67/NCDC/NPCCHH/2023-24/CapacityBuildingReg
3409021/2023/National Centre for Disease Control

सत्यमेव जयते

Ministry of Health & Family Welfare
Government of India

Climate Change and Health: Driving Local Action

A Collection of Case Studies on
Adaptation and Mitigation Measures Implemented in
Public Health Sector in India

November 2023

National Programme on Climate Change and Human Health

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Acknowledgement

This collection of case studies on climate change and health developed by the National Programme on Climate Change and Human Health (NPCCHH), National Centre for Disease Control (NCDC) is envisioned to provide glimpses of adaptation and mitigation measures implemented in the health sector. The health sector is vital in managing clinical and public health institutions, health care delivery, health education, drug and equipment manufacturing, and health promotion and advocacy. For India's billion-plus population, the sector engages through a vast range of healthcare workforce, including public health officials, medical professionals, and an army of community healthcare workers who directly engage with the community.

Climate change poses a dual challenge for the health sector. On the one hand, understanding its health impacts, clinical management, and public health response are yet to be mainstreamed in medical and public health education. On the other hand, a lack of emphasis on health-centric development fails to invest in optimal and urgent health sector strengthening. In this context, case studies become valuable resources for quick knowledge transfer for various levels of public health stakeholders.

The collection includes case studies selected as a part of a case study call by NPCCHH in February 2023. The studies were required to be focused on the activities done in consultation with State/UT Health Departments. The submissions were scored (0-5) on each of eight evaluation criteria: 1. Problem identified, 2. Alignment with climate change and health, 3. Presentation, 4. Language, 5. Community participation, 6. Intersectoral coordination, 7. Sustainability, and 8. Scalability. The highest scoring 20 case studies were invited by NPCCHH-HQ to be presented in the workshop Climate Change and Health: Driving Local Action during July 12-14, 2023, at NCDC, Delhi. The collection also includes case studies submitted to the Call for Case Studies on Climate Change and Health by the World Health Organization (WHO) in 2021. Subsequently, two were presented at WHO's South-East Asia Regional Consultation in October 2021.

We want to thank the authors of the case studies for their diligent efforts in documenting the work; many of those had direct engagement in the fieldwork or project themselves. We appreciate the support from consultants of partner agencies, Dr. Muneer Kutty (World Bank), Ms. Chehak Ahuja (UNICEF), and Dr. Varun Kakde (WHO) in critically evaluating the submissions. We appreciate the leadership and guidance provided by Dr. Aakash Shrivastava (CEOH-CCH, NCDC). We acknowledge the contribution of the NPCCHH-HQ, NCDC team, Dr. Purvi Patel for executing the call, organizing the presentation workshop, and assimilating this collection, and Mr. Praveen G for administrative support.

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Community Engagement

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Integrating Climate Change Lens into Health System from Community Perspective, in Bhor Block, Pune, Maharashtra, August 2022-March 2023

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[1]Senior research fellow, Prayas Health Group, Pune, [2]Social Anthropologist, Pune

Background

Climate change is the largest threat to human health in recent times (1). The countries from Global South, like India, are particularly impacted by the health impacts of climate change. These include an increase in heat-related morbidity, respiratory illnesses malnutrition, injuries during extreme events, altering of the geographic range and seasonality of certain infectious diseases, diarrhea, mosquito-borne diseases, etc. To give some examples, a total of 3,775 deaths were reported due to heat-related illness in India during 2015-2019 (2) or nearly 12.5% of deaths in India can be attributed to air pollution (3).

Further, climate change affects the social and environmental determinants of health like disturbing food-producing ecosystems, air quality the safety of drinking water, and the security of shelter. The population from rural areas directly depends on climate- sensitive sectors and natural resources for their livelihoods. When health impacts are assessed with an equity lens, climate-sensitive health risks are disproportionately experienced by the most vulnerable sections of the population.

India is gradually realizing the urgency to establish well-prepared and responsive health systems to combat health risks posed by climate change. The macro-level policy like National Program on Climate Change and Human Health (NPCCHH) drafted in 2018 is pioneering the healthcare delivery strengthening, through thematic action plans, convergence, advocacy and capacity-building initiatives. The individual state actions are also noteworthy, such as, Chhattisgarh state in India has solarised over 1,400 community health centres and pledged to attain 100% solarisation. This will help to reliably manage cold chains for medicines and vaccines. (4)

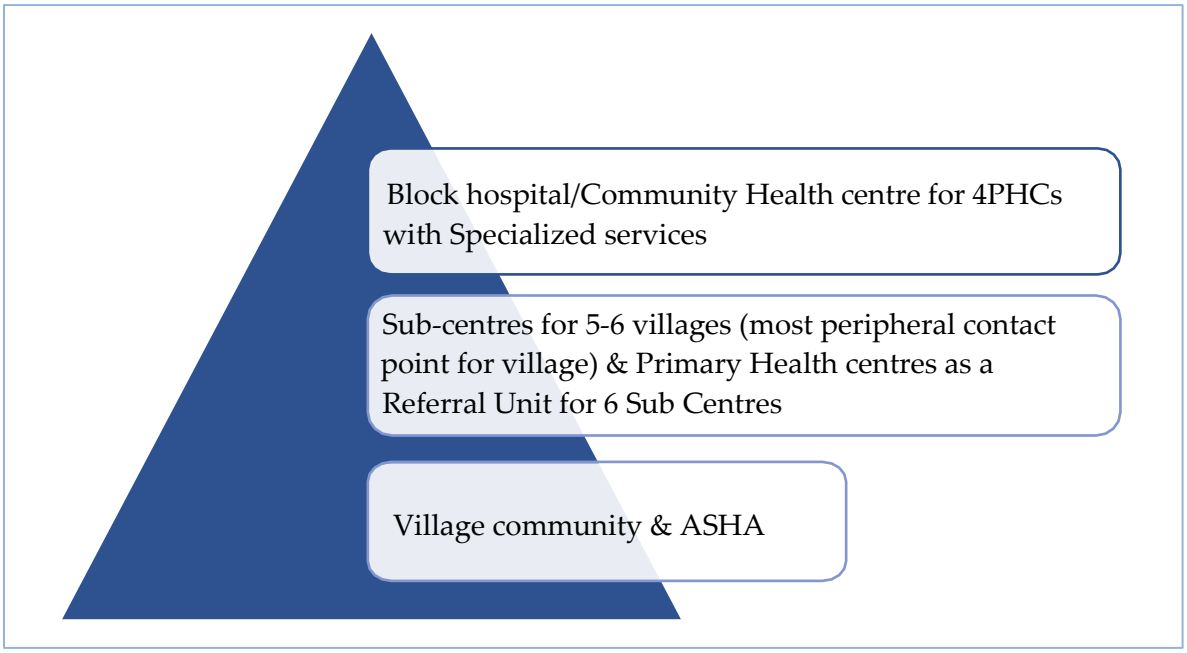
Strengthening health systems is one of the key health adaptation strategies. “People” are an integral part of a discourse about health system strengthening. Their role does not remain limited to being passive beneficiaries of programs. The landmark health system frameworks like the WHO Building Blocks framework advocate “people” to be at the centre of discourse. (5) In the case of climate change-responsive health systems, the role of people and bottom-up approaches must be explored. The health

impacts of climate change are a complex problem, operating through many indirect pathways. If the systems are not responsive to people and don't integrate their voices and active participation, they are likely to fail. The systems, therefore, require context-specific, flexible, adaptive health responses. - demanding bottom-up approaches and active community engagement.

People's beliefs about how climate change would affect their health have been investigated among residents in both industrialized and developing nations. (for example, 6-12) Still, there is a lot to be explored as climate change and health are constantly changing domains.

Do people know about climate change? What are their daily life experiences associated with climate change and health? What are their experiences and participation with existing health system domains? Such questions are important if "bottom-up" approaches are to be developed to envision the climate- responsive health systems of the future.

With this premise, Prayas health group initiated the exploratory action research work in villages of Bhor block of Pune district, Maharashtra. The work is ongoing and nascent- one year old. The work is dual- preparing communities and learning from communities. The work broadly aims to explore the scope and possible opportunities to integrate the climate change lens into village-level health systems.



A glimpse of the health system structure in India including the village level

The present case study aims to reflect upon the account of work completed from August 2022 to March 2023 and disseminate the important lessons learnt during the process.

The focus of this case study is - Advocacy and communications on health and climate change, Health vulnerabilities to climate change, and Preparedness and or response of healthcare systems to climate-sensitive illnesses.

The main thematic area addressed in the context of climate change's health impacts was "Mobilizing the health community". The other specific thematic areas present as a part of dialogues were- extreme heat, air pollution, water and sanitation, disaster risk reduction, infectious diseases, food systems and nutrition, clean energy, and reducing health inequalities.

Research Question

How can community-level processes and mechanisms enable the existing health system to integrate the climate change dimension?

The research question is primarily explanatory in nature. In the research question, the term "processes and mechanisms" imply the meaning of a series of events to produce the results, systematic interrelationships between parts and the actions through which changes manifest. The starting point for the research question assumes the positionality that there might be existing community-level processes and mechanisms within the health system, which need to be documented.

Currently, the bottom-up approach to strengthening climate-responsive health systems is inadequate in India to the best of our knowledge. For instance, a recent-most report about heatwave adaptation in India by the Centre for Policy Research identified that most heat action plans in India are not built for the local context and advocated conducting more localized holistic vulnerability assessments. (13) The present case study generates information "for policy" where the eventual case audience is the stakeholders involved in policy planning and implementation. The case study would also benefit community engagement components under NPCCHH action plans and advocacy.

Process

The process of the present initiative was planned partially. However, the process also emerged spontaneously in a "snowball" manner where one action or consultation with stakeholders lead to another one. The community perspective on climate change and health systems needs to be studied in real-life settings. A "naturalistic" understanding of the issue was required over "controlled" experiments. Therefore the "flexible" case approach was preferred with no tight pre-specifications. Multiple interpretations of the same experience were possible to be documented to enhance the knowledge about gaps. The context in which the health system currently functions was captured.

Case definition: The specific case here was defined as "the village communities as a part of the health system". The village community had a pre-defined fixed boundary however, its interactions and interconnections with other sub-systems (like health sub-centres, health centres, anganwadis etc.) were taken into consideration.

Setting

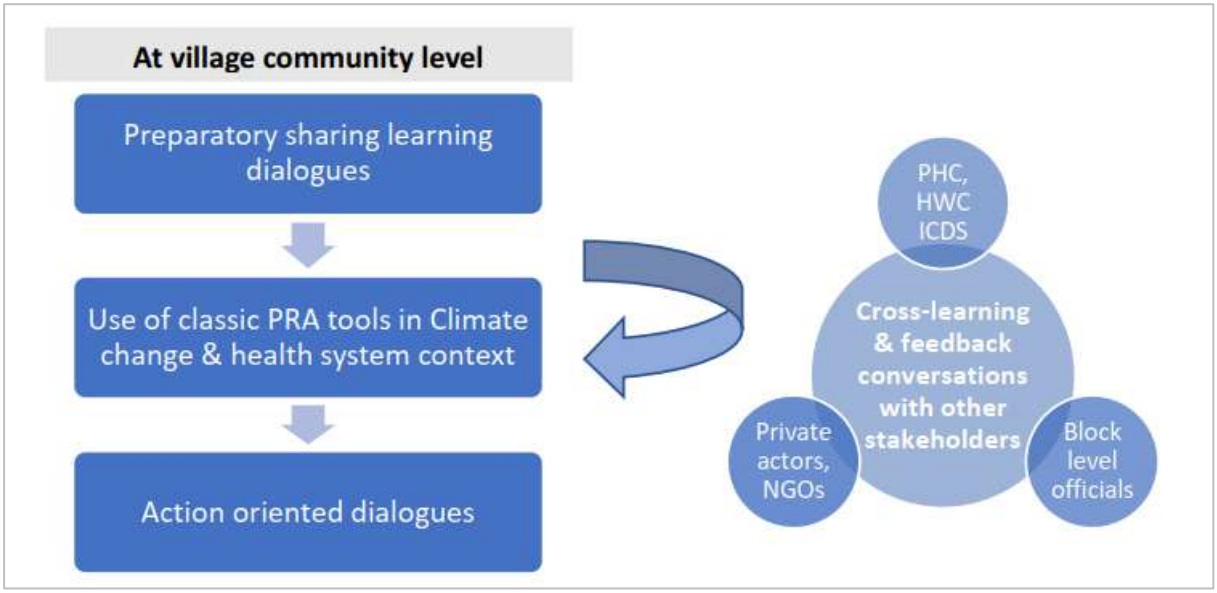
Bhor block in the Pune district of Maharashtra, India

Bhor block in the Pune district of Maharashtra state was purposively selected for pragmatic reasons based on the budget and time resources available with the research team. The Bhongavali Primary health centre from Bhor and three sub-centres (Health and wellness centres) under it, Nhavi, Sarola and Kikvi- have a total of 16 village communities under their catchment area. Out of these, 9 villages were selected for this exploratory initiative as units of activity. Two volunteers from a community- based organization from the same location were selected. The training was given to both regarding Climate change & its health impacts. The training booklet prepared in simple Marathi language made by Prayas health group was used. These two we referred to as 'community level facilitators' between the villages & Prayas.Their roles were to go to villages, meet Sarpanch, Upsarpanch and other gram panchayat members, Village health & sanitation committee members & other eminent villagers, inform them about the initiative & schedule the next plan of action.

Series of Actions

Preparatory sharing learning dialogues with villages aimed at rapport establishment with villages. This also helped to identify formal and informal leaders, map stakeholders and also identify potential sub-groups with whom separate meetings

can be conducted. It was also noted that basic information about climate change given in a simplified way was well received by the villagers and it was important to open the conversation.



The series of actions snapshot

Preparatory sharing learning dialogues with villages aimed at rapport establishment with villages. This also helped to identify formal and informal leaders, map stakeholders and also identify potential sub-groups with whom separate meetings can be conducted. It was also noted that basic information about climate change given in a simplified way was well received by the villagers and it was important to open the conversation.

The use of classic Participatory Rural Appraisal (PRA) tools in the Climate change & health system context was carried out in the follow-up meetings. The tools like listing and ranking, timeline, case vignettes, and village profiling were used. The process emerged in consultation with the villagers themselves. The dialogue also sometimes churned debates and conflicts within the village system which were facilitated by the research team. The dialogue also helped villagers to establish the connections between climate change, health and social determinants of health.

Action-oriented dialogues with villages reflected upon the adaptive measures through which climate-sensitive actions can be integrated into the existing health system. The potential of platforms and roles like village health action plans, VHSNC, and ASHA were understood for micro-level policy advocacy opportunities. It also attempted to develop a village action group of core members. Capacity-building sessions needed at the village level were identified.

Cross-learning & feedback conversations with other stakeholders were extremely essential to keep the momentum of villagers active and to complete the systemic loops. As and when needed, informal and formal dialogues with other stakeholders

were carried out and relevant actions were initiated/ advocated by the Prayas health group.

(Left) Timeline mapping process in one of the villages and (right) sub-group meetings with women and marginalized group participants

The quantum of work covered in an ongoing initiative to date

Coverage area	The initiative is impacting 9 villages covering 9000+ population
Village-level dialogues and cross-learning conversations	A total of 30 dialogues have been carried out pitching approximately 350 individuals

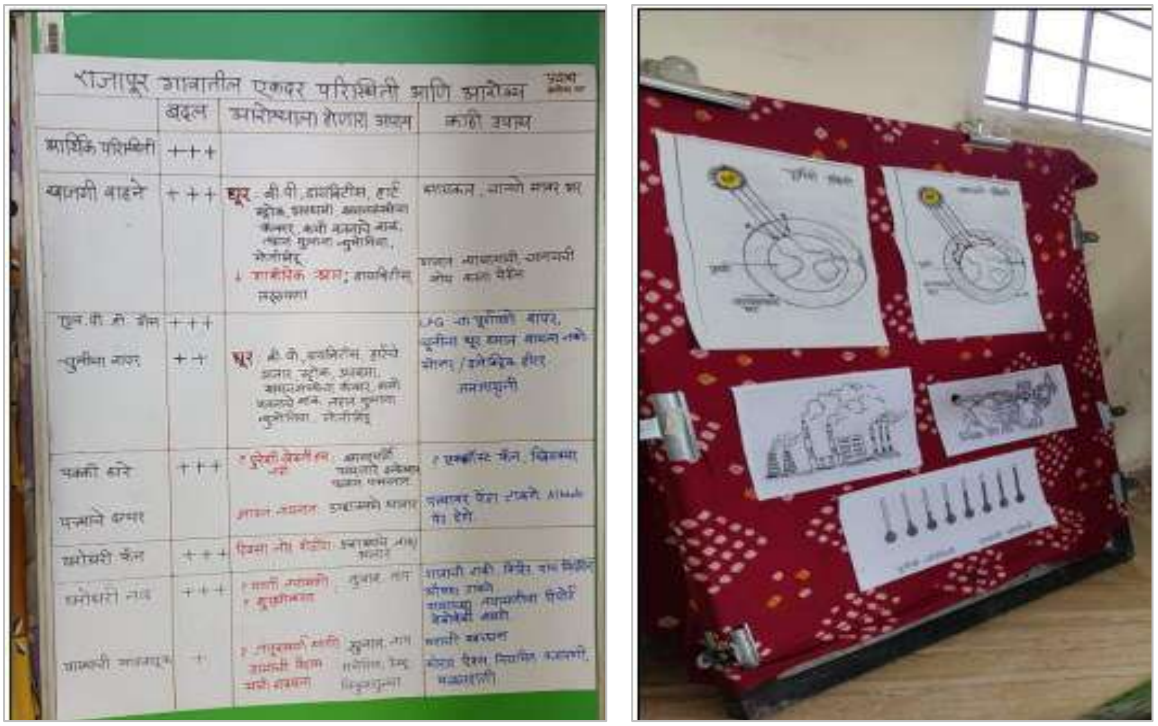
Contribution of the programme in delivering better health outcomes

Learning 1: People can play an active and crucial role in climate-induced health vulnerability mapping

People cannot be viewed as passive beneficiaries of any top-down program. They do not necessarily need an outside "spoon-feeding" of climate change and health associated knowledge to be shared with them in a "one-sided" manner. Contextual

vulnerability can be extracted from the lived realities of people. However, it must be noted that people might need anchors/ interconnections to view climate and health systems as a whole. Such a collaborative exercise can help to map the local vulnerability and generate a set of micro-scale adaptive capacity actions.

During sharing-learning dialogues, a number of "clues" were actively provided by the people. For example - Degradation of land with changing climate and increasing use of fertilizers, chronic water scarcity, increased salinity of water, delayed and unpredictable monsoons and vector and water-borne diseases associated with those, seasonal flu among children, polluted air in villages near the national highways.



However, facilitation was needed to "join the dots" and make the links between health issues with climate change more visible to the people.

(Left) Vulnerability mapping emerged after village dialogues- a ready-made tool for village panchayat. (Right) Pictorial charts to explain climate change in a simplified manner

Takeaway for program implementing agencies/ policymakers-

Mapping contextual vulnerability was an immediate outcome of this process. The vulnerability mapping provides a guiding tool for the village health actions. Its prerequisite is a collaborative dialogue which can be generated if

- the "two-way" dialogue processes are incorporated into the vulnerability mapping tools
- the appealing tools (like pictorial ones) are used to enhance participation
- the real-life cases are extracted through the discussion
- the role of multiple sectors and life domains (like livelihood, lifestyle etc) is brought into the discussion

- the anchors of climate and health linkages are provided creatively by the facilitators

Box 1: Caution if you have diabetes-hypertension and if you are working in extreme heat…!!!

Case A. In March 2022, Sumatibaai from Diwevadi village followed her daily routine and went to accomplish her agricultural work. The afternoon heat was at its peak. After a day-long work in the field, 59-year-old Sumatibaai felt dizzy and fell. Sumatibaai was a diabetes and hypertension patient. Her daughter-in-law gathered people, they made Sumatibaai drink water and took her home. The evening she again started feeling restless. The private hospital was 8 kms away. Sumatibaai was admitted there but after an hour, she expired due to cardiac arrest.

Case B. Diwevadi village witnessed a death in another family in the same month and followed a similar pattern. He postponed drinking water when he was occupied with day-long agricultural field work. When he returned home by evening, the symptoms like headache, fever and disorientation popped up. His demise occurred when he was taken to the hospital.

The Diwevadi villagers were uncertain whether working in extreme heat caused these incidents but then have determined to take extra care of elders in their families during summers henceforth. Facilitators planned to conduct a heat-stress prevention training for the villagers.

Box 2: Collaborative dialogues to join the multi-sectoral pieces of the "climate and health" puzzle

People narrated experiences which were concerns of multiple sectors like agriculture and climate science. The facilitator in her technical presentation connected these concerns with the health sector issue (rise in VBDs) and discussed the need for extended vigilance.

Learning 2: Existing health system provides ample opportunities to integrate the climate change dimension

A parallel system cannot be designed to implement the actions against climate change-imposed health problems. Existing structures under National Health Mission provide various opportunities to integrate the climate change dimension. The dialogues with people and other stakeholders revealed the following opportunities which can be utilized for the climate change purpose.

Sr No	An existing component of the health system to be approached	Examples of challenges in the current scenario	Examples of opportunities to Incorporate the climate change dimension
1	The Accredited Social Health Activist (ASHA)- This programme in India is the world's largest all-female Community Health Workers programme. ASHAs are supposed to bridge the gap between community and health services by functioning as healthcare catalysts, service providers, and community-level health activists.	Vacant positions of ASHAs in some of the village settings, lack of orientation of ASHAs for the climate change theme	ASHAs can provide heat stress early warning messages to families, ASHAs usually conduct NCD surveys so they can provide customized messages to the population at risk (eg elderly, diabetes and hypertension patients) for heat stress prevention
2	Village Health Sanitation Nutrition Committee (VHSNC) – It is the community process for taking "local level community action" for monitoring health status and undertaking local-level health planning.	Need to regularize and strengthen the periodic VHSNC meetings, the lack of orientation of VHSNC for the climate change theme and facilitation for mapping contextual vulnerabilities using simple tools	VHSNC can take up the climate-sensitive health issues on its agenda, prioritize these issues for budgeting and collective actions
3	The Annual Village	Lack of rigour and not	Some actions which can be

	health plan (VHP)- Focuses on issues that affect the health of the community. It's a continuous process and is reviewed every month.	following the detailed protocol as mentioned in NHM guidelines, missing linkages with climate change dimension as villagers don't have the orientation	incorporated in VHP were terrace and kitchen gardening, protection of green spaces, customized VBD-WBD action plans as per weather monitoring, village- level heat health or air pollution action plans, including early warning systems as part of village health action plan
4	The health centres- The infrastructure like SCs and PHCs (recently revised as health and wellness centres) are immediate contact points for villagers	Lack of climate change-oriented surveillance, poor knowledge among health care providers	Climate change messages in regular IEC, introducing heat and air pollution surveillance at the sub- centre levels
5	Private healthcare providers- These are preferred healthcare providers by many of the community members	Lack of partnership between public and private healthcare providers, poor knowledge about health impacts of climate change	Sustained engagement with private providers for improving early reporting of heat stress and respiratory illnesses, participation of private providers in health promotion messages

Takeaway for program implementing agencies/ policymakers-

The immediate outcome in this regard was the opportunities identified across the five components of the existing health system to include the climate change dimension. These opportunities encourage multi-stakeholder actions. They also aim to foster communication between village communities and health service providers in several ways. This outcome can be achieved by

- Understanding the current challenges in those components from people's and service providers' points of view
- Identifying the relevant practical action-oriented opportunities where climate change angle can be introduced

Learning 3: The inherent nature of the village as a "social" system influences the health behaviors of the community.

The community's preparedness for preventing climate-induced health impacts is a direct function of its "hardwiring" as a social system. Many otherwise routine health behaviors, which have a social and psychological explanation, continue to influence the climate and health matters too.

Box 3: Strengthening health system for Water-Borne Diseases (WBDs) in Radhapur village by considering future climate posed risks

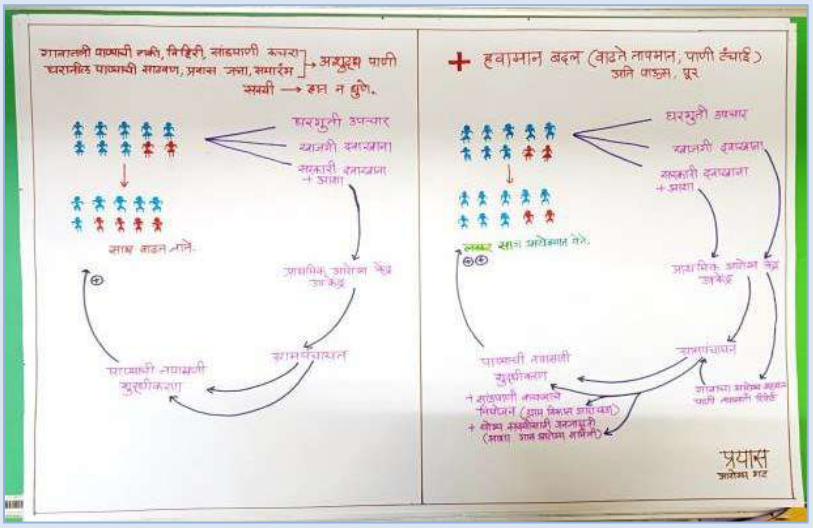
Radhapur was a village which learnt a lesson from the story of its nearby village Saravade.

Saravade village story

Saravade is a village with a 1600 population. The village population depends upon a single water tank for drinking water. This tank was designed to fulfil the capacity of a lesser population in earlier times. The management challenges of the tank for the growing village population do not provide an adequate window for water purification measures. The unsafe drinking water resulted in the rise of diarrhoea cases in the village in February 2023. Initially, 5-6 families had diarrhoea patients and they sought treatment from a private doctor. The private doctor didn't inform the government sub-centre. Eventually Government centre came across the diarrhoea cases in its OPD and they suspected the diarrhoea epidemic. They coordinated with the village panchayat and assessed water quality. Water purification measures were taken and people were sensitized to drink boiled water.

Learning for Radhapur

This case was explained to villagers from nearby Radhapur using WBD cyclic diagram from the PRA toolkit. Villagers were also explained the future risk of rising WBDs due to climate change impacts, water scarcity and unsafe water.



WBD Cyclic diagram from PRA toolkit

Dialogue with Radhapur villagers resulted in the following opportunities for strengthening the health system.

1. The Radhapur village does not have ASHA in place. Measures should be taken for the ASHA's recruitment so that she can take an active lead in early reporting of WBD
2. VHSNC and VHP can coordinate with the sub-centre and nearby private doctors for early reporting if such an incident happens in their village. They will also promote safe water practices among villagers. Monthly village health plans will also consider weather and water level parameters during their planning.
3. Gram sabha and gram panchayat will take necessary actions in the routine for water tank purification.

These field reflections can be explained by using the theoretical construct "Cues to action" from the classic Health Belief Model. (14) The Prayas actions worked here as an 'external' cue or trigger for prompting engagement in climate and health-associated behaviors. This external cue of action by Prayas triggered the following internal cues within the community and eventually initiated some actions.

However, the existing social milieu posed a number of barriers to sustaining the process such as-

Barriers to sustaining the process	How were those barriers addressed?
In many villages, people were found prioritizing other domains of life (like livelihood, and lifestyle) over the health-related discussion	Mobilizing people for the dialogues was not a straightforward path. Prayas tried to reach influential people, and plan meetings during times and occasions convenient for people. For example, in one of the villages, water fetching timing was crucial for women so all meetings carefully excluded those slots. In another village, meetings were kept immediately after the temple puja event to catch hold of the majority of people. The interest and leadership of village leaders in some cases worked in the favour.
People expected immediate direct benefits such as the distribution of free medicines, free consultations, or treatment camps. This adversely impacted their openness and interest in discussing health prevention at the individual or collective level	Bringing forward the economic angle (i.e. disease prevention saves one's expenditure in curative health/ medical treatment) helped to some extent during dialogues. However, preventive health requires a larger discourse. This discourse must emphasize the need for multisectoral planning and action. More innovative strategies need to be identified. Sensitization of influential stakeholders within the community can help. Taluk/PHC/village level health burden data and its linkage with climate indicators data may help. However such data is currently lacking. At PHC and block level, Prayas advocated for producing the village-level data and sharing it with the villages themselves. Examples of such datasets could be the village-level groundwater and rainfall data, health burden data, regular sharing of water quality or vector surveillance reports.
Sub-groups within the village based on gender, age, and social group exhibited	Such a set of modifying variables (*as they call in HBM* (14) were identified and dialogues were planned. For example, separate meetings with sub- groups of

disproportionate participation in the dialogues. Such groups are more vulnerable to climate-induced health impacts. Intersectionality issues within the village affect collective action.	women, and in-migrants were carried out in some villages. Facilitators have plans to target other such sub-groups like youth, katkari tribals etc.
People's individual or collective beliefs were inhibiting their intrinsic motivation to take the action. The same pattern was found repeating for climate change adaptation.	Prayas dialogues attempted to enhance the perceived susceptibility of the community by challenging the belief patterns. Some examples of such beliefs were "*Food cooked on Chulha is healthy and tastes better so we prefer it without considering the indoor air pollution*", and "*The village god protects us from all illnesses*". Such beliefs were carefully challenged by critical questioning, using appropriate examples and helping people to visualize the consequences of their actions.

The villages have health system structures in place but they needed "outsiders" (Prayas) for enabling collective action. For sustainable actions, this outsider effect must be eliminated by making the village systems more motivated and enhancing their self- efficacy.

Box 4: Representative experiences shared by the healthcare providers about Prayas work

"The cyclic diagram for water-borne disease interventions in the village was very effective. People were paying attention to it during the awareness session. From Primary Health Centre, our team would like to attend such dialogues in the village and learn from them. During our village activities, such pictorial tools will also be helpful for us."

(Aarogya Sevak, Bhongavli PHC)

"Things don't change immediately. But people remember things discussed in such meetings. If someone suffers from heat stress, things discussed will be recalled and actions will be taken. We as ASHA workers also get benefitted from any such health-related work that happens in the village. We did this (the present action-research) meetings in the village and later when the village panchayat meeting happened, people discussed regarding the follow-up of water quality reports and decided to follow-it up closely."

(ASHA worker, Vagajwadi village)

"The awareness work that's happening regarding transition to clean cooking fuels is very crucial. The government has launched the schemes like the empanelment of solar heaters in villages. These could be helpful in this regard."

(Block committee member, Bhor)

Takeaway for program implementing agencies/ policymakers-

The outcomes associated with lesson 3 were indirectly contributing to the overall process. The experience provides Dos and Don'ts for community engagement with the theoretical reference from the classic health belief model. Community engagement can be successfully achieved if-

- People's priorities are adequately listened to and the climate-health angle is integrated with their priorities
- Sub-groups of people are identified and their exclusive dialogues are arranged
- The actions are planned flexibly by considering the motivation of leadership in the village
- People's individual or collective beliefs are addressed and challenged
- Consolidated data at the village level is generated and kept available in the village for planning evidence-informed actions
- Intersectionality within the village is sufficiently addressed during the dialogues

Way Forward

The current initiative by Prayas health group was small-scale and exploratory. The present case study reflects on the outcomes and learning lessons, however, the way forward would be sustaining the present work and formal impact assessment.

In a long-term vision, it aims to develop a framework for climate adaptive health system actions through a "bottom-up" approach. The present work will be continued across the three trajectories-

Micro-level advocacy and implementation

This will be continued in the present set of project villages. Examples of some actions already in discussions, aligning with this trajectory are-

- Support to PHC and HWCs for heat and health action capacity building in the villages
- Disseminating IEC material designed by the Prayas with PHC
- Exploring the involvement of private practitioners in climate-oriented disease surveillance and partnership with the public heath sector
- Advocacy activities at the village level like encouraging the formation of village action groups, strengthening communication and trust between villages and PHC-SCs, reviving the role of ASHAs-VHSNC-VHP in climate and health action.

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About the organization

PRAYAS is a non-governmental, non-profit organization based in Pune, India. Its health group (Prayas Health Group - PHG) focuses on public health issues afflicting the disadvantaged sections of society, through a community-centric, rights-based perspective. The thematic focus of the work is on HIV/AIDS, Sexual and Reproductive Health, Cancer Prevention, and the Health impacts of Climate Change. PHG strives to take scientific knowledge and evidence to communities in a simple, sensitive, non- judgmental, empowering, and effective manner and engages in generating evidence, building discourse, and advocating for evidence-informed public health policies and program implementations.

The health impacts of climate change are complex challenges that require flexible, locally acceptable, and community-centric adaptive responses. PHG seeks to understand the nature and extent of the health consequences of climate change in the Indian context and explore the relevance and effectiveness of health adaptation responses at the national and sub-national levels. (More details available on https://health.prayaspune.org/focus-areas/climate-change-health?layout=list)

Involvement and role of the government health sector in the project

The Government stakeholders namely, the Nodal officer, district program on climate change and health, Panchayat samiti member, Bhor taluka health officer, and ICDS supervisors endorsed the initiative. Bhongavli Primary Health Centre and sub-centre staff were active participants in the dialogues. At the village level, Elected representatives, Gram panchayat members, Village Health Sanitation and Nutrition Committees and Community Health workers actively participated in the activities under the initiative.

Acknowledgments

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2

Generating Awareness of Climate Change and Human Health and Preparing the Community for Extreme Climatic Events

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Introduction

Panchayati Raj Institution training is being conducted under the Chhattisgarh National Program of Climate Change and Human Health. As SHRC is the technical cell, it coordinates in training the training of trainers (TOT's) who carries the training with the training modules specifically designed to address Climate Change and it health impacts. The training module has been designed in such a way that it captures the day-to-day activities, struggles, and challenges of climate change on communities and the participant's training module facilitates the communities to come up with an action plan for their gram panchayats to address the sources contributing to climate change and human health through basic necessities of air/water/land/ heat and preserving the environment.

Chhattisgarh is a land of minerals and mines, agriculture and the boon to industrialization have impacted the communities from urban to rural areas.

The urban challenges are easily addressed but rural challenges for issues like Climate change and human health remains unaddressed to a larger extent. Knowing the fact that coordination, networking, and participation are a few of the keynotes on strengthening the communities to be resilient towards any challenge, especially for health. The PRI training was considered in order to address and create resilient communities from the core and most important areas of development.

Chhattisgarh operates a three-tier panchayat system, which is intended to bring the government closer to the people. Chhattisgarh has approximately 11,664 Gram Panchayats at the village level, 146 Janpad Panchayats at the intermediate (block) level, and 27 Zila Panchayats at the district level. (1)

Air /water/land/forest and environment-based livelihoods like fisheries, sericulture, and agriculture are the main interests of the PRI members. These have a direct impact on climate change on human health. The participatory module for the PRI training was prepared to understand the climatic situation of Chhattisgarh, sources of pollution causing climate impacts, especially on health, and the challenges faced by the people

in the rural part of India. The module was prepared to avoid gender biases. PRI Training were considered with the following -

Aim: To train the communities through Panchayati Raj Institution on Climate Change and Human Health for prevention of the diseases impacted by climate change through community action.

Objectives

1. To identify climate change impacting human health issues by the community.
2. To build the capacities and learning around the identified climate change impact on human health.
3. Facilitate the communities through PRI to prepare plan of action with the communities
4. To reduce burnings causing smoke by promoting specific health and environmentally friendly interventions in communities.
5. To promote Intersectoral actions to resist Climate Change.
6. To build health resilience in the community to resist Climate Change

Process

Participatory Rural Appraisal (PRA)

The Participatory Rural Appraisal (PRA) approach is a community-based approach to research and consultation. It is a method that gives priority to the views of local people, with the belief that they are the experts in their own lives, and are thus best placed to come up with a program for collective action.

PRI Training sessio, Chhattisgarh

PRA would provide a wide range of flexible, adaptable tools and techniques, designed to provide methods of consultation that can be chosen and reworked to suit whichever group is taking part in the process. It equips local people with the skills and confidence to work as equal partners with agencies, service providers, and other

stakeholders. It breaks down barriers between community representatives and civil servants and promotes a shared understanding of each other's priorities and constraints.

PRI members in Group Discussion for action plan

The communities will be encouraged to identify the impact of climate change around them on health and the environment, and various disasters that affect the quality of life and health.

The Training of the trainers (ToT) is done at the capital.

Participants from different panchayats presenting their action plans

The trainers are the Swasth Panchayat Samavayak (SPS) they are from the same panchayats and facilitate the PRI members on the training based on the module at the panchayat level

Outcomes

1. PRI Training Module was created.
2. With the first edition of the training module (2020-2021) around twenty-one thousand nine hundred and ninety-five (21,995), the module was updated and in the year 2021- 22 around twenty thousand seventy-eight (20,078) PRI members, and in the year 2022-23 around twenty-two thousand four hundred and forty-two (22,442) PRI members from 146 blocks were trained. The training was very well taken by the participants and overflowed with positive feedback and constructive ideas. The ideas of the participants were included in the second training module which was updated in the year 2021. In total to present around sixty-four thousand four hundred and fourteen (60,414) PRI members have been sensitized and trained and the training is still in process.

3. After the training, the PRI members in participation make a community-driven action plan and pledge to follow it through the panchayats.
4. PRI along with other local bodies have taken action on sensitizing through wall writings.
5. Panchayats promoted the usage of leave plates during village celebrations, marriages, and functions.
6. The PRI members and others have written poems and songs on sensitization on climate change.

PRI Training modules on Climate Change and Health and training report

Short- and long-term outcomes:

The PRI Training seeks to achieve the transformation of the communities/ local bodies/ authorities through self-realisation and responsibilities towards the environment and climate change as climate change has irreversible impacts on living beings and all the ingredients of nature on which life depends. Communities have always been very effective in bringing social and political change. Using the Panchayati raj institute which is a good model of self- governance and can advocate people's rights to a safe environment. The participation of the elected members gives support to the coordinated approaches to tackle the existing issue of climate change on health and surely have the power to make these issues priority issues bringing social and political change in the ways they are dealt with.

- Mainstreaming climate change in the Panchayat decisions.
- Coordinating with others networking groups in reducing the impacts of climate change through collective decisions at a larger level.
- Social and political commitment.

Sharing of learnings with other states:

Panchayati Raj Institutes are present in every state. All the state programs can replicate this according to their priority issues. We all work with the PRI in some way or the other. Climate change is a subject that can touch their day-to-day lives as the impacts of climate change are much felt by the rural part of India. Their participation can lead to taking sensitization in all the nooks and corners of our huge nation and that can help meeting out the vision in the long run to combat the impacts of climate change and human health.

Role of NPCCHH:

PRI has the strength of local people and bodies and the National Program of Climate Change and Human Health facilitates every state to not only strengthen the local communities but also eventually address many health issues which can just be dealt with mere sensitization, participation, and making small changes in the behavioral patterns of our day to day lives like burnings causing smoke, excessive use of fertilizers, water pollution and much more leading to diseases that reduce the quality of life and increases mortality and morbidity,

Chhattisgarh has been facilitated by NPCCHH on this global issue of climate change which has positively strengthened the newly born tribal state to have well-aware and sensitized communities, leading to improved health as the priority starting from the marginalized areas.

Resources and Publicaitions

1. https://shsrc.org/wp-content/uploads/2021/08/Training-of-PRI-members-on-Climate- change-2020-21.pdf
2. The second, edition of PRI Training module 2021 – 22
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1. Panchayat Administration, Chhatisgarh at https://dpcg.cgstate.gov.in/

Media Coverage

पंचायत प्रतिनिधियों का जलवायु परिवर्तन एवं स्वास्थ्य प्रशिक्षण घुघसीडीह में दिया गया

तरुण छत्तीसगढ़ संवाददाता

उतई, 21 मार्च। समीप ग्राम घुघसीडीह में तीन दिवसीय पंचायत प्रतिनिधियों का जलवायु परिवर्तन एवं स्वास्थ्य महिला हिंसा रोकने के लिए कानून स्वास्थ्य की स्थिति को सुधारने के लिए पंचायत क्या कर सकती है। इस विषय पर चर्चा किया गया। जल ही जीवन हैं। धरती पर जीवित रहने के लिए मनुष्य समाज के साथ साथ जीव जंतु पेड़ पौधे सभी के लिए जल सबसे महत्वपूर्ण पदार्थों में से एक है। जल प्रदूषण के विभिन्न कारण हैं। जनसंख्या वृद्धि से मूलमत्र हटाना एक गंभीर समस्या हैं । गांव में लोगों के तालाबों नहरों में नहाने कपड़े धोने पशुओं को नहलाने बर्तन साफ करने आदि से भी जल स्रोत दूषित होते हैं।जिसमें पंचायत प्रतिनिधियों का अहम भूमिका जल प्रदूषण से होने वाली बीमारियों के बारे में लोगों को बताना जल प्रदूषण को रोकने के लिए सामूहिक कार्ययोजना बनवाना जल प्रदूषण पर लोगों में

जागरूकता लाने के लिए दीवार लेखन करना नुक्कड़ नाटक रैली आदि के माध्यम से जल प्रदूषण पर लोगों में जागरूकता लाना शासन द्वारा निर्धारित जल प्रदूषण नियंत्रण कानूनों को कठोरता से पालन करना एवं करवाना चाहिए* *कानूनों संबंधी महिलाओं के साथ मारपीट करने पर (323 भा.द.वी.)गंभीर चोट पहुँचना 325,आत्मा हत्या के लिए दबाव डालना 304, दहेज मृत्यु 304 (बी) नाबालिक लड़की को अपने कब्जे में रखना 344 ए पर्यावरण को सुरक्षा रखने के लिए चारो तरफ पेड़ पौधे लगवाये प्लास्टिक का उपयोग न करें।इस अवसर पर ग्राम घुघसीडीह सरपंच गोवर्धन बारले,मचांदुर सरपंच दिलीप साहू,उपसरपंच रेखलाल टण्डन,मचांदुर उपसरपंच गजेंद्र कुमार साहू,खोपली उपसरपंच सुमन साहू,प्रशिक्षण प्रमुख एवं एसपीएस ललित साहू मितानिन प्रशिक्षण प्रमुख मनोरमा साहू, प्रवीण यदु,तुकाराम साहू,कुंती यदु,सीमा देवांगन,सहित घुघसीडीह खोपली मचांदुर के पंचगण अधिक संख्या में उपस्थित रहे।

जान से मारने की धमकी देते हुए किया हमला

भिलाई, 21 मार्च। खुर्सीपार पुलिस ने बताया कि 19 मार्च रात करीब 11 बजे की घटना है। खुर्सीपार वार्ड- 40 निवासी मुकेश सिंह ने शिकायत की है कि उसके पिता राकेश सिंह और मंजू सिंह एक साथ छठ तालाब के पास बैठे थे, जहां अचानक आरोपी करोन्डा और उसकी पत्नी एवं अन्य उसके साथी पहुंचे।

पुरानी रंजिश को लेकर विवाद किया। जब उनका विरोध किया तो जान से मारने की धमकी देते हुए अज्ञात वस्तु से हमला कर दिया। इस हमले में राकेश सिंह को सिर, कान, चेहरा, हाथ-पैर में गंभीर चोट आई है.

पंचायत प्रतिनिधियों को जलवायु परिवर्तन एवं स्वास्थ्य प्रशिक्षण

रायगढ़। ग्राम पंचायत सरायपाली के पंचायत भवन में तीन दिवसीय जलवायु परिवर्तन प्रशिक्षण का आयोजन किया गया था। जिसमें हमारा पर्यावरण, वायु प्रदूषण ,जल प्रदूषण, मिट्टी प्रदूषण, स्वास्थ्य समाज, स्वास्थ्य सेवाएं और शासन की योजनाओं को पंचायत की भूमिका तंबाकू से होने वाले खतरे सड़क दुर्घटना, स्वच्छता एवं पेयजल से बीमारियों का प्रशिक्षण तीन दिवसीय पंचायत के सरपंचों को स्वास्थ्य पंचायत समन्वयक सीमा राजपूत और मितानिन प्रशिक्षण नलिनी यादव द्वारा दिया गया।

इस अवसर पर विधायक प्रतिनिधि कन्हैया लाल सारथी, सराईपाली सरपंच रूकमणी पटेल, हिरी सरपंच शारदा मालाकार, कुम्हारी सरपंच सरिता सिदार, उपसरपंच विजय, जयदेव, एवं पंचगण, माधव पटेल, भोगीलाल, सोधिराम, माल्हू,ललिता, मंजू जयन्ती, लता, सुमित्रा, चैतमती, विलासिनी, दुखीराम, पंचायत सचिव छोटेलाल पटेल, अघनमती, मिलती व पंचगण उपस्थित थे।

जलवायु परिवर्तन एवं स्वास्थ्य पर पंच-सरपंचों की हुई कार्यशाला

कसडोल (वॉच ब्यूरो)। जनपद पंचायत कसडोल के अंतर्गत ग्राम मल्दा के पंचायत भवन में तीन दिवसीय मल्दा मूडपार (म) मड़कड़ा के पंच व सरपंचों की जलवायु परिवर्तन एवं स्वास्थ पर कार्यशाला हुई जिसमें ब्लॉक समन्वयक त्रिवेणी साहू ने बताया की पर्यावरण का मतलब है हमारे आसपास की हवा, जमीन, खेती-बाड़ी, पानी, नदी नाले, जंगल, पेड़ पौधे, जानवर आदि से है। मकान, भवन, सड़के, वाहन आदि भी हमारे पर्यावरण का हिस्सा है। पर्यावरण में बदलाव का मतलब बेमौसम बारिश, बढ़ती गर्मी और सूखा पड़ना, उपजाऊ भूमि बंजर में बदल जाना, समुद्र का जल स्तर लगातार बढ़ना, प्राकृतिक आपदाओं का बढ़ने से है। स्वास्थ पंचायत समन्वयक सती वर्मा बोले: पर्यावरण सुरक्षा को लेकर समुदाय और पंचायत की भूमिका महत्वपूर्ण है। पर्यावरण में परिवर्तन के कई कारण हैं। जिसमें बढ़ती जनसंख्या और उनकी जरूरतें अभी मुख्य कारण है। उन्होंने जलवायु व मिट्टी में प्रदूषण के संबंध में बताया। बताया कि पर्यावरण सुरक्षा में समुदाय और पंचायत की महत्वपूर्ण भूमिका है। उन्होंने सरपंच व पंचों को प्रशिक्षण से जाकर क्या करेंगे विषय पर एक वर्ष की कार योजना बनाई गई।

3

Building Community Capabilities to Mitigate and Respond to Public Health Emergencies due to Climate Change.

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Background

The community members are most vulnerable to impact of climate changes and play a crucial role to mitigate and respond to public health emergencies due to climate change. They serve as the first shield against infectious diseases and other threats. Therefore, they must be equipped with the skills and knowledge needed to perform their responsibilities meticulously. The pilot project aims to strengthen the capacities and capabilities at the community level to prepare for and respond to public health emergencies and disasters. It also intends to create awareness and support for developing a knowledge-sharing platform and tools for climate- related issues. The project is being implemented by the Integrated Disease Surveillance Program (IDSP), Uttarakhand, with support from the National Centre for Disease Control (NCDC), Directorate General of Health Services (Dte.GHS), Ministry of Health and Family Welfare (MoHFW); National Institute of Disaster Management (NIDM), Ministry of Home Affairs (MHA) and U.S. Centers for Disease Control and Prevention (CDC), Country Office, India.

Climate change adversely impacts health by unfolding its social and environmental variables to the window of uncertainty. The fatalities due to the increased frequency of extreme weather events like heatwaves, cold waves, floods, and augmenting zoonotic and food/water/vector-borne diseases are examples of consequences of climate change on public health. Furthermore, many of the socio-economic factors that contribute to good health, such as employment opportunities, equality, access to medical treatment, and social support networks, are being undermined by changing climatic conditions. Climate change is estimated to cause approximately 0.25 million additional deaths per year between 2030-2030 from health-related issues such as malnutrition, malaria, diarrhoea and heat stress1.

Community participation in public health is imperative because the community plays a vital role in the planning process of program development and the successful

implementation of any health intervention because the community is the real sufferer and the first responder to any emergency or threat. Community empowerment is essential to build emergency resilient communities. Speaking of communities, one must recognise the role of Panchayati Raj Institutions (PRIs) as institutions of self-governance and not mere implementors of externally determined development programs2. PRIs comprise of elected members from the community. Their knowledge of the community, its challenges, its practices, its resources, its demography and its strengths is key to formulating community specific development programs One such development project to build emergency resilient communities – 'Public Health Preparedness and Response Capacity Development in a Community setting through Community Emergency Management Team (CEMT) and Community Emergency Response Team (CERT),' is being implemented at Nausar Gram Panchayat, Khatima Block, Udham Singh Nagar, Uttarakhand.

Project Implementation State and District

Uttarakhand is one of the most climate change-vulnerable states in India3. Situated in the Himalayas, the state's geographical area is 53483 sq. km and the terrain and topography of the state are largely hilly, with large areas under snow cover and steep slopes. Uttarakhand State comprises 02 regions, 13 districts, 78 Tehsils, and 95 community development blocks. The districts in Garhwal Region are Uttarkashi, Chamoli, Pauri, Rudraprayag, Tehri, Dehradun & Haridwar and the remaining 06 in Kumaon Region Udham Singh Nagar, Nainital, Almora, Pithoragarh, Champawat & Bageshwar4. The Himalayas are proven to be vulnerable to climate change. Here, the temperatures have increased at a faster rate than the global average. In 2013, the cloud bursts in Uttarakhand and Nepal, in 2015 the heavy rainfall in Jammu and Kashmir are signs of climate change in the Himalayas. Therefore, Uttarakhand is naturally susceptible to the harms of climate change that have a spillover effect on the public health of the state5.

In this context a pilot project, 'Public Health Preparedness and Response Capacity Development in a Community setting through Community Emergency Management Team (CEMT) and Community Emergency Response Team (CERT),' is being implemented at Nausar Gram Panchayat, Khatima Block, Udham Singh Nagar, Uttarakhand.

Nausar Gram Panchayat in Udham Singh Nagar district has a total population of about 4,896. The village has a male population of 2,213 and a female population of 2,683. The literacy rate is 78.9%. The total area of Gram Panchayat is around 2 acres. The types of houses are Kachcha, Pakka, and Semi Pakka and the major religious groups are Hindu, Muslim, Sikh, and Christianity. The gram panchayat shares its boundaries with districts Pilibhit and Bareilly (State- Uttar Pradesh).

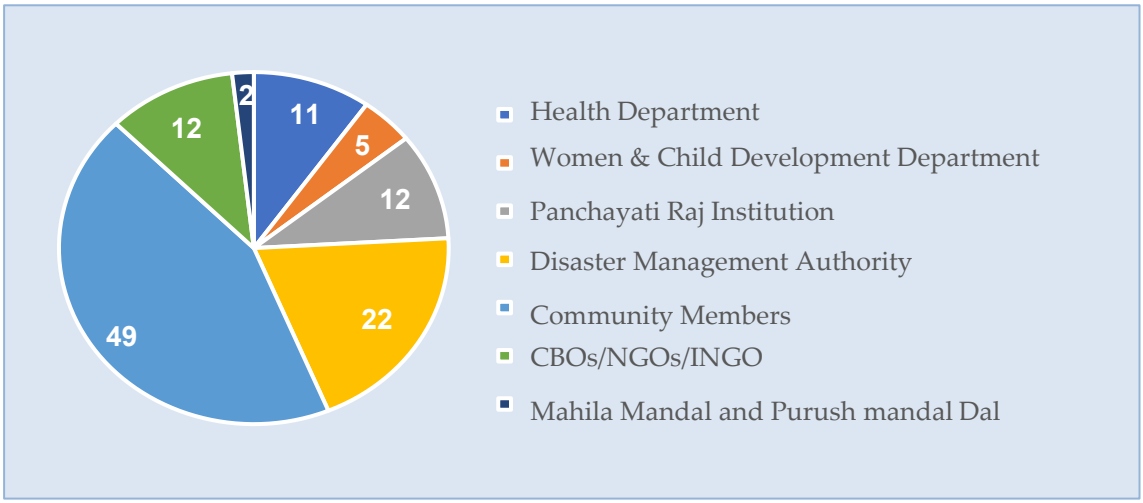
The languages spoken are Hindi, Bhojpuri, and Punjabi; the critical economic activities are labour and agriculture. The mobile communication network is accessible to the entire community. The community is served by one subcentre and five Anganwadi Kendras (Source: Initial assessment tool, EM Team).

The capacity-building activities at the community level were carried out under the project. The details are given below:

1. "Community Training on Flood Preparedness, Risk Reduction, and Response" at Nausar Gram Panchayat, Khatima Block, Udham Singh Nagar, Uttarakhand, from August 01-02, 2022.

The training was conducted to enhance the capacity and capabilities of the local community for preparedness, risk reduction and response to floods and floods-related public health emergencies such as malaria and snake bites.

The training programme benefited about 113 participants (Figure 1), including Gram Secretary, Gram Pradhan, Ward Members, Community Leaders/Influencers, Community Members, ASHA Workers, ANMs, Community Health Officers, Anganwadi, Aapda Mitra, Mahila Mandal, Nehru Yuva Kendra, Nehru Mukti Kendra, local NGOs etc.



Training Programme Participation

2. Capacity building programme on "Impacts of Public Health Emergencies: Preparedness, Mitigation and Response" at Nausar Gram Panchayat, Khatima Block, Udham Singh Nagar, Uttarakhand, December 1, 2022

The local workforce requires knowledge and skills for effective planning, preparedness, and response against public health emergencies and disasters. The programme was conducted to enhance the capacity of the community workers to deal with any public health emergency using a muti-hazard approach. Front Line

Workers were sensitized on pre-requisites and causes of poor health, schemes running under the National Health Mission and social determinants of health. They were also apprised of their roles in implementing preventive measures, preparedness and management of infectious diseases like water-borne diseases (Typhoid, Cholera, Hepatitis, Amebiasis), Respiratory illnesses (Influenza, TB), Vector-borne diseases (Dengue, Malaria, JE) and pandemic like COVID-19. The knowledge of preparedness and response to climate change-related public health emergencies was also imparted.

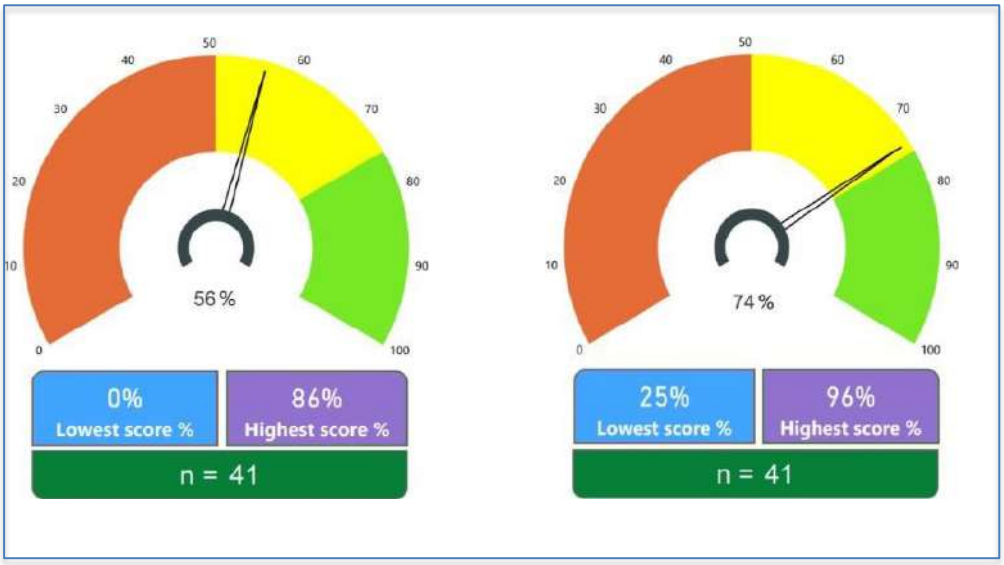
The training programme benefited 41 participants (Table 1), including Gram Pradhan, Ward Members, Community Leaders/Influencers, ASHA Workers, Anganwadi Workers, ANMs, Community Health Officers, Red Cross Volunteers and local NGOs etc. Along with these participants, this training was attended by the representatives of the aligned departments from the District and Block levels.

Table 1: Sector wise number of the participants

Category	Participants Breakdown	No. of Participants
Health Department	LHV	1
	ANM	1
	ASHA workers	3
	ASHA Facilitator	1
	Community Health Officer	1
Women & Child Development Department	Anganwadi Supervisor	1
	Anganwadi workers	5
	Anganwadi Helper	5
Panchayati Raj Institution	Gram Pradhan	1
	Deputy Gram Pradhan	1
	Ward members	6
Self-Help Group (SHG)	Representatives	8
Yukti Yuva Mandal Dal	Representatives	4
Red Cross	Representatives	1
Nehru Yuvak Kendra (NYK)	Representatives	1
Post Office	Post Man (Participated Volunteer)	1
	Total	**41**

Pre and post-training assessment was done using multiple choice questions to elicit the gain from the training. The average post-test score was 74%, with the highest score of 96%, compared to the respective corresponding scores of 56% and 86% in the pre-

test.



Pre-Test results **Post-Test results**

Overall results of pre & post-test

Outcomes

The participants' overall knowledge and awareness level regarding the causes, transmission mode, seasonal spread and preventive aspects of various communicable and non- communicable diseases has increased after training. The CEMT and CERT understood their roles and responsibilities in outbreak management and climate change-related public health emergency (PHE) or disaster. The training gave a clear message to the participants of the essential helpline numbers and authorities to be contacted during a PHE or Disaster and the importance of intersectoral coordination. They also learnt the concept of utilizing available resources at the community level. The long-term impact of the training will also be assessed via an After-Action Review.

Key Learning Points

- The formation and capacity building of CEMT and CERT played a crucial role in accelerating the capacities of the local community in Public Health Emergencies and Climate change. This demonstrated the integration of public health intervention for response at the level of first responders. It highlighted disaster-related (induced by Climate Change) service uptake at the community level and thrusting grass-root level implementation of post-disaster response measures. It necessitated building community capacity by developing CEMT and CERT framework at village level to make community resilient and self-reliant for climate change and public health emergency preparedness and response.

- Involving the local community in reporting and management has long been suggested as a strategy to curb climate change-related events and inculcate a greater sense of ownership among community members.

Linkage to NPCCHH programme strengthening

The project endeavors to enhance the capacity and capabilities at the community level for effective preparedness and response to public health emergencies and disasters and fosters the following objectives of the NPCCHH:

- To create awareness among the general population (vulnerable community), healthcare providers and Policy makers regarding the impacts of climate change on human health.
- To strengthen the capacity of the healthcare system to reduce illnesses/ diseases due to variability in climate

Therefore, it is important coordinating and integrating all activities necessary to build, sustain, and improve a community's capability to prepare for, respond to, and recover from public health threats such as infectious disease outbreaks, natural disasters, and impact of climate change. By building community capacity can respond faster to public health threats and mitigate impact of climate change on health.

Participants' Feedback

"हमारे ग्राम पंचायत में समुदाय स्तर पर इस तरह का प्रशिक्षण पहली बार हो रहा है, जिससे आने-जाने में समय की बचत हुई|"

(This kind of community level training is organized first time in our Gram, so that the time saved in traveling)

Mr. Deepak, Ward Member, Nausar Gram Panchayat, Block Khatima

"हम सभी प्रयास करेंगे की प्रशिक्षण में दी गई जानकारी समुदाय के अन्य सदस्यों को भी साझा करें और जागरूक करे"

(All of us will try to disseminate the acquired knowledge received in training to others and make the community members aware)

Mrs. Sanjeeda, Member, Mahila Mandal Dal, Nausar Gram Panchayat, Blo Khatima

"इस तरह का प्रशिक्षण हमें पहली बार मिला है, यह हम सभी के लिए बहुत महत्वपूर्ण रहा है"

(We have got this kind of training for the first time, it has been very important for all of us)

Egnas John, ASHA, Gram Panchayat, Nausar, Block Khatima

"आज मुझे बहुत प्रसन्नता हो रही है की सभी ग्रामवासियों ने इस प्रशिक्षण में न केवल प्रतिभाग किया बल्कि ध्यान पूर्वक सुनकर ज्ञान भी ग्रहण किया है ! इस तरह के प्रशिक्षण नौसर ग्रामपंचायत में समय समय पर दिए जाये!"

(Today, I am pleased that all the villagers have not only participated in this training but have also listening carefully and acquired valuable knowledge. Such training should be done frequently in the gram panchayat)

Mr. Mahendra Pal Nishad, Gram Panchayat Secretary, Block Khatima

Media coverage

मेरा भारत समाचार

स्वास्थ्य व्यवस्था दुरुस्त करने को लेकर फ्रंटलाइन वर्कर्स को दी जा रही ट्रेनिंग आंगनबाड़ी कार्यकर्ताओं, आशा कार्यकर्ताओं, ग्राम प्रधान, ट्रेनिंग का हिस्सा बने

जनपद उधम सिंह नगर के सीमांत खटीमा के ग्राम नौसर पंचायत भवन में करोना काल जैसी परिस्थितियों में चरमराई सार्वजनिक स्वास्थ्य व्यवस्था से सबक लेते हुए केंद्र सरकार के सहयोग से उत्तराखंड राज्य में आपातकालीन स्वास्थ्य स्थिति में ग्रामीणों को सजग सतर्क करने के उद्देश्य से आशा कार्यकर्ता, आंगनबाड़ी कार्यकर्ता एवं ग्राम प्रधान को फ्रंट लाइन वर्कर्स की भूमिका निभाने के लिए तैयार करने के लिए कराई जा रही है ट्रेनिंग। विगत दो सालों में फैली कोरोना महामारी के कारण पूरे देश में सार्वजनिक स्वास्थ्य व्यवस्था चरमरा गई थी। जिस कारण पूरे देश में सार्वजनिक स्वास्थ्य की आपात स्थितियां पैदा हो गई थी। भविष्य में किसी अन्य महामारी के कारण सार्वजनिक स्वास्थ्य व्यवस्था बदहाल स्थिति में न हो जाए इसके लिए उत्तराखंड राज्य में सार्वजनिक स्वास्थ्य संबंधी आपात स्थितियों के होने वाले प्रभाव व उनकी रोकथाम की तैयारियों के लिए नेशनल हेल्थ मिशन पंचायती राज और नेशनल इंस्टिट्यूट ऑफ डिजास्टर मैनेजमेंट के साथ मिलकर ग्रामीण स्वास्थ्य की रीढ़ आशा कार्यकर्ता, आंगनबाड़ी कार्यकर्ता और स्वास्थ्य विभाग एएनएम को ट्रेनिंग कराई जा रही है।
जनपद उधम सिंह नगर के सीमांत क्षेत्र खटीमा के ग्राम नौसर पंचायत भवन में आज आंगनबाड़ी कार्यकर्ताओं, आशा कार्यकर्ताओं सहित ही एएनएम को नेशनल हेल्थ मिशन व राष्ट्रीय रोग नियंत्रण केंद्र दिल्ली एवं पंचायती राज, आईडीएसपी, उत्तराखंड डिजास्टर मैनेजमेंट अथॉरिटी, नेशनल इंस्टिट्यूट ऑफ डिजास्टर मैनेजमेंट, सेंटर फॉर डिजीज कंट्रोल द्वारा सार्वजनिक स्वास्थ्य आपातकाल और आपदा प्रबंधन की ट्रेनिंग दी गई इस दौरान ग्रामीण भी मौके पर मौजूद रहे। इस ट्रेनिंग के द्वारा आशा कार्यकर्ता, आंगनबाड़ी कार्यकर्ता एवं ग्राम प्रधान को फ्रंट लाइन वर्कर्स की भूमिका निभाने के लिए तैयार किया जा रहा है किसी भी आपातकालीन स्थिति में यह ग्रामीणों को सजग सतर्क कर सकें। वहीं इस कार्यक्रम में डॉ पंकज कुमार सिंह व डॉ राजीव शर्मा के द्वारा बताया गया कि आशा कार्यकर्ता आंगनबाड़ी कार्यकर्ता एवं ग्राम प्रधान, VDO को फ्रंट लाइन वर्कर्स की भूमिका निभाने के लिए तैयार किया जा रहा है किसी भी आपातकालीन स्थिति में यह ग्रामीणों को सजग सतर्क कर सकें। डॉ अमृता गुप्ता ने निक्षय मित्र बनके प्रधान मंत्री TB मुक्त भारत अभियान में प्रतिभाग किया व नौसर गांव के एक मरीज को पौष्टिक आहार भी वितरित किया गया जो कि हर माह वितरित की जाएगी। प्रशिक्षण के दौरान वर्चुअल माध्यम से डॉ पंकज कुमार सिंह राज्य अधिकारी, डॉ हिमांशु चौहान NCDC , डॉ सूर्य प्रकाश NIDM , डॉ राजीव शर्मा CDC, मिस्टर डब्लू चक मच्चिओ US CDC , डॉ रूना गोखले US CDC व डॉ अक्षय धारीवाल वीएचएस सी डी सी ने भी प्रशिक्षण में उपस्थित प्रतिभागियों को संबोधित किया, धर्मेंद्र सिंह कन्याल सहायक VDO, डॉ अमृता गुप्ता रीडीरी इंडिया, डॉक्टर संतोष कुमार पांडे आईडीएसपी उधम सिंह नगर, महेंद्र पाल ग्राम प्रधान, मनोज कुमार वार्ड सदस्य नौसर, पुष्पा मंगल दल, क्षेत्र पंचायत सदस्य उपस्थित रहे।।

आपात स्थिति में बचाव के बताए तरीके

किच्छा। ग्राम नौसर पंचायत भवन में सार्वजनिक स्वास्थ्य संबंधित आपात स्थितियों के प्रभाव व तैयारियों रोकथाम के लिए नेशनल हेल्थ मिशन व राष्ट्रीय रोग नियंत्रण केंद्र एवं पंचायती राज, आईडीएसपी, डिजास्टर मैनेजमेंट अथॉरिटी आदि विभागों ने जानकारी उपलब्ध कराई। कार्यक्रम में डॉ पंकज कुमार सिंह ने बताया कि आंगनबाड़ी कार्यकत्रियों वह आशाओं साथ ही एएनएम भी इस कार्यक्रम में उपस्थित रहे। उन्हें कई जानकारियां दी गईं, जिससे आपातकालीन स्थिति वह रोगों से बचाव हेतु ग्रामीणों को जानकारी दे सकें। आशा, आंगनबाड़ी कार्यकत्रियों एवं ग्राम प्रधानों को फ्रंट लाइन वर्कर्स की भूमिका निभाने के लिए इनको तैयार किया जा रहा है।

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67/NCDC/NPCCHH/2023-24/CapacityBuildingReg
3409021/2023/National Centre for Disease Control

Strengthening Health System Preparedness

4

ARI Surveillance for Climate Action Addressing the Respiratory Illnesses

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Introduction

According to a World Health Organization estimate, acute Respiratory Illness (ARI) is a cause of death globally, causing approximately 19% of all deaths before the age of 5 years. Indoor air pollution from biomass fuels, which is strongly poverty-related, has long been regarded as an important risk factor for ARI morbidity and mortality. Long-term exposure to high concentrations of PM2.5 may increase the risk for acute respiratory problems in small children.

To strengthen the health system, it is vital to be well-connected with all the parameters of health and take action. ARI sentinel surveillance was considered a result of the increasing health burden of respiratory illness, and the increase in deteriorating environmental factors especially air pollution, which adds to poor air quality.

It is essential to have Improved and standardized case management at both primary and tertiary health care. Referral levels include early discrimination of mild and severe ARI by families and PHC workers, supportive measures, and antimicrobial treatment. The involvement of the families and communities becomes the core for improved practices for ARI dealt populations especially the most vulnerable children, geriatric, and pregnant women. Health education of families and community involvement in child-care practices related to ARI and, in particular, strengthening of the ability of mothers and caregivers to recognize early the severe forms of ARI and to provide appropriate supportive care for sick children and elderly.

Detail of Intervention

Immunization against measles, diphtheria, pertussis, and tuberculosis is already part of the Expanded Program on Immunization (EPI) but should combine with the ARI control program, as these diseases contribute heavily to ARI childhood mortality in many developing countries.

National Clean Air Programme (NCAP), launched in 2019, is India's flagship program for better air quality in 122 cities. This review evaluates the scientific, legislative, financial, and institutional framework of the 102 publicly available clean air action plans submitted under NCAP. (7) From the state of Chhattisgarh Raipur, Bhilai and Korba are included in NCAP. Chhattisgarh State National Program of Climate Change and Human Health has identified eight sites for ARI surveillance based on the poor air quality. Eight districts are proposed for ARI surveillance out of which presently seven are considered vulnerable in association with poor air quality, except Sarguja.

Raipur: The capital city of the State of Chhattisgarh is the 7th most polluted city in the world according to the WHO reports of 2016. The city has grown with scant regard for industrial zoning as a result is surrounded by sponge iron factories and brick kilns, with most of these industries and around residential areas.

Korba: A city in Chhattisgarh ranks 5th in the **'critically polluted area'** category according to a study of the Central Pollution Control Board (CPCB) in 2017. The region is a hub of coal mines and power plants. Many coal-based thermal power plants like the National Thermal Power Corporation and Chhattisgarh State Electricity Board among others are located in Korba making it a power hub not only for the State of Chhattisgarh but for North and Central India.

Durg-Bhilla: In Chhattisgarh, Raipur-Durg-Bhilai (RDB) tri-city area hosts the new administrative capital of the state, interconnected by an expressway forming the industrial corridor and is one of the largest steel manufacturing hubs in India. Between 1998 and 2016, the satellite and global model data derived concentrations show a 50% increase in the overall PM2.5 pollution in the region. The ambient source contributions were calculated using WRF-CAMx chemical transport modeling system, highlighting the heavy industries (mostly steel) (23%), followed by transport (including on road dust) (29%), domestic cooking and heating (12%), open waste burning (6%), as the key air pollution sources in the urban area. The city has an estimated 26% of the ambient annual PM2.5 pollution originating outside the urban airshed - this contribution is mostly coming from the coal-fired power plants, large (metal and non-metal processing) industries, and brick kilns located outside the urban airshed and seasonal open biomass fires.

Balodabazar: Balodabazar has been identified for the surveillance of Acute Respiratory Illnesses (ARI) by the Government of India due to the high number of respiratory illnesses cases from the district.

Raigarh: A health assessment of villagers of Tamnar block of Raigarh District by the Indian Council of Medical Research (ICMR) and the National Institute of Research in Tribal health (NIRTH) Jabalpur in 2019 had said:

"Nearby mining activities put the tribal population of Raigarh at increased risk of diseases such as acute respiratory infection (ARI), tuberculosis, road traffic accident (RTA), etc. Apart from environmental health hazards, undernutrition prevalence in the area increases the risk further for various diseases. Kelo river in Tamnar is polluted due to waste disposal from mining activities".

Bilaspur: the continuous poor air quality of Bilaspur with the presence of Sipat thermal power plant and traffic impact the air quality of Raipur. It is also the neighboring district of Janjgir Champa.

Janjgir -Champa: The previous air quality study 2019 indicated Champa as a highly polluted area with three thermal power plants around the city. Coal transportation via road and railways contributes to increasing the coal dust pollution.

Sarguja: Surguja district is a district of the Indian state of Chhattisgarh. The district is one of the oldest districts of Chhattisgarh. The headquarters of the district is Ambikapur. It is a tribal dominated district. It is indeed a mineral deposited district with Bauxite mines.

It is under the National Program of Climate Change and Human Health program the ARI surveillance in which most critically polluted districts are considered namely Raipur, Raigarh, Durg (Bhilllai), Korba, Janjgir-Champa, Bilaspur, Balodabazar and Sarguja.

Purpose: To predict, prepare and respond with integrated coordination between the health systems for Epidemic Outbreaks of ARI, emerging occupational and environmental hazards influenced by poor environmental factors in eight districts of Chhattisgarh.

Materials and Methods: ARI Surveillance is designed for eight districts of Chhattisgarh namely Raipur the capital city, Balodabazar, Durg-Bhillai, Bilaspur, Korba, Raigarh, Janjgir-Champa and Sarguja. The districts are vulnerable to poor air quality, ARI in its first round of activities aims to increase the capacity of health institutions / Medical Colleges to measure, evaluate and manage Acute Respiratory Illnesses. **(A)** Identify new, hidden, and emerging environmental causes of the source of infection, restrict the link, and limit the morbidity, disability, or death. **(B)** Guiding Future Programs of Disease control leading to a) institutionalizing standard protocols of b) digitizing results and ultimate action in real-time.

(C) Building capacities in the different public health Cadres at block, district, and state levels, inadequate numbers, and with composite competencies that are regularly updated. **(D)** Strengthening laboratories, diagnostic tools, and strategies

amalgamated with socio-demographic determinants to provide quality care to the patient.

Operational guidelines of the ARI surveillance identified sites

ARI surveillance is implemented in the eight identified sites within a set of guidelines with the existing human resources and infrastructure. This would require

S.no.	Human Resource	Numbers of staff	Role and responsibility
1	Nodal Officer: Pulmonary specialist only in the absence of the Pulmonary specialist MD Medicine OR MBBS is preferred	1	Supervise the process of surveillance from time to time.
2	Staff Nurses or Paramedics	1	To assist the nodal officer in the process and take the details of the patients diagnosed with COPD/Asthma/Bronchitis/Pneumonia/TB
3	Data entry operator	1	Enter the data required in the given format in Annexure A in the surveillance portal or link provided on monthly basis.

Details of the process

To start the ARI sentinel surveillance at eight sites necessary training on ARI surveillance was given to the district team of ARI Sentinel Surveillance which comprises of medical expert or medical officer/staff nurse and a data entry operator.

The training was conducted in AIIMS Raipur on 23rd August 2022. The training was organized under the Chhattisgarh State National Program of Climate Change and Human Health (CG NPCCHH). Around forty-six (46) participants from twenty-eight (28) districts attended the one-day training. The participants of the training were the ARI team from eight districts and District Nodal Officers from twenty-eight districts.

Dr. Dharmendra Gahwai State Nodal Officer of NPCCHH started the training with an introduction and explained the entire program of NPCCHH to the participants, the need for the program, and the need for ARI sentinel surveillance. The objective of the ARI surveillance was shared with the participants.

ARI surveillance training at AIIMS Raipur

Dr. Ajoy Kumar Behera, Head of Department, Department of Pulmonary Medicine AIIMS Raipur took the one-hour session on Clinal diagnosis and management of ARI disease focusing on COPD/TB/Bronchitis/ Asthma/ Silicosis and Dr. Atul Jindal Associate Professor Department of Paediatrics AIIMS Raipur took a one-hour session on Respiratory illness clinical diagnosis and management among children. Followed by a thorough session of questions and answers by both experts. Along with the format that has been received by the NPCCHH for the surveillance of ARI the state has a format for collecting socio-demographic information.

Outcomes

1. ARI clinics were set up in the District Hospital
2. The respective surveillance has been started.

Long Term outcomes

To improve the data and circulate the advisories accordingly.

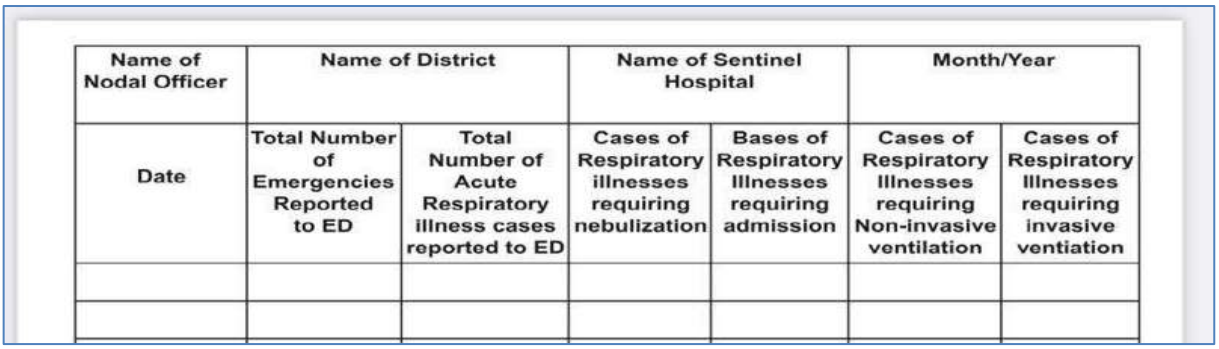
Key Learning Points

1. Data quality can be improved by training the medical officers who make the necessary diagnosis of ARI.
2. Data collected needs to be shared with the authorities from time to time.
3. Advisories need to be circulated during the peak months.
4. Important to generate scientific data for future interventions in and for action plans.

NPCCHH has been the guiding force and facilitating the ARI surveillance from the beginning. The follow-up training is due on 15th to 16th March 2023 to improve the data collection and entry and to bring the mechanism of surveillance as expected.

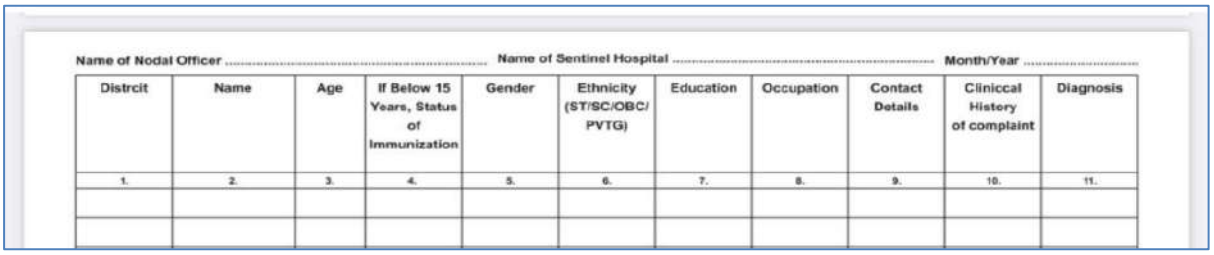
Formats of ARI Surveillance

- *Monthly Reporting Format*



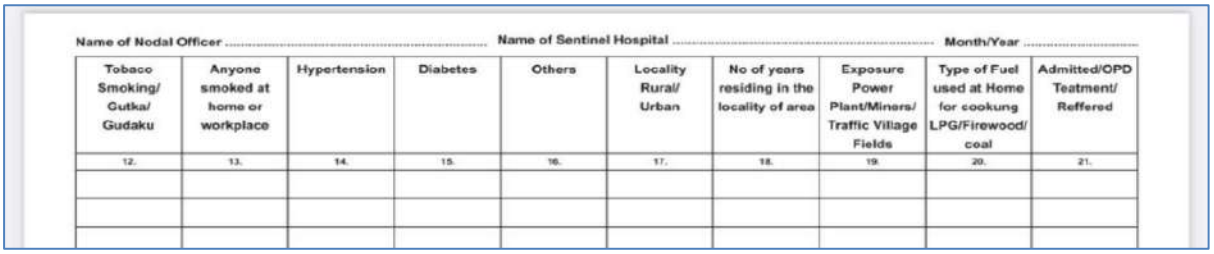
Name of Nodal Officer	Name of District		Name of Sentinel Hospital		Month/Year	
Date	Total Number of Emergencies Reported to ED	Total Number of Acute Respiratory illness cases reported to ED	Cases of Respiratory illnesses requiring nebulization	Bases of Respiratory Illnesses requiring admission	Cases of Respiratory Illnesses requiring Non-invasive ventilation	Cases of Respiratory Illnesses requiring invasive ventiation

- *Social Demographic Details*



Name of Nodal Officer ..... Name of Sentinel Hospital ..... Month/Year .....

Distrcit	Name	Age	If Below 15 Years, Status of Immunization	Gender	Ethnicity (ST/SC/OBC/ PVTG)	Education	Occupation	Contact Details	Clinicca History of complaint	Diagnosis
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.



Name of Nodal Officer ..... Name of Sentinel Hospital ..... Month/Year .....

Tobaco Smoking/ Gutka/ Gudaku	Anyone smoked at home or workplace	Hypertension	Diabetes	Others	Locality Rural/ Urban	No of years residing in the locality of area	Exposure Power Plant/Miners/ Traffic Village Fields	Type of Fuel used at Home for cookung LPG/Firewood/ coal	Admitted/OPD Teatment/ Reffered
12.	13.	14.	15.	16.	17.	18.	19.	20.	21.

5

Response to 2018 Floods at Kodagu District, Karnataka

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Introduction

The Karnataka state has been subjected to several Natural Disasters, especially HydroMeteorological Disasters, with various intensity and magnitude across the state during successive years. The Drought, Flood, Hailstorm are some of the major Hydrometeorological disasters which are often occurring in different parts of the states.

Kodagu and other Malnad and coastal districts were severely affected by floods in the year 2018. The South West monsoon made an early onset on May 29th and covered the whole of Karnataka by 8th June 2018. The onset was powerful with vigorous monsoon activity across the state and the state as a whole recorded an excess rainfall of 93% as on 13th June 2018 and subsequently the monsoon lost its strength especially over North Interior Karnataka.

Further, Kodagu and other Malnad and coastal districts received very heavy rainfall in the range of 700 mm to 1712 mm with the percentage departure from normal ranging from 100 to 722% during 8th to August 19th.

Moreover, heavy rains in the Cauvery catchment during June, July and August 2018 have augmented record inflows, which was the highest in the past 42 years. As a result all reservoirs in Cauvery basin, i.e., Harangi, KRS, Kabini and Hemavathy, attained full reservoir levels in record time (mid-July). The 42 years average annual cumulative inflow into the Reservoirs in Cauvery basin in Karnataka was 318 TMC, but in 2018 by August 28th the cumulative inflow was 450 TMC, i.e., 141% of annual flow which generated in a record time of three months.

Background

The four districts, viz. Kodagu, Hassan, Chikkamagaluru and Shivamogga, where the

Western Ghats runs along the adjoining coastal districts of Karnataka, is popularly called as Malenadu (Hillly Region). The hills of Malenadu are richly forested. Coffee and Arecanut are grown in many places. The table land of Madikeri maintains average latitude of about 1166 m amsl and slopes down a little to reach 910 m amsl near Kushalnagar.

The Topography of the region is sensitive/fragile and vulnerable to landslide. Thus, the district along with its scenic beauty and pleasant climatic conditions is also becoming known for natural hazards. The soils of the district are heterogeneous and consist of lateritic debris found in different stages of weathering and laterization.

Rainfall

It is very important to note that the pre-monsoon rainfall during the month of May 2018 was impressive and unusually higher than the normal. The cumulative rainfall data showed that state received 137 mm of rainfall against the normal of 83 mm with a departure of +64%.

Kodagu District has 105 Telemetric Rain Gauge (TRG) stations covering all the Gram panchayaths in the District. The rainfall records of these TRG stations from 1st June 2018 to 21st Aug, 2018 showed that Heavy Rainfall events (>64.5 mm) have occurred successively in 54 Gram panchayaths in June 2018, 71 Grampanchayaths in July 2018 and about 78 Grampanchayaths in August, 2018 (up to 21st Aug 2018).

Flooding in Kodagu, Karnataka, 2018

Kodagu district received 730 mm of rainfall with a departure of (+) 289 % which is highest in the last 118 years for the period from 8th to 17th August. The Virajpet Taluk received 133% more rains than the normal, followed by Madikeri (84%) and Somwarpet (74%). Incidentally, Madikeri, the district headquarters, recorded its highest ever rainfall of 300mm in a single day on 17th August 2018. Kodagu District as a whole received rainfall of 3224.4 mm as against 1896.7, with a departure of (+) 70 % for the period of 01st June – 24th August 2018 which is considered as under LARGE EXCESS Category.

The effects of Rainfall and over flow of streams and Rivers

Landslides

The landslides in Kodagu have been attributed to several factors such as lithology, structure, slope, morphometry, geomorphology, land use/land cover, drainage density, lineament density, rainfall and soils. However, the following are the specific reasons for the landslides occurred:

1. The Topography of the Kodagu region is sensitive and caused landslide or slope failures affecting the local population.
2. Majority of slopes along the highways pose significant risk dominantly from rainfall induced slope failures.
3. Humans induce mass movement when subjecting a slope to a load that exceeds its ability to resist movement.
4. Heavy rains during monsoon season lead to slope saturation by water, decreased the effective cohesion and generates hydrostatic pressures in the soil profile allowing significant slope failures.
5. Including roadwork with inadequate retaining walls, lack of drainage, clearing of vegetation, and weakening of slopes through unscientific construction of houses.

Inundation & Floods

The pre-monsoon rainfall in May 2018 created havoc in some places in the state. As the SW monsoon entered and progressed over the state, the rainfall intensity and amount continued to be above the normal and occasionally very high in parts of Kodagu district which caused inundation and floods in many parts of the region. The fiercely flowing water carried the debris of the scoped soil / debris from the adjoining hills / slopes inundated and submerged habited areas, caused loss of life and property. Many buildings collapsed or carried away in the flooding water. Agricultural land, coffee estates and other perennial crop areas were all heavily damaged due to floods and inundation for a long time.

Jodupala along Madikeri-Sampaje-Mangaluru National Highway

Consequences of Landslides, Inundation and Floods in Kodagu District

The Floods, in any region, will impact on both individuals & communities, and it will have social, economic and environmental consequences. Overall the consequences of floods are always largely negative.

The immediate impacts of flooding in Kodagu and adjoining districts includes loss of human life, damage to public and private property, destruction of crops, loss of livestock, destruction of natural vegetation (ever green forest cover) and deterioration of health conditions owing to waterborne diseases. As communication links, public infrastructure such as power gridlines, roads and bridges were damaged and / or disrupted most of the economic activities had come to a standstill, people were forced to leave their homes and normal life was disrupted beyond ones imagination. Damages to the infrastructure had serious impacts on supplies of electricity, transport, communication, clean water, wastewater treatment etc. Floods had also affected the services like health care and education in the area. The Loss of livelihoods in and around Kodagu district was such that the community, which was known to be always resourceful and confident, had lost everything and thousands of people had taken shelter in Relief camps.

The community in the Kodagu District is also known for their gallantry and they have been serving in the Armed Forces of India since historical times. The devastating flood in August 2018 had shaken them to a large extent. Floods had traumatized victims and their families. The loss of loved ones had deep impacts, especially on the children. Displacement from one's home, loss of property and disruption to business and social affairs had continuing stress. For some people the psychological impacts were long lasting. As expected the community was fighting back to get back to their life and certainly needed lot of social, moral, psychological and financial support for a very long time. The reconstruction and rehabilitation had to be taken up immediately with a war-footing and to be completed within a stipulated short time frame.

Relief and Response measures of the State Government

Massive rescue operation was launched involving multiple agencies. The team worked in close coordination with district administration. Community and NGOs were also working in close tandem with district administration
Honorable Chief Minister, Honorable Revenue Minister, Chief Secretary and Relief Commissioner were constantly monitoring the situation and providing all necessary support and guidance to the district administration.

- Relief Materials were stocked in transit warehouse established in Mysuru and on need basis transported to Kodagu to prevent dumping of materials. Three warehouses were set in Madikeri, Suntikoppa and Virajpet.
- Relief Management dashboard was developed by Revenue (DM and Bhoomi) where in citizen can request relief items.
- Around 100 jeeps were engaged in distributing grocery kit (food grains, sugar, oil, salt,etc) in villages.
- 300 pourkarmikas, 7 health inspectors, and engineers were deputed to take care of sanitation aspect.
- 1 Barrel of Kerosene was placed in all Grampanchayat to ensure enough fuel to light kerosene lamps
- Electricity was restored by CHESCOM in most of the villages within 5 days.
- Food, warm clothing, medical care, baby feed, bed sheets and other essential items were provided in relief camp. Two doctors with paramedics were posted in every relief camps.
- Hygiene of the relief camp was monitored by health inspectors. Gas geysers were installed in all relief centres to provide hot water. Psychosocial counselling was provided to the inmates of relief camps by trained counsellors.
- Necessary precautions were taken to prevent outbreak of water or vector borne disease (epidemic). Distribution of chlorine/halogen tables, fogging, larval survey were taken up in relief camps and affected area. Clean drinking water was provided in the camps.
- Employment opportunities were provided under MGNREGA to displaced people and will be involved in clearing debris.

Steps taken by Govt for Restoration and Rehabilitation

- Rs.30 crore released to Kodagu district under SDRF for rescue and relief operations.
- Geo-Technical team comprising of experts from GSI (Geological Survey of India), NIRM (National Institute of Rock Mechanics), IISc (Indian Institute of Science), NITK (National Institute of Technology Karnataka) Suratkal will be conducting an comprehensive geo-technical of landslide affected areas. NGRI (National Geophysical Research Institute) has set up a seismic monitoring centre in Novadaya School to closely monitor seismic activity in and around Kodagu.
- Team from Border Road Organization visited landslide affected areas and guided engineers in reconstruction of roads.
- Deputy Commissioner, Kodagu, already identified land for rehabilitation of displaced people.
- Several thousand temporary dwelling units using prefabricated aluminium

were constructed to house displaced people until permanent structure is constructed.

- Issue of duplicate certificates/documents/IDs: UIDAI issued free printouts of Aadhaar no to people who have lost their cards.
- Cash assistance was provided for agriculture workers[1].

Lessons learnt:

1. Floods are most dangerous natural phenomena and are a real threat to the sustainable development of nations.
2. After the 2018 floods in Kodagu district, it was felt need to include disaster preparedness, risk management, and contingency and response capacities according to the lessons of catastrophic floods.
3. Experience in Kodagu district showed that creation and development of effective and steadily functioning systems of hydrological monitoring and early warning systems at a local, regional, and national level as key components of more realistic warnings of flooding threats.
4. Limited available resources are one of the most important problems for both disaster preparedness and disaster response.
5. The example of Kodagu showed that climate change adaptation needs to be achieved through the understanding of vulnerability in all sectors (social, infrastructure, production, and environmental) and this knowledge needs to be used for the formulation of preparedness and response mechanisms.

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6

Public Health Emergency Management in Context of Land Subsidence Attributed to Climate Change in Joshimath, Chamoli, Uttarakhand, January 2023

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Background

In January 2023, the event of land subsidence attributed to climate change was reported in Joshimath area, District Chamoli, Uttarakhand, India. Ensuring health safety and provision of health care services to the residing and displaced population in the affected area was a major concern. Health department is the nodal department for protecting human health. The State Climate Change & Human Health Unit, National Programme for Climate Change & Human Health (NPCCHH), National Health Mission, Directorate of Medical Health & Family Welfare Uttarakhand was the leading agency to take appropriate health interventions.

Landslide hazards rank high among the hydrogeological hazards because they pose a threat to life and livelihood ranging from disruptions of normal activities to widespread loss of life, property and destruction in large parts of mountainous region of India. Himalayan and other hilly regions of India are affected by landslides and landmass movement activities.1 Major parts of the northern states of India namely Jammu & Kashmir, Himachal Pradesh, Uttarakhand and north-eastern states of the country viz. Sikkim, Arunachal Pradesh, Mizoram, Nagaland, Manipur, Meghalaya, Assam and Tripura are vulnerable to landslides due to fragile geology, active tectonics, high relief, critical slopes, intense rainfall as well as anthropogenic activities at various locations of these states.[1]

Joshimath is a town situated in Chamoli District in the state of Uttarakhand. Not only is Joshimath a major tourist centre within the Chamoli district, but it is also the gateway to Badrinath, Auli, and Valley of Flowers etc. Areas of particular focus for tourism are: the main city, Vishnuprayag area, Govindghat, Ghangharia and Hanuman Chatti area[2].

Pictures of Land subsidence - Joshimath, District Chamoli, Uttarakhand, India

The town of Joshimath is also nicknamed as Jyotirmath and is the winter seat of Lord Badri, whose idol is brought down from Badrinath temple to Vasudeva temple at Joshimath. This holy town is revered by the Hindus for being an important pilgrimage center of the country.[3]

Problem statement

The Joshimath area of Chamoli District, Uttarakhand is currently facing land-subsidence due to which cracks are seen in many of houses and buildings. According to the National Oceanic and Atmospheric Administration (NOAA), subsidence is the "sinking of the ground because of underground material movement". It can happen for a host of reasons, man-made or natural, such as the removal of water, oil, or natural resources, along with mining activities. Earthquakes, soil erosion, and soil compaction are also some of the well-known causes of subsidence. Land subsidence is a gradual settling or sudden sinking of the Earth's surface due to removal or displacement of subsurface earth materials.

The District administration is assessing the situation on continue basis. As on 15 March 2023, the cracks have identified in 868 buildings. A total of 771 family members

were displaced from 201 households to a safe place4. The cracks also appeared in the building of Community Health Centre, Joshimath. The raised situation may pose public health challenges like COVID-19, other communicable disease outbreaks and psycho-social problems.

Profile

Joshimath lie in the Great Himalaya physiographic zone and in the Alaknanda basin. This is a mountainous zone consisting of ridges and slopes formed by valleys of Alaknanda River and its tributaries. The topography consists of crests of ridges, falls, springs, rocky knobs, deep valleys with steep gradient formation of rocks. These steep rocks are mostly hard but at some places are soft which makes these areas a landslide prone zone. Joshimath is at an elevation of 1890 metres above sea level[5].

As per the Census India 2011, Joshimath have a population of 16,709 with sex ratios at 673 due to the large proportion of migrant male workers in the population of these towns. At Joshimath, the non-workers are higher at 56% with main workers at 42%. Amongst the working population a majority are engaged in the "others" category whereas cultivators form 14% of the workers in Joshimath. A majority of the population is dependent on tourism to earn their livelihoods[4]. Three of the 7 healthcare centers are sub-centers whereas the rest include 1 CHC and 3 hospitals.

Joshimath is densely populated and though Badrinath is inhabited only for half of the year during the tourist season. Joshimath City is classified as being Extreme Risk with respect to earthquakes. The built-up area in Joshimath is dense and congested in certain parts with many buildings built without earthquake resistance[5]. Flash flooding is assessed as high risk in Joshimath City. Landslides have been assessed as a low-moderate risk hazard in the Joshimath City[4].

Interventions

Due to the climate change related land subsidence disaster in the Joshimath, there may be a risk of transmission and outbreak of various infectious and climate sensitive diseases among the displaced population in the disaster-affected area. Along with this, there may be a possibility of maternal and child health services being affected.

Considering above and to prevent spread of various infectious and climate sensitive diseases in affected area, the State Surveillance Unit, Integrated Disease Surveillance Programme (IDSP) and State Climate Change & Human Health Unit, National Programme for Climate Change & Human Health (NPCCHH), Uttarakhand has developed a detailed public health advisory for the affected area on following key interventions[1]:

1. Provision of Safe drinking water
2. Provision of food safety
3. Hygiene and sanitation
4. Waste management
5. Waste water management
6. Medical and Mental Health Camps
7. Communicable disease surveillance and outbreak management
8. COVID-19 prevention and control
9. Maternal & Child health services and Immunization
10. Vulnerable population

Capacity building and sensitization of the District Health Officials on the public health interventions mentioned in the above said advisory was also conducted on 02.02.2023.

Health professionals and Frontline workers providing health care services in Joshimath, Chamoli, Uttarakhand

In compliance of the above public health advisory, the District Health Department, Chamoli is committed to provide best health care services in the affected area. District Health Department is taking all necessary steps in the Joshimath area for addressing the challenge. Some of the key steps taken by District Health Department are given

below:

- Regular Medical Health camps are being organized in the relief camps for routine health check-up and providing health care services to the displaced population. Routine immunization is being done through medical camps.
- Dedicated Mental health team is deployed for providing psycho-social support and counselling.
- IEC/BCC initiatives are being undertaken to prevent and control the spread of communicable and climate sensitive diseases.
- Community awareness on hygiene and sanitation; proper waste management and food safety measures is being done.
- Health workers are sensitized about case definition and instant reporting of notifiable diseases like Cholera, Dengue, Polio etc.
- Rapid Response Teams are placed to respond any clustering or outbreak.
- Water samples are being tested on regular basis to control the spread of any waterborne disease.
- COVID-19 and other communicable disease surveillance is enhanced in the affected area.
- Special vaccination drives for COVID-19 and routine immunization are ongoing in the relief camps.
- All pregnant women those who are nearing their EDD are being communicated to anticipate any complications that may occur in their delivery.
- Dedicated ambulances are placed in the affected area.
- Surge capacity has been identified in District Hospital.
- All the vulnerable population i.e. dialysis, diabetes , cancer ,heart disease & geriatric population have been demarcated in the affected area and a follow up is being maintained for their well-being.
- Intersectoral coordination with municipality, water board, food safety and disaster management departments are being done.

Other Interventions

- The sensitive families are being temporarily shifted to relief camps at safer places by the State Government and District Administration.
- Construction works has been banned in the area.
- A total of 12 teams of SDRF and 02 teams of NDRF is placed in the Joshimath area for timely response and mitigation.
- In view of the cold wave, bonfires are being lit at a total of 20 places under Joshimath area and room heaters have also been provided for the affected people in the relief camps.
- Nutritional food arrangements are being made in the relief camps.

Details of Process

The public health interventions taken by the State and District Health Department supported the optimal health care service delivery to the community. The challenges are being tackled at the local level. The frontline health care workers are working in full capacity to provide all possible health care services to the community. Regular health check-up and Psychosocial support is being provided to the community. The vulnerable population like children, pregnant women, old aged persons etc. are being taken care for any health complications. The community is also extending their support to the health system. Till date, no outbreak or any other health casualty reported due to the strategic implementation of the public health interventions in the affected area.

Outcomes

Timeframe

The case study is ongoing and shall be completed after the disaster free declaration by District/State Administration.

Short term outcomes-

- No outbreak or clustering of communicable and climate sensitive diseases has been reported till date.
- Health care accessibility to the displaced population.

Long term outcomes-

- Strengthen communicable and climate sensitive disease surveillance.
- Improve health care service delivery.
- Community engagement in public health emergency management.
- Build climate resilient health care system.

Key Learning Points

In emergencies, disasters and other crises, the lives and well-being of the affected population must always be protected, particularly in the minutes and hours immediately following impact or exposure as time is of the essence in saving lives. The ability of health services to be delivered by critical infrastructure such as health facilities without interruption in these situations is a matter of life and death.

For providing uninterruptable and accessible health services to community before, during and immediately following an emergency or disaster, the following key points should be considered:

- Prepare such health infrastructure that can resist exposures and forces from all types of hazards (e.g., retrofitted towards disaster risk reduction)

- Availability of emergency medicine and medical equipment
- Availability of critical services (such as water, food, electricity and medical supplies) that are available to support the delivery of health services
- Prepare a pool of trained health personnel in public health emergency management.

Way Forward

A Community Assessment for Public Health Emergency Response (CASPER) study will be conducted in Joshimath, Chamoli, Uttarakhand by State Climate Change Unit, NPCCHH, Uttarakhand with the support of development partners.

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7

Climate Action Improves Health from Cleaner Air in Ahmedabad, India

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[1]Natural Resources Defense Council (NRDC)

Background

Climate change-driven temperature increases worsen air quality in places where coal combustion powers electricity for air conditioning. Climate solutions that substitute clean and renewable energy in place of polluting coal and promote adaptation to warming through reflective cool roofs can reduce cooling energy demand in buildings, lower power sector carbon emissions, and improve air quality and health.

We investigate the air quality and health co-benefits of climate solutions in Ahmedabad, India—a city where air pollution levels exceed national health-based standards—through an interdisciplinary modeling approach. Using a 2018 baseline, we quantify changes in fine particulate matter (PM2.5) air pollution and all-cause mortality in 2030 from increasing renewable energy use (mitigation) and expanding Ahmedabad's cool roofs heat resilience program (adaptation). We apply local demographic and health data and compare a 2030 mitigation and adaptation (M&A) scenario to a 2030 business-as-usual (BAU) scenario (without climate change response actions), each relative to 2018 pollution levels. We estimate that the 2030 BAU scenario results in an increase of PM2.5 air pollution of 4.13 μg m−3 from 2018 compared to a 0.11 μg m−3 decline from 2018 under the 2030 M&A scenario. Reduced PM2.5 air pollution under 2030 M&A results in 1216–1414 fewer premature all-cause deaths annually compared to 2030 BAU.

Achievement of National Clean Air Programme, National Ambient Air Quality Standards, or World Health Organization annual PM2.5 Air Quality Guideline targets in 2030 results in up to 6510, 9047, or 17 369 fewer annual deaths, respectively, relative to 2030 BAU. This comprehensive modeling method is adaptable to estimate local air quality and health co-benefits in other settings by integrating climate, energy, cooling, land cover, air pollution, and health data.

Our findings demonstrate that city-level climate change response policies can achieve substantial air quality and health co-benefits. Such work can inform public discourse on the near-term health benefits of mitigation and adaptation. These findings are

published in the peer-reviewed scientific journal *Environmental Research: Health* (Limaye *et al* 2023).

This project focused on the municipal (taluka) area of Ahmedabad, a city of about 8.5 million people in Gujarat state in western India (see Figure 1). While the urban area of Gandhinagar is immediately adjacent to the north and the two cities are often considered together, we limited the study to Ahmedabad because of availability of local population, baseline mortality, energy, and air pollution data. With respect to air pollution emissions sources relevant to air quality in Ahmedabad, there are two local thermal coal-fired power plants in the region, both relatively old and both high pollution-emitting sources (see Figure 1); there are six total fossil fuel- fired power plants in Gujarat (Gujarat Electricity Regulatory Commission (Gandhinagar) 2022b, p 147, 2022a, p 39, Joshi *et al* 2022).

As part of a related analysis (Joshi *et al* 2022), we identified major point sources of PM2.5 emissions that provide power to meet Ahmedabad's energy demand and are in close enough proximity to also affect the city's air quality (Ganguly *et al* 2020, Guttikunda and Jawahar 2014, System of Air Quality and Weather Forecasting and Research, Indian Institute of Tropical Meteorology 2017) . The coal-fired Torrent Power Plant (TPP) in the heart of the city on the Sabarmati River was the focus for modeling energy, air quality and health. TPP largely supplies municipal electricity and cooling needs, and TPP's PM2.5 emissions directly impact the city's air quality (Guttikunda and Jawahar 2014). Among the other power plants shown in Figure 1, only the Surat gas-fired plants also supply power to Ahmedabad, but at approximately 200 km distant from the urban core do not appreciably impact city air quality.

The Gandhinagar Power Plant, while nearby, does not supply power to Ahmedabad, is already operating near capacity, and is projected to remain so in the foreseeable future (Joshi *et al* 2022), so its emissions were expected to remain fairly constant by 2030 and were considered as stable inputs to the overall modeling domain (Gujarat Electricity Regulatory Commission (Gandhinagar) 2020). The Wanakbori and Vadodara plants, nearly 100 km distant, also do not supply power for Ahmedabad and thus their emissions are held constant in our analysis (Gujarat Industries Power Company Ltd. 2016, Guttikunda and Jawahar 2014, Gujarat Electricity Regulatory Commission (Gandhinagar) 2020). According to India's Central Electricity Authority, TPP is a "Category A" power plant because of its location within a 10 km radius of a million-plus city (in this case, Ahmedabad); such plants are being prioritized for emissions controls to reduce pollution exposures to nearby population centers (Central Electricity Authority, Ministry of Power (Government of India) 2022).

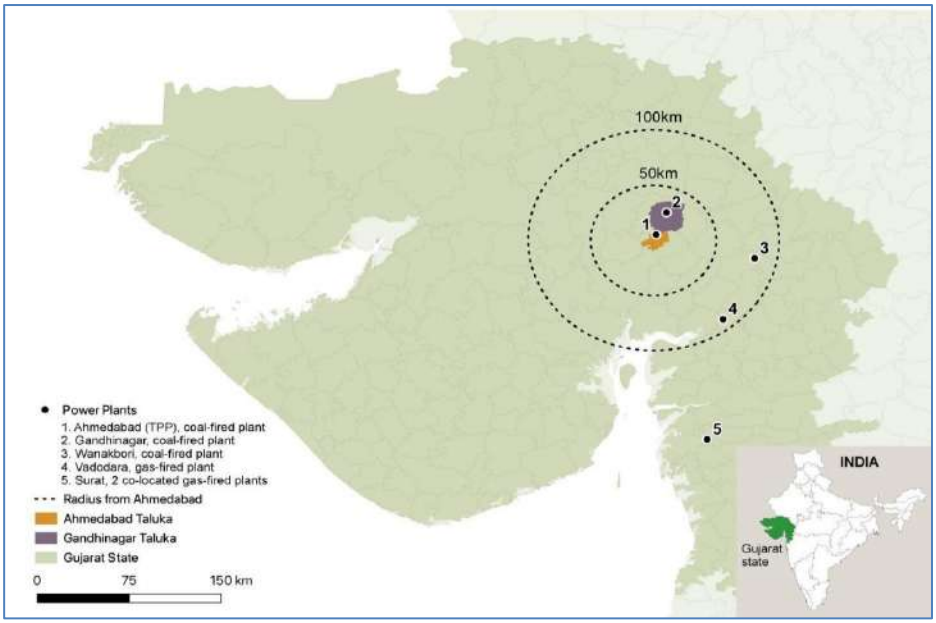

Figure 1: *Map of Ahmedabad study area with inset map of in India and Gujarat state*

The study area map displays the six fossil fuel-fired power plants in

Details of Intervention

- Scale of activity/intervention
- Unit of activity/ intervention (HCF/community/ frontline workers/ panchayat/block/district/state)
- Details of key actions

Climate change, air pollution, and extreme heat are interconnected public health threats: combustion of fossil fuels emits health- harming fine particles as well as carbon pollution that fuels rising temperatures. Extreme heat in India is already associated with significant excess all-cause mortality (Azhar Shah et al., 2014), and climate change is projected to further increase annual average temperatures as much as 4.4 °C (~8 °F) by the 2080s (Sanjay *et al* 2020) relative to the 1976-2005 average. Recent air modeling studies led by Indian researchers indicate that climate warming could worsen PM2.5 pollution across the country (Upadhyay *et al* 2020, Kaur and Pandey 2021).

Air conditioning (A/C) offers an important heat-health adaptation, as recognized in India's Cooling Action Plan (ICAP). Although only 6% of Indian households were estimated to have A/C in 2019 (Romanello *et al* 2021), the ICAP projects nationwide cooling demand to grow eight-fold by 2037-38 compared to 2017- 18 (Ministry of Environment, Forests, and Climate Change (Government of India) 2019) . The ICAP sets forth a comprehensive cross-sectoral plan to address India's growing demand for cooling energy through climate-friendly solutions (Ministry of Environment, Forests,

and Climate Change (Government of India) 2019). In addition to planning for increased cooling needs, the Government of India also launched a National Clean Air Programme (NCAP) in 2019 to provide a roadmap for reducing unhealthy air pollution levels (Ganguly *et al* 2020). The NCAP aims to reduce PM2.5 levels 20-30% by 2024 relative to 2017 levels in 132 cities not yet attaining the annual NAAQS (Central Pollution Control Board, Government of India 2021).

While A/C saves lives, its use can worsen both air pollution and climate change itself, if the energy to meet associated increases in electricity demand is supplied from fossil fuels (Abel *et al* 2018) . India operates 47 coal-fired power plants more than 25 years old, with an average age of 34 years (Global Energy Monitor 2022, Singh and Sharma 2021), including the Torrent Power Plant (TPP) in Ahmedabad. Prior work estimated that in India, air pollution from coal combustion in thermal power plants and industries contributes to 169,000 premature deaths annually (Ganguly *et al* 2020). Electricity use for A/C is becoming more sensitive to rising temperatures (Gupta 2012), with unclear health effects. The city of Ahmedabad has developed coordinated climate resilience strategies to reduce health vulnerabilities from extreme heat and air pollution. Ahmedabad developed and launched South Asia's first heat action plan (HAP) in 2013, an effort integrating heat forecasting with improved municipal governance, health risk communication, and landcover interventions, including reflective cool roofs (Knowlton *et al* 2014, Limaye *et al* 2018, Pingle *et al* 2018). Cool roofs can help to moderate indoor temperatures (adaptation) and save energy from reducing A/C and fan use for cooling (mitigation). In 2017, Ahmedabad launched an Air Information Response (AIR) plan (Limaye *et al* 2018) to establish continuous air quality monitoring and health risk communication.

This project characterizes the current state of local air quality and cooling demand in Ahmedabad, and, for the first time, projects 2030 PM2.5 pollution levels and air pollution effects on all-cause mortality from implementing climate change mitigation and adaptation strategies (compared to a business-as-usual future). To do so, our project team conducted an interdisciplinary analysis spanning climate, energy, air pollution, and health models to estimate future air pollution and health co-benefits at the city level. We configure the Benefits Mapping and Analysis Program-Community Edition (BenMAP-CE) with local air pollution, population, and baseline health data to estimate, for the first time, air quality effects on human health. Because this research is executed using an adaptable modeling framework and designed within the context of the ICAP, NCAP, and India's climate goals, it can help to inform broader city and state actions across India to address climate change and achieve near-term improvements for air quality and public health.

Details of Process

- For health system/ health facility focused case study: how the activity/project supports health facility/system to improve/sustain health care service delivery in view of climate change
- For community focused case study: how the activity/project supports communities to reduce the impacts of climate change on health?
- Mention role of key stakeholders/beneficiary

Conducting an interdisciplinary modeling analysis with local data and expertise, our team estimated the air quality and health co-benefits of potential climate change mitigation and adaptation actions in Ahmedabad by 2030. We explored two main actions implementable at the city level: (1) mitigation of climate pollution through control of emissions from Ahmedabad's coal-fired Torrent Power Plant, a scenario of interest because pollution controls at this plant and others located in urban areas are being prioritized to reduce risks to nearby population centers and (2) adaptation to extreme heat via expansion of cool roofs across the city, an intervention that helps to lower indoor temperatures at the household scale and reduce citywide demand for energy to power A/C.

This project estimated the city-wide air quality and health benefits of those two climate change response actions by the year 2030. Our team linked models (Figure 2) to explore the air quality-related health effects of these responses, with a focus on fine particulate matter (PM2.5), the most dangerous air pollutant regulated under India's NAAQS.

- **Energy policy experts at GERMI** estimated Ahmedabad's electricity demand in 2018 and 2030, considering how demand for air conditioning is expected to rise due to climate warming, population growth, and economic expansion. This team also considered the growth of renewable energy capacity and opportunities to substitute fossil fuel-generated electricity with power provided by solar and wind sources.

- **Climate and air quality scientists at IITM** collected air quality ($PM_{2.5}$) monitoring data for 2018 and modeled air quality for two different 2030 scenarios: (1) a business-as-usual scenario in which Ahmedabad continues to rely heavily on its thermal coal-fired power plant to meet city energy needs and takes no further actions to expand cool roofs (beyond existing 5 percent roof area coverage), and (2) a combined mitigation and adaptation scenario in which the city takes strong climate actions to completely substitute fossil fuel power with renewable energy, a plausible future given the growth of renewable energy capacity in Gujarat, and expands its cool roofs program to cover 20 percent of available building roof area.

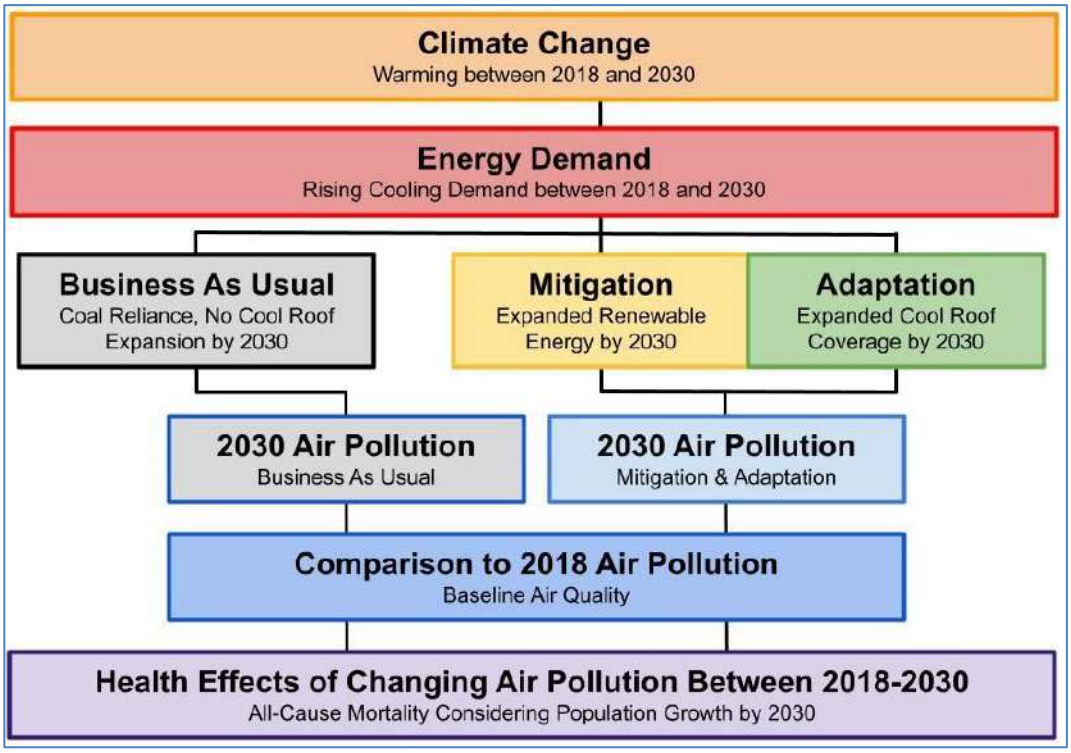

Figure 2: *Flowchart depicting project model integrating projections of climate warming in Ahmedabad (orange box), energy supply and cooling demand modeling (red box), and two 2030 comparison scenarios that shape air quality modeling (business-as-usual, grey box and a combined mitigation and adaptation scenario, yellow and green box). Air quality modeling and monitoring data (boxes with blue outlines) were analyzed using a health impact assessment approach (purple box) to arrive at air quality effects on all-cause mortality in the city in 2030, relative to a 2018 baseline (Credit: Limaye et. al (2023)).*

- **Public health scientists at NRDC and IIPH-G** collected baseline mortality data from the Ahmedabad Municipal Corporation, developed population estimates for 2018 and 2030, and analyzed the different air quality projections provided by IITM to estimate city-wide health effects in 2030 under the business-as-usual scenario and in a future with strong climate action on mitigation and adaptation. Projected health effects in 2030 are relative to a common 2018 air quality baseline.

Outcomes:

- Climate Change and Energy Demand

Our energy analysis shows that demand for energy to provide cooling in Ahmedabad could nearly triple between 2018 and 2030 as the city population increases from 8.5 to 9.3 million and climate warming increases the annual average temperature from 27.6 °C in 2018 to 28.4 °C in 2030. However, renewable energy capacity to supply energy in Gujarat is expected to expand by a factor of five over that period, part of

India's national commitment to provide half the country's energy mix from renewable, non-fossil fuel sources by 2030.

Expansion of cool roofs from 5 to 20 percent of total residential roof area would reduce cooling energy demand by 0.21 Terawatt-hours (TWh) in 2030 from 2018. That energy savings would more than offset the city's climate change-driven 2030 increase in cooling demand from 2018 (0.17 TWh); the reduction in cooling energy demand is equivalent to avoiding 191,000 metric tons of carbon dioxide pollution from a thermal coal-fired power plant, emissions equivalent to 21.5 million gallons of gasoline.

Air Quality

Continuous air monitoring data used in an IITM model show that $PM_{2.5}$ air pollution levels averaged 71.04 $\mu g/m^3$ in 2018. Our air pollution modeling suggests that if the city takes no additional climate actions by 2030 (business-as-usual scenario), local air quality will further deteriorate, as the annual $PM_{2.5}$ pollution level rises to 75.18 $\mu g/m^3$. In contrast, if Ahmedabad executes strong clean energy and cool roofs actions (mitigation and adaptation scenario), annual $PM_{2.5}$ air pollution would slightly decrease (by 0.10 $\mu g/m^3$) from 2018 levels to 70.94 $\mu g/m^3$ in 2030. That level is still well above the national annual $PM_{2.5}$ air pollution limit (NAAQS) of 40 $\mu g/m^3$, but avoiding an increase in air pollution from 2018 to 2030 is a significant outcome, considering anticipated growth in both the city population and cooling energy demand over that period.

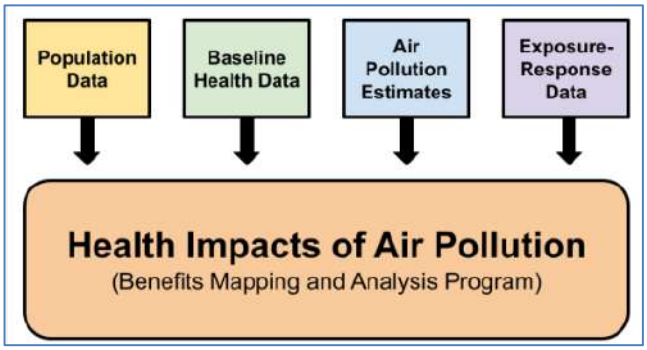

Figure 3: *Data components integrated in Benefits Mapping and Analysis Program Community Edition (BenMAP-CE)*

Health

We combined city population projections for 2030, baseline health data, and air pollution epidemiology evidence with air quality modeling results using the Benefits Mapping and Analysis Program-Community Edition, BenMAP-CE, (Figure 2) to estimate the health effects of PM2.5 air pollution in 2030 under the business-as-usual vs. the combined mitigation and adaptation scenario. Using an established air quality health impact assessment tool, we found that the air quality benefits of mitigation and adaptation actions result in up to 1,414 fewer annual all-cause premature deaths city-wide in 2030, compared to the business-as-usual future (i.e. without any additional steps to reduce fossil fuel reliance or expand cool roofs).

Furthermore, our health modeling for 2030 scenarios also demonstrates that Ahmedabad could achieve even more significant health benefits with even greater ambition to improve air quality. Compared to a business-as-usual 2030, we estimate that the city could avoid up to 6,510, 9,047, or 17,369 premature deaths annually by 2030 if NCAP targets, NAAQS limits, or World Health Organization $PM_{2.5}$ air quality guidelines (WHOAQG) are achieved, respectively (Figure 4).

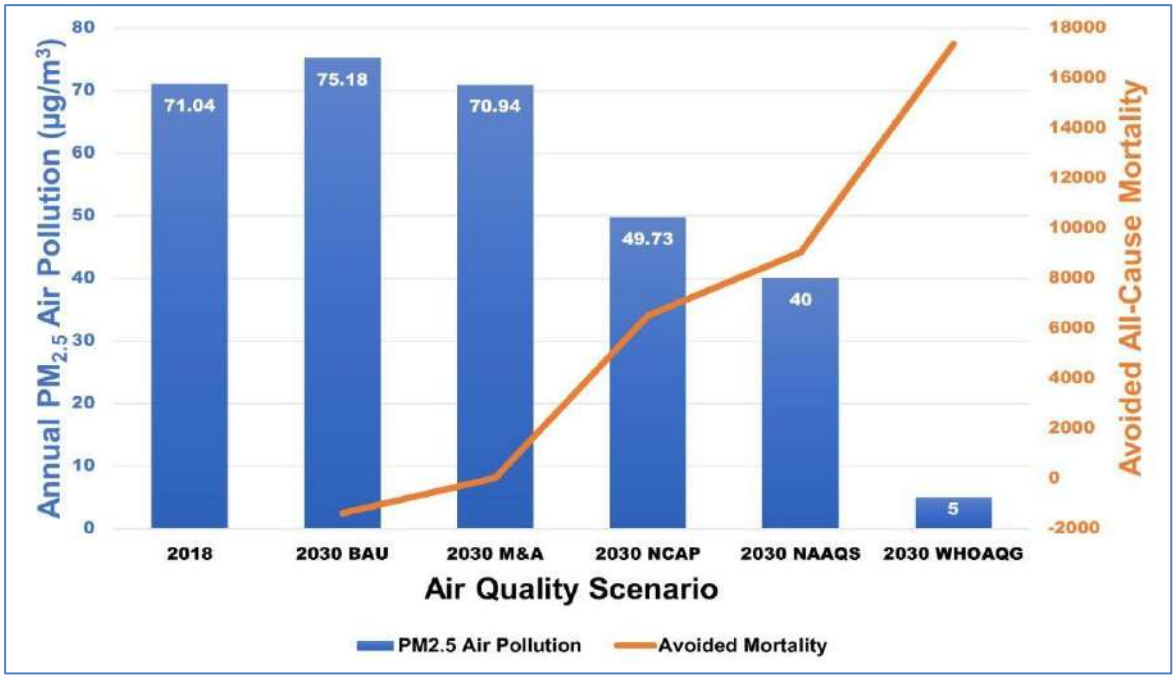

Figure 4: *Key air pollution and health results: BenMAP-CE input air pollution values (blue bars) and health effect estimates (orange line) under 2018 baseline, 2030 business- as-usual (BAU), 2030 mitigation and adaptation (M&A), 2030 NCAP (National Clean Air Programme) attainment, 2030 NAAQS (National Ambient Air Quality Standards) attainment, and 2030 WHOAQG (World Health Organization Air Quality Guideline) attainment. Health effects are for each scenario compared to baseline air quality for 2018. For avoided all-cause mortality, negative values indicate excess deaths in 2030 relative to 2018, positive values indicate avoided deaths in 2030 relative to 2018 (Credit: Limaye et al. 2023).*

Key Learning Points

Because the threats of climate change, extreme heat, and air pollution to public health are intertwined, so are the solutions. This study shows that shifting India even further and faster away from fossil fuels and towards clean energy and stronger heat adaptation through cool roofs can help reduce deadly air pollution, keep people cooler and healthier, and reduce the carbon dioxide pollution that fuels climate change. By incorporating climate, energy, cooling, land cover, air pollution, and local health data, the comprehensive modeling method we deployed is scalable to estimate local air

quality and health co-benefits in diverse situations. Our findings show that city-level climate change response measures can produce significant co-benefits for air quality and health in the near-term.

Our sequence of climate, energy, air quality and health modeling provides a blueprint for future studies to estimate local air quality and health co-benefits of climate change responses in India. Such research can help the public understand how climate action in India can deliver cleaner air. It can also strengthen understanding of health implications of policies in India that affect energy use and air quality, such as the India Cooling Action Plan, India's climate change goals under the United Nations Framework Convention on Climate Change, and further implementation of the National Clean Air Programme. Our findings on avoidable premature deaths from air quality improvements strengthen the health argument for scaling up climate solutions across the country.

Acknowledgement

Our collaborating team included the Indian Institute of Tropical Meteorology (IITM), the Gujarat Energy Research and Management Institute (GERMI), the Public Health Foundation of India/Indian Institute of Public Health-Gandhinagar (IIPH-G), and NRDC:

- Website: https://www.nrdc.org/resources/identifying-health-benefits-addressing-climate-change-ahmedabad-india

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8

Water Sanitation and Hygiene Interventions in Health Care Facilities for Better Health in Aspirational Districts of Chhattisgarh, India

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Background

The availability of safe drinking water, safely managed sanitation, adequate water for cleaning and hygiene maintenance, gender responsive Water, Sanitation and Hygiene (WASH) facilities and services in a sustained manner is a prerequisite for quality care and Infection Prevention and Control (IPC) in Health Care Facilities (HCFs). Sustainable Development Goals include a provision (Goal 6) to "provide universal access to safe drinking water in health centers by 2030." SDG 3 aims to 'ensure healthy lives and promote well-being for all at all ages' and includes a specific target (3.9) to reduce the burden of disease from unsafe water, unsafe sanitation and lack of hygiene. Targets (3.1, 3.2) call for reducing maternal mortality and under-five and neonatal mortality, all of which are directly impacted by WASH conditions in health care settings.[1]

Weak, poor functioning of WASH facilities, services and IPC programs would result in a vicious cycle of widespread infection, antibiotic use and misuse and spread of anti-microbial resistance (AMR). Particularly, an effective WASH and IPC will reduce the spread of hospital acquired infections, including resistant ones. Hence, WASH in HCFs is basic to primary health care, maternal and newborn health, and outbreak response.

As per Sample Registration System 20202, in Chhattisgarh 10.6% of children die within first year in comparison to 9.1 percent in India. Neonatal mortality rate (less than 29 days) is 26 in Chhattisgarh and 20 in India. As per Special Bulletin on Maternal Mortality in India, 2018-20, maternal mortality at 137 per 100000 live births annually in the state (India: 97) is a major contributor of newborn deaths. In Chhattisgarh, 68.8 percent (India: 71.9%) of the Infant Mortality Rate (IMR) (SRS Statistical report 2020) is due to neonatal mortality. Potential Health Care Associated Infections (HCAIs) are directly associated with poor WASH in health care facilities. Delivery rooms require tailored WASH services to ensure a safe and dignified delivery and minimize the risks of infections including sepsis, a leading cause of both maternal and neonatal mortality[1].

In this context, UNICEF India, Chhattisgarh office prioritized its WASH in health intervention in three remote tribal, conflict affected, hard to reach, aspirational districts: Bijapur, Dantewada and Sukma of Chhattisgarh, a state located in central India.

Details of Intervention and processes

In 2022, several activities were undertaken with the collaboration of UNICEF and District administration. Hand holding support on improving WASH in Health was provided by UNICEF Chhattisgarh. This specific intervention involved 53 HCFs: three District Hospitals (DH), 38 Community Health Centres (CHCs) and 12 Primary Health Centres (PHCs) in three districts.

Activities undertaken includes a) assessment of healthcare facilities on WASH indicators and preparation of costed improvement plans b) knowledge and skill enhancement of health service providers c) promotion of inclusive WASH services in HCFs with special focus to gender responsiveness in provisioning infrastructure d) advocacy for climate resilient (HCFs) e) health system strengthening f) knowledge management and evidence generation.

Healthcare facilities Assessment and Improvement Plan Preparation:

An assessment tool relating to WASH indicators was developed in line with the national initiatives viz. Kayakalp, Swachh Swasth Sarvatra (SSS), National Quality Assurance Standards (NQAS) and existing global tool, WASH FIT on water sanitation for health facilities improvement. The assessment tool consists of 76 questions under seven sections: a) General infrastructure and basic services, b) Water, c) Sanitation, d) Hand Hygiene, e) Cleanliness, f) Biomedical waste management, g) Climate resilient HCFs was developed and vetted with district health officials. Approx. 150 Block Medical Officers (BMO), Medical Officers (MOs), Registered Medical Assistance (RMA) and staff nurse were oriented on the tool for assessment of

Demonstration of PPE kit at Dantewada

their respective HCFs.

Objective was to develop the skill of health service providers and managers to conduct the self-assessment periodically. Further, do the needful on identified gaps for improving quality care and to meet the Kayakalp criteria.

Training on hand hygiene to health staff at Sukma

Knowledge and skill enhancement of health service providers

Capacity building of managers, health service providers, and housekeeping staffs was one of the important interventions. Stakeholder mapping and training need assessment was the initial activity conducted based on the gap identified and interaction with key health service providers. Training materials were developed focusing Bio Medical Waste (BMW) management, IPC, WASH related indicators in Kayakalp checklist, etc. Face to face trainings organized in collaboration with district health society for district, block and facility level health care service providers.

Hand washing with water and soap at critical times were promoted in general with patients, care takers and health staffs. Five moments of handwashing practices by health staffs were promoted and monitored by medical officers to ensure IPC.

Promotion of gender responsive and People with Disability friendly WASH infrastructure in Health Care Facilities

There was an effort to ensure participation of all female staffs in the training programs.

Hand hygiene promotion by nursing staff at Bijapur

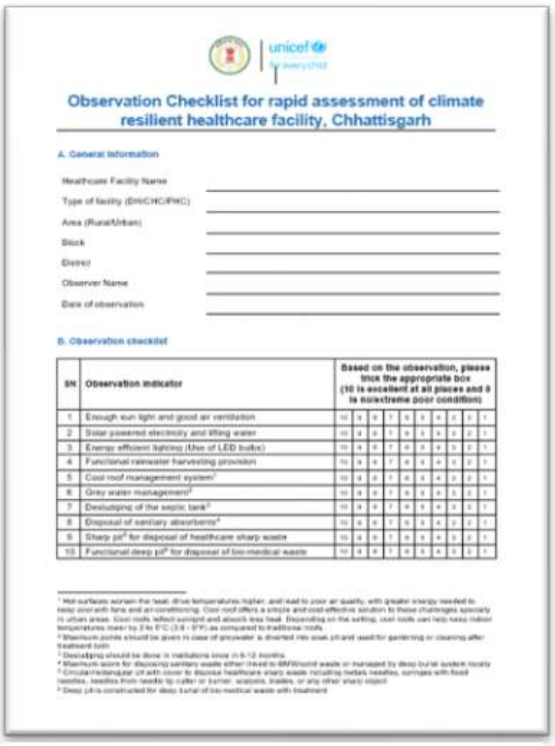
Each training program had a session on gender responsive WASH facilities and services in HCFs. Major gender inclusive points advocated and discussed in training programs were on infrastructure meeting specific gender needs: gender segregated toilets, western toilet in labor room with running water, clean

breastfeeding corner with privacy, availability of sanitary absorbent at healthcare facility and safe disposal of used sanitary absorbents. Considering the number of hours spent by female health care workers in health centres, it was advocated to ensure separate gender segregated toilet facilities for women staffs in health centres emphasizing on menstrual hygiene management system at place.

Access of people with disability to health centre and toilet facilities were advocated for ensuring provisions like ramp to approach HCFs, wheelchair in the entrance and separate one for toilet. Further to have grab bar inside toilet for comforting access of PWD patients in health centres.

Advocacy for Climate Resilient Health Care Facilities

Climate-resilient and environmentally sustainable health care facilities contribute to high quality of care and accessibility of services, and by helping reduce facility costs also ensure better affordability. They are, therefore, an important component of universal health coverage (UHC)4. Thus, there was at attempt to include basic WASH indicators for climate resilient clean and green HCFs in the assessment tools. Six of 74 indicators of WASH assessment tool for HCFs were on climate resilient and environmentally sustainable: a) water conservation provision, b) functional rainwater harvesting provision c) safely managed gray water with provisioning of soak pits d) use of treated gray water in gardening or other purposes e) dedicated person to monitor wastewater management f) management of biodegradable and recyclable waste. Based on the gaps, strategy has been prepared and training for the healthcare service providers (Medical Officer, Rural Medical Assistance, staff nurse, and housekeeping staff) has been conducted on clean and green, climate resilient HCFs.Further, an observation checklist for rapid assessment of climate resilient HCFs with 10 indicators on climate, energy and water has been developed to be piloted for basic understanding on the status of HCFs.


Observation Checklist for rapid assessment of climate resilient healthcare facility, Chhattisgarh

A. General Information

Healthcare Facility Name
Type of facility (DH/CHC/PHC)
Area (Rural/Urban)
Block
District
Observer Name
Date of observation

B. Observation checklist

SN	Observation indicator	Based on the observation, please tick the appropriate box (10 is excellent at all places and 0 is extremely poor condition)
1	Enough sun light and good air ventilation	
2	Solar powered electricity and lifting water	
3	Energy efficient lighting (Use of LED bulbs)	
4	Functional rainwater harvesting provision	
5	Cool roof management system[2]	
6	Gray water management[3]	
7	Desludging of the septic tank[4]	
8	Disposal of sanitary absorbents[5]	
9	Sharp pit[6] for disposal of healthcare sharp waste	
10	Functional deep pit[7] for disposal of bio-medical waste	

[2] Hot surfaces worsen the heat, drive temperatures higher, and lead to poor air quality, with greater energy needed to keep cool with fans and air-conditioning. Cool roof offers a simple and cost-effective solution to these challenges specially in urban areas. Cool roofs reflect sunlight and absorb less heat. Depending on the setting, cool roofs can help keep indoor temperatures lower by 3 to 5°C (3.6 - 9°F) as compared to traditional roofs.

[3] Maximum points should be given in case of greywater is diverted into soak pit and used for gardening or cleaning after treatment both

[4] Desludging should be done in institutions once in 6-12 months

[5] Maximum score for disposing sanitary waste either mixed in MWI/solid waste or managed by deep burial system society

[6] Circular/rectangular pit with cover to dispose healthcare sharp waste including metals needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, or any other sharp object

[7] Deep pit is constructed for deep burial of bio-medical waste with treatment

Health system strengthening: Investment in infrastructure, supplies, information dissemination, staffs, funds, over all guidance, etc. on preventive health interventions like WASH plays an importantrole in health system strengthening. Strengthening

health systems relating WASH-CCES (Climate Change and Environmental Sustainability) means addressing key constraints in each of these areas. So, technical support was given directly by UNICEF staff members, state consultants and implementing partner's staffs in these three districts.

UNICEF supported four district facilitators through a partnership with local Civil Society Organisation (CSO) Samya Bhoomi Foundation to provide hand holding support at health care facility level in three districts for a period of six months. Periodic visits to HCFs, orientation of staffs and constant sharing of status with senior district officials were part of system strengthening process. Self-assessment of HCFs were encouraged to be done by respective health officials after giving training on WASH in Health assessment tool. 34 HCFs were self-assessed by BMOs and MOs in June 2022. Advocacy was done on additional finance mobilization through dovetailing of funds from other WASH programs by allied departments, Corporate Social Responsibility (CSR) funds, District Mineral Funds (DMF) etc.

Outreach activities by Health care staff during Swachhta Pakhwada at Bijapur

Convergence meetings of Health and Family Welfare Department and public health engineering department (PHED) were organized for ensuring safe piped water connection to HCFs under Jal Jeevan Mission and ensuring periodic water quality testing (both bacteriological and chemical) in district or sub divisional laboratory of PHED. UNICEF, WHO and district administration jointly conducted training program for district and block level health officials at Dantewada district.

In the entire process Chief Medical Health Officer (CMHO), Civil Surgeon (CS) of District Hospital, District Program Managers (DPM) at district level, Block Medical Officers (BMO) at block level, Medical Officers (MO), Rural Medical Assistance (RMA), Staff Nurse (SN), ward boy and housekeeping staff at facility level, patient and their care takers were the key stakeholders in the entire intervention. Support and monitoring by District Collector of respective districts was vital to achieve the results.

Progress and Reports

Capacity Enhancement: Approximately, 450 health care service providers including ward boy and housekeeping staff were trained in three districts on WASH in Health program with special focus to Bio Medical waste Management (BMW), Infection Prevention and Control (IPC) protocols, preparing HCFs for Kayakalp award, gender segregation and disposal. Dr. Vikas Gavel, Block Medical Officer, Usoor, district Bijapur mentioned, "the training of WASH in HCF assessment tool and improvement plan preparation based on the gaps identified held in collaboration with UNICEF helped us in planning and improving the WASH responsive and clean and green climate resilient HCF.

Approx. 200 nursing and housekeeping staffs were trained at facility level for preparation of bleaching solutions to cater different needs such as cleaning of HCFs (labor table, OT table, wall and floor mopping, etc.), instrument cleaning and treatment of left-over sample at laboratories. In addition, training included cleaning protocols such as, unidirectional cleaning, preparation, and usage of spill management kit, doffing and donning of Personal Protective Equipment (PPE), hand hygiene (practices, procedure and five moments) and hands on training on BMW indicators in HCFs. WASH indicators like installation of western toilets in the labor room, gender-segregated toilets at required areas, ensured elbow taps for each handwashing facilities, and clean green components like developing herbal and natural plantation in premises has been created in six HCFs (CHC: 1, PHC: 4 and Sub Health Centre: 1) of Usoor block."

Assessment and Planning: 53 Health Care Facilities assessment was done covering all DH, CHCs and PHCs of three districts. 53 costed improvement plan was prepared based on the gaps identifies in the assessment report. Mr. Girdhar Lal Deshlahre, RMA PHC Awapalli of Bijapur district says "Self-Assessment exercise of WASH indicators in Awapalli PHC made us realized about the gaps in water sanitation hygiene provision in the facility. This drives us in improving various indicators under broad category of safely managed gender segregated toilet, corrections in providing safe treated drinking water, hand hygiene promotion at 5 moments, waste management, climate resilience in Awapalli PHC. Fund was mobilized from Jeevan Deep Samity (JDS) and the Ayushman Bharat card. These WASH interventions helped PHC in achieving 90 Percent in external assessment of Kayakalp in 2022-23".

System strengthening and implementation: 81 handwashing stations installed in vaccination centres (NRCs, HCFs and Schools) of Sukma and Dantewada districts with UNICEF funding. Office order was issued by CMHO, Sukma district for construct sharp pit and deep pit for proper disposal of BMW. Alternative financing was mobilized by few health officials at district and local level. Improvement noticed

in several facilities in modifying normal tap to elbow taps, installation of handwashing stations on required places (specially OPD, labour room, toilets, etc.), gender segregated toilets, western toilet in labour room, adoption of three bucket system for cleaning, water harvesting structures, plantation under clean and green initiatives. 16 HCFs in UNICEF supported districts (Bijapur: 9, Dantewada 3, Sukma: 4) have been selected for external assessment of Kayakal award 2022 (a national level competition). Some key knowledge products were rolled out in three districts.

Key Learning Points

Some key learnings as follow.

- Improving preventive components of healthcare services requires sustained efforts in capacity building, refresher trainings, periodic visits by key stakeholders to health care facilities for assessing WASH-CCES indicators, regular monitoring by senior officials, recognizing and motivating better performing staffs at facility level.
- An uninterrupted, adequate supplies of housekeeping and hygiene stuffs viz. mops, cleaning solutions (Floor, wall, equipment, instrument), liquid soap and alcohol-based hand rub, BMW liners and gloves is essential to keep the facilities clean and hygienic. Therefore, buffer stock of housekeeping and hygiene stuffs should be maintained at facility level to avoid stock-outs.
- Tracking of WASH indicators with focus on IPC in the Identified HCFs where maternal and neonatal deaths are higher would help in improving quality health care services resulting reduction of hospital acquired infection.
- An evidence-based tracking of patients for hospital-acquired infections (discharge and referral of patients after 48 hours of stay) can be done to identify hygiene related issues in any HCFs.

Linkage to NPCCHH programme strengthening: NPCCHH recognizes the importance of addressing challenges relating to WASH facilities and services in HCFs. It emphasizes the need for sustainable water management practices, improved sanitation facilities, proper waste management and better hygiene behaviors to reduce the risk of waterborne diseases and other health impacts.

Adoption of hygiene practices, the use of sustainable water sources such as rainwater harvesting, groundwater recharge, availability of safe drinking water, and promotion of safely managed sanitation covering entire value chain - toilet installation to safe disposal of human excreta, solid waste management facilities to reduce the risk of water contamination and associated health impacts are covered under NPCCHH.
UNICEF Chhattisgarh WASH in HCFs intervention factored key WASH intervention given in NPCCHH guidelines.

Resources and Publications

Social media links relating to case study:

1. 19 Oct 2022 Training on BMW and Hand hygiene of health staffs at Bijapur district: https://twitter.com/birajakabi/status/1582743271037489153?s=20
2. 15 Oct 2022 on Observation of handwashing day with health staffs at Sukma https://twitter.com/birajakabi/status/1581341425639510016s=20
3. 22 July 2022 on WASH- CCES and IPC training at Dantewada district https://twitter.com/birajakabi/status/1550508391336136704?s=20
4. 5 April 2022 on Swachta Pakhwada Activities by Health care providers at Dantewada district https://twitter.com/birajakabi/status/1511163254457835523?s=20
5. 24 March 2022 on hand holding support on IPC at Bijapur district https://twitter.com/birajakabi/status/1506962242910429192?s=20
6. 23 March 2022 orientation on WASH in Health at Bijapur district https://twitter.com/birajakabi/status/1506649571564601347?s=20
7. 9 March 2022 visit to HCFs and meeting with health officials at Bijapur district https://twitter.com/birajakabi/status/1501569119803437061?s=20

Note: Authors supported district administration and implementing partner in planning, capacity building and roll out of WASH in Health program in three UNICEF supported districts.

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9

Public Health Preparedness for Respiratory Emergencies in Raipur and Korba District, Chhattisgarh

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Background

A total of fifty-six public health facilities were surveyed in this study, out of which 31 were from Raipur and 25 from Korba Districts of Chhattisgarh. Out of the 56 facilities, three were tertiary care centers i.e., one medical College and two district hospitals, the remaining fifty-three (53) were Urban and Rural Community Health Centers, Primary Health Centers, and Urban Primary Health centers.

The shortage of hospital beds and oxygen and the subsequent loss of lives during the deadly second wave of COVID-19 in India exposed the weakness of the country's health systems. Learning from this episode and seeing the link between the health impacts of air pollution and COVID vulnerability of the populations, the State Health Resource Centre, Chhattisgarh, began a process of assessment of the health infrastructure preparedness for air pollution vulnerability in the State. The need to draw patients to public health care facilities with to reduce out-of-pocket expenses and provide quality care to the patients living in the most vulnerable areas of air pollution. To complement the usage of the respiratory drugs available at the CHC and PHC levels, it is indeed necessary to have qualified health professionals preferably MD Medicine at the health centers. Though these postings may be a challenge for the health department perhaps due to the remoteness of the regions. It is important that adequate training is provided to the existing health staff to handle patients affected by air pollution.

Vulnerability profile

Among COVID-19 patients, relatively greater proportions of patients with COPD received mechanical ventilation and intensive critical care. COPD is an independent risk factor for all-cause mortality in COVID-19 patients in Korea (16). Attention to local action is necessary for communities where there are hazards that make the population

more vulnerable to impacts of pollution resulting from man-made disasters, industrialization, unplanned development, fossil fuel-based activities, etc. Chhattisgarh is a state with rich natural resources, serves the entire nation with more than 17% of the coal reserves and about 15% of the steel production. Due to rapid industrialization and the shifting needs of the state, there is a need to assess the vulnerabilities and be prepared for the state to manage and mitigate the needs of the pollution-impacted communities.

Korba, a city in Chhattisgarh ranks 5th in the 'critically polluted area' category according to a study by Central Pollution Control Board (CPCB) in 2017. The region is a hub of coal mines and power plants. Many coal-based thermal power plants like the National Thermal Power Corporation and Chhattisgarh State Electricity Board among others are located in Korba making it a power hub not only for the State of Chhattisgarh but for North and Central India. Raipur the capital city of the State of Chhattisgarh is the 7th most polluted city in the world according to the WHO reports of 2016. The city has grown with scant regard for industrial zoning as a result is surrounded by sponge iron factories and brick kilns, with most of these industries in a residential area. Both Korba and Raipur have also been listed in the 122 non-attainment cities by Central Pollution Control Board under the National Clean Air Program (NCAP).

The mitigation measures to air pollution at the hospital/ health center level play an important role in addressing the impact of air pollution on health. The health sector needs to be equipped with adequate resources in terms of manpower, diagnostic tools, availability of drugs, etc. to manage the higher patient load at times of air pollution-related emergencies.

Therefore, it becomes crucial to know the level of preparedness of the healthcare facilities to respond to any air pollution-related events. This knowledge will also help the policymakers frame policies that help mitigate the air pollution-related health crisis and build a resilient healthcare system.

The following are some of the possible negative health effects or health challenges associated with inhalable coal dust:

Respiratory Effect	Contaminants from coal combustion include particulate matter (PM), sulfur dioxide (SO2), and nitrogen oxides such as NO2, which cause harm to the airways and lungs by cell damage caused by oxidizing molecules in pollutants. Inflammation, cytotoxicity, and cell death result as a result of this.

Cardiovascular Effect	The cardiovascular effect of coal-fired power plants is largely due to particulate matter emissions, which contribute to the global burden of cardiovascular disease. Particles with a diameter of fewer than 2.5 microns (PM2.5) have been related to cardiovascular disease and death. Cardiovascular injury is caused by the same mechanism as respiratory injury: oxidative stress caused by oxidizing molecules in toxins causes inflammation and cytotoxicity. Adverse effects of inhalable coal dust. Possible adverse health effects associated with inhalable coal dust include: Extra thoracic Region: Nasal Cancer, Sinusitis, Buccal, and lip cancer Pharyngeal and laryngeal cancer, Gastric Cancer, (Throat and Eye Irritation) Tracheobronchial Region: Chronic bronchitis, Chronic obstructive airways disease and loss of FEV1b, Alveolar Region, Coal Workers Pneumoconiosis (CWP), Silicosis, Emphysema Tuberculosis, Caplan's Syndrome. (1)
Asthma	Asthma is a long-term condition affecting children and adults. The air passages in the lungs become narrow due to inflammation and tightening of the muscles around the small airways. This causes asthma symptoms: cough, wheeze, shortness of breath, and chest are also thought to increase the risk of asthma, including indoor tightness. Apart from many one of the factor's triggering asthma is exposure to a range of environmental allergens and irritants that and outdoor air pollution, house dust mites, molds, and occupational exposure to chemicals, fumes, or dust. (2) Asthma is not a curable condition, but management techniques focus on keeping the disease under control and lowering the associated morbidity and mortality. To effectively treat asthma, it may be necessary to consider not only guideline-based clinical approaches but also socio-environmental risk factors. To manage the disease in developing countries, all hospitals must provide sufficient public health facilities and services, as well as have standard treatment.(3)

Economic challenges of Air Pollution:

In India, economic losses resulting from premature deaths and morbidity due to air pollution totaled US$288 billion (214–374) and $80 billion (59–103), respectively, in 2019. This cumulative loss of $368 billion (274%–477% of India's GDP) amounted to

136 percent of the country's GDP (GDP). The economic loss as a percentage of state GDP varied 32 times between states, ranging from 067 percent (047–091 percent) to 215 percent (160–277 percent), with the lowest per-capita GDP states of Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh, and Chhattisgarh suffering the most. In 2019, Delhi had the highest per-capita economic loss from air pollution, followed by Haryana, with a 54-fold difference across all states. (4) Additional health effects from coal-based pollution were quantified in the report, including a high number of heart attacks, emergency room visits, hospital admissions, and missed workdays. The study estimates that the monetary cost of these health consequences is between Rs. 16,000 and Rs. 23,000 crores per year. (5)

Intervention:

Chhattisgarh is a state with rich natural resources and serves the entire nation with more than 17% of the coal reserves and about 15% of the steel production. With more than 156 mineral-based industries in the state, Chhattisgarh is also one of the worst affected due to air pollution. Air pollution is a public health emergency, according to the World Health Organization, every day around 93% of the world's children under the age of 15 years (1.8 billion children) breathe air that is so polluted it puts their health and development at serious risk. Health workers from the pollution-impacted communities in Chhattisgarh report that they see more and more cases of premature births, low birth weights, and stillbirths in their communities, something that was unheard of a few years ago.

The mitigation measures to air pollution at the hospital/ health center level play an important role in addressing the impact of air pollution on health. The health sector needs to be equipped with adequate resources in terms of manpower, diagnostic tools, availability of drugs, etc. to manage the higher patient load at times of air pollution-related emergencies. Therefore, it becomes crucial to know the level of preparedness of the healthcare facilities to respond to any air pollution-related events. This knowledge will also help the policymakers frame policies that help mitigate the air pollution-related health crisis and build a resilient healthcare system.

Action taken:

1. Shared the study report with higher government authorities – Principle Secretary, MD NHM, State Nodal Officer Climate Change and Human Health, CMHO's Korba and Raipur District.

2. The recommendation of capacity building was considered in the PIP by the State

Environmental Heath Cell

3. Community sensitization was encouraged and strengthened through air quality monitoring by mitanins on air pollution.
4. Mitanins were identifying the patients with respiratory illnesses and started educating the community members and referring them to Public health facilities. Especially in the case of Asthma.
5. Proposal for ARI surveillance in eight vulnerable districts was initiated.

Progress and Reports

The cross-sectional assessment of the public health facility was conducted in the Raipur and Korba Districts of Chhattisgarh. As per convenience, two districts have been chosen: Raipur and Korba. (The cities have thermal power plants, so the likelihood of respiratory illnesses is inevitably higher.) The data was collected over 3 months from March 2021 to May 2021. List of public health facilities (Urban and Rural) from selected districts are drawn from health. nic. in [website under Department of Health & Family Welfare, Govt of Chhattisgarh]. Data was collected from Dr. B.R.Ambedkar Medical College and hospital; District hospitals (2), Community Health center Six (6). Primary Health Center (47) was randomly selected. Data was collected in a pre-framed semi-structured questionnaire with 65 questions capturing information related to human resource availability, capacity building, equipment availability, drug availability, referral and follow-up, and awareness of emergency helplines after the pilot testing of the questionnaire. Data was collected in Kobo collect the application – Kobo collects an Android-based Mobile Application tool to collect Answers with a GPS location tracker from the respondents. The data collected were compiled and analyzed in STATA and Microsoft Excel 2013. Descriptive analysis was done and proportions were identified for the study variables.

Findings

The assessment found major gaps in health services provided by the health centers in severe air pollution-impacted regions. Some of the key findings from the assessment are:

1. There is a need for trained health professionals at the primary and secondary levels of health facilities to attend to respiratory emergencies.
2. There is a need for suitable respiratory diagnostic tools at primary and secondary healthcare facilities.
3. There is a need for a spirometer for lung function tests at District Hospital Raipur. There is a need for trained spirometer technicians or staff at District Hospital Korba.
4. There is a need for respiratory emergency drugs in all health facilities,

especially at primary and secondary levels.

5. Health workers need to anticipate respiratory emergencies and make planned interventions including various community awareness programs.
6. There is a good follow-up system by public health facilities in place for the patients in general.
7. Most follow-ups of the patients are done by health facilities through home visits and telephone

Capacity Building training of Medical Professionals, Chhattisgarh

Recommendations

1. Primary and secondary public health facilities need to be prepared for respiratory emergencies with trained health professionals for treatment intervention. It is important to have specialist doctors at the CHC and below hospitals, as these facilities cater to most of the population. The state health department should train the general doctors on emergency care for respiratory illness to take care of emergencies and refer the patient to a specialist once the emergency is tackled.
2. Appropriate diagnostic tools like spirometers must be procured immediately at district and PHC levels, in addition, the available paramedic staff should be adequately trained to handle the equipment. Health facilities should also be equipped with appropriate medicines to tackle respiratory emergencies.
3. Given the need for trained health professionals in the health department, the technical capacities of the existing health professionals need to be strengthened through capacity-building training. They could be stratified as – Human Resource Training on – diagnostic tools (Spirometer, ECG reading) -

Training for Diagnosis, and line of treatment to utilize the health facility for respiratory emergencies. This could lead to improving the preventive action for respiratory illnesses through screening and surveillance and addressing follow-up treatment.

4. Training for the medical practitioners on 'Diagnosis and Line of treatment' for respiratory emergencies and illness at the primary and secondary level should be provided every quarter. IEC materials for health professionals and hospital staff should be provided and regularly updated.
5. ASHAs services should also be utilized to spread awareness on ambulance services for Acute Respiratory Illnesses as people are not aware of it. Training ASHA workers as messengers on air pollution and health are essential.
    a. The State should establish Surveillance on illnesses due to air pollution to help understand the health problems in the area in a better manner.
    b. There should be a timely issue of alerts/warnings on health risk factors related to the air quality level (AQI) and weather conditions like temperature, humidity, etc., obtained from IMD/Pollution Control Boards to the health professionals and the common people.
    c. Patients should be encouraged to visit the public health facility to avail treatment and drugs through 'community outreach programs' if required for a longer period (for example 'Asthma').
    d. IEC materials for the communities should be provided within the health centers and at important locations within the communities – like a place of worship, schools, colleges, bus stops, and markets.
    e. The State should undertake programs to sensitize leadership and government officials - Since the districts face the acute issue of air pollution, local and state administrations should be actively involved to seek alternatives for mitigating the possible causes of air pollution. A graded health action plan like the one for Delhi and NCR can be replicated in these districts, including the implementation of suggestions highlighted in the 'Health Sector Preparedness for Air Pollution-Minimizing the health Impacts' released by the Ministry of Health and Family Welfare.
    f. A similar health infrastructure assessment should be conducted in all the districts of Chhattisgarh, especially in the regions more vulnerable to air pollution.

Role of Stakeholders and Beneficiaries:

The health professionals learned intervention and the preparedness of public health facility for emergency respiratory illnesses like Acute Respiratory Illness (ARI) and Asthma provides quality care to the patients, reducing out-of-pocket expenses and

making the public health facility available and functional for the patients.

The process for the flow of patients to the public health facility has slowly started and capacity building of the medical officers in diagnosis and management of related illnesses can also eventually bring the patients for treatment from the begging, this could lead to reducing the time to start the treatment and would also affect the out-of-pocket expenses and rightly referrals can be done.

Outcomes

1. **ARI surveillance:** Air polluted vulnerable eight districts of Chhattisgarh State were identified for ARI surveillance. The team was formed in the districts comprising a medical officer, a staff nurse, and a data entry operator. the training in regard to this was also conducted in AIIMS Raipur where forty-six participants participated including the district nodal officers. The surveillance has started and is in the process but needs to be strengthened through regular monitoring.

2. **Capacity Building of Health professionals:** It was essential to build the technical capacities within the existing staff to meet the gap to not only address the preventive action for air pollution-related respiratory illnesses but also to address respiratory emergencies. Early detection of respiratory illnesses under preventive action can provide timely care, and early referral, and improve the prospects of early detection for compensation in case of silicosis/occupational health hazards. Capacity Building of the Medical Officers was planned in the PIP and budget was proposed for the entire state. The budget was approved and capacity building of Medical Doctors from District Hospital and Community Health Centers including a few PHC's from the entire state of Chhattisgarh were conducted. Around one thirty (130) medical officers so far has been trained. The entire training on ARI/Asthma/COPD/TB on diagnosis and management were resourced by faculty of AIIMS Raipur.

3. The health professional at this level may require training to make a diagnosis of respiratory illnesses and prescribe the line of treatment. This also links back to the unavailability of trained Doctors (MD, General Medicine) at the levels of CHCs and PHCs to complement the usage of the respiratory drugs available at the CHC and PHC

4. **Grass root level reach for treatment:** According to the WHO document on 'Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected Interim guidance 13 March 2020', Primary

Health Centers are capable of handling emergencies related to Acute Respiratory Infection (ARI) and Severe Acute Respiratory Infection (SARI) with guidance, supportive management, trained human resources and availability of appropriate drugs. To address this, training on diagnosis and line of treatment for ARI and SARI to the health professionals at the primary level could strengthen the capacity and technical knowledge of the existing staff to observe better results on the existing 'Health and Wellness Center' apart from screening and surveillance which are the most important key role of the primary care.

5. **Community Reach out:** Communities are aware of 24×7 ambulance 108 and 104 but are not sure whether the ambulance service can also be utilized for respiratory emergencies. Through the community reach-out programs (Mitanins) it was suggested to promote the usage of the ambulance for respiratory illnesses also. Follow-ups are being done regularly by the health center through ANM/MPW/Mitanins. Follow-ups are done through home visits and telephone which is a good initiative and should be promoted. Follow-ups are encouraged by all means.
   Primary and secondary health facilities' referrals should be considered at the tertiary level to process speedy compensations for occupational hazards.

Short and Long-Term achievements and Expectations:

- **Strengthen ARI Surveillance:** ARI surveillance clinics have been established and the surveillance started which needs to be strengthened.
- **Availability of diagnostic** tools like Spirometer is expected to be available at least at every CHC, Training of the one existing staff is expected to be achieved.
- **Availability of drugs:** Drugs have been made available, especially inhalers.
- Quality care to the patients: reduce the time to start the treatment / referrals done at the right time.
- **Strengthen the referral system:** the follow-up and referral system need to be strengthened in the long run-in order to reduce the time wasted at the periphery and the patient reaches tertiary care in his /her last times.
- **Addressing occupational health hazards** through the referral system for compensation and documentation.
- **Capacity Building of Nursing Cadre**

Lesson learned

The studies like this provide grass root level understanding of the challenges faced by health professionals and eventually by the patients. The gaps identified can help focus efforts to strengthen the health system design future strategies and interventions complimenting the vision, aims and objectives of the health system.

Sharing of Learnings:

1. **Vulnerability assessment:** Understanding the key vulnerabilities of your own area. All the climatic vulnerabilities lead to an impact on health. The health system needs to be resilient first with the health professionals/drugs/ diagnostic tools and infrastructure.
    a. **Tapping the gaps in the health system:** small assessment studies need to be conducted using the available resources as the scientific approach of identifying the gaps brings an entirely different view, and helps and facilitates the design of the plans to be more effective and effective.
    b. Use of the local resource center's like AIIMS at central and state levels should be promoted.
    c. The recommendations made in the study healed in formulating the PIP, Including the Chhattisgarh State Action Plan of Climate Change and Human Health.

The case study can be replicated in all the mineral-rich states and districts with resources of pollution like thermal plants, industries, and traffic. Other states can also utilize the learning to strengthen the health system in their own perspective of vulnerabilities.

The health professionals have expressed the need for the training and they expect the investigation and management of respiratory health in association with Air Pollution and Climate Change. One of the doctors in the training feedback shared, that

> *'The training especially on asthma and TB are very good and would like to have more training on spirometry test and to keep on practicing we need to have the machine. We, doctor usually treat the disease based on priorities but the induction on climate change and air pollution was an eye opener for understanding the impacts.'*
>
> *~A medica officer*

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10

Case Study of Heat Action Plan for Ahmedabad City: Development and Lessons

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Background

In May 2010, Ahmedabad faced a deadly heat wave with peak temperatures of over 46°C causing a spike in heat related illnesses and death. The city of Ahmedabad, along with IIPHG, NRDC and partners, developed South Asia's first HAP in 2013 through several innovations, including government temperature forecasts calibrated to heat-health thresholds. This was first such preparedness plan for extreme heat events in South Asia. The plan piloted an early warning system and interagency disaster risk reduction plans to increase the resilience of vulnerable communities in Ahmedabad. A reduction in (all-cause) mortality rates was observed in 2014 heat wave as compared to 2010 in Ahmedabad city. An impact assessment study of the city's HAP in 2018 estimated that approximately 1,190 average deaths were avoided annually in the post-HAP period. During a particularly severe heat wave in 2015, more than 2,300 deaths were reported across the country. In 2015 and subsequently, Ahmedabad has reported significantly lower heat related mortality than in the pre-HAP years.

Details of Process

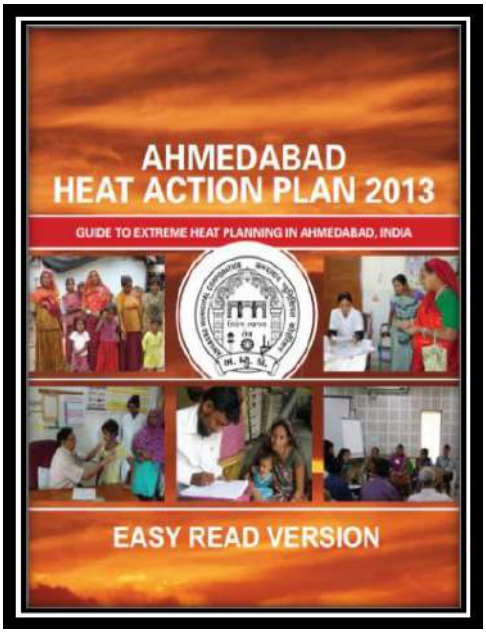
- Increasingly intense and frequent record-breaking hot weather is a major health threat in India, perhaps more-so than in other parts of the world. Studies on the direct relationship between high temperatures and increased in mortality and morbidity are well documented across the globe. A major impact of these heat waves is in the form of mortality; other indirect effects include a spectrum of heat illnesses ranging from heat exhaustion to heat stroke. These occur when heat exposure stresses underlying physiological systems and results in other specific manifestations such as renal insufficiency, acute cerebro-vascular disease, and exacerbations of pulmonary disease.

- The COVID-19 pandemic saw the response to heat-related illnesses worsen, since

hospitals and urban health centers are already stressed, according to the Indian government. Drawing on the strengths of government leadership, efficient interagency coordination, scientific expertise, robust communication programs, effective community engagement, strong action on heat preparedness can deliver lifesaving benefits – especially in building back better after the coronavirus.

- Given the alarmingly increasing patterns of the heat wave in the country there is an urgent need for preparing the cities to combat the impacts of extreme heat on citizens. In the year 2010, Ahmedabad experienced a major heat wave and our study showed an excess of 1,344 all-cause death in the month of May compared to the year before and after (Azhar et al. 2014). Ahmedabad has been the leading city in India for its work on building resilience against extreme heat. Following the heat wave in the summer of 2010, in which Ahmedabad experienced a deadly heat wave, which caused hundreds of additional deaths due to the devastating health impact of public exposure to extreme heat, in 2013, the AMC partnered with the NRDC and the IIPH-G to develop a plan to reduce the health impact of such extreme heat waves on vulnerable populations (Knowlton et al., 2014). The "Heat Action Plan (HAP)" has been developed in close consultation with the Health Department of the AMC, as well as feedback from the public health and medical communities of Ahmedabad, and has been in continuous implementation since 2013. The HAP provides a framework for the implementation, coordination, and evaluation of extreme heat response activities in Ahmedabad. The HAP alerts those populations most at risk of heat-related illness that extreme heat conditions can exacerbate, and to take appropriate precautions.

- The Plan has been a pioneering example of active adaptation and community resilience building against exposure to extreme heat. Key components of the Ahmedabad HAP include (Figure 1):



- Building public awareness and community outreach to communicate the risks of heat waves and implement practices to prevent heat-related deaths and illnesses. Disseminating public messages on how to protect people against extreme heat through media outlets and orientation materials, such as pamphlets and advertisements on heat stress prevention, text messages, email, radio and social media, such as WhatsApp. Special efforts are made to reach vulnerable populations through inter-personal communication from March to June annually. Initiating an early warning system and inter-agency coordination to alert residents of predicted

extreme temperatures. The AMC has created formal communication channels to alert government agencies, health officials and hospitals, emergency responders, local community groups, and media outlets of extreme temperatures forecasted by the Indian Meteorological Department's (IMD) Meteorological Centre located in Ahmedabad.

- Capacity building among health care professionals to recognize and respond to heat-related illnesses, particularly during extreme heat events. Such trainings focus on primary medical officers, paramedical staff, and community health staff so that these experts can effectively prevent and manage heat-related cases and reduce mortality and morbidity.

- Reducing heat exposure and promoting adaptive measures by launching new efforts, including a draft city-wide Cool Roofs Program. The citywide Cool Roof Program includes mandatory, voluntary, and low-income housing focused measures.

- A 2018 study evaluated the effectiveness of the Ahmedabad HAP before and after implementation (Hess et al. 2018). The findings suggest that the Ahmedabad HAP protected people against mortality associated with extreme heat. The HAP reduces both chronic and acute health effects of exposure to extreme heat. In addition, it increases the productive capacity of individuals and families, directly impacting their incomes. With efforts to safeguard the health of the city's residents during an extreme heat event, the long-term prosperity of a city is addressed through the Ahmedabad Heat Action Plan. Further, the study found that an estimated 2,380 deaths were avoided in the post-HAP period.

- Unequivocal changes in climate and sprawling urban growth intensifying Urban Island effect, redoubling urban heat related health risk and causing discomfort. In November 2019, Ahmedabad has announced an expansion of its ongoing urban afforestation program to increase the city's green cover and reduce ambient outdoor temperatures. The city has also decided to scale up the Cool Roofs program to retrofit cool roof technologies with the AMC's own buildings. The Ahmedabad HAP has a special focus on targeted beneficiaries such as outdoor construction and industrial workers, street vendors, women, children, and senior citizen. Outdoor workers and residents of low-income neighbour-hoods with poorly insulated houses are especially prone to the effects of heat, with disproportionate impacts on economic productivity, medical expenses, and other opportunity costs.

- The Ahmedabad HAP is centered around establishing and strengthening of governance structures within the city's local government to build immediate and

long-term resilience among communities to rising temperatures and increased number of extreme heat-days. It also builds linkages between key departments and establishes standard operating procedures (SOPs) for the urban local government's response to extreme heat. These mechanisms, once established, are being used to address other impacts of climate change such as air pollution and extreme rainfall as well.

Key learnings from Ahmedabad Heat Action Plan (HAP)

Table 1: Lessons Learned: description of challenges that the project faced, and the team's response (source: Kim et al. 2014)

Challenge	Description	Response	Looking Forward
Recognition of heat as a disaster and growing health threat	Heat waves were not initially considered to be disasters requiring high-level preparation.	Heat adaptation plans adopted by other cities offered best practices adaptable to the Indian context.	City leaders have taken ownership and are implementing a comprehensive response to extreme heat.
Interagency communication and coordination	Limited communication between municipal agencies; hospitals and the public were not alerted to impending heat waves.	Leveraging national, state, and local infrastructure already in place facilitated plan implementation.	Improving formal communication channels and designating an AMC "nodal" (lead) officer to direct heat-related efforts.
International team coordination	Challenges communicating across time zones and in different languages.	Weekly calls with the international team, combined with regular visits to India.	Technologies, such as Skype, and leadership and commitment contributed to the team's effectiveness.
Data collection	Collecting temperature data and mortality data was challenging.	Developed relationships with meteorological and health agencies to get access to	Will streamline the process of instituting heat data collection, making it easier

		information.	to evaluate the HAP.
Budgetary concerns and political will	Resources are precious and are allocated judiciously; city engagement and leadership were crucial.	Project partners identified and prioritized policies and programs that would have the biggest impact.	Study group working with AMC nodal officer to measure these programs' effectiveness and hope to add more programs.

Linkage to NPCCHH programme strengthening if applicable

Climatic changes, hot summer months are unavoidable but with strategic community-based plan and simple interventions can reduce mortality and morbidity. The present case study is an example which showcase the potential role of HAP and heat health research in improving resilience of communities against extreme heat events and for prevention and management of heat related illnesses. The NPCCHH and other line organisations should work jointly under national mission on climate change and human health for implementing such climate resilience heat action plans. The NPCCHH should prioritise integrating climate services for health in public health policy and planning.

Limitations

- One of the important limitations for effective development and implementation of heat action plan is unavailability of health-related data about heat related illness on daily or weekly basis. Without health-related data city specific temperature threshold and heat stress index cannot be worked out. There are several challenges to conducting heat health research in India. Due to modest registration of deaths, it is very difficult to get all-cause mortality data. Further, it is difficult to understand the effects of heat on cause-specific mortality in sufficiently large sample sizes.

- Due to efforts of National Disaster Management Authority, Indian Meteorological Department, IIPH-Gandhinagar and Natural Resources Defense Council, most cities developed the heat action plan based on Ahmedabad, but effective implementation is lacking, as there is no state level monitoring. Another limitation is lack of India specific or region-specific Heat Stress Index. The present early

warning system is largely based on temperature.

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11

Millets: A Step Towards a Sustainable Future

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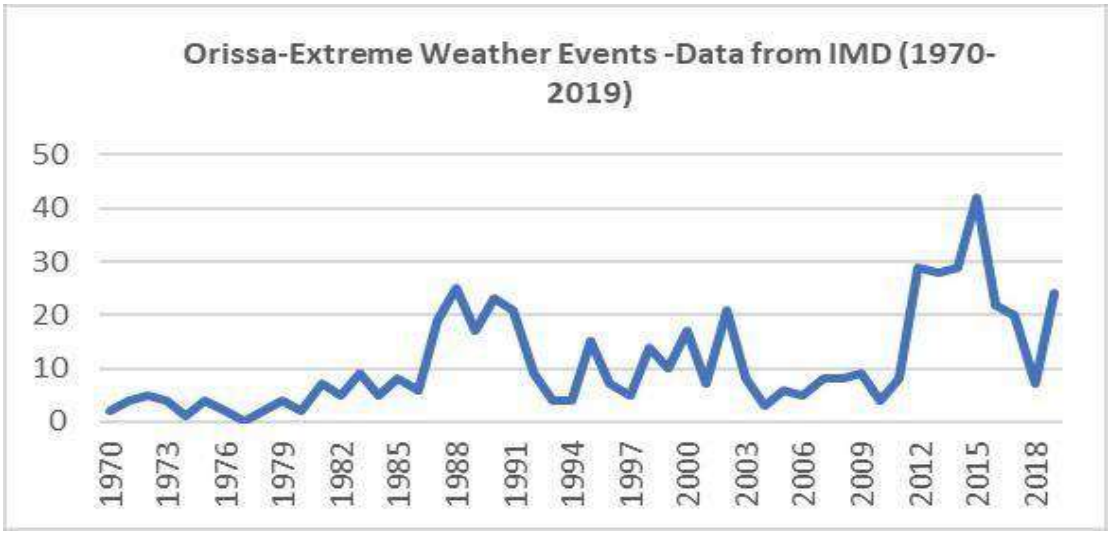
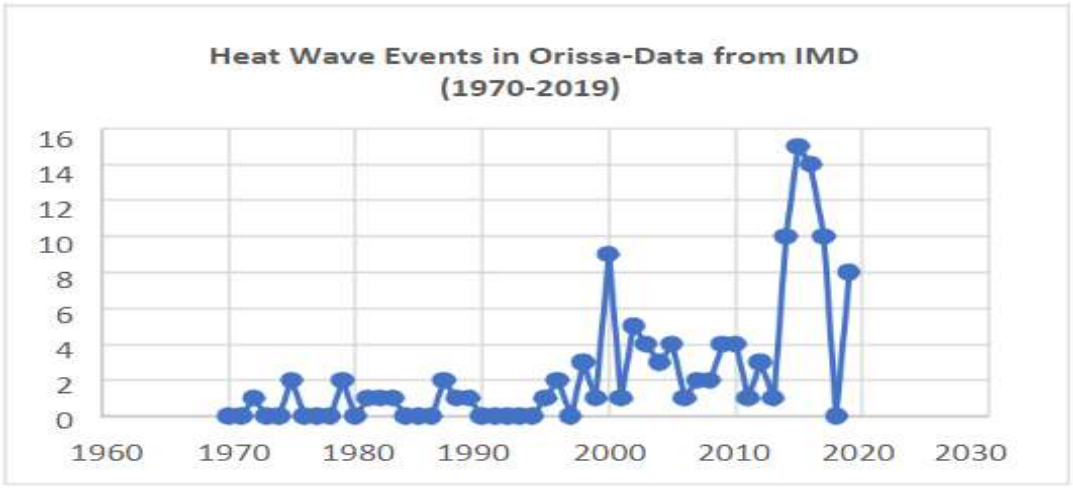
Background

Climate change is a reality. There is no denying that the climate is changing – and that too at a very rapid pace. The most obvious evidence towards this is the surge in the frequency of extreme events. According to IMD data, India experienced an exponential increase in extreme events during the period 1970–2019, with a marked acceleration in 2000–2019. Over the years, increase in temperatures, changing monsoon and more frequent extreme climatic events have affected cultivation, forestry, aquaculture, etc, thereby posing a threat to India's food security, causing severe socio-economic consequences like the disruption of trade, livelihood distress, and adverse health effects. According to a report released by the Intergovernmental Panel on Climate Change (IPCC) 2021, India would experience more weather extremities, such as heat waves, floods, cyclones, drought, etc in the future (IPCC 2021). This foreshadows food security crisis in India.

According to a report by International Food Policy Research Institute, by 2030 climate change may force many Indians into famine owing to a reduction in agricultural productivity and disruption in the food supply chain (Global Food Policy Report 2022). Moreover, several studies have predicted that intense and early-onset heatwaves, along with unpredictable rainfall patterns could jeopardize India's rice and wheat output, thus leading to severe shortages. According to Indian Council of Agricultural Research, 9 million hectares out of the 30 million hectares of wheat have been categorized as being prone to sudden heat stress. This is also evident by the fact that the year 2020 saw a late surge in rainfall, led to a 4% deficit in rice sowing.

The Indian state of Orissa has been one of the most vulnerable states with regards to extreme weather events. According to the IMD data, a significant increase in extreme events during the period 1970–2019 has been observed.





Odisha, which lies in the sub-tropical India is vulnerable to different types of natural calamities like droughts, floods, and cyclones. Frequent occurrence of extreme climatic events has been detrimental to the livelihood resilience of the poor and marginalized people.

According to the Council on Energy, Environment and Water analysis, apart from cyclones and floods, the state of Odisha also witnessed a four-fold increase in droughts in the last ten years. The analysis of the IMD data showcases an increase in the overall heat wave events in the state from 1970-2019. According to an analysis of the state's heat wave days, out of the 525 that have occurred between 1970 and 2019 (50 years), 52% (or 272 heat wave days) have occurred in the last 15 years. This has had a profound affect on crop production both in terms of quantity and quality.

Over the years, Kharif crops have been more impacted than Rabi crops owing to variability in rainfall associated with Heat Waves. Since Kharif crops are sown in May to June and harvested in September to October, any extreme change in temperature

affects its productivity. Within Kharif, rice production has been particularly affected with decreased grain yield which is a matter of concern as rice is a staple diet of Odisha (NDMA, 2019).

In order to mitigate the decline in rice production in Odisha due to climatic events, Millets that were traditionally grown and were lost in translation due to modern agriculture have now made a comeback. The present case study tries to showcase how the state of Odisha combated climate change and its impact on food production by reviving traditional farming and cultivation of traditional crops i.e Millets. This was undertaken by conducting multiple consultations among the State Government, Civil Society, and tribal population of Odisha to secure nutrition and mitigate drought. Millets require less water than rice and wheat. They are very tolerant of heat, drought, and flood, and this makes millets an ideal choice for farmers in an era of climate change.

Moreover, millets are nutritionally analogous to leading cereals and serve as an excellent source of protein and other micro-nutrients.

Details of Intervention

Odisha Millets Mission (OMM) & awareness by tribal volunteers and local non-government organizations

In the past, millets used to be the staple food for tribals in Odisha. However, tribals began regarding millets as a subsistence crop that they had earlier farmed to use or eat themselves rather than to sell when paddy and other foods reached their doorstep through the public distribution system and the consumer market. This led to further decline in millet production by the tribals.

With the changes in climatic conditions, heavy rainfall brought destruction to crops like paddy, lands became more infertile owing to chemical pesticides and hybrid seeds failed to withstand weather extremities and heat stresses. This paved a grim situation for hundreds of farmers struggling to cultivate amidst extreme weather changes. Thus arose a need to cultivate millets that are resilient to droughts, extreme heat, diseases, pests, require less water than paddy and are richer in nutrition.

Millet Network of India and other civil organizations began raising awareness about millets with the aid of tribal volunteers, highlighting its nutritive value and climatically robust nature. The traditional wisdom of tribals, who grew interdependent crops in a single field and harvest them one after another, was the major reason that helped millets and other crops survive. Realizing the importance of

highly nutritious and climate resilient millets, the Government of Odisha launched Millet Mission in the year 2017.

Odisha Millets Mission (OMM) is the flagship programme of Department of Agriculture and Farmers Empowerment, Government of Odisha. This program was designed to promote Millets in tribal areas of Odisha (Odisha Millets Mission) and was launched by Government of Odisha to revive millets in farms and on plates. **Odisha Millets Mission** provided institutional impetus such as guaranteed purchase and higher prices, which led to an increase in awareness about millets cultivation using improved farming techniques to address nutritional and climatic challenges.

According to a study conducted by Niti Aayog in 2020, Odisha recorded a 215% increase in gross value of millet produced per farmer household from Rs 3,957 in 2016-17 to Rs 12,486 in 2018-19.

In the same period, area under millet cultivation has increased from 2,949 hectares to 5,182 hectares and the yield rate has increased by 120%.

Details of Process

- Decline in food production of mainstream crops like rice due to climate change
- Production of Millets that is resilient to heat, drought and flood, and required less water than rice and wheat
- The tribal population of Odisha were traditional cultivators of millets.
- Consultation between State Government, Civil Society and tribal population to increase millets cultivation and production.
- The establishment of OMM based on the traditional farming of millets was set with the objective to promote household consumption, conservation, and promotion of millets.
- Indian Institute of Millet Research has acted as a key player in cultivation of millet varieties.
- Inclusion of Millets in Integrated Child Development Scheme (ICDS), Mid Day Meal (MDM), and Public Distribution System (PDS).
- OMM has incentivized and helped in supporting farmers particularly tribal population through the value chain from growing the crop to selling the products.

Health Impact

- In India, there exists a complex challenge characterized by a triple burden encompassing malnutrition, obesity, and deficiencies in essential micronutrients.

As per the State of Food Security and Nutrition in the World 2022 report published by the UN Agencies, the nation houses a staggering 224.3 million individuals between 2019 and 2021 who suffer from undernourishment. At this juncture, it has become imperative to adopt a nutrient-dense diet. In this regard, the public distribution system (PDS) has a crucial role to play in procuring and distributing a wider variety of traditional and nutritious grains.

- First and foremost, millets are a rich source of dietary fiber. Fiber is essential for maintaining a healthy digestive system and preventing constipation. It also helps regulate blood sugar levels and promotes satiety, making it an excellent choice for individuals looking to manage their weight or control diabetes. The high fiber content in millets can contribute to improved gut health and reduce the risk of developing various gastrointestinal disorders.

- Additionally, millets are packed with important vitamins and minerals. They are particularly rich in magnesium, phosphorus, and iron. Magnesium plays a crucial role in maintaining healthy bones and teeth, regulating blood pressure, and supporting proper muscle function. Phosphorus is essential for energy production and the formation of healthy cells and tissues. Iron is vital for red blood cell production and preventing iron-deficiency anemia. Incorporating millets into your diet can help meet your daily nutrient requirements and promote overall health.

- Moreover, millets have a low glycemic index (GI), which means they are digested and absorbed more slowly by the body, resulting in a slower and steadier release of glucose into the bloodstream. This property is particularly beneficial for individuals with diabetes or those looking to manage their blood sugar levels. By opting for millets instead of refined grains with a high GI, individuals can better control their blood sugar and reduce the risk of developing chronic conditions such as type 2 diabetes.

- Another notable health benefit of millets is their antioxidant content. Antioxidants help protect the body against oxidative stress and reduce the risk of chronic diseases, including heart disease, cancer, and certain neurological disorders. Millets contain various antioxidants, including phenolic compounds, which have been associated with anti-inflammatory and anti-cancer properties. Including millets in your diet can contribute to overall well-being and support a healthy immune system.

- Furthermore, millets are gluten-free grains, making them an excellent alternative for individuals with gluten intolerance or celiac disease. These grains can be substituted for wheat, barley, or rye in various recipes, offering a wider range of options for individuals on a gluten-free diet. Millets can be ground into flour for

baking or used as whole grains in salads, porridge, and pilafs, providing a versatile and nutritious base for many dishes.

- Lastly, millets are environmentally friendly crops. They are highly resilient to drought and require less water compared to other staple grains, making them suitable for cultivation in arid regions. Millets also have a shorter growing season and are less susceptible to pests, reducing the need for pesticides and fertilizers. Embracing millets as a staple crop can contribute to sustainable agriculture and help mitigate the impact of climate change.

- Consistently including millets in the diet can have a substantial positive impact on essential nutritional aspects for children and women. Millets have the potential to enhance hemoglobin levels and alleviate iron deficiencies. Consumers are increasingly becoming aware of the nutritional potency of millets, recognizing their benefits for conditions like diabetes and obesity, as well as their potential to lower the risk of heart and cardiovascular diseases (Nithiyanantham et al, 2019). The grains of these millet varieties are extensively consumed both as traditional remedies and as essential dietary components for maintaining good health.

- Many Indian states have introduced millets in their food security program such as Karnataka, Odisha, Telangana, etc. Moreover, OMM has introduced ragi in various social safety net programs such as PDS, Supplementary Nutrition program under ICDS, Mid-day meal scheme and tribal hostel. Efforts by the state have been taken up to promote and increase procurement of millets. Including millets in PDS would be a game changer for combating malnutrition and mitigating climate change.

- However, the challenge remains that only around 25% of households consume millets distributed under PDS since there is a strong preference for rice. Thus, shifting consumer preference becomes key. Behavioral change campaigns, enabling policies and investments are needed to bring millet back to people's diets. A comprehensive design framework is imperative instead of piecemeal approaches. The comprehensive model of OMM to improve nutrition in tribal districts has been recognized by World Food Programme. Promoting agronomic practices, accessibility to quality seed and locally suitable varieties would help in boosting production to balance demand and supply. Government of India has recommended that the OMM operational framework should be adopted by other states. Through such comprehensive and innovative approaches, PDS can be reformed to include millets. And, with the inclusion of millets in public diets, India may well improve its ranking in the Global Hunger Index.

Outcomes

- Increased cultivation of native millet varieties - finger (ragi), foxtail (kakum or kangni), barnyard (sanwa), proso (chena) and pearl (bajra) millets--which are climate-resilient and ensure the food and nutritional security for tribals.
- In the year 2022, almost two lakh farmers in 19 districts are involved in millet cultivation.
- About 3.23 lakh quintals of millets have been procured, since the formation of OMM
- The Odisha government has also started celebrating *Mandia Dibas* (Millet Day) on November 10 annually to popularize the crop.
- Odisha Millet Mission (OMM) made an impact on the millet value chain leading to an increase in its demand and supply.
- Orissa became the first state to include Ragi Laddu in ICDS through the support of District Mineral Foundation.
- After the introduction of the OMM and its growing impact, the Government of India has asked all states to adopt Odisha Millets Mission model for promotion of millets, pulses and oilseeds.
- In this 'International Year of Millets 2023', the Central Government is focusing on millet promotion in tribal areas and creating livelihood opportunities for tribal communities through millet processing and value addition.
- Government of India is set to document tribal recipes that are prepared by various PVTG (Particularly Vulnerable Tribal Groups), which will help in scaling up nutritional security of tribal population.

Key Learning Points

- Documenting traditional cultivation of crops and indigenous farming practices and drawing out narratives from tribals that are climate resilient and nutritious is the key and one giant leap towards sustainability.
- Dissemination of this information about millet production, adopting and scaling up of such practices is the need of the hour to ensure food and nutritional security.

Resources and Publications

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Green and Climate Resilient Health Care Facilities

12

Piloting of the Climate and Disease Vulnerability Assessment in Selected Healthcare Facilities of Idukki District, Kerala

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Background

The climate crisis is a health crisis. As a result of climate change, healthcare facilities around the world are getting affected by overall temperature rise, intense and recurrent floods, storms, extreme temperatures, droughts, wildfires, or sea-level rise, changing patterns of climate-sensitive infectious diseases or climate-related non-communicable diseases, or injuries, individually or often combined[1].

Health sector damage can further add to the aftermath of disasters. If we want our focus on victims to be meaningful, we must prioritize a resilient healthcare infrastructure that can provide continuous medical support as people die and suffer excessively when hospitals and health services fail during and after disasters.

However, the impact of climate change and climate hazards vary over time and space. So that climate vulnerability assessment becomes at regular intervals of time is vital for identifying appropriate adaptation measures to tackle climate vulnerability and its health effects.

Climate Vulnerability

The Intergovernmental Panel on Climate Change's (IPCC) fifth assessment report defines vulnerability as "the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt."[2] The IPCC's third assessment report describes vulnerability as "The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity[3]"

India ranks 7th in the 2021 Global Climate Risk Index (GCRI), which analyses to what extent countries and regions have been affected by impacts of weather-related loss events (storms, floods, heat waves etc)4. In the IPCC's sixth assessment, over 3.5 billion people, i.e. over 45% of the global population, are living in areas highly vulnerable to climate change. The report identifies India as one of the vulnerable hotspots, with several regions and important cities facing a very high risk of climate disasters such as flooding, sea-level rise, and heatwaves[5].

The state of Kerala ranked 26th in climate vulnerability, according to the report titled 'Climate Vulnerability Assessment for Adaptation Planning in India using a common framework' conducted by the Department of Science and Technology and Swiss Agency for Development and Cooperation (SDC) in 2019 to 20206.

Context

The monsoon data of the state of Kerala in the last 120 years (1901-2020) clearly indicate that there has been a rise in temperature in this millennium (2000-2020) by more than 0.5 degree Celsius. Severe weather incidences such as heavy rainfall days and thunderstorm activities have increased as a result of climate change. In the districts such as Wayanad, Kasaragod, Idukki, Thrissur, Kozhikode, Ernakulam, and Kannur, the frequency of heavy rainfall has been increasing[7]. According to the Kerala State Action Plan on Climate Change, the percentage of flood-prone areas in Kerala varies from 0.8% to 53.89%. It can result in an increased burden of vector-borne, waterborne diseases and respiratory and allergic diseases, etc posing serious public health implications.[8]

Kerala State Action Plan on Climate Change indicate that there is an increasing burden of communicable and non-communicable disease in the state. With the rising temperature, unpredictable rainfall, and the loss of agricultural area owing to droughts and flash floods, malnutrition can be a major public health issue. According to the NFHS-5 data for Kerala State, the percentage of children under the age of five who are stunted has increased from 19.7% in NFHS-4 to 23.4%, and the percentage of children who are wasted has increased from 15.7 to 15.8%. Children under the age of five who are underweight have increased from 16.1% to 19.7%. Anaemia has increased in people of all ages9. Severe dry spells and droughts were experienced by the State in recent decades. In 2019, the Kerala health department has reported 1671 cases of heat-related conditions of which most of which are sunburn and sunstroke conditions.[10]

Kerala which is a small state with a high population density (859 persons per km2)11, from the experience of the 2018 floods is committed to carry out climate and disease

vulnerability assessment in the state to make the health system climate and disaster resilient for which the health system of the state was badly affected. A climate and disease vulnerability assessment was piloted in selected healthcare facilities of Idukki district of Kerala in the last quarter of year 2022.

Idukki District

Idukki is one of the 14 districts of Kerala state, India. The place is known for its geographically mountainous hills and dense forests. Idukki which lies in the Western Ghats of Kerala is the second-largest district in the area but has the lowest population density12. The Idukki district has a total area of 4,36,328 hectares (5087 sq Km)13 of which 2713.7 ha. are forest land.

According to the 2011 census, it has a total population of 11,08,97414. About 66% of the State's Power needs come from the Hydroelectric Power Projects in Idukki15 which has seven rivers flowing across the district and two of which are major rivers. A total of 18 reservoirs are present in the district.

Hazard Profile of the district

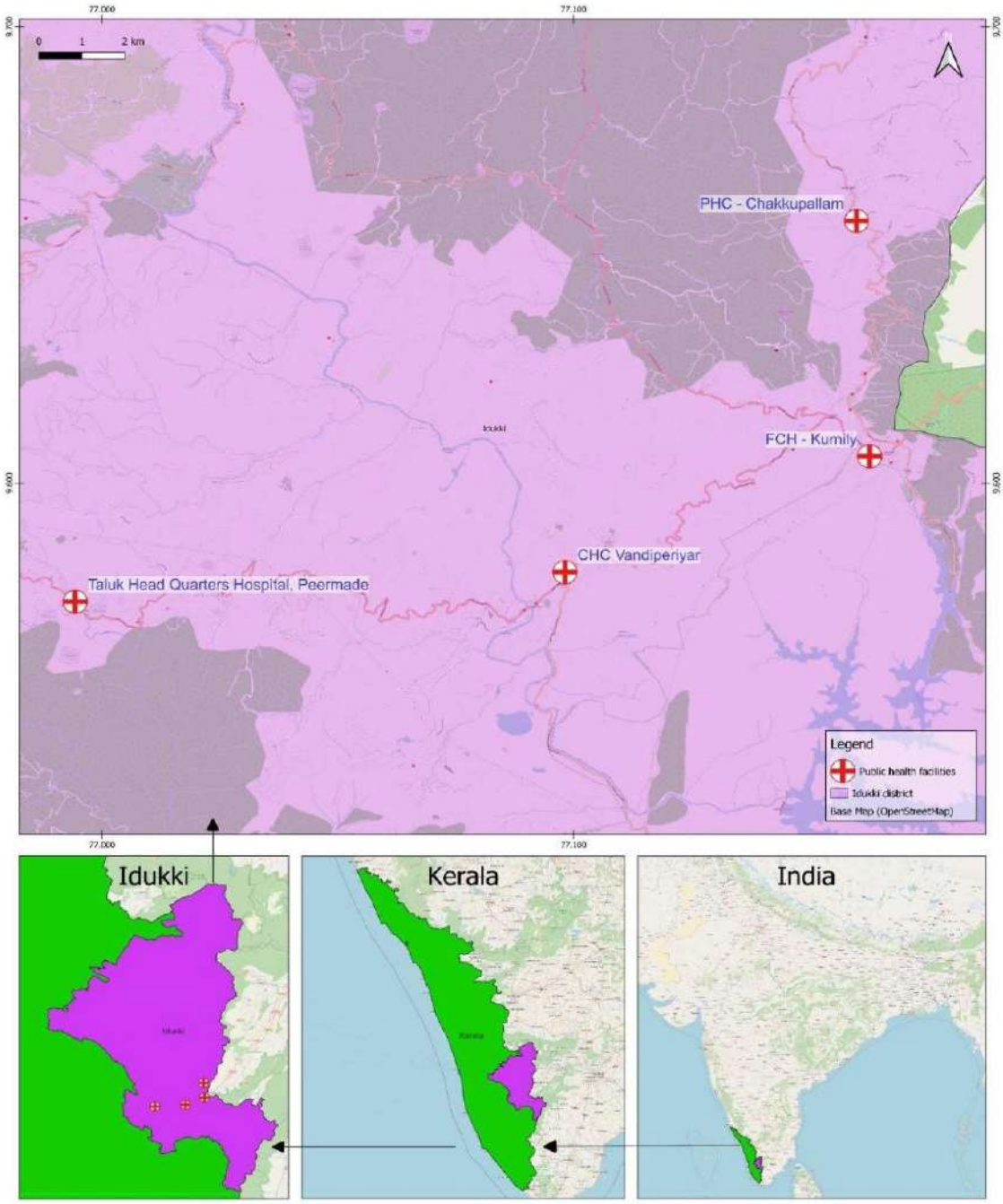
- Flood
- Cyclone
- Landslide/ mudslide
- Thunderstorm and Lightning
- Drought
- Earthquake
- Dam burst
- Forest Fire

Details of Process

The vulnerability assessment was conducted in four selected hospitals.

- Community Health Centre, Vandiperiyar.
- Primary Health Center, Chakkupallam
- Family Health Center, Kumily
- Taluk hospital, Peerumade

Four hospitals were selected based on the levels of service delivery in the district, which included a community health centre, primary health centre, family health centre and taluk hospital of the district. The assessment was conducted in two stages. At stage 1, a vulnerability assessment was conducted in Family Health Center at Kumily and the Primary Health Center at Chakkupallam. The second stage extended



Maps showing the four public health facilities Assessed for Climate Vulnerabilities

the assessment to Peerumedu Taluk hospital and Community Health Centre Vandiperiyar.

The vulnerability assessment was conducted in coordination with the district health department. Hospital staff who is voluntarily willing to get trained in the vulnerability assessment was trained on the customized mini vulnerability questionnaire with the technical support of Health Energy Initiative. The trained staff administered the vulnerability assessment questionnaire at their respective healthcare facilities together with the guidance of technical team.

The vulnerability assessment questionnaire consists of two parts.

1. Infrastructure Vulnerability
2. Climate-sensitive disease vulnerability

A questionnaire on the infrastructure vulnerability assessment had already been piloted and administered in the other part of the country. In stage 1, the infrastructure vulnerability of the hospital was assessed. The experiences faced by healthcare facilities in the past five years (2018- 2022) were collected. The infrastructure vulnerability assessment questionnaire contains variables under 3 categories:

- Past experiences of extreme weather events;
- History of damage/impacts of healthcare infrastructure/services
- Preparedness to tackle the impacts of extreme weather events

While conducting the infrastructure vulnerability assessment, there was a need to understand the climate-sensitive disease vulnerability of the hospital. For that, a questionnaire has been developed based on a detailed literature review. The disease vulnerability assessment questionnaire contains variables under 2 categories:

- Past reporting of climate-sensitive diseases
- Preparedness to handle the diseases.

The questionnaire was administered at the second stage of vulnerability assessment along with the infrastructure vulnerability checklist.

Outcomes

Key observations:

- It is observed that extreme weather events have disrupted the healthcare facilities service delivery during multiple occasions. To address the medical needs of the community during these times, medical camps were held at alternate locations.
- No death or accidents of the patients or staffs have been reported, but infrastructure of the healthcare facilities, damage to medical equipments and drugs, damage to electrical equipments were reported as a result of extreme weather events, particularly floods and strong winds.
- The hospital reported long power outages. Some of the hospitals in the assessment was equipped with power back up facilities for critical medicines for up to one week and back up for cold chain system for up to 24 hours following which it

needs to be moved to other nearby healthcare facilities.

- Some healthcare facilities experienced persistent water shortages. To respond to this rainwater harvesting system with upto 1 lakh litres capacity was available at some of the hospitals visited for the assessment.
- There were no Standard Operating Procedures (SOP) or written plans for disaster response. Each response is based on prior knowledge from experiencing the disasters and advice from senior staff. There would be no institutional recall of the responses if those staff members left. Five member (doctor, nurse, pharmacist, attender, ambulance driver) rapid response team has been formed in healthcare facilities.
- During extreme weather events, it was difficult for patients and personnel to access the facilities. Uprooting of trees in the area restricted access to the healthcare facility and made residents and medical personnel more concerned about their safety.

(Left) Flood water levels marked on the wall, (Right) Dirt in walls due to flooding, Vandiperiyar CHC

- The assessment could also observe that mock drills and workshops were conducted in some hospitals on annual basis.
- The disease vulnerability assessment could find that Snake bite, scorpion bite cases were reported in increasing numbers after rainy days. Post-traumatic stress disorders were also reported in these days. Cases of drowning and increasing road traffic accidents were reported during or after the rains. Seasonal variations were observed in vector borne diseases like dengue and respiratory diseases. Acute diarrheal diseases and urinary tract infections were reported in increasing numbers during the summers.

Equipment are kept on the tables and benches - Vandiperiyar CHC

Follow up after the climate and disease vulnerability assessment

- As a follow-up of the assessment, a stakeholder meeting was held in coordination with the Idukki district health department and Local Self Government (LSG) to disseminate the findings of the climate and disease vulnerability assessment report and to discuss the key strategies to mitigate the healthcare facilities from the identified vulnerabilities.
- Medical Officers, Health Inspectors, Block Panchayat President, and other LSG representatives were part of the meeting. Key Findings of the assessment were shared in the meeting. The meeting has given an understanding to LSG members on the vulnerabilities faced by the hospitals.
- LSG representatives have shown a very positive approach to the issues mentioned has offered its support to mitigate these vulnerabilities.

Support offered by Local Self Government to mitigate the vulnerabilities are listed following:

- Provision of a Bore well in Family Health Center Kumily, for the water scarcity issue they are facing
- Retrofitting of the canal running in front of the hospital to prevent flood in Vandiperiyar CHC
- Medical Officers have agreed to prepare a standard operating procedure or a written action plan for disaster response based on the risk of their facility for a period of one year. A template of SOP has been requested from them.
- In long term, LSG offered support to solarize the health facilities and move the equipments to energy efficiency.

Conclusions and Recommendations

A vulnerability assessment of the hospitals can identify the risk a particular healthcare facility has against climatic events and diseases which helps develop strategies to mitigate the potential health impacts. This could include improving hospital infrastructure to withstand extreme weather events, developing emergency response plans, and providing education and outreach to vulnerable communities.

Stakeholder meeting as follow up of Assessment with LSG, District Health Department

Additionally, understanding the potential health impacts of climate vulnerability can help hospitals prepare for the spread of vector-borne diseases such as dengue, malaria etc. or accidents like drowning or road traffic accidents which are likely to have a seasonal variability etc. Training the hospital staff for self-administering the vulnerability assessment tool, will help the institution identify potential vulnerabilities in a very short time facilitating them to take adequate measures for adapting and mitigating to the effects of the identified vulnerabilities.

Based on experiences and conclusions arrived by piloting of vulnerability assessment we recommend expansion of climate and disease vulnerability assessment across healthcare facilities of the state and suggest for replication of similar assessments across various states of the country to identify the locality specific climatic and disease vulnerability and equip the health system mitigate the health effects.

Acknowledgement

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13

Effect of Solarization of Quepem Health Centre, Goa

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Background

Goa is a tiny emerald land on the west coast of India with a population of 14.59 lakhs (2011 census). The climate of Goa, being a comparatively smaller state has negligible variations currently, with seasons of hot and humid summer, heavy monsoons and mild winters being well demarcated. However, extreme temperature and extreme rainfall events are projected to further increase in the state. The flood vulnerability analysis of the state reveals that 14.73% of the land is under 15 meter elevation, much of it in the coastal zones, and is severely vulnerable to flooding both from extreme rainfall events and sea-level rise.

Quepem is a Taluka located in South Goa district of Goa. It is one of 5 Talukas of South Goa district. There are 35 villages and 3 towns in Quepem Taluka. As per the Census India 2011, Quepem Taluka has 19119 households, population of 81193 of which 40722 are males and 40471 are females. The population of children between ages 0-6 is 8402 which is 10.35% of total population.

The sex-ratio of Quepem Taluka is around 994 compared to 973 which is average of Goa state. The literacy rate of Quepem Taluka is 74.35% out of which 78.31% males are literate and 70.36% females are literate. The total area of Quepem is 318.24 sq.km with a population density of 255 per sq.km.

The Health Centre in Quepem provides 24/7 healthcare to the residents. Initially it was built as an Outpatient service only centre. This annexe still stands till date and OPDs are still conducted there. The new Health centre providing 24/7 care stands Behind the old annexe. The Health Centre is of importance since its located in a relatively rural area as compared to the rest of Goa and most patients are unwilling to travel to the District hospital for routine medical services. Any power cuts impede the quality of care provided to the populace. Also, use of backup generators is not only expensive but also highly polluting since Diesel is the fuel that is used for these. With the help of steps taken by NPCCHH and the funds provided by them for retrofitting of pre

existing health facilities, this health centre at Quepem was taken up as a pilot for solarisation of health facilities in Goa.

Approach

Even prior to receiving directives from NPCCHH, the Health Officer of Quepem health centre Dr. Lorna Fernandes had undertaken replacement of all existing light fixtures with LEDs in both the old and new buildings using funds from other programmes. Each building has a separate meter and consumer ID for billing. Even with the shift to LED lighting the bill decreased by a small margin. Because of her personal interest in shifting to renewable sources of energy, when the tentative plans of solarisation under NPCCHH were announced in the monthly meeting, Dr. Lorna was the first to approach Dr. Prashant (SNO for climate change in Goa) and Dr. Rajendra Kanekar (State Epidemiologist) and request them to initialise this plan at her centre for improvement of conditions of the pre-existing infrastructure in order to provide better quality of uninterrupted health services, while effectively decreasing the expenditure of the State Exchequer.

The position of said health centre is also such that it stands independently and comparatively isolated on the side of the highway. At no point of the day (at least currently) does it fall under shadows of trees and natural or manmade structures. Considering that there is an abundance of unobstructed sunlight in Goa throughout the year, barring monsoons, there is continuous generation of more than sufficient energy.

The Proposal for installation of 20 kW solar power system at cost of 9.7 lakhs was approved in DHS and was passed on to Goa Energy Development Agency (GEDA). This installation was Installed and initiated under Dr. Samita Gauns and Dr. Seema Fondekar respectively, the successive Health Officers of PHC Quepem respectively. A MoU was also signed with the Electricity Department as well in order to supply the excess energy generated to the grid and adjust the same with the bills. This MoU also resulted in freezing the rates of electricity units sold to PHC.

Outcomes

The installation as well as all above documents were verified in person by Dr. Geetanjali (Goa state Consultant NPCCHH) and Dr. Annet Oliveira (District Epidemiologist, South Goa District). The entire facility was inspected along with the installation. Dr. Seema Fondekar was very invested in showing the positive effects post solarisation. On going through the electricity bills the marked decrease in expenditure post solarisation was evident. The staff as well patients were equally happy about the greater comfort afforded in the centre which led to increased

satisfaction in services provided as well.

PV solar panel installed at Quepem Health centre, Goa

Lessons learned and possible shortcomings

- While the replacement of lighting to LEDs was done it has left a stockpile of a significant number of old generation lights that are possibly usable, and hence which can neither be scrapped nor disposed.
- Also there is no clarity or understanding between PHC staff and the installers GEDA about who should wash the panels and what the frequency/ procedure for the same is.
- GEDA does conduct inspections and any breakage of panels/ components within warranty period are being replaced/ repaired by them. Future plan of action after warranty period is currently not know and needs to be chalked out.
- Also, in Quepem PHC it is only the new building which could utilise the benefits of solarisation. The old building still runs on conventional electrical supply since the wiring of the building is ancient and the entire system needs a revamp.
- All in all the PHC will recover the cost of the panels and break even in a few years provided no untoward events take place.
- These are a few points to be considered while proceeding with subsequent solarisation of other centres.

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14

Leadership in primary healthcare in Noolpuzha, Kerala Family Health Centre as a step towards climate resilience

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Background

Poor community health is a key determinant of climate vulnerability. Hence, strengthening primary healthcare should be seen as one of the foundational blocks for achieving climate resilience. Healthier communities are more resilient to changing climate, therefore, it needs to be ensured that there is an equitable and affordable access to primary healthcare. The Noolpuzha Family Health Centre (FHC), a primary healthcare facility under the public health system, operates with a vision of providing inclusive, affordable, and equitable primary healthcare to all.

This Family Health Centre is located in Noolpuzha, a village in Wayanad district of southern state of Kerala. It is the second largest tribal-populated Panchayat in Kerala. Noolpuzha's estimated population is around 16,000. The FHC is a primary healthcare provider, under the public health system of Kerala. It provides services across various sections such as deliveries, non-communicable diseases, vector borne diseases, other communicable diseases, etc.

The success and uniqueness of this FHC can be attributed to Kerala's decentralised planning, which started with People's Plan Campaign in 1996. It was a pioneering movement towards empowering the Local Self Government bodies. Under the campaign, the state government committed to devolve 35-40 percent of the plan or development budget to LSGs. Kerala follows a multi-stage decentralised planning process, which involves multiple stakeholders from the concerned sectors, including the residents. After consultation with stakeholders, decisions are made regarding programmatic needs and budgets. This kind of decentralised planning helps to include voices at the ground level and ensures representation of both the community and community healthcare providers.

Dr Dahar Mohammed, the Medical Officer of Noolpuzha FHC, has been at the forefront of providing quality primary healthcare services to the residents of

Noolpuzha. Since decentralisation, different levels of healthcare facilities have been under the control of the respective levels of government. This FHC is under the authority of Noolpuzha gram panchayat. Driven by his own vision to develop a sustainable healthcare facility and leveraging the benefits afforded by decentralized planning, Dr Dahar has been very proactive in pursuing funds for the implementation of primary healthcare initiatives. It is his vision to ensure that the tribal population of Noolpuzha has access to all primary healthcare services, that too of good quality.

Interventions implemented

Digital health

- Noolpuzha FHC operates on an e-health system, an initiative under Ayushman Bharat Digital Mission. The digitisation began in the year of 2018. The users of the healthcare facility are issued an eHealth card, which is linked with their Aadhar card (India's unique identity system for its residents). The user's health records are linked with the health ID number. 'Paperless prescription' is a unique feature of this FHC. The doctor feeds the prescription in the health system which is forwarded to the pharmacy located in the same premises. Thus, the e-health system cuts down on the use of paper, with health records, referrals, and prescription being done online. Printout of treatment history is provided to patients only when they demand it.

E-health system implemented at Noolpuzha FHC, Kerala

Solar energy and water management:

- Water heating and outer lighting are powered by solar energy. The solar water

heater has a capacity of 300 litres. The FHC is in talks with Kerala electricity board for solarisation of the entire facility.

Solar powered water heating and outdoor lighting facility at Noolpuzha FHC, Kerala

- The FHC has a rainwater harvesting setup connected to a tank with a capacity of 2000 litres. The water that is collected is used for gardening.

Rainwater harvesting setup at Noolpuzha FHC, Kerala

Waste management:

- The FHC has a composting pit on its premises, with a capacity of 50 litres. All the food waste that is generated is dumped into the composting pit. Compost is used for gardening and sold to the people.

  Biomedical waste is segregated at the point of generation. The facility has colour coded bins for different types of biomedical waste, as outlined in the Biomedical Waste Management Rules, 2016. Every two days, the biomedical waste is collected and taken for treatment by IMAGE (Indian Medical Association Goes Ecofriendly). IMAGE is a state-of-the-art common biomedical waste treatment and disposal.

- For e-waste, the collection is done as needed by Clean Kerala Company Limited,

formed under the Local Self Government department, Govt. of Kerala, for management of non-biodegradable solid waste.

Composting pit and segregated bio-medical waste at Noolpuzha FHC, Kerala

Other green initiatives

E-rikshaw for patient transport and sitting area built around a tree, Noolpuzha FHC, Kerala

- Care has been taken that existing trees are not cut during construction of new structures and renovations that took place in 2016. Any new structures that were built were made around the existing trees. There is an electric auto on the premises which is used for picking up and dropping certain sections of patients, especially patients from Adivasi (tribal) hamlets. This is a step towards improving health services in tribal regions, as Noolpuzha is the second largest tribal populated Panchayat (local body) in Kerala.

- The effort is proving to be beneficial in reducing the GHG emissions that come from patient commutation in regular vehicles that run on fossil fuels. The administration is planning to increase the number of electric vehicles for outreach activities. The FHC also offers telemedicine services once a week, for an hour. This is used for getting opinions from specialist doctors. Telemedicine can help in reducing patients' vehicle traffic which in turn reduces the GHG emissions.

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15

Solarization of Patewa PHC, Chhattisgarh: A Success Story of a Solarized Health Facility

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Background

The Primary Health Centre (PHC) is located in Patewa village in Mahasamund district of Chhattisgarh. The PHC is present on a slope along NH6, which connects the state of Odisha. This area is in the outskirts of Raipur, the capital of the state. Power cuts were a main problem faced by the health staff in Patewa PHC.

Currently, the PHC serves a population of thirty-three thousand (33000), of which 30-40% are tribal. The PHC works 24×7 hours and provides outpatient services, emergency services, vaccination services, and speciality services such as maternity services, etc. A monthly average of 50 deliveries are performed, and 30–40 outpatients visit the PHC every day. The PHC has two single- storey buildings. One building has a room for doctors, a waiting area, an emergency room with one bed, a ward, a pharmacy, a laboratory, a store room, a washroom, and a separate room to keep solar batteries and their inverters. The second building has a delivery room, a 10-bedded maternity ward, a washroom, and a room to keep the refrigerator and an autoclave. They have 16 permanent staff and one each from Jeevan Deep Samiti (JDS) and Ayushman Bharat schemes.

The study was conducted by Healthy Energy Initiative - India (HEI) in collaboration with State Health Resource Centre (SHRC), Raipur, and Chhattisgarh State Renewable Energy Development Agency (CREDA).

Inervention

The PHC was solarized in 2016. They have an off-grid system. Before the solarization process, an assessment was conducted by CREDA to understand the electricity needs of the PHC. The assessment also included an inspection of the site, identifying the location to keep the panels and the type of photovoltaic system needed in the centre. Possibilities for climate vulnerabilities were also considered during this process.

Details of Process

Currently, 30% - 40% of PHC is solarized. Solar energy is mainly connected to lights, fans, one deep freezer and one computer system. As part of solarization, new wires to connect the SPV system were setup in the PHC. Most of the lights and fans that are connected to solar energy are energy efficient, such as light-emitting diode (LED) lights etc. Lighting in the emergency room makes it possible for the staff to provide treatment. "Now, we have electricity in the injection room at night which is helpful for us to provide emergency treatments", said a rural medical assistant. In addition, it enables them to conduct deliveries even when the grid fails.

"सोलर से कनेक्ट होने के बाद मेटरनिटी वार्ड में पर्याप्त रोशनी होती है। हम रात में भी प्रसव करने में सक्षम है। हम रात में भी नवजात शिशुओं के लिए सक्शन और आपातकालीन रिससिटेशन काने में सक्षम है।"

~रूरल मेडिकल असिस्टेंट

After connecting to solar, there is enough light in the maternity ward. Even at night, we can conduct deliveries and in case of emergencies we are able to do suction and resuscitation for newborn babies

~A rural medica assistant

Solarization of the PHC has made a great impact on the service delivery by the health centre.

Maintenance of SPV System

The maintenance services are provided by CREDA. Maintenance is done once a month. In the PHC, one technician and one helper are appointed for this purpose. During the monthly maintenance process, panels are cleaned, they are checked for rust, and the branches of trees that shadow the panels are removed. In cases when solar gets shut down, the PHC staff informs the in-charge rural medical assistant, and they will contact the corresponding maintenance technician. CREDA also had a complaint and grievance system. On the website, PHC staff can submit complaints so that CREDA can resolve them as soon as possible.

Satisfaction and Suggestions of PHC Staff

PHC staff are completely satisfied with the solarization of the hospital. At present, the PHC is 30% solarized, but the staff expect at least 80% of the PHC to be solarized. The suction, warmer, and autoclave machines need to be connected as a priority. Once the power goes out, a person has to manually switch to the battery system. The process will take 5 to 10 seconds. This time can be reduced if the system is automatic.

Outcomes

Communication

Since there is an SPV, the staff are able to charge their phones even when the grid fails. It brings a sense of safety and security, especially for female staff working on the night shift.

Financial benefits

Since there is an SPV, the staff are able to charge their phones even when the grid fails. It brings a sense of safety and security, especially for female staff working on the night shift.

Water and sanitation

Solarization has brought better availability of water in the PHC. Water from the well is pumped to the tank with the help of a solar-powered motor, which is later supplied to taps inside and outside the PHC. Outside the PHC, there is a solar dual pump. It is an innovative pump designed to utilize the power of the sun during the day and act as a normal hand pump when solar energy is not available, hence ensuring an uninterrupted water supply for drinking, sanitation, personal hygiene, etc. Solar heaters are also available in PHC so that the patients, especially the postnatal mothers and staff, are able to access hot water. Drinking water is supplied by the grama panchayat.

During extreme weather events

In the extreme rainy season, there are voltage fluctuations and power outages. Since there is a solar energy connection, the PHC was able to provide services during these times. Even in situations when the battery is getting drained, CREDA is able to do a booster charge to the batteries for a continuous supply of power.

Key Learning Points

- The benefits of solarizing health facilities are multi-dimensional. Uninterrupted power supply enables health professionals to provide quality care for their community.
- In areas that are remote and rural, communities are able to access the healthcare they need, when they need it.
- Money is also saved when using solar energy, which can be reinvested to support other priority health programmes.

- Solar energy also contributes to making health systems more resilient. Reliable power supply ensures the effective management of health facilities.
- By solarizing the health facility, we are able to contribute to the overall universal health coverage.

(Left) Water tank connected to Solar Panels (Right) batteries of solar placed in a separate room, Patewa PHC, Chhattisgarh

"हमारा अस्पताल सुदूर इलाके में है। पहले हम रात में भी दो घंटे बिजली कटौती होती थी। अस्पताल में सोलर होने के बाद, हमारे पास बिजली है।

~रूरल मेडिकल असिस्टेंट

Our hospital is in a remote area. Earlier, there were power cuts for two hours during nights. But, after the hospital has become solarized, electricity is available.

~A rural medica assistant

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Solarization of Sub-Centres in Meghalaya to Reduce Energy Costs and Avail Financial and Environmental Benefits

Sunila Dixit[1]
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Background

The state of Meghalaya has a population of 29.67 lakhs. It has 11 districts with a total of 463 sub centres. According to the National Family Health Survey 5, the infant mortality rate is 32.3 deaths per 1000 live births and as per the Sample Registration Survey 2016-18, maternal mortality rate is alarmingly high at 197 deaths per 1,00,000 deliveries.

Meghalaya faces frequent power cuts which affects the delivery of healthcare services. These disruptions in power can last as long as eight hours per day and can be worse during the monsoon period as the power supply lines go through the forest. Sub-centres are the first point of contact in the public health system of India, and they assume even more importance in states like Meghalaya, where 80% of the population lives in rural and remote areas that do not have access to state of the art health facilities, given its hilly terrain.

Thus, it was the need of the hour to make Meghalaya's health system reliable by addressing the energy needs in a sustainable way. Clean energy access is essential in reducing the energy footprint of the health systems and making them climate resilient in the face of extreme weather events.

Sustainability interventions implemented

- The government of Meghalaya, in partnership with SELCO Foundation, under National Health Mission has installed solar panels on 100 sub-centres in eleven districts, along with energy efficient equipment. The list of equipment that runs on solar energy includes – tube lights, fans, charging points, radiant warmer, suction apparatus, spotlight, and vaccine refrigerator.

- The solar power system provided in sub-centres is off grid, i.e., there is no dependency on the grid. The battery that accompanies this system provides a

backup of up to three days, in case of unavailability of sun due to weather conditions. For sub centres, they have segregated the solar power system for luminaries, equipment, and staff quarters.

Luminaries (DC system)	0.2 kW
Labour room medical equipment (radiant warmer, spotlight, suction apparatus)	0.75 kW
Luminaries in staff quarter (DC system)	0.1 kW
Standalone solar streetlight	0.04 kW

- Before the installation of solar panels, the delivery of health services used to be affected due to power cuts. Since the installation, the Auxiliary Nurse Midwives have experienced significant improvement in the functioning of sub-centres, especially in the way there is no interruption during the delivery of pregnant women. The sub-centres run entirely on solar energy. SELCO Foundation has trained the staff at sub-centres on how to maintain the solar panels which includes cleaning it and refilling the distilled water in batteries.

Solar panels installed at Darugre sub-centre

Outcomes

The subcentres are saving up to Rs 7,380/USD 95 annually each, while preventing approximately 25 tonnes of carbon dioxide emissions. The government of Meghalaya, along with SELCO Foundation, intends to solarise the remaining 342 sub centres and 122 primary health centres across the state. The site assessment is in progress.

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Assisted Telemedicine Services for Increasing Access to Healthcare and Reducing its Carbon Footprint

Indumathi Arunan[1], Mohammed Gowth[2]
[1]Health and Environment Leadership Platform, [2]Aravind Eye Care Madurai

Background

City: Thiruppuvanam and Madurai
State/province/region: Tamil Nadu
Type of institution: Private tertiary Eye Care Hospital and its satellite assisted telemedicine centre
Number of full-time staff: 2 staff at the telemedicine centre
Patient population served annually

- **Number of patients served annually (total of inpatient and outpatient):** 9600
- **Geographic area served by your institution:** Thiruppuvanam town (and 7km around)

Health Equity Concerns in population: Lack of access to eye care facilities in town.

At present, public health infrastructure and services in peri-urban and rural India are lacking or inadequate leading to a gap in access to healthcare, especially for rural poor. In Thiruppuvanam, a small town in Tamil Nadu, there is a poorly functioning government Community Health Centre without ophthalmology services. The residents in and around Thiruppuvanam practiced basic traditional eye care and did not seek early treatment for treatable eye ailments. The closest eye care hospital was 20km away in the city of Madurai, and patietns would have to travel that distance, often at the cost of their daily wages.

Detail of Intervention

- Established a vision centre in a small town without prior ophthalmology services.
- Provided service for over 59,000 patients since 2009
- Incentivized patients to seek earlier treatment for vision problems
- Disseminated IEC materials on eye care and eye safety.
- Trained and hired local women as ophthalmology nurses and provided workplace

benefits and job security.
- Reduced 54.3 tCO2e emissions due to reduced patient travel in 2021

Aravind Eye Care Hospital, Madurai set up a satellite telemedicine centre (called Vision Centre) in Thiruppuvanam. The Vision Centre provides primary eye care to populations within a 5-7 km radius of the town. The centre is staffed with a coordinator and a vision technician. The coordinator manages the administration work and the technician does primary eye tests and care for the patients. Eye examination findings are entered into the electronic medical record system known as **Eye Notes**. In the base hospital in Madurai, the ophthalmologist in the teleophthalmology centre access these records in real-time and provide teleconsultations and referrals as needed. The teleophthalmology centre is staffed with four doctors (three ophthalmology post graduate students and one consultant ophthalmologist)

The vision centre receives 25-30 outpatients in a day. Only 12% of patients are referred to the base hospital in Madurai for tertiary care. Prior to the setting up of the vision centre, home remedies were used by people of Thiruppuvanam to treat infections. Vision conditions like myopia and hypermetropia were left untreated, leading to needless blindness. Due to the presence of the vision centre, patients are getting cured of needless blindness as well as seeking early treatment for infections. The Madurai base hospital provides teleconsultation to 34 other such vision centres in the state.

The service provided at Vision Centres is subsidized to be affordable for peri-urban and rural populations. New patients are given a unique number upon registration. A fee of Rs. 20 (0.27 USD) is charged for a first-time full eye checkup, along with two additional visits which are free of cost. A blood sugar test is also done at Rs 25 (to check for potential diabetes as a causal link to eye ailments). Medicines provided are subsidized at a cost of Rs 50-100 (~ 1USD). Staff ensure regular follow ups for patients, to ensure treatment is complete.

The vision centres are further economical for the patients because they do not have to

Vision Technician and patient at Thiruppuvanam Centre reception and IEC Materials in Tamil language

travel to the base hospital for care, which saves travel costs and ensures no loss of wages and opportunity costs for daily wage workers. Patients of the vision centres spend only 50% of the cost of visiting the base hospital. Further, patients usually visit the base hospital with an attender for company, however half of the patient population at vision centres are able visit individually (saving time and money).

At Thiruppuvanam, the Vision Centre was established in an already existing housing complex. Aravind Eye Care rents the property to run the Vision Centre. In this way, Aravind Eye Care has prevented the construction of a new building for providing healthcare. Energy use is minimal-lighting and ceiling fans, as well as medical equipment. Since there is no consistent power supply in the area, inverters are used for backup. 10 vision centres of Aravind Eye Care are equipped with solar power. The Thiruppuvanam centre is yet to get solar. Patients travel within 7 km to the vision centre, and only those who require tertiary care (~12% of patients) travel 20 km to the Madurai base hospital by public buses. The quality of service provided in the vision centres is the same as provided at the base hospital, but in a less energy intensive building. In Thiruppuvanam, since there was no prior eye hospital in the area, patient travel for primary eye care has increased, but the need to travel longer distance to the base hospital for tertiary eye care has reduced.

Base Hospital Teleophthalmology center and medical professional on a telemedicine call

Reduction in Carbon footprint due to reduced patient travel (2021): Thiruppuvanam

- Total Outpatient Visits: 9590
- Specialty cases referred to base hospital: 590
- Trips avoided to base hospital: 8553kms (40 km two-way)
- Emissions saved by trips avoided: **54.3 tCO2e**

Other measures that reduce the carbon footprint of the vision centre are:

- The use of electronic medical records since 2008 has saved paper usage
- Spectacles are now ordered online. Initially, spectacle orders were placed to the

base hospitals and the frames transported to the vision centres; but now they are directly delivered to the vision centres, reducing delivery travel.
- During COVID, gloves used by the staff were initially replaced every 3 hours, but were reduced to daily replacement, thereby reducing waste generation. Through this, **732 less gloves were used** during the period.

Scaling across south India

- 100 vision centres established in India (in Tamil Nadu and Puducherry) (as of March 2022)
- Services a population of 8,500,000 who would have not had access to eye care
- Around 700,000 out-patient visits annually
- 90,000 spectacles dispensed
- 85% patients fully treated on site; only 15% referred to tertiary eye care hospital
- 25,000 Cataract surgeries done through referring to tertiary eye care hospital

Implementation Process

- While setting up vision centres, a demographic study is conducted first, to assess the socio-economic status of the location. Vision Centres are established in areas only where there are no prior ophthalmology services - public or private. Once the location is selected and the facility is set up, three days of intensive outreach is done to spread awareness of the facility.
- Thiruppuvanam has a large community of people in the brick work profession, and hence brick factories were targeted to spread awareness. In other communities, door to door outreach was also done.
- It took Rs 1,250,000 (16,500 USD) to set up the Vision Centre and takes Rs 606,595 (7800 USD) to run annually.
- Equipment for the facility is sourced from Aravind's own equipment manufacturing plant which is nearby (Aurolab), thus reducing costs and carbon footprint of procurement. Aurolab manufactures affordable intra-ocular lenses, medications and ophthalmic equipment. It has 12% of the global market in intra-ocular lenses. It also practices many sustainable initiatives in the eye care supply chain. Some medication provided to patients is also from Aurolab.
- Aravind Eye Care prioritizes hiring of local women for all their operations. Over 80% of staff are women from nearby areas who are intensively trained for two years in various skill sets that will be used in ophthalmic care giving process. They are called midlevel ophthalmic personnel (MLOP). When needed, these staff are trained and re-posted in vision centres. Aravind ensures continued employment for their staff even in the case of relocation (which happens often after marriage).

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18

Composting Vertical Pipes, Community Health Center, Shirali, Karnataka

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Background

Composting pillars was implemented in Community Health Center, Shirali, Bhatkal Tq, Uttara Kannada district. In the hospital backyard garden, there was lot of food getting wasted by clients and attenders. They used to throw it in bins and sometimes outside. Due to that some stray animals like dogs, birds, cats, etc come to eat this rotten food and spread all over. This was making nuisance in hospital premises leading to land and air pollution.

Details of intervention

- Collecting the waste food materials in black colour coded bin which is meant for wet general waste.
- Disposing this food in composting pillars and covering partially with hand full of soil or some amount of soil.
- Closing the lid of composting pillar.
- Repeating the same process until the composting pillar gets filled.
- Food gets fermantation in due coarse and convert to compost which can be used as plant nutrient.

Process

- Take 8 pipes of 6 feet height, 6inch in diameter with the lid.
- Dig the pit of 1feet depth from the ground level.
- Then to fit the composting pillar in that pit
- To this pipe add 1kg liquid jaggery, ½ bucket cowdung and a layer of soil in each pit.
- To fill the waste food and mud,close the lid every day.
- Once the pipe is filled completely close the lid.
- Then start the same process with the other pipes till the last pipe gets filled.
- Then content of the first pipe is emptied.

- Dig the pit surrounding the plants , fill it with the composted content and cover with a layer of mud.
- This becomes a compost and will act as a very good nutrient for plants.

Food waste collection for composting in verticle pipes, Community Health Center, Shirali, Karnataka

Outcomes

- Time frame: 3 months cycle
- Composting verticle pipe is a ongoing process.

Outcomes achieved:

- The nuisance created by waste food is stopped.
- Land and air pollution is controlled.
- The compost is used as a very good nutrient to plants.
- Economic saving and a organic fertilizer.

Key learning points

- Can be implemented in other health care facilities.
- This is replicable at all settings

19

Sustaining WASH infrastructure and IPC in a 60-year-old Building Located in Hard-to-reach Tribal Areas: Sub-Divisional Hospital Chitrakonda, Malkangiri, Odisha

UNICEF-India

Programmatic Achievement: Despite functioning in an old building with crumbling infrastructure, SDH Chitrakonda has received two Kayakalp awards – 2020-21 and 2021-22. The story of change started around 2019-2020 when the HCF received simultaneous funding of Rs. 10 lakh under the Swachh Swasth Sarvatra (SSS) program.

Background

Health service delivery in challenging negative externalities

- **Hard to reach:** Sub-divisional hospital (SDH), Chitrakonda is an island of hope for health service access to a large tribal population in hard-to-reach areas of Odisha. The hospital has 18 sub-centers in its catchment area out of which 11 centers are only accessible through inland waterways via local boats. The State government has arranged for boat ambulance to reach patients in these areas which goes twice a month to different centers. Despite the ambulance service, the patients cannot be treated at doorstep and are often carried on a stretcher till the ambulance for health service provision. SDH Chitrakonda is the only medical facility within reach to several tribal hamlets and its outreach staff caters to them in difficult environments and logistical hurdles.

- **Language constraints:** The Chitrakonda area falls on the border with the state of Andhra Pradesh and is mostly surrounded by dense sandalwood forests. The population is largely tribal having several mixed dialects, thus posing severe language constraints for health service providers.

- **Limited connectivity:** Due to a mix of hilly terrain, forest area and water-logged regions, communication and connectivity is also bleak which further mars effective health service delivery.

- **Socio-cultural difficulties:** The health staff at SDH Chitrakonda narrated their common issues in serving the tribal population. Shashank Shekhar Kara, Health Supervisor spoke - *"they still resort to traditional healers. Sometimes we use these healers as influencers to help extend our services, especially during vaccination drives".* Satyabhana Mahanta, Nursing Officer, Labour Room who has been at the hospital for 15 years shared her experience – *"they have traditional mindsets, that no one can touch their women, so institutional delivery becomes a challenge. They also have caste system and religious superstitions. Moreover, the tribal women are very hardworking, they work till the last of 9 months of their pregnancy. Sometimes, it is difficult to convince them to come and stay at the residential facility at our hospital for pregnant women (called Maa Graha). They also don't want to come as they don't eat hospital food. They often cook their own food outside the hospital."*

- **Health and hygiene behaviour:** The health seeking behaviour of the population visiting the SDH is low. The hospital staff says – *"they have no knowledge of hygiene. Open spitting, open urination is common. They don't know how to use toilets. Even female patients prefer bathing in the open. The toilets given to them under Swachha Bharat Mission are mostly used by them as storeroom."*

- **Hospital building related issues:** The hospital building is from year 1962 i.e. almost 60 years old. The infrastructure is crumbling and dilapidating rapidly. Also the building is as big as a district hospital with limited cleaning and maintenance staff, limited funds and limited access to resources due to hard-to-reach area.

Surabhi Hanta, sanitation worker, age 24 yrs. mopping the floor using three bucket system © UNICEF/UN0643263/Jariwala

The story of change

- **Swachh Swastha Sarvatra (SSS): Fueling funding for WASH initiatives**
  Despite functioning in an old building with crumbling infrastructure, SDH Chitrakonda has received two Kayakalp awards – 2020-21 and 2021-22. The story

of change started around 2019-2020 when the HCF received simultaneous funding of Rs. 10 lakh under the Swachh Swasth Sarvatra (SSS) program. The coinciding of SSS funds with the onset of Kayakalp gave the funding impetus to fast-track action and transform plans into immediate implementation for transformation/'kayakalp' of the hospital. Dr. Khirodchandra Mohanta, Medical Officer In-Charge (MOIC) recalls – *"in 16 years of my service, the hospital was never painted. Through SSS funds for the first time, we undertook painting of the building. We purchased the paints, but the labour was provided by the hospital staff and Nirmal workers. When we all painted the hospital together, it created a homely feeling towards the hospital and since then we have been continuously improving this old building"*.

Other works which were accomplished through the funds include:

- Cleaning of overall premises.
- Ground- leveling
- Covering open drains
- Addressing pipeline blockages in toilets.
- Minor repairs in toilet to make them functional.
- Installation of elbow taps
- Installation of new wash basins in critical care areas.
- Purchase of bins for BMW segregation.
- Concretization of footpath in the containment area for BMW disposal.
- Creation of herbal garden
- Installation of rain water harvesting system
- Purchase of automated sanitizer machine
- Conversion to LED bulbs
- Improving hospital ambience – installation of fountain, making a badminton court etc.

Hospital staff engaged in painting the premises

- While appreciating the role of SSS funds in the hospital transformation, the MOIC talked about overall funding constraints for WASH and IPC related works – *"RKS funding is Rs. 5 lakhs annually. Of this Rs. 1.5 lakh is ambulance driver salary plus ambulance repairs are there. So there is hardly any fund available. We barely manage to keep up purchase of housekeeping supplies. And with COVID-19, IPC needs have also increased. Only because we got SSS funds, we could think of competing for Kayakalp, or else we would have never been in the race only!"*

WASH Assessment and UNICEF support

- **Gap assessment and cost-based action plan:** With the onset of Kayakalp at SDH, Chitrakonda, UNICEF field staff facilitated a WASH assessment of the hospital to identify gaps in existing infrastructure, existing staff practices on WASH and IPC and operation and maintenance of WASH infrastructure. Based on the gaps identified, handholding support was extended in setting priorities and drawing up a cost-based action plan for improving WASH and IPC. This also included suggestions on proper utilization of SSS funds as highlighted above.

- **Augmentation of additional funds and guidance on fund-utilisation:** The cost-based action plan was shared with CDMO, who sanctioned further funds for drainage cover; changing all ceiling lights to LED for energy efficiency; installing an autoclaving machine; purchasing shredder; and improving flooring for hospital entrance.

- Further, through UNICEF liasoning at district level, BMW funds have been increased for SDH Chitrakonda. MOIC acknowledges – *"infact we started having that much fund in BMW that we were not able to utilize it fully, then UNICEF guided us on how to improve BMWM – containment area was renovated and a proper footpath was built for waste handler to carry the trolley from facility till containment area".*

- **Enhanced departmental coordination:** UNICEF helped in coordinating with other departments like public health and engineering department (PHED). Junior engineer (JE) lent technical expertise in reorganization of labour room and improvising on the previously uncovered entrance to the labour room. Wall tiling was undertaken as an IPC measure in many areas. Deep and wide basins were installed with engineering guidance from JE. MOIC said – *"we installed deep and wide basins after we learnt of their proper purpose and use through UNICEF field staff."*

Handholding, Supportive Supervision and On-site training:

- ***Water Quality*** - SDH Chitrakonda is located in a hilly terrain with hard rock, so ground water access is an issue. The MOIC said that out of 8-9 borewells, only three are functional. After UNICEF's interventions in WASH, water testing was

done for quality surveillance. The groundwater was found to have high iron content with red mud. After testing, the borewell depth was increased to fix the water quality issue. Checklists for overhead tank cleaning were also regularized after WASH assessment.

- **BMWM:** Uptil two years back, the HCF was having issues with BMWM disposal. The boundary wall was broken. Households on the fringe were also throwing their waste in the hospital open pit. Proper segregation was an issue due to limited skill amongst staff. There was no containment zone for collected waste. All segregated wastes were being dumped together and mixed again, thus rendering the segregation effort futile.

- UNICEF and Region Resource Centers (RRC) staff repeatedly trained nurses on proper waste segregation. Waste handlers were given training on safe collection and disposal of waste. MOIC recognized UNICEF's role in improving BMWM – *"they gave use proper information and trained us on how to better manage our waste."*

- **IPC in Labour Room:** Labour room nurse spoke of the conditions - *"the labour room and newborn care unit often used to smell and were not cleaned properly. When UNICEF staff came and gave us training on proper waste segregation and other IPC related tips, the conditions have improved"*

State government support through Nirmal Yojana

- **Toilets:** The MOIC praised the support extended by the State government through the Nirmal Yojana for provision of cleaning staff to the hospital – *"Nirmal Yojana changed everything. Earlier we could only have two staff from Rogi Kalyan Samiti funds for such a big premise. Now we have eight cleaning staff so work is done properly. There are 17 toilets and they are cleaned three times a day. The Nirmal Supervisor maintains the checklists."*

- **Water quality management:** Overhead tank (OHT) cleaning is being practiced regularly at the health care facility (HCF) with the help of the contractual staff provided by the State government under the Nirmal Yojana.

- **Bio medical waste management (BMWM):** The HCF has been provided with waste handlers under the Nirmal Yojana who perform the critical task of collection and disposal. The pharmacist has been assigned as the BMW supervisor who oversees the work of the waste handlers.

- **IPC:** The hospital staff highly appreciates the help extended through the Nirmal Yojana's cleaning staff. The nursing staff was vocal about the lacunae and lapses in overall cleaning of the hospital and critical areas, especially labour room

previously when the Nirmal staff was not assigned. A drastic change in IPC practices has been observed and acknowledged with the addition of Nirmal human resources.

Community engagement

- SDH Chitrakonda has active community support which engages in hospital upkeep and is willing to give labour and material contributions. The Border Security Force (BSF) participates in cleanliness drive at the hospital 3-4 times annually. As a mark of recognition and reciprocation, HCF provides staff and drug support during BSF health camps.

BSF's participation in WASH and IPC related activities at the Hospital

- The forest department also extended help in plantation and garden development in and around the hospital.

- The local MLA's visits the HCF regularly to understand the emerging needs. He actively takes patient feedback for monitoring. His active presence also helps in maintaining an open channel of communication till the district administration to address issues on a need basis.

Way forward

Water Security: The 40 bedded hospital has ten overhead tanks with total capacity of 6500 liters. Given the low patient occupancy of 15-20 beds on an average, the water capacity is sufficing at the moment. But altogether, the HCF has water security issues. In the future, it would require water augmentation as the demand increases.

- The HCF has taken up efforts for rainwater harvesting but at the moment it is limited to collection of water to use for secondary purposes like gardening. The

MOIC plans to extend the rain water harvesting system for replenishment of ground water aquifers/borewells in the future as a sustainable measure for water security.

Biomedical waste management (BMWM): There is a continuous need for BMWM handholding and training support. The disposal mechanisms also need further streamlining as currently waste collection vehicle is unable to reach the remote area.

Behaviour change: The hospital also needs to lead SBCC initiatives in the region for improving health and hygiene behaviours and practices amongst the populace.

Conclusion

Altogether, in his concluding remarks, the MOIC proudly shared the achievements made in the last few years and said – *"a 60-year-old building has been renovated to the level that it can now sustain many more years, although as per government guidelines, a building becomes non-functional after 30 years of use. So the teamwork done to achieve this level of renovation in the building is noteworthy."*

Submissions to WHO's Call for Case Studies on Climate Change and Health 2021

1

Building Climate Resilient "Pozhuthana Family Health Center"

Sushama P.S[1], Nitha Thankam George[2], Shweta Narayan[3], Manu MS[4], Basil Saju[4]

[1]Medical Officer, FHC Pozhuthana, [2]Healthy Energy Initiative India, [3]Health Care Without Harm, [4]NPCCHH Kerala

Background

Extreme weather events have become more frequent and intense globally over the recent decades due to climate change. In the last ten years, India experienced over 15 extreme flooding events. In the year 2018 state of Kerala in India witnesses the worse flooding event in a century. Kerala's Directorate of Health Services estimated a loss of almost Rs.110 crores to government hospitals alone. In the worst affected districts of Ernakulam, Pathanamthitt a, Thrissur and Alappuzha, several hospitals were forced to evacuate patients and suspend surgeries and critical care.

This case study focuses on the resilient recovery of a Primary Health Care Centre (PHC) in Wayanad District in Kerala.

Damage at the PHC Pozhuthana, Wayanad, Kerala

Aftermaths of 2018 floods

Heavy rainfall resulted in landslides in the Wayanad district resulting in silting of rivers and further aggravation of the floods. All regions in the Pozhuthana panchayat were submerged for at least two days in August 2018. Pozhuthana PHC was one of the worst affected health centers in the entire district. The PHC lost most of its equipment, patient records, medicines due to flooding in its premises. In addition, there were structural damages to the building itself, the floor of the mini hall had broken, and the boundary wall collapsed. There was no power supply as the grid was affected due to landslides, and the backup generator was underwater as it was located on the ground floor of the PHC. The drinking water source for the PHC was also totally contaminated.

Leadership Of the Medical Officer At PHC In The Immediate Aftermath Of The Floods Dr. Sushma P.S. is the medical officer and the senior-most person at the Pozhuthana PHC. She has been the officer in charge of the center since 2010.

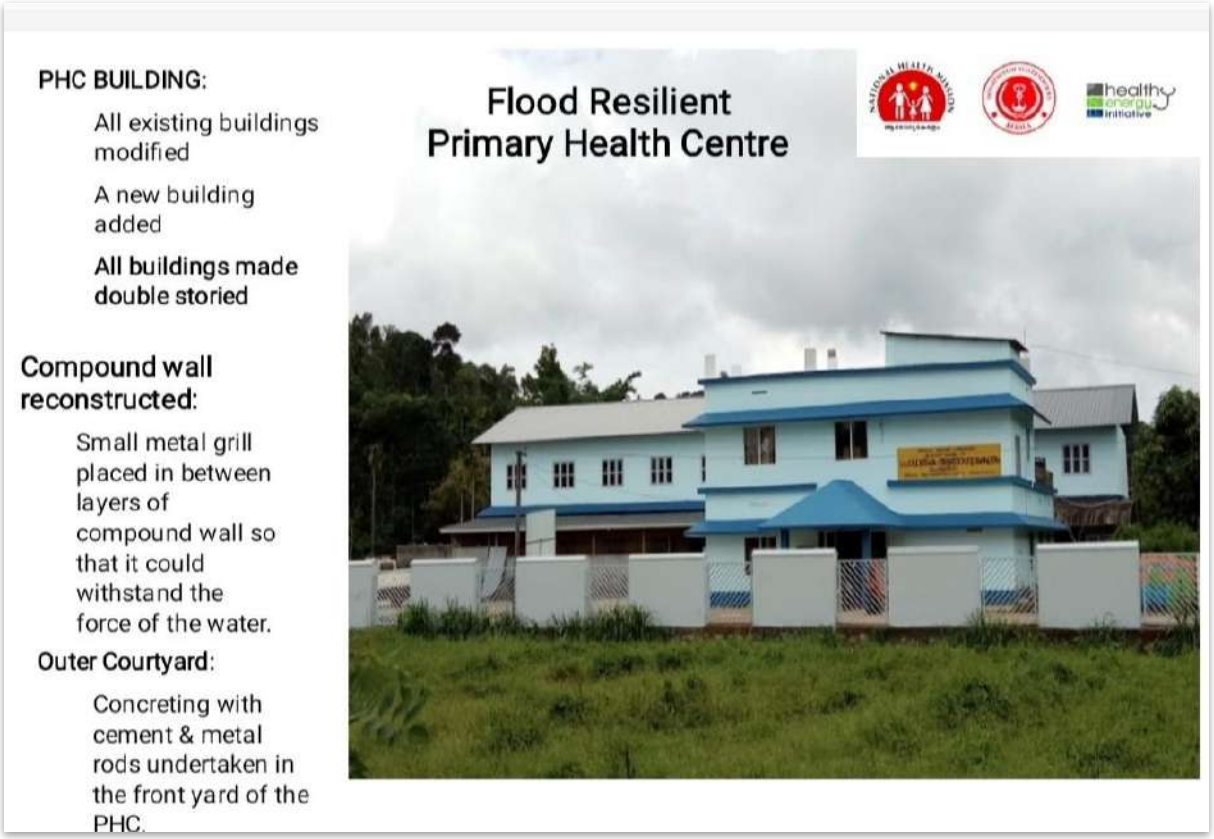
The devastating impacts of the floods on the PHC completely shattered the entire team's morale. Dr Sushma single-handedly documented the damage to the PHC and coordinated with the panchayat members about the situation at the PHC. The coordination and support from the local administration were prompt, and Dr Sushma was able to restart the health service delivery in the region from the moment the floodwater receded the next day. With the help of the panchayat president, she arranged a panchayat community hall to start the medical camp.
She coordinated with a local pharmacy to organize basic medicines like paracetamol, ranitidine, doxycycline, amlodipine and metformin, and medical equipment like stethoscopes, thermometers and BP monitoring machine and she started the outpatient (OPD) services. The PHC staff scheduled OPD in the morning hours and field visits in the afternoons.

Connecting The Climate Dots

Within a week of the floods, volunteers were organized to help clean up the PHC and shift the services back to the premises after obtaining a fitness certificate from the Assistant Engineer of the panchayat. While the majority of the funds for the restoration of the PHC came from the National Health Mission, the local panchayat also made a small contribution to show community contribution.
During the reconstruction phase, the medical team realized that such an event might occur again, and the new PHC should stand for such disasters. As the PHC is in flood-prone, low-lying region and it was difficult to shift the hospital itself, thus many aspects of the PHC were retrofitted to become flood resilient. For example, the compound hall was reconstructed to withstand the pressure of the water in the future.

A small metal grill was placed in between layers of the compound wall to ensure it withstood the force of the water.

Some of the walls of the PHC were tiled, and partitions were made using aluminum fabrication and painted so that walls could withstand the pressure of the water in the event of flooding. There are also plans to make additional ramps in the buildings for the easy-shifting of equipment and medicines in case of water inundation.



Newly constructed PHC floor with higher floor level, high wall tiling and ramps, FHC Pozhuthana, Wayanad, Kerala

2019 Floods

In 2019 Wayanad witnessed heavy flooding again. The PHC was still under construction and all aspects of floodproofing were not final. However, under the leadership of Dr Sushma, damage to PHC was minimized to a great extent. She and her team closely followed flood warnings. They worked with community members to move the medicines, machines, pieces of equipment to the higher floor before the PHC was inundated. Learning from 2018, the team had undertaken a disaster planning exercise much before the rain season. This helped them in building their knowledge and prepared them to act fast during the disaster. This an integrated multi-sectoral approach with shows that proper planning and capacity building can help in reducing damage to infrastructure and human health in the face of climate change.

Resilient Health Systems Lead To Resilient Communities

This story of Dr. Sushma P.S and her team at PHC Pozhuthana village is a statement of the collective determination, perseverance and collective resolve of the people of Kerala during a disaster. Dr Sushma's leadership and courage transformed the flood battered health centre to a well-functioning Family Health Center and is commendable. The transformation is also a shining example of inter- departmental collaboration and coordination. The members of panchayat, local and state-level health departments, Aardram Mission, DDMA and NGOs played a critical role in the process.

This case also highlights the need to see health systems not merely as healthcare providers but equally as the essential foundation for preventive care and a department that adds to building resilient and equitable societies. As demonstrated, a truly responsive and responsible health system would take a lead before disaster strikes by taking necessary measures, being prepared to manage disasters, and pointing to the harmful and inequitable effects of developmental activities in their local context. This principle of developing climate resilient health facilities through active participation of communities forms the core of the National Programme on Climate Change and Human Health (NPCCHH). Through different initiatives likes training, guidelines, and health adaptation plans, NPCCHH supports all states and union territories in India to build climate-resilient health services and more resilient communities.

2

Adoption of Risk Mitigation Measures Towards Air Pollution Through Community Mobilization in Chhattisgarh, India: An Aspiration for National Programme on Climate Change and Human Health

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Background

This case study is an excellent example of community mobilization in the fight for clean air through advocacy and communications on health. The ongoing efforts for pollution prevention at source by various stakeholders—Department of Health and Family Welfare (DPHFW), National Programme on Climate Change and Human Health (NPCCHH), State Health Resource Centre (SHRC), health professionals, local governing bodies and communities, has led to the strengthening of health care preparedness and community empowerment for adoption of risk mitigation strategies.

Threat in the air

Chhattisgarh, located in the centre-east of India, is the ninth-largest state with a population of 32.2 million as of 2020. The state had 40% population below poverty line in 2012 and 31% tribal population as per the 2011 census. The state has the highest number of mines and mineral-based industries. In north Chhattisgarh, Korba district is home to more than 10 coal-fired thermal power plants producing 6000MW of electricity and large opencast coal mines. These industries have led to a critical level of air pollution due to open disposal of fly-ash and have impacted water quality, damaged crops and impaired sun-dried food preservation process traditionally used by the residents to survive the lean season.

Over the years, residents of villages located in the periphery of the Korba power plant complained of health problems, specifically increasing skin and respiratory illnesses. As a pattern started to emerge, public health measures were taken to understand the gravity of the situation.

Assessing the impact

Chhattisgarh began assessing the health impact of the environment over the last 5-6 years with the help of SHRC and DPHFW. Initially, around 25 focused group discussions (FGD) were conducted to learn communities' concerns and identify sources of environmental contamination. Based on that, a cross-sectional comparative study was done in Korba and Raipur between 2016 and 2019. Area coordinators took environmental samples to assess the

extent of the contamination. A Health survey was done to estimate the respiratory disease burden around industries. The findings of higher pollution (high PM2.5 and heavy metals in dust) and high respiratory illness prevalence around power plants of Korba further strengthened the communities resolve to reduce their exposure to polluted air

Beginning of change

The researchers and communities did not have to wait for the Korba study outcome to act.

Area Coordinators are being trained for manual air sampling from Raipur and Korba, Chhattisgarh.

They identified notable gaps early on and immediately took action to reduce the health impact. The SHRC, with the health department and Health Energy Initiative India co-supported by Shakti Sustainable Energy Foundation, installed 150 low-cost monitors in the communities for real-time air quality monitoring and a spirometry machine were acquired in a nearby government hospital for early detection of respiratory issues. The findings from the FGD and Korba study paved the path for more significant reforms. The learnings translated into sensitization workshops and material for information, education and communication for general awareness and capacity building efforts to highlight the link between air pollution and human health, which are now being continued through NPCCHH. Messages on air pollution and health were developed in regional dialects, using local examples.

Low cost air quality monitor has been installed for real time air quality monitoring

The Panchayati Raj Institutions (PRI), administrative entities for villages' self-government, have played a critical role in empowering communities and spreading awareness on important issues. To build their capacity, manuals were created, and extensive

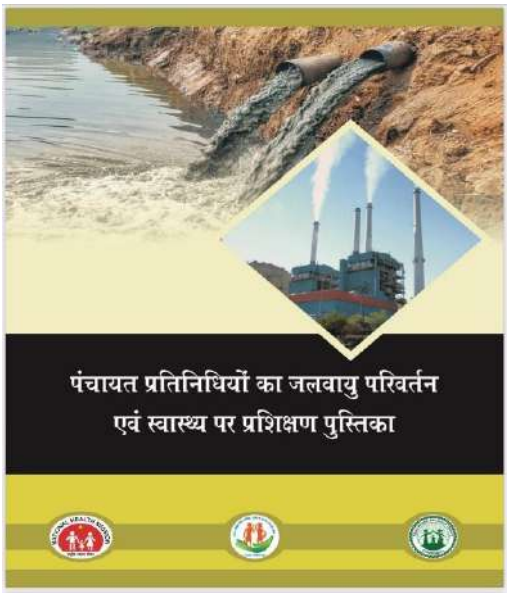
training drives were conducted in early 2020. Almost 21,995 PRI leaders were trained in various matters like tree plantation, organic composting, cope selection, solarization, rainwater harvesting, proper waste disposal, energy conservation, smokeless stoves and reduction of air pollution exposure.

IEC material on Air Pollution based on focus group discussions

Health workers as advocates of change

Over the last decade, India has implemented many national programmes on communicable and non-communicable diseases, but environmental health was not included. Chhattisgarh has been actively working on air pollution and climate-related health issues over the years. Still, with the establishment of State Climate Change and Human Health Cell (SCCHH) and NPCCHH, these efforts are now streamlined and formalized. Consequently, the state conducted training of trainers for awareness of the impact of air pollution in women and children (September 2020), observed the International Day of Clean Air for Blue Sky (September 7, 2020) and training PRI officials (November 2020) under NPCCHH.

As health professionals became aware of the challenges at hand, many important actional and policy decisions were taken. Environmental assessments were carried out in eight pollution-vulnerable districts in Chhattisgarh. State-level policy-makers acknowledged air pollution as a crucial health issue and requested a cohort study by a medical institution. DPHFW also collaborated with multiple stakeholders like civil societies, academic institutions, and subject matter experts to find solutions.



Training Module for Panchayat Leaders on Climate Change and Health

Air pollution warriors

The community health workers, called Mitanins (mean female friends in local dialect) in Chhatisgarh, have played a vital role in implementing health initiatives at the grass-root level since early 2020. They organically became a part of adaptation plans against climate change-related health issues. They were trained in air quality monitoring, air sampling and related health messaging. Additionally, their observations and experiences while caring for their own community's health need overtime imparted authenticity to their campaigns, regarding them "air pollution worriers".

Local health professionals were also inspired to get involved. So far, 6000 Mitanins and 500 doctors are trained and engaged in raising awareness. These efforts made communities more vigilant to sources of air pollution in and around their houses, raise concerns and take small measures to mitigate the exposure. The behaviour change included steps like willingness to adopt smokeless stoves, if a transition to cleaner energy source was unaffordable, and smaller measures like burning single incense instead of burning the whole packet, proper disposal of waste instead of burning etc.

> *Not just the land, human beings are turning infertile too. I am a Mitanin. When I meet people, I see so many miscarriages, stillbirths.*
> *~ Ms. Meena (a Mitanin from Korba)*

Way forward

There are plans to develop a community-based air quality monitoring system in the entire Chhattisgarh with the help of local pollution control authorities and continue training more health care workers and doctors. Two tertiary care hospitals are identified for sentinel surveillance of acute respiratory illnesses in the context of air pollution in the state under NPCCHH.

Lessons from Korba experience

Smokeless chulha (stove)

Community mobilization can be an important way to make a paradigm shift in all-encompassing issues like environmental health and climate change. It enables communities to help themselves assess their health needs, demand policy change, and ensure demand-driven, accessible, and high-quality health care services. Enabling community health workers is the key to community awareness. The model of Mitanins is replicable and scalable. It was scaled up country-wide in the form of Accredited Social Health Activist (ASHA) when National Rural Health Mission was implemented in India. Small household measures that communities adapted are replicable by any community needing feasible, low-cost solutions to reduce household air pollution exposure. Localized illness-oriented health care preparedness, i.e., health surveillance, providing basic diagnostics and treatment facilities at the community level around polluting industries, helps communities adapt to the persistent risk.

Additional resources

1. Pollution and Gender Korba (Video)
2. Meet the Mitanin- Korba's new air pollution warrior (Video)
3. Articles: Chhattisgarh leans on citizen science and participatory decision making to combat toxic air
4. Meet the Mitanin- Korba's new air pollution warrior

3

E-health: An Initiative to Climate-proof Medical Records

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[1]State Digital Health Mission- eHealth Kerala, [2] State Digital Health Mission- eHealth Kerala, [3] NPCCHH, Kerala

Background

In India, the state of Kerala has witnessed many unexpected floods, heatwaves and climate change in the recent years impacting lives of millions, these disasters are predicted to get more intense in the coming years. These disasters have not only displaced people and economy but greatly affected the public health systems in multiple ways. Disaster increases health burden, cause damage to health infrastructure and limits access to health facilities. At patient level, many lose their medical records due to emergency evacuation and displacement. As medical records are usually maintained at patient's level, valuable case history is lost and it becomes difficult for doctors to provide best diagnostics and treatment. To address the challenges posed by increased natural disasters and to adapt to the latest technology in health service delivery, the Department of Health and Family Welfare, Government of Kerala has implemented e-health project.

The e-health project is a flagship programme of the Department of Health and Family Welfare, Government of Kerala, designed with the help of the Department of Electronics and Information Technology (DEIT), Government of India. The World Bank- aided project is supporting to create Electronic Health Records (EHR) for the 3.46 crore population of Kerala. Launched on 26 January 2018, the project aims to provide end-to-end automation for all government healthcare institutions, along with the integration of an electronic demographic database.

In addition, this project is designed to digitize and safely store medical records for hospitals and patients and hence eliminate paper-based record keeping. By switching to the e-health programme, patient data is now available on a secure cloud environment owned and managed by the state, enabling the state to achieve One Patient – One EMR. The initiative also reduces the health systems' footprint in resource use and waste generation by going paperless.

Climate Change and Health Services

World Health Organization has listed ten components in its operational framework for building climate-resilient health systems. Out of the ten-component e-Health programme aims to address Essential medical products and technologies and Health Information System components.
The journey of adopting to different component of the framework is described below:

Vulnerability, Assessment and Adaptation

The initiative follows the principles of Green and Climate Smart principles described under the National Programme on Climate Change and Human Health. While setting up the e-health infrastructure in any health centre, the geographical vulnerability of the region and the particular centre is given significant consideration. For example, hospitals in a flood-prone region will have the server room located on a higher floor, and all the electrical points would be at least 1 meter above the ground floor. This arrangement will prevent water-related damage to the system.

Integrated risk and early warning systems

The e-Health project has a unique integrated Hospital Management and Public Health management system. It has a unique feature that alerts community health workers about a break-in continuity of care for patients. This feature is critical in managing diseases like tuberculosis, diabetes etc. The health data collected through the project also helps in observing disease trends in a region. Real-time data analysis can help identify an early disease outbreak and alert the health system to activate necessary protocols. The data that the e-health system will generate will be valuable for looking at the individual and community data.

Service delivery

The project also has a component that will allow the public to improve access to the health service. The health portal linked with the E-health project will give real-time information about health services. People would be able to locate specialists, make

> "Even though initially it was difficult for me as I took more time for entering the details of patients in the E -health system. After few months I have become an expert and can enter data easily. Now patients can come to us without any old records. We can also access records from other hospitals in district which makes getting medical history easier. As solar power is used to run the system we do not have to worry about power failures."
>
> *~Shaila Beevi ,Front desk receptionist, Coastal Specialty Hospital Valiyathura, Thiruvananthapuram*

appointments, make payments and find information about ongoing and upcoming health initiatives. Using this service, families would save time, effort, and money spent for accessing health services. This service will be beneficial during emergencies like heatwaves, floods etc., when movement is restricted, health service would see a significant increase in patient footfall.

Partnerships and local solutions

The project is dependent on high-grade computing power. However, this means an increase in energy consumption and a higher initial investment. To overcome this challenge, the state health department collaborated with ITI Ltd, which has a manufacturing plant located in Palakkad, Kerala. The Unit is accredited with ISO 9001 and 14001 certifications, which shows its commitment to developing clean and environment-friendly technology. Through their support, special computers were deployed in health facilities. The average power consumption of these systems is around 10-12 watts. They also come with the extended backing of repair, thus reducing the need to use new equipment in case of malfunction.

Learnings from Coastal Specialty Hospital Valiyathura, Thiruvananthapuram, Kerala

The e-health project is being implemented at the Coastal Specialty Hospital Valiyathura in the city of Thiruvananthapuram since last 1 year in a pilot environment
friendly model adjusting to climatic vulnerabilities. The hospital located right next to Valiathura Beach caters to members of the fishing community living in rural areas.

Onsite energy generation through solar panels

Since the facility joined the E-Health Project it has enrolled 10,000 patients on the new system. During routine feedback activity from other e health implemented facilities, staff informed about an increase in

> "Being a facility serving the climatic vulnerable costal community, having gone through the hardships of Tsunami in 2004 and Cyclone Okhi 2017, the electronic health records is definitely a need of the hour; that too with environment friendly solar power in a cost effective manner is really something replicable."
>
> *~Dr Manu StateNodal Officer-NPCCHH, Kerala*

electricity bills since the new system was put in place. Even with the low energy system, there was an increase in electricity consumption. To overcome this challenge, a consultation was held with ITI Palakkad. Based on the facility's requirements, they designed an on-site power generation system using solar panels and the UPS with the Li-Fe based batteries. Currently, the entire IT Infrastructure at Coastal Specialty Hospital Valiyathura, Thiruvananthapuram is functioning on Solar power. The Smart-UPS system designed by ITI helps to utilize maximum solar power so as to minimize the power supplied by the power grid.

67/NCDC/NPCCHH/2023-24/CapacityBuildingReg

3409021/2023/National Centre for Disease Control