National Workshop on Health Sector Measures to Mitigate and Adapt to Impact of Extreme Heat

Date: 9 and 10 of June 2022

Venue: Fairfield by Marriott, Ahmedabad, Gujarat, India

PROCEEDINGS OF WORKSHOP

UN environment programme

National Programme on Climate Change and Human Health

With support from:

INDIAN INSTITUTE of PUBLIC HEALTH GANDHINAGAR

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NRDC

ABBREVIATIONS

AC	air conditioning
AMC	Ahmedabad Municipal Corporation
CCH	Climate Change & Health
CEOH	Centre for Environmental & Occupational Health
DCS	district cooling system
EMR	Emergency Management and Research Institute
EMT	Emergency Medical Technician
ERCP	Emergency Response Centre Physician
HAP	Heat Action Plan
HRI	heat-related illnesses
IEC	Information, Education and Communication
IIM	Indian Institutes of Management
IMD	India Meteorological Centre
MHT	Mahila Housing Trust
NHM	National Health Mission
NPCCHH	National Programme on Climate Change and Human Health
SNO-CC	State Nodal Officers-Climate Change
UHIE	Urban heat island effect
UNEP	United Nations Environment Programme

WORKSHOP SUMMARY

The Centre for Environmental & Occupational Health, Climate Change & Health (CEOH&CCH) manages the National Programme on Climate Change and Human Health (NPCCHH) introduced under National Health Mission (NHM) by National Centre for Disease Control, Ministry of Health and Family Welfare. The NPCCHH objectives and initially identified key actions are:

i. To create awareness among the population (vulnerable communities), health-care providers, and policy makers regarding the impacts of climate change on human health.

ii. To strengthen the capacity of the national healthcare system to reduce health impacts caused by extreme weather events.

iii. To strengthen health preparedness and responsiveness by performing situational analysis at national, state, district and neighbourhood levels.

iv. To develop partnerships and create synergies with other missions, ensuring the country's climate agenda adequately addresses health issues.

v. To strengthen research capacity by filling the evidence gap on climate change impacts on human health.

On World Environment Day 2022, NPCHH, NHM, NCDC, NRDC and UNEP, along with partners – the Indian Institute of Public Health and Ahmedabad Municipal Corporation – came together to conduct a two-day National Workshop on **Health Sector Measures to Mitigate and Adapt to Impact of Extreme Heat** for State Nodal Officers-Climate Change (SNO-CC) under the NPCCHH. **Health Sector Measures to Mitigate and Adapt to Impact of Extreme Heat** for State Nodal Officers-Climate Change (SNO-CC) under the NPCCHH.

Key outcomes

- Extreme heatwaves are going to increase further due to the effects of climate change.
- Extreme heat has multiple direct and indirect impacts on human health. Localized, health-focused action plans and their coordinated and timely implementation along with health sector preparedness are essential adaptation measures to prevent and manage heat-related morbidity and mortality.
- Climate interventions focused on human health provide an opportunity to showcase climate leadership, and health risks due to climate change provide urgency and momentum for climate action.
- Cooling demand is set to accelerate rapidly due to rising temperatures, particularly in the commercial and residential sectors. Consequent impacts include growing peak power demand and associated infrastructure expenditures, rising CO_2 and refrigerant emissions from mechanical cooling, infrastructure lock-in, higher long-term energy costs, and higher water demand for cooling energy systems such as chillers.

- Most of India's infrastructure is not built for temperatures beyond 45°C. Urban surfaces and structures absorb and store heat, while internal combustion engine vehicles and poorly efficient air conditioners add even more heat to urban areas. This vicious cycle creates the so-called urban heat island effect (UHIE), whereby urban areas are hotter than surrounding areas.
- Redesigning our cities to make them more climate-resilient must go beyond improvements in energy efficiency and reductions in carbon emissions, it must also consider protecting the most vulnerable and delivering thermal comfort to all.
- One of the best ways to deal with heat is to bring nature into the urban fabric[1]. Cities need to increase the number of trees and green coverage to reduce temperatures and provide shading for buildings and people. Urban nature also supports biodiversity and make water a more prominent element of public spaces.
- Ultimately, the reduction of CO_2 emissions remains the only long-term solution to reduce global warming and its devastating impacts on temperatures and weather conditions.

Lessons learned from Ahmedabad city's Extreme Heat Plan

- A key component of the development and implementation of the Ahmedabad Heat Action Plan (HAP) was the engagement of the city's health department. By appointing a health officer in-charge of implementation of HAP and by enabling continued health sector engagement, the city ensured the identification and implementation of a new, ad-hoc strategy to reduce heat impact on the population.
- Capacity building for various stakeholders played an important role. It is essential to sensitize all stakeholders on the criticality of heatwaves and potential preventive actions to protect vulnerable groups.
- Consistent communication and coordination channels are key to the success of the Heat Action Plan, as well as constant research by experts on heatwaves' risks and mitigation strategies.
- HAP preparation was not a one-time activity, but one that is updated every year. This allows for contextual and situational changes to be made in the plan, along with the incorporation of new strategic solutions.
- Cities hold sufficient planning powers to successfully promote health sector measures to mitigate and adapt to extreme heat. They can also promote urban cooling through masterplans and leverage their experience in a range of sustainable practices that can be scaled up quickly in extreme heat scenarios.
- Significant political will is needed to implement new policies, provide incentives and adopt best practices to ensure cities lead on solutions for extreme heat through suitable health sector measures.

[1] https://www.sciencedirect.com/science/article/pii/S2590332222003232

Next steps to replicate best practices to counter extreme heat risks in cities

The workshop participants agreed on next steps to bring action to scale in India:

- Adopt learnings from other countries/cities' heat health action plans, including Ahmedabad.
- Involve local city or district administrative, health and political leadership in the development of HAP.
- Engage with vast number of local stakeholders to enable for various, coordinated actions: meteorological department, disaster management authority, health sector, and multiple departments of city government.
- Involve local and national research institutions, experts and universities to facilitate information exchange and targeted research and data collection.
- To bring to scale, expand the initiative, partners, and national governments' support beyond a single pilot, including by providing grants, capacity support and training to relevant stakeholders.
- Measure projects' implementation progress and impacts on mortality and morbidity to adjust and strengthen strategies, and increase their effectiveness.

DETAILED WORKSHOP REPORTING

Day 1: 9th June, 2022 – Field Visits (9:15 am to 9:15 pm IST)

Meeting at Head office, Ahmedabad Municipal Corporation

The day started with a meeting at head office of Ahmedabad Municipal Corporation (AMC) which was chaired by Shri Lochan Sehra, Municipal Commissioner. Dr Bhavin Joshi welcomed all the participants with a quick round of introduction and set the agenda for the first day.

Dr. Tejas Shah, Nodal Health Officer for Heat Action Plan, **AMC** made a small presentation covering the initiatives taken by AMC to mitigate and adapt to extreme heat's impact.

The key points from the meeting are as follows:

1. Ahmedabad city was the first in the country to develop a Heat Action Plan in 2013 with support of NRDC and IIPH. Since then, several actions have been taken on the ground to implement the heat action plan.
2. The green area coverage of Ahmedabad city increased from 4.22% in 2012 to 12% in 2022 and AMC aims to raise it further to 15% by 2025.
3. Using the Miyawaki technique, AMC corporation is creating 10 new urban jungles and 14 new gardens in all 7 zones in Ahmedabad by 2022-23. Through this technique, the plantation becomes 30 times denser than normal, grows 10 times faster and becomes maintenance-free after 3 years.
4. Every year the corporation is planting 10 lakhs (c.a. 2022 USD 1 million) worth of trees,

including at roadsides. By using a mobile App called "Plantation on Demand" to monitor trees, it was found that the survival rate of trees is 60%. Therefore, next year AMC plans to plant 15 lakhs (c.a. 2022 USD 1.5 million) worth of trees.

5. To reduce ambient temperatures in the city, the corporation is developing a dense forest on the 45-acre landfill sites in the outskirts of Ahmedabad.
6. AMC is developing affordable housing for the poor and low-income groups by considering thermal comfort measures and new technologies.
7. A study conducted by the Indian Institutes of Management (IIM) identified Ahmedabad city as the highest potential area for solar rooftops in the country due to high concentration of single-unit housing. AMC is encouraging the citizens to install rooftops photovoltaic systems and the local government to give a 10% rebate in property tax for consumers installing PV projects.
8. AMC installed water fountains on crossroads and main junctions.
9. AMC is implementing a project interlinking lakes and encouraging societies to create percolation wells for rainwater.
10. AMC is converting all its public transport Compressed natural gas (CNG) and Electric by December 2022.
11. AMC is also promoting E-mobility and implementing a PPP project to install 300 charging stations across Ahmedabad city.

During the summer season, AMC undertakes the following activities in collaboration with the Health Department:

- Ensure color-coded impact-based early warning focusing vulnerable population and protective actions
- Prepare rapid response team
- Distribute "Dos and Don'ts" flyers to the community to share recommendations in case of extreme heat, and intensify Information, Education and Communication (IEC) activities and cool roof programmes
- Send a "Don't Panic!" message to the community to avoid rushed behaviours and increase confidence in response system
- Ensure access to Medical Mobile Van in the Red Zone – the area of the city with highest heat risk
- Ensure additional medical vans are available throughout the city
- Ensure drinking water provision at crowded areas and shades at busy road intersections
- Ensure implementation of legislative/regulatory actions as per Occupational Health Standards to protect vulnerable workers
- Coordination with meteorological department for analysing cases and death data with meteorological variables, like maximum temperature and relative humidity.

Shri Lochan Sehra, Municipal Commissioner, Municipal Commissioner delivered concluding remarks. The city health infrastructure experiences a spike in the Heat illness ward's cases in May and June each year due to extreme heat, and if not mitigated, they may increase further as temperatures rise. Some of the issues associated with HAP implementation are 1) increasing UHIE outpaces the efforts to counter extreme heat risks, and lack of hotspot assessment affects the benefits of implemented solutions; 2.) Challenges in implementing passive cooling solutions, due to regulatory hurdles.

To take up such massive work and overcome existing barriers, a multi sectoral and multi stakeholder approach should be considered. The **city nodal officer for extreme heat** planning must be very dynamic and must proactively push all departments to align their activities, raising awareness and coordinating the efforts. Ahmedabad city maintained the same nodal officer for 10 years who has done a very good work. Ahmedabad's Mayor is currently reviewing the progress of the work weekly and proactively supporting the municipality to move things forward.

1. Field Visit to LG Hospital, Maninagar, Ahmedabad

Workshop participants visited the Heat Stroke ward. The doctors in the Heat stroke ward explained how they identify the symptoms of extreme heat-illnesses in patients. Then, they talked about the key diagnosis and respective treatments for these patients. They also explained that they track key data in logbooks for statistical analysis and report them to the State Health department. Additionally, participants visited the maternity ward to learn how doctors take care of new-born babies during extreme heat.

- To prevent the adverse effects of high ambient temperature on neonates, Dr. Khyati Kakkad invented the so-called “DOME” technique, analysed in a study conducted at the LG Municipal General Hospital.
- The DOME (Damp cloth Over Mosquito net) technique involves placing a damp cotton cloth over an umbrella-like structure such as a non-medicated mosquito net.
- This umbrella-like mosquito net is placed over the baby and a soft, damp cloth is placed all around in such a way that the top portion of the mosquito net (or umbrella-like structure) is kept open for air circulation and monitoring.
- This helped in creating a cooler microenvironment for the newborn by implementing a simple, cost-effective, and socially acceptable technique.
- Mothers are thoroughly advised regarding health hazards of heat, keeping neonates away from sunlight, the importance of breastfeeding and hydration, as well as methods and instructions to implement the DOME technique.
- A pictorial display was also done in the maternity ward on how to use the DOME technique.

2. Field visit to Community Health Centre (CHC), Vatva

Urban health centres are present in all Ahmedabad city's wards. Workshop participants visited one of these Community Health Centres (CHC) at Vatwa. CHCs are small hospitals where doctors and nurses provide basic services to patients in need. If necessary, they refer patients to bigger hospitals that offer basic treatments.

Walls displayed detailed Do's and Don'ts posters on the precautions to be taken during heatwaves. CHCs admit patients to the heat stroke ward, use icebags and IV saline to replenish lost fluids, deliver medications, and sustain patients through dialysis. There was adequate ventilation from fans and coolers in the ward.

The nurses and doctors are pre-planning to control the heatwaves impact on poor people by taking following measures prior to summer season:

- Distribute pamphlet and other materials to community.
- Sensitize link workers and community leaders.
- Develop and execute school health program.
- Disseminate materials in slum communities.
- Coordinate outreach efforts with other community groups, non-profits, and higher education.

3. Field visit to Bus Stand of Ahmedabad Municipal Transport Services, Sarangpur

AMC identifies places and work sites in the city to construct cool shelters/sheds at public places, bus stands, etc. The AMC staff, with support from local self-help groups/NGOs, are providing drinking water facilities and butter milk facilities free of cost to the commuters and travellers at the bus stands. Thirsty people replenish the lost fluids to get some relief from the scorching heat.

4. Field visit to Community level Cool Roof programme

The site visit's purpose was to see the painted roofs of slum households. Ahead of the 2021 heat season, AMC, with support from the NRDC and Mahila Housing Trust (MHT), painted over 460 roofs of selected slum households with solar reflective paints.

People living in slums and low-income communities are particularly heat vulnerable — a large percentage of their homes are far from optimal, with few options for cooling. The demonstrations served as an outreach tool to spread the word to the larger community on the benefits of passive cooling solutions such as white roofs, which can help indoor temperatures to drop by a substantial 7-8 degree Celsius.

5. Field visit to India Meteorological Centre (IMD), Airport Colony, Ahmedabad

The next visit was to the India Meteorological Centre (IMD), where participants learned how weather forecasting is done in the city, and how critical heatwave alerts are given by the IMD to the city and district administration.

IMD controls a big network of surface observatories covering the entire country to measure various metrological parameters like temperature, relative humidity, pressure, wind speed and direction, etc. The Centre measures weather data up in the stratosphere twice a day – in morning at 8:30 am IST and in the afternoon at 4:30 pm IST. They connect wind speed sensors, temperature sensors, and pressure sensors with a GPS device to a Hydrogen balloon sent in the sky. The balloon travels up to 36 Kms above the ground level and records live data at each second on a computer.

Based on the daily maximum temperature station data, the climatology of maximum temperature is prepared for the period to find out the maximum temperature of the day for a particular station. Thereafter, IMD declares a heatwave over the region.

Heatwaves are predicted by calculating the forecast maximum and minimum temperatures over the next three days. This information is compared to historical data of that location, and to the observed temperatures over the last 30 days.

If the maximum temperature of a station goes beyond 40^0C in plains and 30^0C in hilly regions, then the IMD considers it as a heatwave.

a) Based on Departure from Normal
   Heatwave: Departure from normal is 4.5^0C to 6.4^0C
   Severe Heatwave: Departure from normal is >6.4^0C

b) Based on Actual Maximum Temperature
Heatwave: When actual maximum temperature ≥ 45^0C
Severe Heatwave: When actual maximum temperature ≥47^0C

If the above criteria are met in at least 2 stations in a Meteorological sub-division for at least two consecutive days, the presence of a heatwave is declared on the second day.

IMD issues special heatwave warning guidance bulletins (at 08:00 & 16:00 hours IST) in meteorological sub-division and district levels to different users such as the Ministry of Home Affairs, National Disaster Management Authority, State Disaster Management Authority, Deputy Commissioner/District Magistrates of different districts of states, health department, Indian Railway, Road transport, Media etc.

IMD conducts the preseason exercise at state and national level. IMD also contributes to the preparation of heatwave guidelines and the heat action plan. IMD provides the required past data for heatwave advisories and development.

6. Urban Forest

Participants visited the urban forest developed on land fill site of 9 acres by AMC. The forest was created using the Miyawaki technique, which allows for native urban forest ecosystems to grow much quicker than other techniques. The method takes inspiration directly from natural processes and biodiversity: 15 to 30 different species of trees and shrubs are planted together. This plant community works very well together and is perfectly adapted to the local weather

conditions. Moreover, the habitat attracts much biodiversity. Vegetation becomes much denser than conventional plantations, and its structure resembles that of a mature natural forest. The temperature in the forest was 4^0C less than the outside temperature in the city.

7. Emergency preparedness: 108 emergency unit

Workshop participants also visited the GVK Emergency Management and Research Institute (GVK EMRI), the major corporate social responsibility arm of GVK and provides integrated Emergency Response services in Public Private Partnership with AMC and IIPH in the Gujarat state.

The guiding operational principle of GVK EMRI's 108/112 service is Sense, Reach and Care.

Sense: Emergency victim/attendant dials 108/102. Emergency Response Officer' Screen helps facilitate and assess emergencies and assigns ambulance (Ambulance/ Police/ Fire) in strategic locations.

Reach: Ambulance(s) reach the site/scene.

Care: Emergency Medical Technician (EMT) provides pre-hospital care while transporting patient/victim to the appropriate hospital for stabilization. Emergency Response Centre Physician (ERCP) advises patient care with the support of ERO, EMT to ensure optimal pre-hospital care.

Day 2 - 10th June, 2022 – Conference (9:30 am to 5:00 pm IST)

Dr. Sujit Kumar, Director of NCDC, welcomed all the participants to the workshop. He praised the great importance of Gujarat state's organizations taking part in the workshop on the eve of World Environment Day 2022. NCDC is focusing on various climate sensitive diseases like air pollution, heat-related, disaster-related, vector-borne diseases, mental health issues and climate-resilient infrastructure through the National Programme on Climate Change and Human Health. NCDC effectively works with IIPH on technical support on health sector response to heat related illness. He emphasized that extreme heat not only leads to increases in heatstroke but also increases incidence of cardiovascular, respiratory and renal emergencies, and pre-mature births. He raised concerns that preparedness for heat sensitive illnesses at State level, district level, and city level should be strengthened. The deliberations in this workshop will go a long way not only in raising awareness but also creating plans/strategies on reducing health impact of heat and enhancing cooperation between various agencies working on these areas.

Mr. Atul Bagai, Head of the United Nations Environment Programme India Office, provided a special address to the workshop participants. He said that prolonged and deadly heatwaves directly impact human health, health service delivery and air quality. Sadly, as the world heats up and our country urbanizes, heatwaves will increase in frequency and intensity. By 2100, cities across the world could warm as much as 4.4°C on average, with catastrophic impacts on the health, comfort, and resilience of all urban communities. The poor are certainly more vulnerable to heatwaves. Tackling extreme heat in

urban areas will be critical for social development and sustainable energy transition. This means investing in biodiverse urban nature, better buildings and urban design, and implementation of low-cost cooling technology solutions needs to be accelerated. Access to sustainable cooling is an urgent necessity in tackling extreme heat. Cooling is inter-linked with numerous Sustainable Development Goals, in particular its role in human health and well-being, productivity, and for keeping food and medicines fresh. We must urgently plan for emergency cooling, shading, robust health system reinforcement and water supply during heatwaves.

Under the framework of the Cool Coalition, UNEP is working with RMI, the Ministry of Housing and Urban Affairs (MoHUA) and NIUA to integrate extreme heat mitigation in city master plans and climate action plans. These include multi-layer interventions, from neighbourhood (nature-based solutions, urban greening, etc.) and passive cooling solutions reducing cooling demand, to improving cooling technologies' energy efficiency (ACs, adoption of DCS solutions).

The consortium aims to support 100 Indian cities in extreme heat planning, integrating cooling into urban planning and leading to a rapid transition to sustainable, affordable and climate-friendly cooling for all.

Dr. R. B. Patel, Deputy Director (Epidemics), Health & Family Welfare Department in Gujarat, welcomed the workshop participants. Dr. Patel stressed the impact of climate change and poor socio-economic conditions in increasing vulnerability to heatwaves for certain individuals. Similarly, extreme heat's impacts may not be uniform across the country. Various communities are at different risk levels, depending on a variety of factors such as their demography, neighbourhood vegetation, health status, household amenities, etc. In Gujarat, simple readiness strategies and activities – like raising awareness, early warnings, and communication – have shown to dramatically lower heat-related deaths. They also proved to be extremely cost effective.

Prof. Dileep Mavalankar and Dr. Mahaveer Golechha from IIPH identified the challenges for developing and implementing effective Heat Action Plans. They said the state and district administration often do not have reliable data on morbidity and causes of death. They stressed the need to establish systems for improved and real-time health surveillance to track heat health, patients suffering from heat strokes, heat stress, and high temperatures. More research at local level is needed to build evidence and strengthen the information system – the focus should be on how to protect vulnerable groups.

State, district and city administrations must prepare heat action plans. Such plans should have four components – 1. Early warning systems; 2. Public awareness; 3. Capacity Building and 4. Short term and long-term measures for cooling and water availability, cool roofs, plantations, with consistent measuring the impact of these measures. There is a need for each city and district to establish an environmental body and an environmental health officer to analyse heat-related illnesses (HRI). Relevant stakeholders should receive proper training and qualification, as well as proper decision and implementation power and authority.

Mr. Lav Agarwal, Joint Secretary (Public Health), Ministry of Health and Family Welfare inspired participants to keep health at the centre of climate response, take all necessary health sector adaptation and mitigation measures and also take individual actions to counter heat risks.

Dr. Akash Shrivastava, Additional Director, NCDC and National Lead, NPCCHH, thanked the speakers, organizers and participants of the workshop. He said there are solutions available alongside guidelines developed to implement health sector adaptation measures to extreme heat, but state and district governments to understand the urgency and need to take this implementation forward.

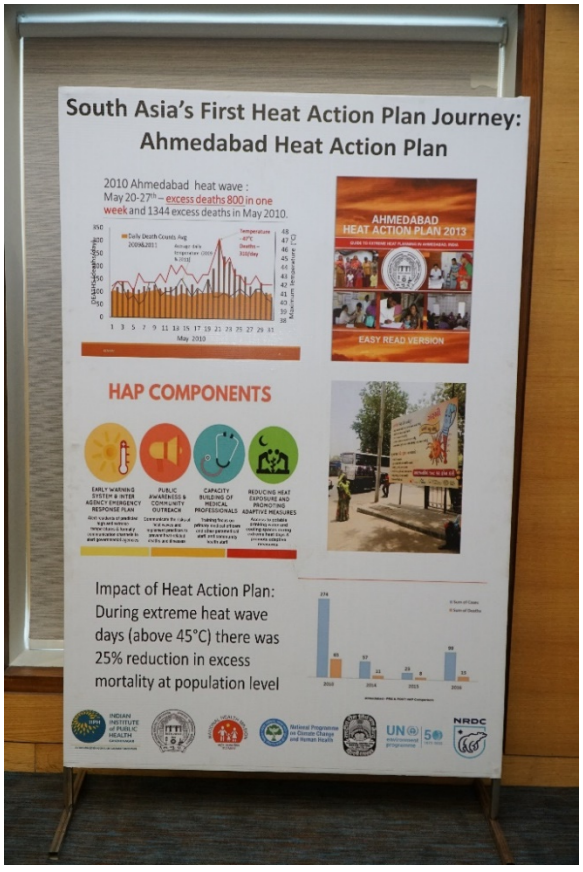
Technical Session (11:00 am to 3:30 pm) – Part 1

Dr. Purvi Patel provided insight on the ongoing initiatives undertaken by NCDC under NPCCHH on areas that include: health impact of heat, health facility preparedness, state heat health action plan, heat-related illnesses (HRI) surveillance. NCDC has provided awareness raising, webinars on research findings and conducted training and capacity building for State and District nodal officers–Climate change at central level. Some states have done good efforts in taking that training to district and sub-district health officers, medical officers and health care workers but all states/union territories must seriously focus on information, education and communication (IEC) and capacity building as all states have observed increased in annual average temperatures over last few years and all Indian population is exposed to higher and longer heat.

The NPCCHH with support from National Health Mission has strengthened health sector preparedness in the following areas:

1. Early warning, automated daily forecasts from March 1-July 31 to states and districts from IMD.
2. Provided guidelines - National Action Plan on Heat Related Illnesses
3. Hospital preparedness to prevent and manage cases of HRI
4. Heat-Related Illness (HRI) Surveillance – daily reporting of cases and deaths.
5. HRI case identification and management protocols
6. Implementation of State Heat Health Action Plan - 29 states submitted preliminary drafts
7. Green & resilient health care facilities (Long-term adaptation measure) - IPHS standards updated to include climate-resilient measures such as solar rooftop, cool roofs, window shading, water conservation, plantation etc.

Dr. Purvi shared status of HRI surveillance reporting status in summer 2022. She commented on quality of the reports received and clarified case definitions and reporting requirements to SNO-CC on updated formats which includes reporting of suspected heatstroke (case and death), confirmed heatstroke deaths, confirmed cardiovascular deaths, total emergency visits and deaths at health facility level. She also demonstrated digital HRI surveillance reporting which will potentially replace the existing reporting system next year.



Poster and PPT presentation by SNOs on health sector measures on heat in their state/UT

This session covered about nine PPT and poster presentations made by SNO-CCs on health sector measures taken in response to extreme heat in their State/UT and discussions. Different States explained the initiatives undertaken by them on health measures for extreme heat mitigation and adaptation. Under NPCCHH, most States are taking up activities such as training and awareness building of people, tree plantation, preparation of heat health action plans, preparing the health centres to prevent and manage cases of HRI, etc.

Dr. Aakash requested them to take some targeted actions and a focus approach to increase their efforts. He requested each SNO to take up two pilot districts after going back and implement at least two measures that they had seen/learned in this workshop.


Technical Session (03:30 am to 04:45 pm) – Part 2

This was a panel discussion moderated by **Mr. Manjeet Singh** (National Programme Officer-Environment and Public Health, WHO).

Panelists:

- Ms. Eleni (Lenio) Myrivili, Chief Heat Officer, City of Athens, Greece and Senior Urban Heat Advisor, Arsht Rock Resilience Center
- Mr. B. Gautham Baliga, ISHRAE
- Mr. Polash Mukerjee, Lead Air Quality and Climate Resilience, NRDC
- Ms. Bhavana Maheriya, Programme Manager, MHT

Coordinated Health and City Responses to Extreme Heat: Experiences from Athens and Internationally – Ms. Eleni (Lenio) Myrivili, Chief Heat Officer, City of Athens, Greece and Senior Urban Heat Advisor, Arsht Rock Resilience Center

We have been talking about global warming for decades, but not about extreme heat - especially in urban settings. Extreme heat is the deadliest of all extreme weather phenomena. But we overlook it. Heat does not come with the drama of roofs flying and streets turning into rivers. Heat destroys silently. And yet, there is little escape from extreme heat. These are temperatures that the human body is not made for and cannot adapt to. In modern cities, most of our infrastructure is not made for these temperatures.

As Chief Heat Officer of Athens in Greece, Ms. Eleni organized efforts in three broad categories of action: **awareness, preparedness, and redesign**. Building awareness requires that we recognize the threat, it's hard to get people, especially in hot climates, to take heat exposure seriously. This summer, with the assistance of Arsht-Rock Resilience Center, cities in the US and Athens are planning to start naming and categorizing heatwaves, the way that we do with hurricanes.

Preparedness means being ready to respond to a heat crisis. There is a whole arsenal from smartphone apps helping people to determine their personal heat risk in real time and find the nearest cool spot for protection. Or something we developed a few years ago in Athens and New York was for people from the neighbourhood to check in on the vulnerable. New York City also provided 74,000 air conditioners to low-income seniors.

But the real task ahead of us is to use landscape architecture and urban design to create cooler urban environments and to think beyond air conditioning. Before we started depending on fossil fuels for heating and cooling, architecture had incorporated centuries' worth of wisdom in design solutions and materials finetuned to local climate conditions.

Thick walls with small openings, well-placed windows pulling cool air from the lower parts of the building up and out, external shutters, shady and verdant internal courtyards with fountains, and outside walls whitewashed every spring to best reflect the hot summer heat. Compare that with the concrete glass and steel air-conditioned buildings – the ones with sealed windows which are making our cities heat traps, compounding the problem rather than solving it. We will remain stuck in this vicious circle unless we radically rethink and redesign our built environment, rejecting the logic of carbon modernity.

This is the decade to build urban heat resilience. Some cities are already changing beautifully, and they are learning from each other like never before through global urban networks like Resilient Cities Network, C40 etc.

Some city examples are: In Athens ancient monument will be used to enhance the resilience of modern Athens, sustaining trees, green spaces, many different species, biodiversity, and more

surface water features, all helping our city to cool down. In Medellin, Colombia, they created 36 green corridors and they have already seen up to 4 degrees Celsius of temperature reduction in the surrounding areas. In South Korea, in Seoul, they dismantled a 10 lane roadway to restore a city stream and they have managed to reduce temperatures up to 5.9 degrees Celsius, while also creating flood protection, increased biodiversity but mostly attracting thousands of visitors and creating a lot of new jobs and businesses in the area. Paris is using the water of Seine to provide free cooling in surrounding districts. Melbourne has created a "Nature in the City Strategy" that supports all parts of the ecosystem: from the soil and the underground fungi to plants and animals, setting out the actions needed to ensure that the urban environment their children inherit is richer and healthier than it is today.

State Heat Health Action Plans with Respect to Existing/Planned Health Infrastructure in Event of Extreme Heat – Mr. B. Gautham Baliga, ISHRAE

Heatwaves represent a major challenge for hospitals' resilience. Hospitals host elderly people, infants, burnt and low immunity patients. All these patients are at high risk of experiencing heat strokes during heatwaves.

During extreme heat, air conditioning systems come under the great strain of higher load & these could falter or fail when required the most.

Designed properly, air conditioning prevents infection and speeds up recovery in health facility settings. Poorly designed air conditioning, which unfortunately is mostly the case, propagates infection and can result in nosocomial disease.

Though air conditioning is a necessity, it is an energy guzzler, and its usage has to be judiciously determined. Air Handling Unit (AHU) systems with requisite filters and air changes will need to be used for critical areas like Operation Theatres, ICUs, Isolation Areas, Labs, Imaging & Diagnostic Rooms in order to maintain the temperature, humidity, cleanliness, and pressure value in accordance with standards and codes. These AHU systems should be designed more robustly to be able to operate well during the higher ambient temperatures that heatwaves bring.

In other areas like patient rooms, quarantine, reception, admin areas, etc., we could look at natural cooling systems in dry climates and natural cooling together with supplementary cooling in humid climates.

Mr. Baliga also highlighted structural aspects and design of geo-thermal air conditioning system and its benefits. With such strategies, there are immense possibilities to reduce cooling demand and improve hospitals' resilience to extreme heat without compromising the chances of infection.

Cooling Measures in Health Facilities & Communities – Mr. Polash Mukherjee, NRDC

Cool roof initiatives addressing the urban heat island effect issues and reducing cooling demand are key steps to tackle extreme heat in growing urban regions. Most cool roof pilot initiatives show that they directly impact poor people's health and reduce energy consumption in the city environment.

Ahmedabad and Hyderabad have shown leadership by proactively including cool roofs within the city's heat action plan and developing cool roof policy and governance framework for implementation of cool roof technologies.

The next steps taken by Ahmedabad and Hyderabad include implementing cool roofs on municipal buildings, promote incentive mechanisms for cool roofs in private buildings, incorporate cool roofs projects into the cities' building codes as a voluntary or mandatory initiative, along with budget and financing considerations. Both cities leverage different types of financial mechanisms:

1. Utilizing public funds (national and state) under smart city or energy efficiency schemes.
2. Utilizing Corporate Social Responsibility (CSR) funds for cool roof installations in low income and vulnerable housings.

The city of Ahmedabad is likely to resume its target to paint 15,000 slum roofs with cool paint following COVID related disruptions. Many local real estate developers have already expanded cool roofs to private buildings on a voluntary basis. Broken China Mosaic tiles terracing, and reflective paint coating are the standard technologies adopted by real estate developers to cover the RCC concrete slabs/terraces. Telangana, in collaboration with NRDC and partners, is expected to release a Cool Roofs Policy.

Implementing Cooling Solutions in Communities - Ms. Bhavana Maheriya, MHT

Poor women and children are among the most vulnerable groups to heatwaves and training them on the technological solutions to tackle extreme heat can have great benefits. Multiple state authorities, from urban local bodies to state disaster management authorities, have been involved in initiating these programs. However, **inter-agency coordination and financing are two challenges that need to be addressed to move from a pilot project to an implementable city-wide programme**. Although cool roofs can be cost competitive with regular roofing, the upfront costs of cool roof materials are posing a stumbling block for low-income communities. Developing Cool roof policies and adoption of energy conservation building codes at State level will mandate cool roofs implementation in residential, government and commercial buildings. Dedicated funding for financial incentives and citizen awareness programs, worker training programs and officer training programs are important.

Civil society and educational institutions have a wealth of knowledge that can support initiatives at the ground level and ensure a city's cool roof program responds to its local conditions.

In Ahmedabad Mahila Housing SEWA trust a non-profit organization, has installed over 250 cool roofs in low-income communities, using a material called ModRoof – roofs made of coconut husk and paper waste – as an alternative to concrete roofs. A 2017 study by MHT, NRDC and IIPH-G found that at 1:00 pm the ambient temperature of homes with mod roof were approximately 4.5ºC lesser than other concrete roofs.

The broad level activities initiated in some of the cities are provided below:

1. Awareness and Engaging Citizens: designing dedicated information, education and communication materials and Handbook on cool roofs to increase community awareness on what cool roofs are, on how they can help reduce indoor temperatures and what materials can be used to convert concrete roofs to cooler ones. In the process, they also empower women with knowledge and method to install cool roof or paint by themselves.
2. Pilot project implementation: focusing on urban low-income communities with little or no access to adequate housing, electricity and other urban services. The following technologies were tested in pilot projects:
    a. Applying three-layer coating of lime wash on tine, metal and cement sheets – US$ 1 per square foot. This is the lowest cost amongst all technologies, but its lifespan is only 2-3 years.
    b. Using composite roofing material made of locally available Mangalore tiles, cement mortar bedding and lime concrete. The cost for this technology is US$ 5

to USD 7 per square foot which is higher than lime wash coating, but it represents longer-term alternative for low-income homes in India which often do not have proper roof structures.

c. High-density Polyethylene (HDPE) cool roof coating membrane, Tyvek for tin, asbestos/cement roofs. Monitoring results showed indoor air temperatures were lower by an average of 2^0 C in the homes with cool roofs as compared to similar homes without cool roofs. Peak over deck roof temperatures in the cool roof homes were observed to be 15^0 C lower than temperatures in homes with just asbestos roofs and 10^0C lower than temperatures in homes with just cement roofs.

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Participants and organisers:

In this two-day workshop, representatives from 22 states/UT (23) participated with organizers: NPCCHH team (7), AMC (5), IIPH-G (2), UNEP (2), and NRDC (1). The event ended with a high note and state representatives appreciated the learning experience they had.

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