heatstroke deaths** and **confirmed cardiovascular disease (CVD) deaths**
2. The total number of all-cause deaths in a health facility (casualty/emergency of medicine, and paediatrics) should also be recorded
3. **Institute and department who will report suspected heatstroke cases:**
   a. All public hospitals with OPDs & casualty/emergency.
   b. All private hospitals are having casualty/emergency.
   c. Reporting departments will be casualty/emergency of medicine and paediatrics.
4. **Date of death and recording:** Date of death will be considered as day zero. Cases that died on day Zero should be recorded on the following day, i.e., Day One in FORMAT 1 (B). Example: Cases diagnosed on Sunday (Day Zero) will be recorded on Monday (Day One).
5. **Data compilation:** A hard copy of each completed and signed **Format 1 (B)** should be stored in a file **daily** in proper order. A soft copy of the line list should be maintained as a single excel sheet which should be updated **weekly** to include all suspected heatstroke deaths and confirmed CVD deaths. It should be made ready to be submitted to the district or state nodal unit as per request.

Nil reporting is mandatory in the prescribed format. No columns will be left blank; in case of nil reporting, **"0"** should be written.

Format 2: Health Facility Format For Sending To District

Daily numbers of Suspected Heatstroke CASES[#] and All cause DEATHS[*]

(Compilation of Format 1, A & B)

(To be sent to the District Nodal Unit daily)

Name of health facility: _____ _____ Block:_____ District:_____				Date of reporting: _._/_._/_._			
Type of health facility (Circle the applicable): 1. PHC 2. CHC 3. Taluka/Rural Hospital/Block Hospital 4. Sub-district 5. District Hospital/Civil Hospital 6. Medical College & Hospital 7. Private hospitals with emergency facility 8. Other……							
Department (Circle the applicable): 1. Emergency Medicine 2. Emergency Paediatrics 3. Casualty							
Date	**Total patients in the department**	**New Suspected Heatstroke Cases (A)**	**Total Suspected Heatstroke cases since 1st March 2020 (B)**	**All-cause deaths****			
				Suspected Heatstroke deaths## (a)	**Confirmed CVD deaths (b)**	**Others including unknown (c)**	**Total deaths (a+b +c)**
01-03-20							
02-03-20							

Form filled by (Name): Name of Facility In-Charge:

Designation: Signature of Facility In-Charge:

Signature: Date:

****All-cause death:** All of the deaths in casualty/emergency medicine plus paediatrics, regardless of cause.

[#]**Suspected Heatstroke:** Altered mental status (including disorientation, delirium, seizure, obtundation) **with elevated core body temperature ≥ 40**°C/**≥104**°F**,** without signs of stroke, history of infection, or signs of medication overdose **or** altered mental status (including disorientation, delirium, seizure, obtundation) with hot and dry skin and deranged vitals, i.e., tachycardia, tachypnoea and wide pulse pressure without signs of stroke, history of infection, or signs of medication overdose *(definition is applicable during the the heat wave season i.e., March to July)*

[##]**Suspected Heatstroke Death**: This is death on account of a suspected heatstroke patient.

***Cardiovascular Death** includes death resulting from an acute myocardial infarction (MI) or sudden cardiac arrest or heart failure (HF) or cardiovascular (CV) procedures or CV haemorrhage or death due to other CV causes.

Standard Operating Procedures: Format 2
(Health facility format for sending to District)

1. **Format 2** will be compiled from data of **Format 1 (A)** and **Format 1 (B)** by the nodal person at the health facility daily.
2. **Institute and department who will report HRI:**
   b. All public hospitals with casualty/emergency.
   c. All private hospitals are having casualty/emergency.
   d. Reporting Departments will be medicine, paediatrics, and casualty/emergency.
3. **Time of reporting to district nodal unit: Format 2 compiled from Format 1 (A) should be reported to the District nodal unit on the following day (day one) by 12.00 hr (i.e. noon).**
4. **Reporting person:** A nodal person identified for the health facility will prepare the report.
5. **Data compilation:** A soft copy in the form of an excel sheet shall be e-mailed **daily** to the district nodal unit through a proper channel. In places where the internet facility is not available, the report can be communicated by any possible means. A hard copy of each **Format 2** should be kept in a designated file daily at the institutions/health facility.
6. **Data collection period**: In standard, it will be from **01st March to 31st July every year**. Further direction will be communicated during the start of the year if required.
7. **Nil reporting is mandatory in the prescribed format.** No columns will be left blank; in case of nil reporting, **"0"** should be written.

If not submitted on time: A late report must be submitted within 48 hrs.

Investigation of Suspected Heatstroke Deaths

Confirmation of asuspected heatstroke death requires a detail death investigation akin to a social autopsy especially, when a suspected heatstroke case fails to access a health care facility to receive timely and adequate treatment. All suspected heatstroke deaths should be investigated using format provided in National Action Plan on Heat Related Illnesses, Chapter 7 within 48-72 hours of a suspected non-accidental death during summer/heatwave.

Following are the guidelines for investigation and reporting of a confirmed heatstroke death.

1. Any of the following should fill the HRI and death investigation form:
    a. Medical officer of Primary Health Centre or Community Health Centre.
    b. Doctor on duty in health facility/hospital where the suspected case of HRI died.
    c. Epidemiologist doing HRI death investigation.
2. Data sources to fill the form are as follows:
    a. Deceased's photo ID record: aadhar card/pan card/voter ID/ration card/driving licence, etc.
    b. Respondent's photo ID record: aadhar card/pan card/voter ID/ration card/driving licence, etc.
    c. Past medical records.
    d. Hospital medical record
    e. Interview with the relatives/caretakers/neighbour/person brought or saw the ill or suspected deceased.
    f. Weather record from Indian Meteorological Department (IMD) website or IMD office.
3. Unique ID:
    a. The unique ID will be as local government directory available at https://lgdirectory.gov.in/
4. Section A: deceased's details
    a. Section A.1 to A.6.: The name, age, sex, father's/spouse's name, residential address should be as per valid government ID. The information taken from government ID or relative or some other source should be mentioned in the remarks box.
    b. Section A.7: Current occupation: Within a week of death.
    Note: The activities/occupational activities just before death/onset of symptoms will be mentioned in section D.
5. Section B: Death detail
    a. Section B.2.: Place the deceased found: The purpose of getting information on the place where the decedent was found dead is to know the circumstances in which the death of person occur and to correlate it with the weather condition of that area (*the weather condition will be recorded in section H*).
    b. The name of the hospital where the deceased was brought dead or declared dead is for record purpose.
6. Section C: Clinical history in the past 24 hr before death (from medical record and relatives)
    a. The answers for this section should be extracted from medical records. If the information is not available from medical records, then it should be sought from respondents/relatives.
    b. Symptoms at the time of onset of illness: for diagnosis purpose
    c. Date and time of onset: for correlating with climate variables of that day and time.
    d. Place of onset of symptoms: for correlating with climate variables of that place.
    e. Did the deceased have an alcoholic beverage within a day of onset of illness?: for contributing factors

7. Section D: Outdoor activities just before the onset of illness:
    a. Section D. requires the details of whether the decedent was outdoor/indoor before/during the onset of symptoms.
8. Section E: Indoor conditions just before the onset of illness
9. Section F: Other non-Heat-Related questions, i.e., chronic, acute and medication history.
    a. Medical record: Any public or private facility or pharmacy note
10. Section H: Weather data from the India Meteorological Department
11. At the bottom of the form, give the details of the person filling the form with his/her name, designation, signature and date of signing. The form should be filled as by the person mention in the first point.

Integrated Digital Heat-Related Illness Surveillance

The current HRI surveillance formats are under process of digitation on existing Integrated Health Information Platform (IHIP). This will allow data entry from health facilities at level equivalent to IDSP P-form. Form next year, all the health facilities, PHC and above, of heat-prone States/UT will require to submit daily data on IHIP.

There will be components of digital HRI surveillance.

a. **HRI data collection page:**
   A P-form user, once logged into to the IHIP platform, will be able to access the HRI data collection page through a separate link for National Programme on Climate Change and Human Health (NPCCHH). Total numbers of emergency visits (medicine, casualty, paediatrics), **suspected heatstroke cases and deaths, confirmed cardiovascular deaths** and other unknown deaths that occurred in the health facility during 24hr period of 8:00am previous day to 8:00am on the day of reporting should be submitted daily as per the case definition provided. For suspected heatstroke cases and deaths, patient details limited to their socio-demographic information, provisional diagnosis and circumstances of onset of heatstroke should be entered to allow better understanding of impact of ambient heat.

   Reporting of a confirmed heatstroke death:
   The digital data collection will allow uploading of completed suspected death investigation. Uploading of completed investigation report will be allowed at health facility and also at district level. A blank data collection form (as per Chapter 7 of National Action Plan on Heat-Related Illnesses) will be available for download on the data collection page itself.

b. **HRI dashboard**
   The integrated dashboard will provide visualization of health data with observed meteorological parameters like daily maximum and minimum temperatures and relative humidity from India Meteorological Department. Time (daily, weekly, monthly) and place (up to district level) distribution of suspected heatstroke cases and deaths will be visualized. Monitoring of trends of all-cause deaths and emergency OPD visits with maximum temperatures will provide understanding of overall health impact and health serviced demand.

   District, state and central level access will allow near real-time tracking of heat and its health impacts at the respective levels for necessary action.

   A step-by-step guidance manual and trainings will be provided in due course.