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Session Proceedings

Climate Adaptive Heat Stress Management in South Asia

23rd January, 2021

Integrated Research and Action for Development

IDRC · CRDI
International Development Research Centre
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GLOBAL HEAT HEALTH INFORMATION NETWORK

This document is an outcome of the session organised by IRADe in the Gobeshona 7th International Conference hosted by International Centre for Climate Change & Development (ICCCAD), 23rd January 2021 for the project Climate Adaptive Heat Stress Action Plans supported by International Development Research Centre, Canada (IDRC Canada)

Disclaimer

Acknowledgement

We would like to thank everyone who has contributed to the session on Climate Adaptive Heat Stress Management in South Asia" at The Gobeshona 7th International Conference hosted by International Centre for Climate Change & Development (ICCCAD), 23rd January 2021.

IRADe is thankful to the session collaborator Global Heat Health Information Network (GHHIN) and also, Dr Joy Shumake- Guillemot and Chris Boyer for their help throughout the conference.

IRADe extends its thanks to the sponsors of the project International Development Research Centre, Canada and to Dr Melanie Robertson, Senior Program Specialist, Climate Change, for her support and contributions.

We also thank Prof Saleemul Huq, the Director, International Centre for Climate Change and Development (ICCCAD) and his team for their support in organizing this session.

We are thankful to Executive Director, IRADe Prof Jyoti K Parikh and distinguished panelists Prof. Ajit Tyagi, Dr Subhash Chander Bhan, Dr Mahaveer Golechha, Dr Vijendra Ingole, and Mr Adam Abdullah. IRADe.

Last but not least, we would like to thank Vijay Raj, Mohit Kumar, Moumita Shaw, Nimisha Jha, Ananya Bhatia and Yashi Sharma, who supported organizing the session.

Mr Rohit Magotra
Deputy Director, IRADe

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Workshop Agenda

Climate Adaptive Heat Stress Management in South Asia

Session	Climate Adaptive Heat Stress Management in South Asia
Conference	Gobeshona 7th International Conference
Date	23rd January 2021
Time	13.30 - 15.30 IST (7:00-9:00 UTC)
Duration	90 minutes
Chair	Prof Jyoti K Parikh, Executive Director, IRADe
Invited Panelists	Prof Ajit Tyagi, Former Director General, India Meteorology Department Dr Subhash Chander Bhan, Scientist – F, India Meteorological Department Mr Rohit Magotra, Deputy Director, IRADe Dr Vijendra Ingole, Postdoctoral Fellow, IS Global Dr Mahaveer Golechha Associate Professor -IIPH, Gandhinagar Mr. Adam Abdullah, Karachi Urban Lab (KUL) IBA

Integrated Research and Action for Development (IRADe) and Global Heat Health Information Network (GHHIN) successfully conducted a Session on "Climate Adaptive Heat Stress Management in South Asia" at The Gobeshona 7th International Conference hosted by International Centre for Climate Change & Development (ICCCAD), 23rd January 2021. The session was supported by the International Development Research Centre, Canada.

The session was chaired by Prof Jyoti K Parikh, Executive Director, IRADe and the panelists include Dr Ajit Tyagi, Former Director General, IMD, Dr Subhash Chander Bhan, Scientist, IMD, Mr Rohit Magotra, Deputy Director, IRADe, Dr. Mahaveer Golechha, IIPH-Ahmedabad, Dr. Vijendra Ingole, Researcher, IS Global, Barcelona and Mr Adam Abdullah, Researcher, Karachi Urban Lab.

Speakers Profile

Dr. Jyoti Parikh is the Executive Director since the inception of IRADe in 2002. Dr Parikh is the former member of the Prime Minister's Council on Climate Change – India and is a recipient of Nobel Peace Prize awarded to IPCC authors in 2007. Dr Jyoti Parikh has made a valuable contribution to the environment and climate change issues of the developing countries. She is also heading the Center of Excellence (CoE) on Urban Development and Climate Change, Ministry of Housing and Urban Affairs (MoHUA), India. Dr Jyoti Parikh has also provided energy and environment consultancy to the Planning Commission, New Delhi (1978-80), World Bank, U.S. Department of Energy, European Economic Community, Brussels, and UN agencies such as UNIDO, FAO, UNU, UNDP and UNESCO. Moreover, she has been actively contributing as an advisor to various ministries for the Government of India. Dr Parikh served as the Senior Professor at Indira Gandhi Institute of Development Research (IGIDR), Mumbai, and was the Acting Director of IGIDR during 1997-98. She also worked at the International Institute for Applied Systems Analysis (IIASA), Austria, and was visiting professor at the Institute of Advanced Studies (IAS) of UNU, Tokyo 1995-96. She holds a PhD. from the University of Maryland, College Park and M.Sc. in Physics and Mathematics from University of California, Berkeley.

Mr. Rohit Magotra is deputy director of IRADe and committee member of the South Asian Heat Health Information Network. He is currently leading research on climate change and cities. His research work focuses on climate adaptation and climate action in Indian cities. He has a Masters in Environmental Sciences with an advanced degree in management from IIFM, Bhopal. He has authored/co-authored/contributed several national and international papers and publications related to energy policy, disaster resilience, climate resilience, public health, energy, forestry environment, smart cities, e-governance & SME supply chains. He has 19 years plus experience in policy research, advocacy, consensus building, programme management, setting multi-stakeholder consortiums of government, public and private sector. He is an impact investor and recipient of prestigious awards, which include Stockholm Challenge GKP Award, 2007, Dell Small Business Excellence Award, 2009 NASSCOM Social Innovation Honours, 2010. Mr Magotra's work on Heat Stress was covered in the Guardian documentary and the New York Times.

Dr. Ajit Tyagi is currently Senior Consultant, IRADe. He is also a member of World Tropical Meteorology Research Group of World Meteorological Organisation (WMO). He has served as Koteswaram Chair Professor with Ministry of Earth Sciences, working in the areas of weather, environment and climate till March 2015 and as a Director General of Meteorology, India Meteorological Department (IMD) for a period of four years till January 2012. He was a Permanent Representative of India with WMO and member of its Executive Council. Dr Ajit Tyagi is a post-graduate in Physics from Birla Institute of Technology and Science, Pilani and Ph D in Numerical Weather Prediction. He is Master in Business Administration and alumnae of College of Defence Management. He has served Indian Air Force as Assistant Chief of Air Staff (Meteorology) in the post Air Vice Marshal prior to joining IMD.

Dr. S.C. Bhan is a Scientist-F in the Agromet advisory service division of the Indian Meteorological Department. He has worked in the agromet and the operational weather forecast services at the State, regional and national weather forecasting centres by providing expertise in weather and agromet services. He has been engaged in research in operational meteorology for many years and has numerous publications in various national and international journals.

Dr. Mahaveer Golechha, Associate Professor and Acting Registrar-IIPH-Gandhinagar, has a Masters degree in Health Policy Planning and Financing from The London School of Economics and Political science (LSE) and Diploma degree from LSHTM, UK. He is the recipient of Wellcome Trust-UKC Master's fellowship. He also has a Masters and PhD from All India Institute of Medical Sciences, New Delhi. He is currently involved in teaching and research activities at IIPH-Gandhinagar. His areas of expertise are Health System and Policy Research, Environmental Public Health, Climate Change and Health and Pharmaceutical Policy and Economics.

Dr. Vijendra Ingole is trained in public health with a focus on climate change and health and environmental epidemiology and from Umeå University, Sweden. He has wide field experiences in research, programme management, and teaching. His research experience at the King Edward Memorial Hospital Research Centre in Pune, India, has varied from epidemiological to social

science research. In the course of his doctoral programme, he has collaborated with a number of international institutions in the environmental health sciences, including Johns Hopkins' Bloomberg School of Public Health, London School of Hygiene and Tropical Medicine, University of Nottingham's School of Geography, and the International Network for the Demographic Evaluation of Populations and Their Health (sites in 20 low and middle-income countries).

Mr. Adam Abdullah is currently pursuing a PhD in City and Regional Planning at the Middle East Technical University, Turkey. His thesis explores the Foucauldian analysis of urban planning discourses. As a Senior Research Associate at the Karachi Urban Lab, he is investigating land-use changes, displacement, and conceptualizations on urban density.

1. Climate Adaptive Heat Stress Management in South Asia

1.1 Background

IPCC's Fifth Assessment Report indicates that the last 50 years have witnessed a hike in the frequency of hot days, nights and heatwaves globally. Future projections of temperature indicate a steady increase across the three periods (the 2030s, 2050s, 2080s). According to the Global Climate, Risk Index 2020, countries in South Asia are among the most vulnerable globally to the impacts of climate change. Heat stress-induced deaths in 2100 are estimated to be about 85 per 100,000 globally and above 100 per 100,000 in lower-income groups. In addition to their profound impacts on health, heatwaves also pose significant economic and non-economic impacts affecting livelihoods and productivity. Impacts of heat stress are more severe in urban areas due to Urban Heat Island (UHI) effect (CCA, 2016). Majority of the world's population will live in cities by 2050.

The need of the Hour: In order to help cities and the vulnerable population to adapt to heat stress, it is important to develop climate-adaptive heat stress action plans and incorporate nature-based solutions. Climate adaptive heat stress plans and strategies for South Asian cities will prevent mortality as well as reduce economic and non-economic impacts of heat stress.

1.2 About the Session

The session was conducted to present the findings of work done by IRADe on the Impact of Heat Stress (Health, Productivity & Livelihood) on Vulnerable communities and how to develop response mechanisms through Climate Adaptive and Gender-Sensitive Heat Stress Action Plans. The session also focussed on developing a monitoring mechanism to implement the action plan in short-, medium- and long-term time frame of the preparedness, mitigation and response. It deliberated on the various methodologies and approaches, potential adaptive measures like heat adaptive urban infrastructure, nature-based solutions and early warning systems. The session addressed the need for capacity building among municipalities, regional and national administrative bodies, hospitals, policy-making bodies and the public.

Key questions addressed during the session:

- What are the socio-economic impacts of extreme heat events on the health, work productivity and livelihoods of vulnerable populations?
- What are the best approaches and designs to inform choices on pathways required at national and international for heat adaptation?

- Why do Heat Stress Actions plans need to be Climate Adaptive?
- How to integrate Heat Action Plans and nature-based solutions with post-COVID19 sustainable development goals?

Snapshot of the session

Prof Jyoti K Parikh, Executive Director, IRADe gave the welcome address and provided insights into climate change and cities. She stressed on the need for more research and participation for expediting Heat Stress action in South Asia.

Dr. Subhash Chander Bhan, Scientist F from the Indian Meteorological Department, gave a presentation on Heat Wave Early Warning and Management System in India and Regional Support System. He summarized the evolution of Heat Action Plans in India and key drivers behind them. Dr Bhan also shared the various regional level co-operations that are in place to address heat stress problems effectively.

Dr. Mahaveer Golechha, Associate Professor at Indian Institute of Public Health – Ahmedabad, deliberated on why Heat Action Plans (HAP) are a Successful Environmental Public Health Intervention for Climate Resilient Cities.

Mr. Rohit Magotra, Deputy Director of IRADe, has been leading IRADe and IDRC Canada's heat stress action plan research and implementation in three Indian cities. He briefed the attendees on the overall state of Climate Adaptive Heat Stress Management in South Asia and the need for focused Action plans.

Dr. Vijendra Ingole, Post-Doctoral Research Fellow from IS global in Barcelona, gave a presentation on "Association between ambient temperature and heat waves with mortality in South Asia: Systematic review and meta-analysis".

Mr. Adam Abdullah from Karachi Urban Lab addressed the "The Covid-Heat Nexus", which understood COVID's role in heat stress impact through a 'Cool-Infrastructures' Survey.

Prof. Ajit Tyagi, Former Director-General of IMD, explained the need for climate-adaptive heat stress management in South Asia. He briefed about the increase in temperatures, heatwave days, heat stress impact in South Asia, the need for urban heat hotspot mapping, and various adaptation plans such as cool-roofing, green infrastructure, and community adaptation.

Dr. Joy Shumake, Head, WHO-WMO Joint Climate and Health Office, shared presentation about Global Heat Health Information Network (GHHIN) made a presentation on the state of Heat Action Plan and the initiatives taken by GHHIN to facilitate Heat Stress adaptation through research and collaboration globally among heat health practitioners and researchers

2. Introductory Note by Session Chair

Prof Jyoti K Parikh, Executive Director of IRADe, welcomed the speakers, organizers and attendees and chaired the session. IRADe has been at the forefront of research that aims to improve heat stress adaptation and mitigation in the cities of India. Professor Jyoti Parikh lauded the efforts of Gobeshona conferences over the years and thanked the partner organizations. She said IRADe is active in the area of climate resilience and vulnerability analysis for nearly 12 years through its Center of excellence for climate change and urban development, designated by the Ministry of urban development. It has collaborated with city planners, administrators, national and international organizations and think tanks in South Asia.

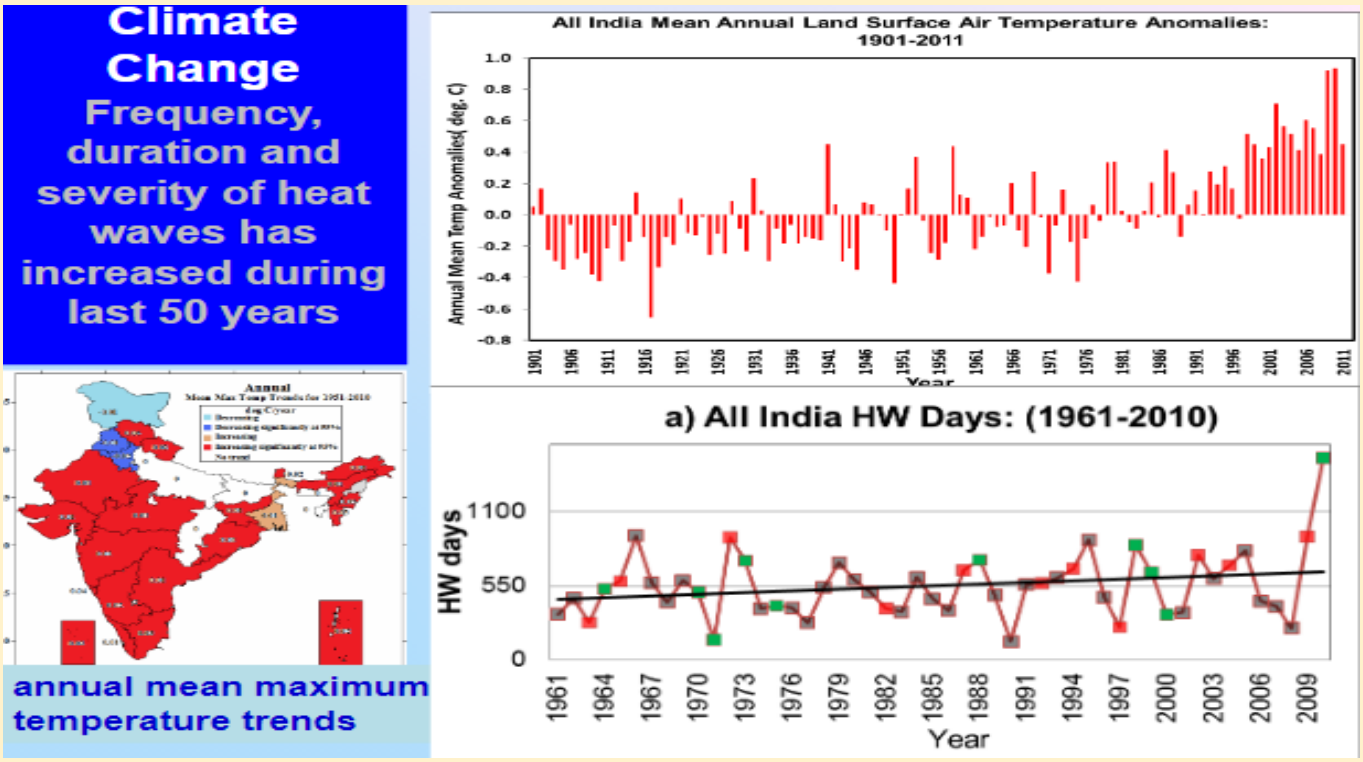
In Collaboration with IDRC Canada and various partners like IIPH-Gandhinagar, IRADe has developed Comprehensive climate-adaptive and gender-sensitive Heat Stress Action Plans for three cities in India - Delhi, Rajkot and Bhubaneswar. As a part of the action plan, IRADe has helped the cities arrive at a better heat threshold value for issuing heatwave alerts. As a result of IRADe's intervention in developing a climate-adaptive heat action plan, the Odisha State Disaster Management Authority is now able to predict and act pre-emptively during potential heatwave days. As a part of implementing these heat action plans, IRADe has conducted Medical Stakeholder Training in three cities, and hundreds of medical practitioners have benefitted and gained valuable insights on their role during Heat Wave adaptation and mitigation actions taken by the local authorities. IRADe's research has been instrumental in helping authorities devise the Heat Alert Thresholds and issue Heatwave alerts.

In collaboration with its partners and the Global Heat Health Information Network, IRADe has now established the South Asian Heat Health Information Network (SAHHIN), the launch of which will happen in February 2021. IRADe is also designated as a Centre of Excellence (CoE) for Urban Development andClimate Change in 2008 by the Ministry of Housing and Urban Affairs, Government of India. As a CoE, we have undertaken rapid vulnerability assessment of20 cities, devised a roadmap for mainstreaming climate and disaster resilience components in the smart city development plans of 10 cities, and piloted urban climate vulnerability index. Committed towards strengthening city health resilience, the COE is actively involved in developing Climate Adaptive Heat Stress Action Plans, Early Warning System for Dengue and Air Pollution Action plans.

2.1 Need for climate-adaptive heat stress management in South Asia

Prof. Ajit Tyagi, Former Director-General of IMD

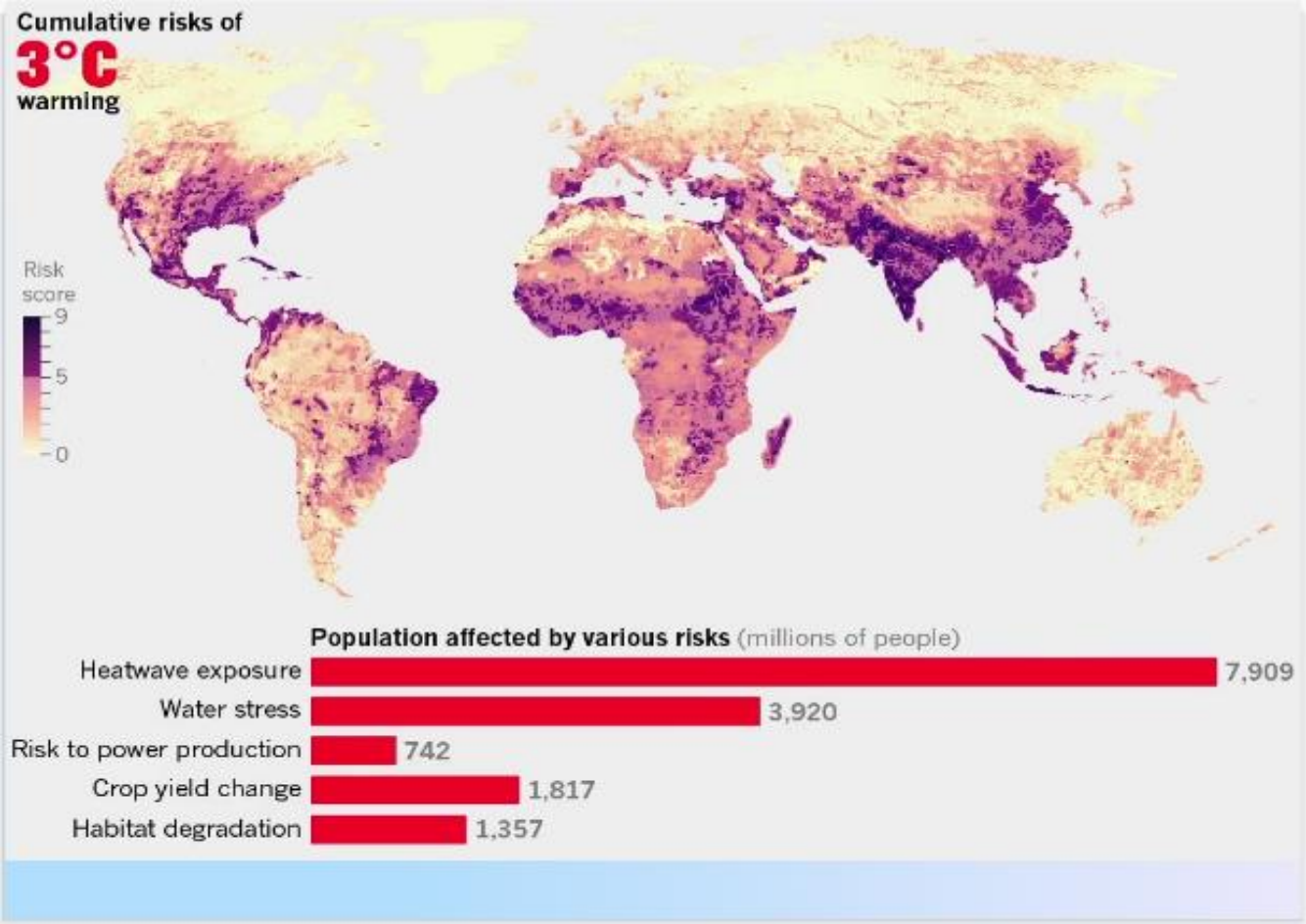
Heatwave has emerged as one of the major weather-related natural hazards. In view of ongoing global warming and climate projections, it is critical to assess the increase in temperatures and the associated increase in the severity and duration of heatwaves to initiate necessary mitigation and adaptation measures. South Asian countries, because of geographical location in tropic and socio-economic conditions, are highly vulnerable to heatwaves. Although the Indian Meteorological Department (IMD) has been issuing Heat Wave warning for a long time, in the absence of a coordinated action plan, a large number of deaths were taking place because of heatwaves.



It was after more than 1300 excess all-cause deaths in May 2010 that led to the development of a comprehensive Heat Action Plan for Ahmedabad city in 2013. It comprises of four key components: **a**. Building Public Awareness and Capacity Building; **b**. Early Warning System and Inter-Agency coordination; **c**. Capacity building of Medical Care Professionals and **d**. Reducing Heat Exposure and Promoting Adaptive Measures. The success of the Ahmedabad Heat Action Plan led to the formulation of National Guidelines on Management of Heat Waves by National Disaster Management Authority (NDMA), and implementation of Heat Action Plans by many states and cities. It has substantially reduced Heatwave related deaths.

However, more efforts are required as the frequency and intensity of Heat Waves is to increase further in the coming years. Urbanization in South Asia is going to be a major challenge for the management of Heat Waves. Cities can no longer be taken as a monolithic entity Temperature

variation from the city centre to peripheral areas can be as high as 6- 8 degree Celsius. Urban Heat Island and socio-economic disparity will require identification of ward level vulnerabilities, Heat Wave thresholds and Heat Action Plans. Cities will have to start implementing various adaptation plans such as cool-roofing, green infrastructure, the revival of water bodies and an increase in green cover.

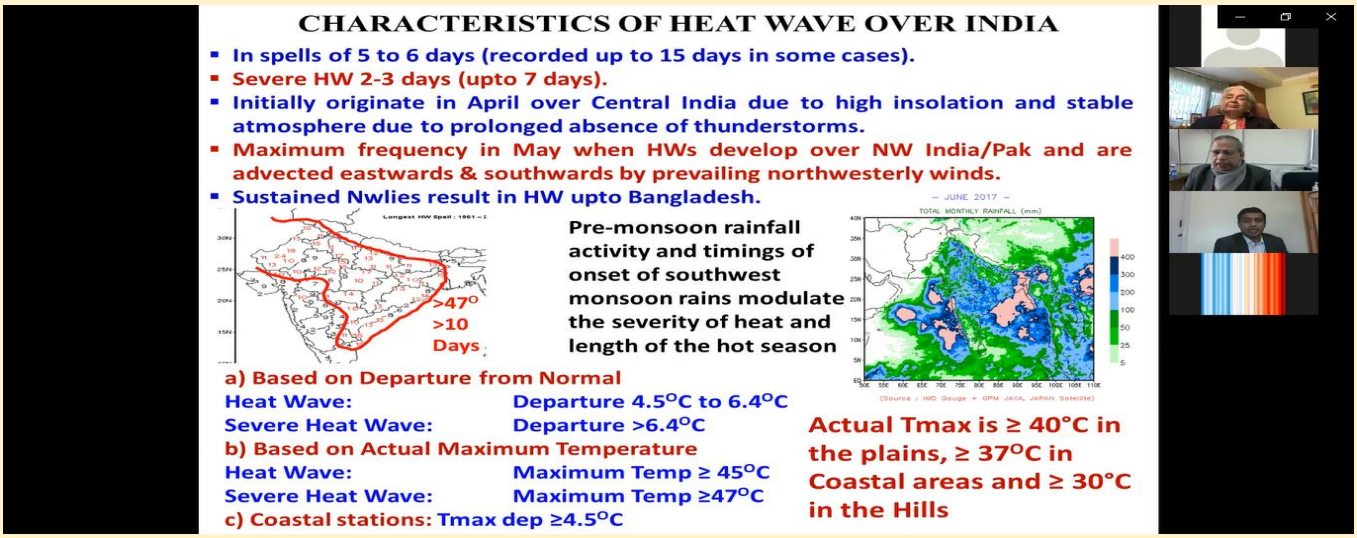


Prof. Tyagi congratulated IRADe and other partners on the development of South Asia Heat Health Network. He emphasized the importance of Regional partnerships and interactions and the need for more such platforms, which brings the stakeholders together, which will further strengthen the studies and policy interventions.

2.2 Heat Wave Early Warning and Management System in India & Regional Support System

Dr SC Bhan, Scientist F, Indian Meteorological Department

The summer temperature in the Indian subcontinent region starts building up from Sri Lanka and the extreme south of India in March and peaks towards the end of May/early June. Some parts, particularly northwest India and South Pakistan, could remain quite warm into the entire June/early July in case of early-onset or weak monsoons. The warm nights and High Humidity are additional issues in North-West India and South Pakistan. In India, observed trends show that the Annual mean temperatures have diverted by 0.61 C in 100 years. This is very similar to the global temperature rise, and most of the warming is attributed to the increased greenhouse gas concentration.

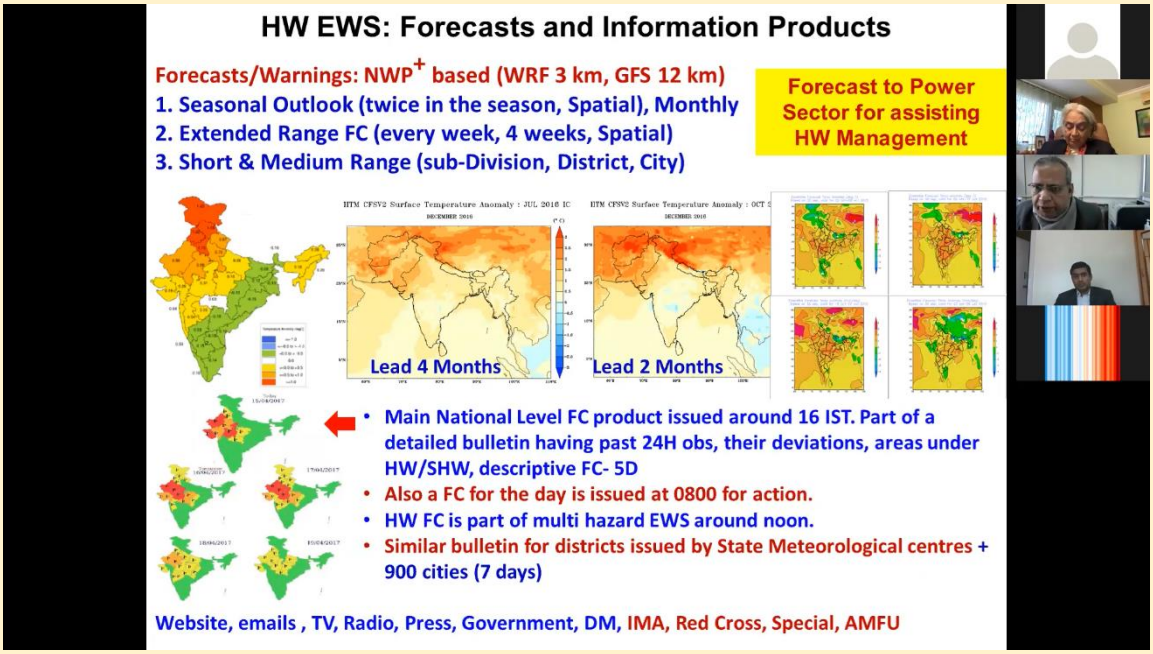


(a) Warming Temperatures in South Asia are significantly reflected in increased incidences of Heat Wave. The average number of Heatwave (HW) days during the hot weather season (March - July) over India has increased considerably. There has also been an increase in the duration of heatwaves during the day. In India, the heat waves come in spells of 5-6 days normally and can even go up to 15 days, as noticed in some cases.

(b) Mean Monthly maximum temperature anomalies from 2016-2019; most of the months were warmer than the average. The warmer post-monsoon and winter seasons also led to the early onset of heat stress; heat waves are coming earlier and are more severe. Temperature trends in India, Bangladesh, Pakistan and Nepal have seen alarming rises in temperature.

(c) The Heatwave Early Warning System and forecasts are based on the numerical weather prediction models. A "Get, Set & Go" Heat Wave Early Warning System for different temporal scales is usually issued by IMD. An outlook is prepared for Mar-May issued on the last day of February. The Central, State and District agencies review the HW preparedness coordination based on the seasonal outlook. This outlook is revised at the end of March for April-June. The forecasts for weekly maximum - Minimum temperatures and rainfall are issued once a week out for the next four weeks.

This helps the health system and other concerned departments review their level of preparedness in case a heatwave is predicted.



(d) Early Warning Systems: With regard to the early warning system, he elaborated on how IMD coordinates with the states to make the heatwave warnings more effective (temporally and spatially sensitive) and about the support mechanisms needed for the people to adapt. During the time of heatwaves, Early warning systems of the Medium range are circulated through websites, emails, TV, radio, press, Government, Indian Meteorological Association, Red Cross, Agromet Field Units, Social media. The warnings are colour-coded for severity and duration of the heatwave. The likely impacts on various sectors and vulnerable populations; and suggestive actions are included. Similar bulletins for districts are also issued by state meteorological centres.

(e) Drivers of Heat Action Plans: The National Heat Action Plan was triggered by the 2015 severe heatwave in India when more than 2000 people died due to heatwaves. Considering a large number of deaths and the success of Ahmedabad Heat Action Plan, the NDMA and IMD coordinated with various stakeholders and states and came out with the first National Guidelines for management of heatwaves in the country. The guidelines issued in 2016 were revised in 2017 and 2019. Seventeen states and more than 130 districts have a heat action plan. Several studies have also been conducted on heatwave related issues. After these measures, less number of deaths were reported after 2015 despite an increase in Heatwave events.

He also suggested that the outlook of the Heatwaves in the South Asia region done by IMD can also be made available to the other South- East Asian Countries

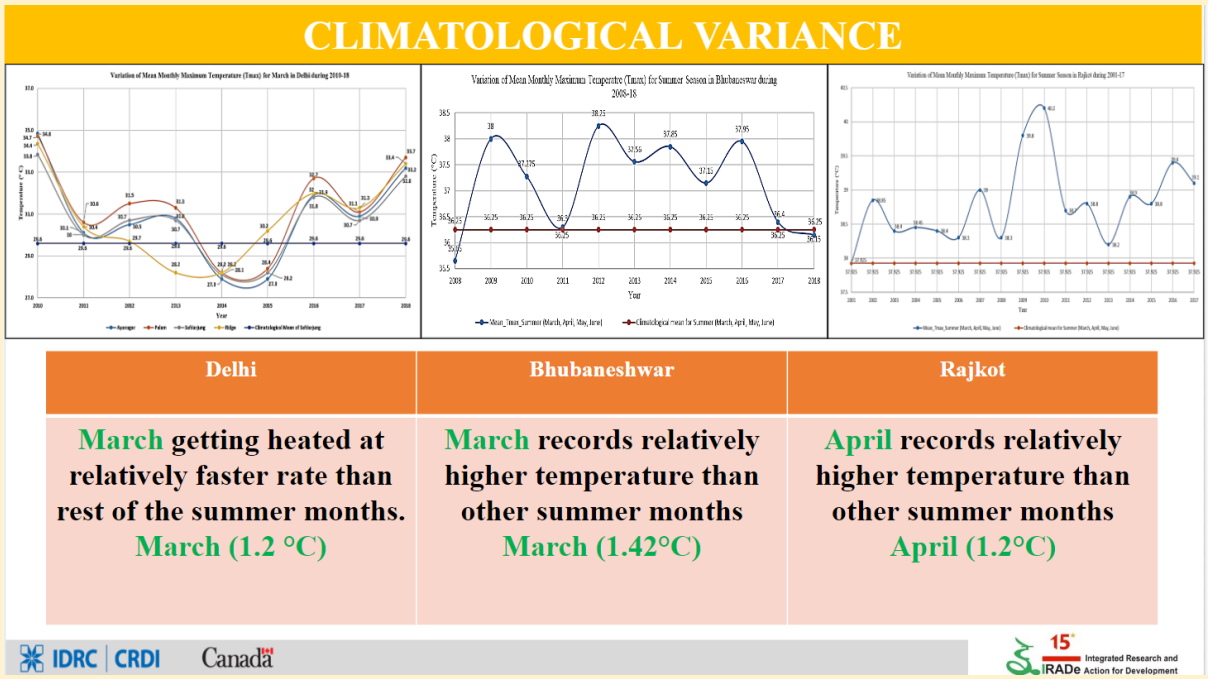
2.3 Climate Adaptive Heat Stress Management & the need for focused Action plans

Mr Rohit Magotra, Deputy Director, IRADe

Climate Change Frequency, duration and severity of heatwaves has increased during the last 50 years. From 2015 - 2020, the world witnessed the fifth consecutive year of high temperature. June and July 2019 was the warmest June and July month on record

Unprecedented Heat waves across the globe in South West Asia, Europe, Western Africa and Australia were observed in 2019. In Delhi particularly, Highest heatwave days have been recorded in 2012 and 2019, and the number of hot days has increased from 49 days in 2018 to 66 days in 2019 in 3 months of April, May and June, showing an increase by 35%.

Climatological variance in Delhi, Bhubaneswar and Rajkot

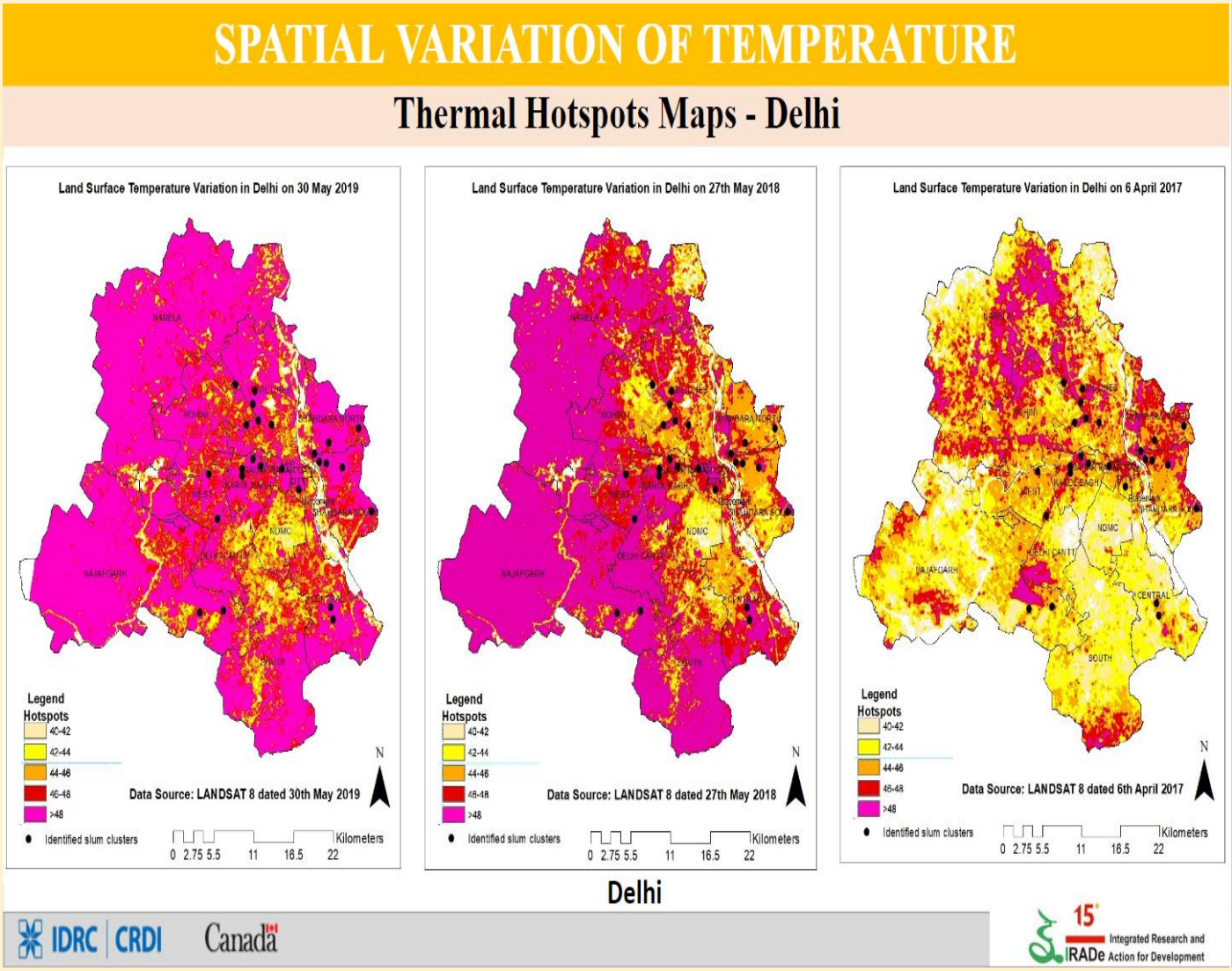


Heat Action Plan has not been adopted by all cities across India. Only 30 cities and 11 states in India have developed/ Adopted Heat Action Plans, and they are broad-based.

IRADe has been working on Improving the management of heat stress risks in India by helping cities develop spatially differentiated (ward wise) gender-sensitive Heat Stress Action Plans (HSAPs). The process of drafting such Heat Action plan involves Heat Stress Impact Research, Thermal Hotspot Mapping, Evaluation of Climatological Variations in Summers, enabling Stakeholder Engagement, aiding in Capacity Building and Sensitization, Drafting Heat Stress Action Plan, Dissemination and Outreach Activities.

(a) A vulnerability mapping assessing the geographic variability in heatwave vulnerability forming the basis for planning appropriate targeted adaptation strategies was also carried out in the study

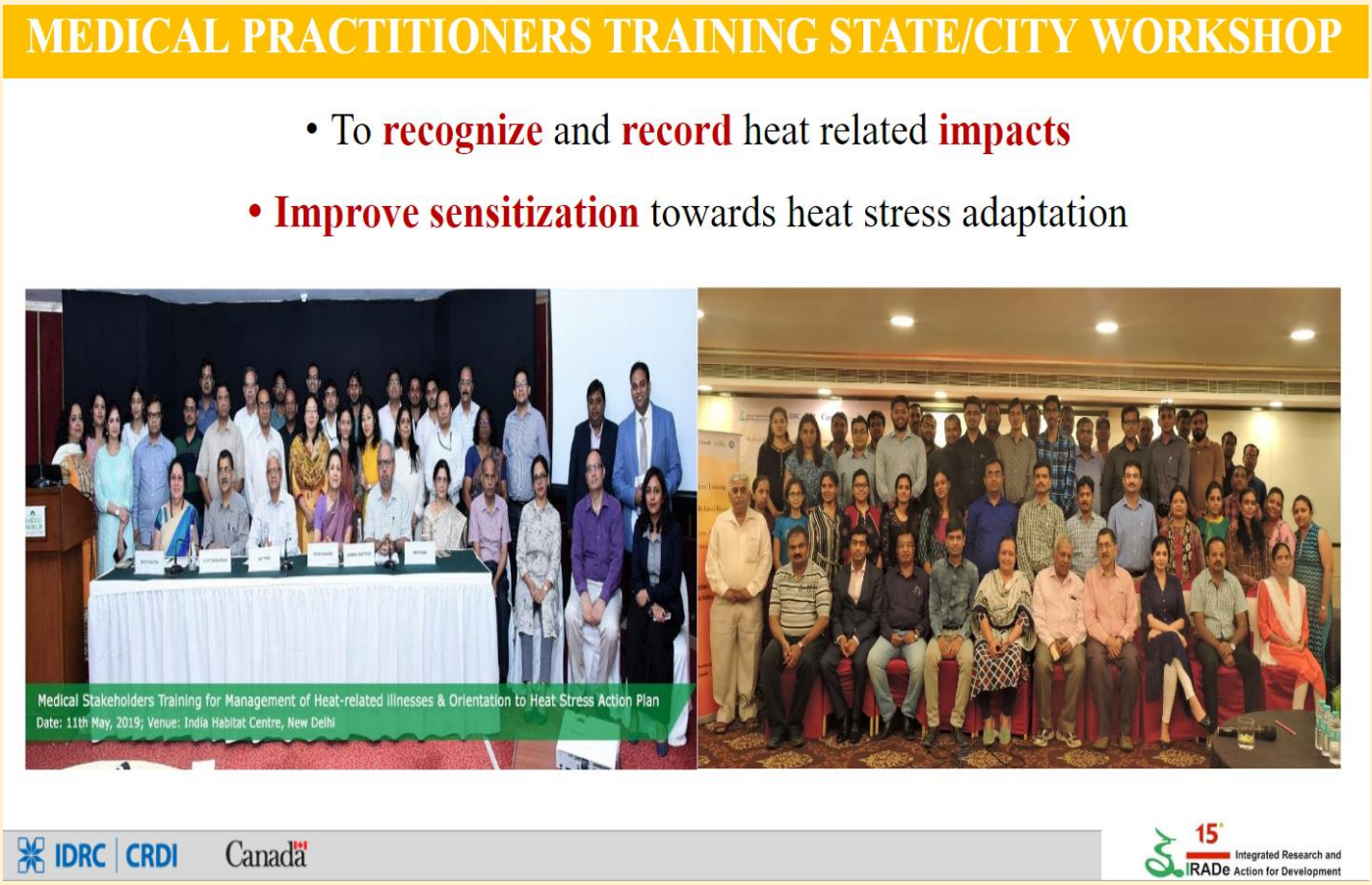
areas. Thermal hotspot maps for Delhi, Bhubaneshwar and Rajkot, were developed by IRADe The surface temperature imageries city are taken by LANDSAT 8 and were superimposed on the ward-boundaries map of the city to develop the city hot spot area. Wards with the temperature above 40 degree Celsius were delineated across the cities



(b) The study results captured the spatial variation of temperature within the cities, including ward wise impact of factors like Housing, Water Supply, electricity, ventilation, Heatwave awareness, access to health care and overall cumulative ward vulnerabilities across the study areas. The study also included analysis on wage loss, productivity loss and heat stress symptoms.

(c) The adaptation and mitigation measures include the awareness campaigns, mitigation measures on how to keep the local environment and individual cool, Early warning communication systems, Medical preparedness and monitoring and analysis. During the Project timeline, IRADe has conducted several state/city workshops to train the medical practitioners for sensitization towards

heat stress adaptation. IRADe's work has been highlighted by several media platforms, urban local bodies and in the form of several papers and articles. He also shared the publications on the work by IRADe



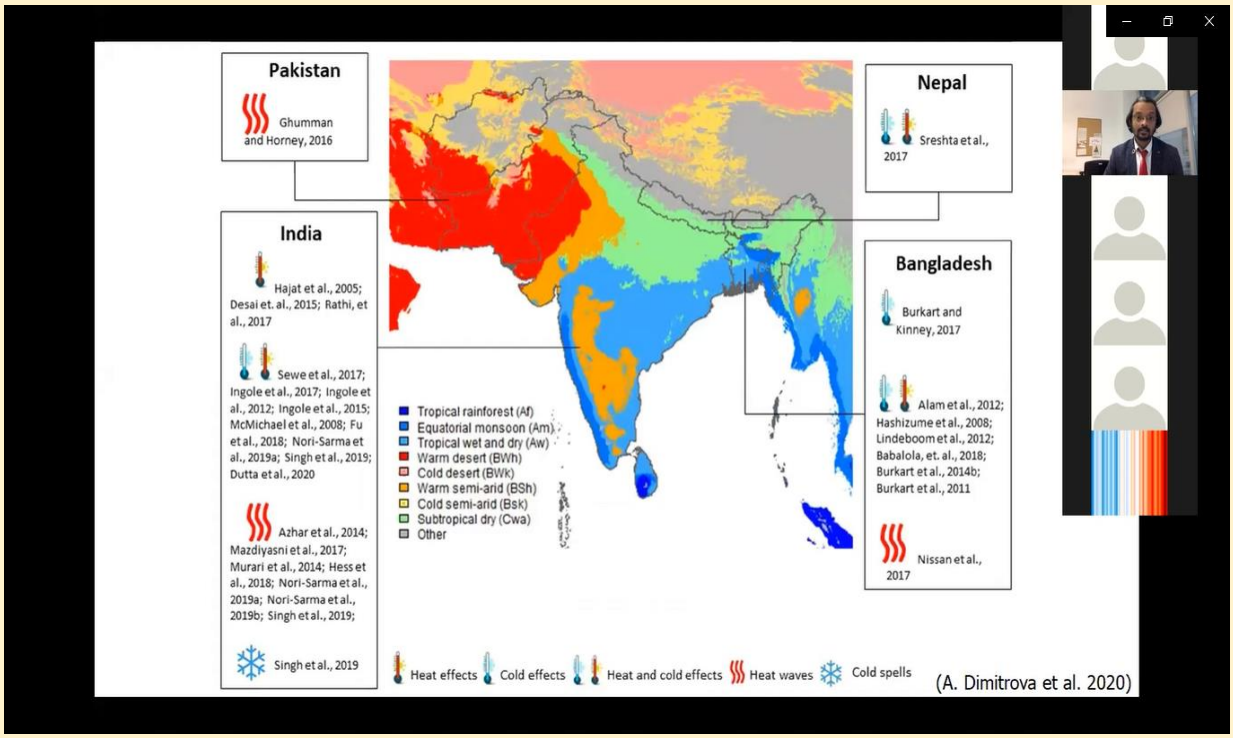
There was an announcement of the formation of the **South Asian Heat Health information network (SAHHIN),** an independent, voluntary, and member-driven forum of scientists, practitioners, and policymakers focused on improving capacity to protect populations from the avoidable health risks of extreme heat in a changing climate. The network aims to create a common space to promote evidence-driven interventions, shared-learning, co-production of information, synthesis of priorities, and capacity building that can empower multidisciplinary actors to take more effective and informed life-saving preparedness and planning measures. The website can be accessed at https://climateandcities.org/ for more information.

2.4 Association between ambient temperature and heat waves with mortality in South Asia: Systematic review and meta-analysis

Dr Vijendra Ingole, Post-Doctoral Research Fellow, IS Global, Barcelona Institute for Global Health, Barcelona, Spain

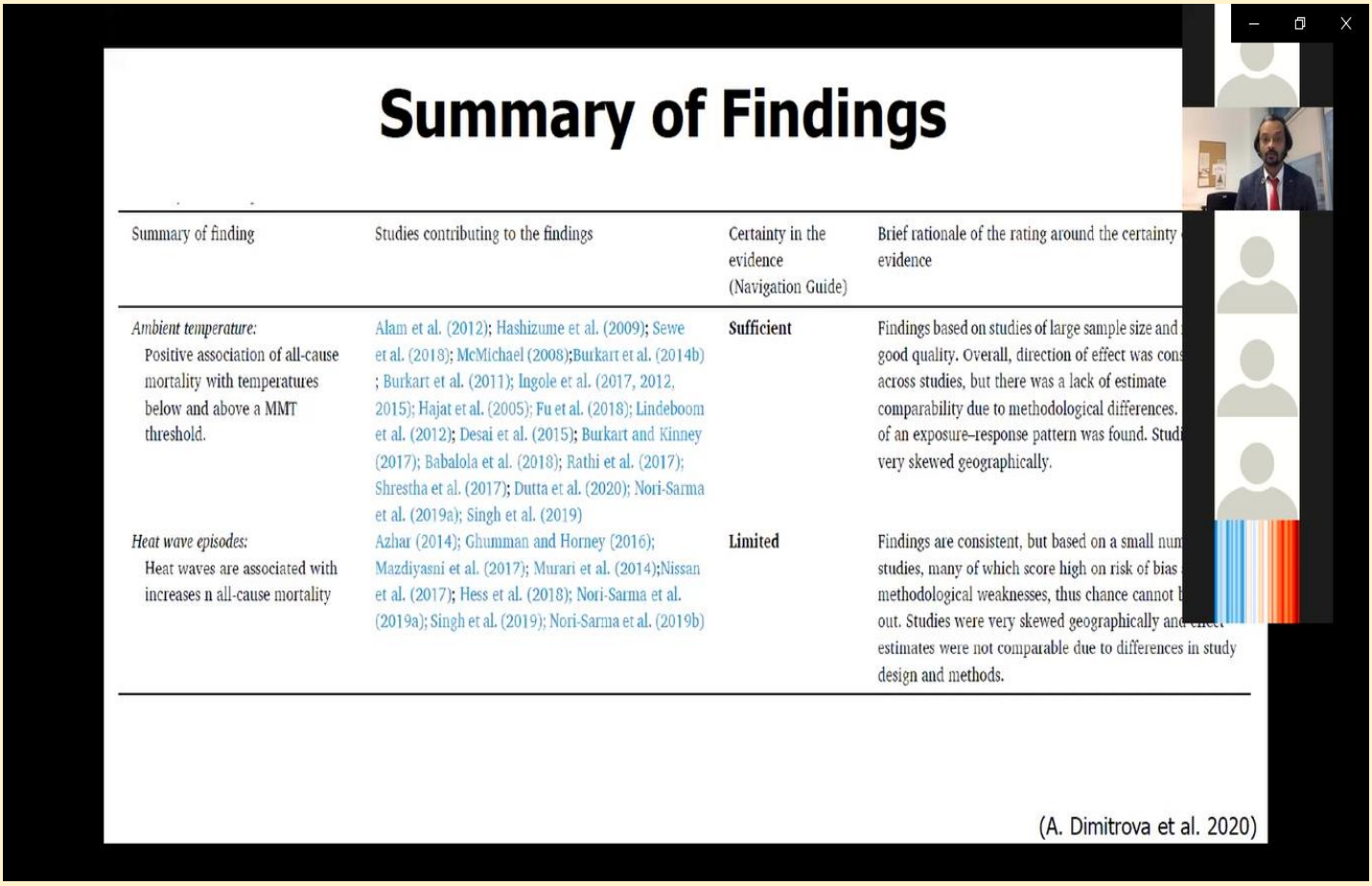
Are ambient temperature (high and low) and heatwave events associated with increased all-cause mortality in the general population in South Asia? What can be inferred about heat health impact from the increased all-cause mortality in the general population in South Asia? Which are population groups at higher risk of mortality from exposure to ambient temperature?"

Research systematically synthesized more than 6000 peer-reviewed research papers; 27 were included in the qualitative synthesis and five in a meta-analysis. A Meta-analysis showed that South Asia is at high risk of climate impacts due to the combination of its climate and geography, large and growing population, rapid urbanization, low adaptive capacity (poverty and inequality).



The studies also revealed only 50% of Southeast Asia regions had epidemiological studies on ambient temperature and mortality, and other half of the countries in the region did not have a single epidemiological study on ambient temperature and mortality (Afghanistan, Bhutan, Maldives, and Sri Lanka)

A pooled estimate of the temperature- all-cause mortality association of meta-analysis was done for all five studies in which for each 0.5-degree celsius relative risk was estimated with respect to low and high temperature. Based on the analysis, the vulnerabilities and modifying features identified were **(a)** Ambient temperature impacts on Infant, children, elderly, agricultural workers (outdoor), low educational attainment, living in urban areas. **(b)** Heat Waves impact most on women and populations with lower economic status. Built Environment also plays a critical role in defining heat vulnerability. These vulnerability factors include building features, urban form, the density of green space, and these are also key modifying features for the scope of improvement.



Summary of Findings

Summary of finding	Studies contributing to the findings	Certainty in the evidence (Navigation Guide)	Brief rationale of the rating around the certainty evidence
Ambient temperature: Positive association of all-cause mortality with temperatures below and above a MMT threshold.	Alam et al. (2012); Hashizume et al. (2009); Sewe et al. (2018); McMichael (2008);Burkart et al. (2014b) ; Burkart et al. (2011); Ingole et al. (2017, 2012, 2015); Hajat et al. (2005); Fu et al. (2018); Lindeboom et al. (2012); Desai et al. (2015); Burkart and Kinney (2017); Babalola et al. (2018); Rathi et al. (2017); Shrestha et al. (2017); Dutta et al. (2020); Nori-Sarma et al. (2019a); Singh et al. (2019)	**Sufficient**	Findings based on studies of large sample size and good quality. Overall, direction of effect was cons across studies, but there was a lack of estimate comparability due to methodological differences. of an exposure–response pattern was found. Studi very skewed geographically.
Heat wave episodes: Heat waves are associated with increases n all-cause mortality	Azhar (2014); Ghumman and Horney (2016); Mazdiyasni et al. (2017); Murari et al. (2014);Nissan et al. (2017); Hess et al. (2018); Nori-Sarma et al. (2019a); Singh et al. (2019); Nori-Sarma et al. (2019b)	**Limited**	Findings are consistent, but based on a small num studies, many of which score high on risk of bias methodological weaknesses, thus chance cannot b out. Studies were very skewed geographically and effect estimates were not comparable due to differences in study design and methods.

(A. Dimitrova et al. 2020)

Recommendations

(a) More robust exposure-response functions (using local epidemiological studies needed) are essential for health impact assessments of temperature-related mortality and morbidity burdens. The individual or area level socio-economic indicators like (poverty, informal settlement, insulation in housing, lack of access to health care, sanitation and information

on heatwave risk, access to clean water, electricity, household ventilation) are also needed to consider when defining exposure-response.

(b) The role of adaptation for minimizing health impacts of ambient temperatures and the heatwave is poorly investigated in south Asia. Nevertheless, the included review studies propose a range of interventions based on their findings, e.g. increasing public awareness of the problem through public messaging or health education campaigns; encouraging preventative measures (e.g. wearing light, bright-coloured and sun-protective clothing, avoiding physical activity or outdoor work during the hottest hours, staying hydrated), especially among the vulnerable population enhancing response capacity and coordination of public health centres; distribution of electric fans; setting-up of cooling centres air-conditioned sites designated as shelters during extreme heat, and introducing early warning systems.

(c) The existing body of evidence, focused mainly on India and Bangladesh, points to excess mortality associated with hot and cold temperatures as well as heatwaves and more studies needed in other South Asian countries.

(d) A better understanding of the modifying factors of the temperature-mortality relationship is necessary to inform targeted interventions in the South Asia region.

(e) Similar to most LMICs, the majority of deaths in countries of the region occur at home and remain undocumented or without a medically certified cause of death. Continued efforts to strengthen environmental and health monitoring not only help us for mapping vulnerabilities due to temperatures but also due to other climate-related health impacts.

(f) In light of slow progress in achieving greenhouse gas emission reduction targets, more evidence on viable adaptation options for the population in South Asia is required. More robust exposure-response functions are essential for health impact assessments of temperature-related mortality and morbidity burdens.

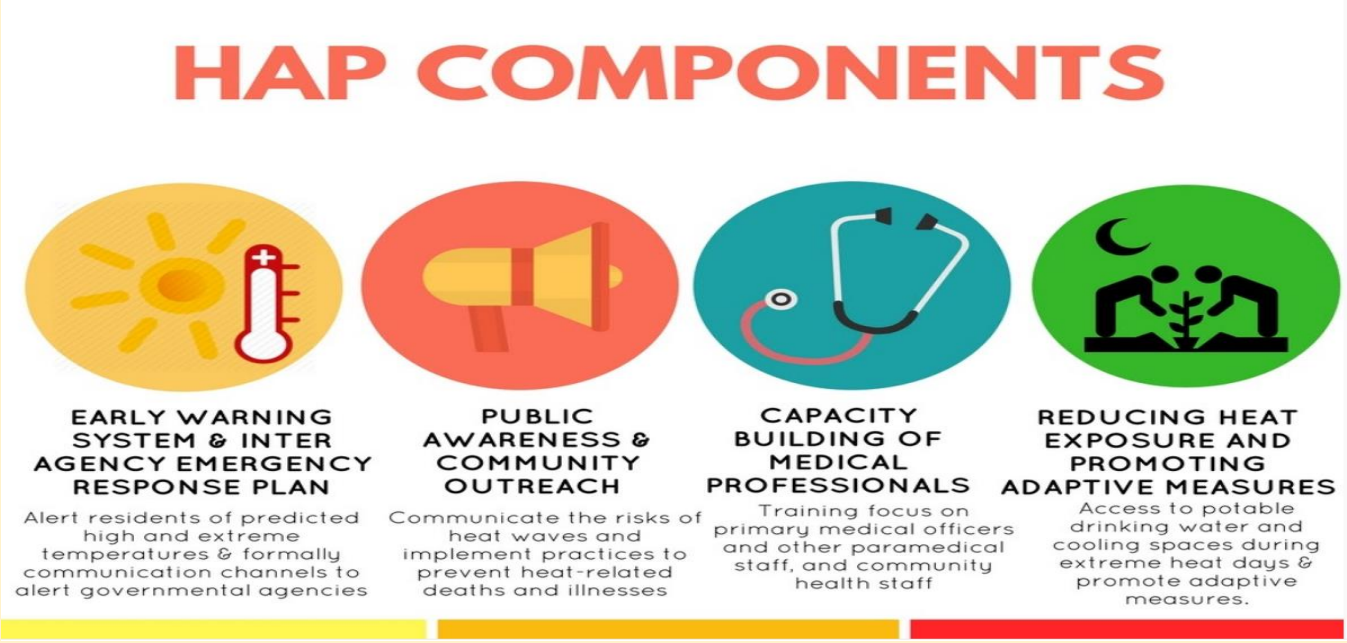
2.5 Heat Action Plan: (HAP) A Successful Environmental Public Health Intervention for Climate Resilient Cities

Dr Mahaveer Golechha, Associate professor,Indian Institute of Public Health – Ahmedabad

Ahmedabad was one of the first city Heat Action Plan in South Asia. In 2010, the temperature reached as high as 47 Degree Celsius on 21st May 2010 in Ahmedabad. May 20-27th, 2010 witnessed excess deaths of 800 in one week and 1344 excess deaths in May 2010. These events stressed the need for Heat Action Plans, and the Ahmedabad Heat Action plan was launched in 2013.

HAP's primary objective is to alert those populations at risk of heat-related illness in places where extreme heat conditions either exist or are imminent and to take appropriate precautions which are at high risk.

The key strategies of the Heat action plans was Building Public Awareness and Community Outreach to communicate the risks of heatwaves and implement practices to prevent heat-related deaths and illnesses; Utilizing an Early Warning System and Inter-Agency Coordination to alert residents of predicted high and extreme temperatures; Capacity Building Among Health Care Professionals to recognize and respond to heat-related illnesses, particularly during extreme heat events; Reducing Heat Exposure and Promoting Adaptive Measures by undertaking new efforts including mapping of high-risk areas of the city, increasing outreach and communication on prevention methods, access to potable drinking water and cooling spaces during extreme heat days.



Recommendations

(a) The key lessons from Heat Action Plan highlighted the importance of Involvement of Local city or district administrative and health and political leadership; Engagement with all stakeholders: IMD for weather data, Health data for analysis, city govt for various actions.; Facilitation by local and national institutions/experts – universities; Learning and adapted HAP developed in other countries/cities and Measurement of the process of implementation and impact on mortality and morbidity.

(b) There is a need to recognize and respond to heat-related illnesses, particularly during extreme heat events, and medical stakeholder training are of importance for effective prevention and management of heat-related mortality and morbidity.

(c) HAPs have been improved in a few Indian Cities- Jhansi, Sagar, Nagpur, Chandrapur under the Department of Science and Technology initiative on Climate Change and Human Health. Under UNICEF-IIPH partnership Rajasthan Climate Change Project- HAP has been implemented in rural settings of Rajasthan. In the City of Rajkot, IIPH-Gandhinagar and IRADe partnered with the municipal corporation for development and implementation of Heat Stress Action Plan.

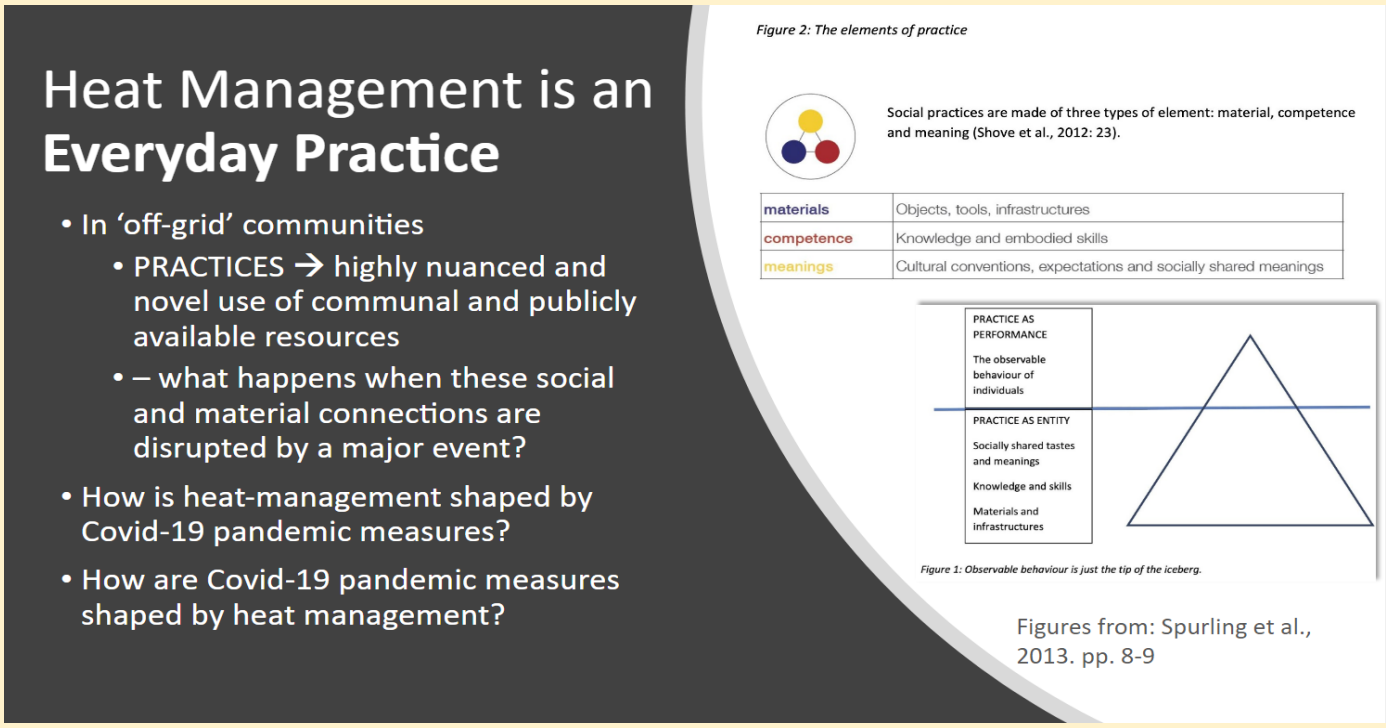
(d) South Asia's economy is susceptible to events like heat waves as it is largely an informal sector, comprising people who work with no formal contracts, including construction workers and manual farm labourers. It is dangerous for people to perform heavy labour outdoors, leading many people to stop working when temperatures soar. According to Recent Lancet Report- India alone lost close to 75 billion labour hours in 2017 due to extreme heat, about half the global total of 153 billion hours lost to extreme heat days in the same year

(e) Heat is increasing, and it will increase further for the next 80 years. Heat can kill, and hence we need to protect the citizens. All stakeholders have to prepare a health-based heat action plan and implement it to reduce morbidity and mortality.

2.6 The Covid-Heat Nexus: COVID's role in heat stress impact through a 'Cool-Infrastructures' Survey conducted in India, Pakistan, Cameroon, and Indonesia

Mr Adam Abdullah, Karachi Urban Lab and Dr Elspeth Opperman, Ludwig Maximilians University

Chronic exposure to extreme heat is a major health issue. The global tropics are most exposed to these conditions and are already close to physiological limits. Even Small shifts in **Hazard** (e.g. Temperature OR humidity), **Exposure** (e.g. time indoors, outdoor work duration) and **Vulnerability** (e.g. loss of income/resources, services) can have dramatic effects. Large populations of outdoor workers, people in informal, poor quality housing, and women indoors are exposed and vulnerable.



A Covid-Heat Nexus Survey was conducted to study the role played by heat management practices and their efficiency. The Survey included Mobile Phone survey (Geopoll) covering 4,400+ residents in Hyderabad (India), Sindh Province: Karachi + Hyderabad (Pakistan), Jakarta (Indonesia) and Douala (Cameroon).

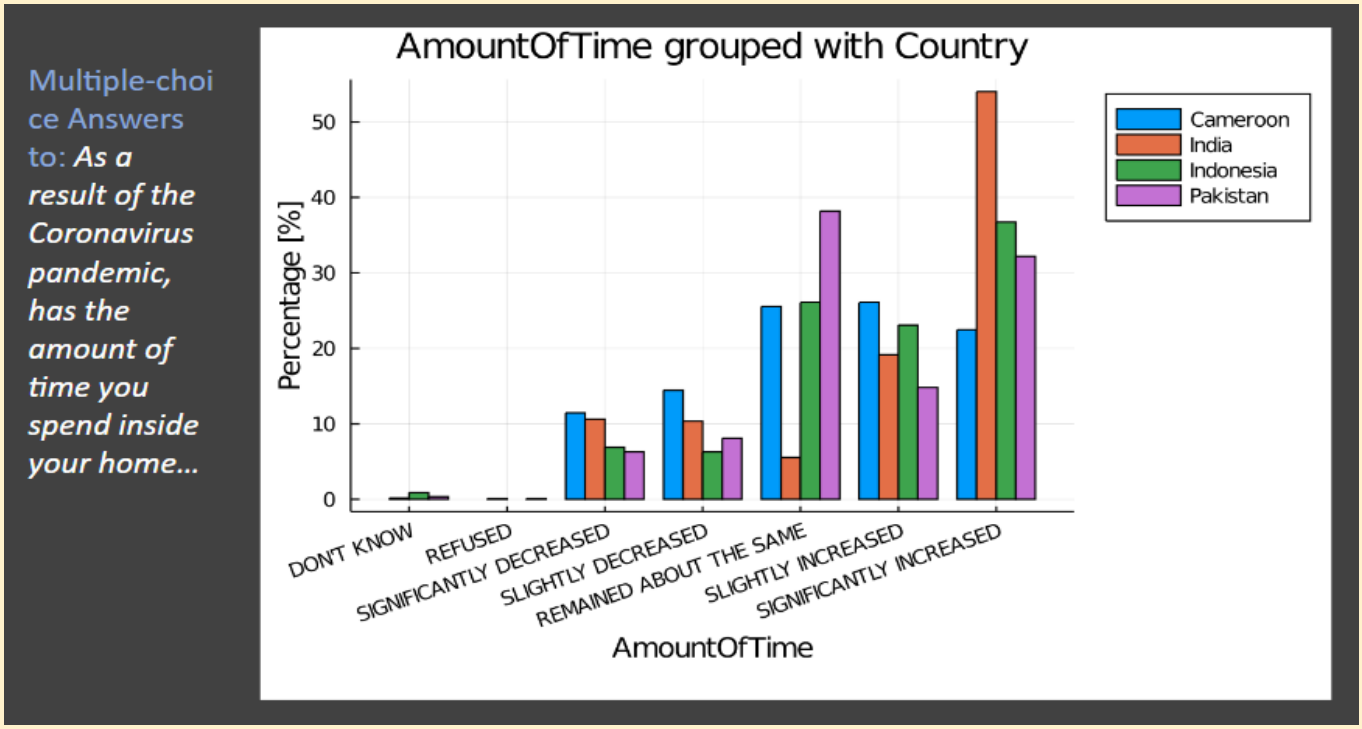
Data collected included information on Demographic information, Socio-economic status (occupation, tenure/ownership), Building characteristics (windows, rooms, construction materials), Water and electricity along with the change from the pandemic, Food and income along with pandemic change, Time at home along with pandemic change, Heat management practices along with pandemic change, Thermal perception, indoor and outdoor, Heat illness symptoms, Well-being and domestic violence, Temperature, Relative Humidity, and Heat Index added exposure inside.

Outcomes of the study:

(a) Informal settlements often have a higher temperature than surrounding areas

(b) Construction materials matter to determine the heating of the surfaces; for example, material like zinc/tin/girder/sheet roofing raise indoor temperatures.

(c) For low-income populations, cost and availability of materials are more important than thermal properties, and the majority suffered excess heat stress due to increased time spent at home.



(d) During the COVID-19 lockdowns, Heat stress was exacerbated by people choices of not going outside, forgoing visits to parks, trees in public areas, sitting outdoors, combined with time spent inside poorly built infrastructure with closed doors and windows

(e) The availability of basic needs(Electricity, Food and Water) was a deciding factor as there was not enough electricity, and people used hand fans or portable fans (cheap USB- or battery-operated).

(f) Income and food intake reductions due to loss of productivity and livelihood were also observed.

(g) Fainting, fatigue, irritability and domestic violence were also observed as common symptoms of heat stress.

The research' Open data sets available for download:

https://datashare.is.ed.ac.uk/handle/10283/3804.

The detailed survey results are available for researchers at https://coolinfrastructures.com

2.7 Global Heat Health Information Network

Dr Joy Shumake- Guillemot

GHHIN was launched in 2018 due to an overwhelming concern of experts, including public health agencies, national meteorological services, and academics and NGOs from a range of disciplines — that we need a rapid acceleration in awareness, policy action, scientific research and evidence, and community action to reduce avoidable deaths and injury from extreme ambient heat. We saw many good actions being taken, particularly at the local level, but limited capacity and fragmentation of systems were slowing impact and learning. Together we are working to become more effective catalysts for action and providing a forum for facilitating exchange, learning and identifying needs.

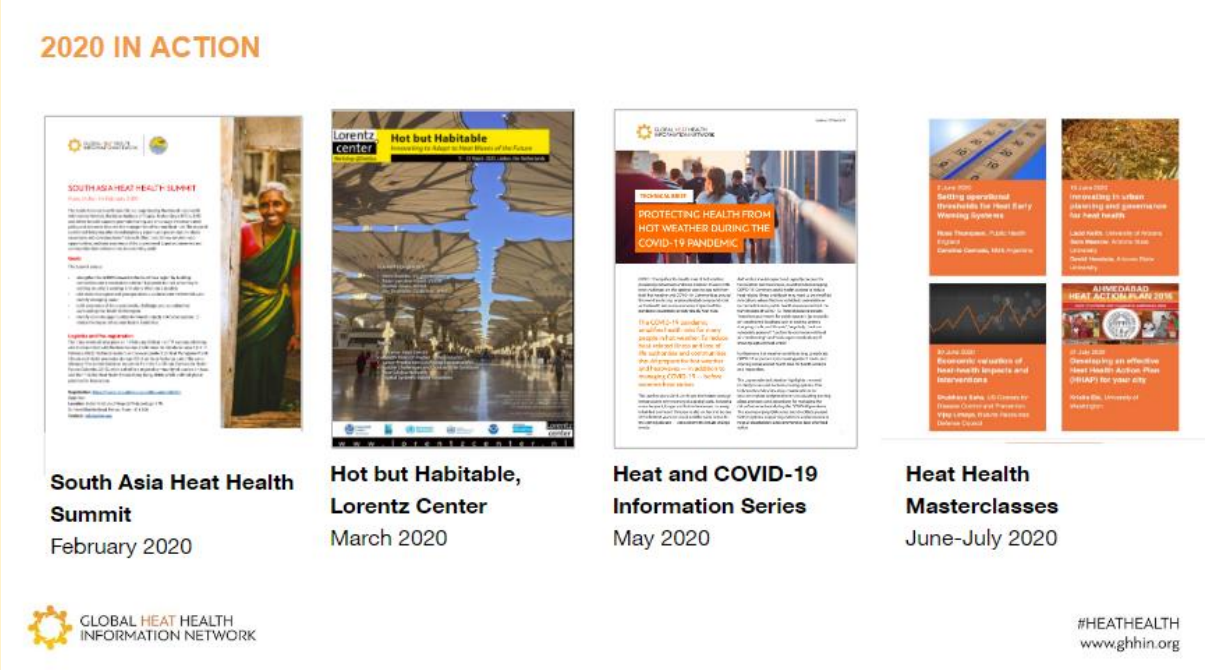
GHHIN is a network of Government agencies / academic institutions / international organizations / NGOs / private sector and individuals in relevant fields who have Diverse expertise and perspectives, have a compatible motivation and have Scientific integrity and shared principles

The Focus areas of GHHIN include **Awareness-** Urgently improving awareness of the disaster that increasing extreme heat poses to human health, wellbeing, and productivity worldwide. **Partnership-** Catalyzing and sustaining interdisciplinary partnerships and co-learning between research and practitioners across relevant government, academic, private sector and civil society bodies. **Synthesis-**Synthesizing and advancing science and technology available for decision making and risk reduction across sectors and time scales. **Expertise-** Improving access to expert

resources and opportunities for learning, exchange, and engagement. **Leadership-** Identifying and promoting action to address critical gaps in research, knowledge and action.

Key activities of GHHIN include improvement in the knowledge and capacity of governments, organizations, and professionals to protect populations from the avoidable health risks of extreme ambient heat. By bringing together the work and progress of its members, GHHIN helps create a more holistic picture of the needs, science, and strengths across the network.

Some of the highlighted works of GHHIN in 2020 are given below:



The new website of GHHIN - www.ghhin.org is live and have new and improved features such as heat health resource library and learning, Easy to use tools and services directory, Focus areas: work, urban, sports, etc., Inventory/maps of heat health action plans case studies and Expert and projects directory. Additional features like action platform/directory of evidence and evaluation of interventions will be coming soon.

3. Key Messages

Key messages which emerged from the session deliberations are as follows:

- The global health community has a vital role to play in ensuring that climate change policies also improve public health and reduce health inequalities. To achieve this, global health institutions and interest groups need the necessary expertise and political support.
- Enhanced collaboration between sectors is required in order to ensure a comprehensive response to climate change, especially heat stress.
- Mechanisms that facilitate inter-sectoral policy development and implementation of heat stress management plans at the global and local level are needed.
- In wake of slow progress in achieving greenhouse gas emission reduction targets, more evidence on viable heat stress adaptation options for the population are important.
- More robust exposure-response functions are also essential for health impact assessments of temperature-related mortality and morbidity burdens
- There is a lack of Heat Stress mortality data across South Asia, and there is an immediate need for capturing the impact of heat stress on communities in South Asia.
- National Level policy is required to make reporting of heat-related illnesses and the number of mortality during summer to understand its impact on human health better in India.
- The panelists acknowledged the need for more comprehensive documentation in order to build evidence for the impact of heat stress.
- The formation of the South Asian Heat Health Information Network was welcomed by the Panelists and the Participants, with many expressing intentions in utilizing the platform to make progress in heat stress management.
- Climate Resilient Heat Action Plan should be part of city planning and an important component of smart city
- India's and South Asia's specific heat stress threshold determination needs to be addressed by more research and actions.

Annexure

Annexure 1: Workshop Flyer

Session Partners

About the Project

To manage the mounting heat stress risk in Indian urban centres, IRADe is spearheading an inter-disciplinary research study on "Climate Adaptive Heat Stress Action Plans" is funded by IDRC Canada. The project aims to improve the management of heat stress risks in Indian cities by developing spatially differentiated and gender sensitive HSAPs. It will support medium term development planning for climate resilient smart cities. Learn More: www.climateandcities.org

About IRADe

IRADe is an independent advanced research institute that aims to conduct research and policy analysis to engage stakeholders such as government, non-governmental organizations, corporations, academic and financial institutions. Energy, Climate Change, Urban Development, Poverty, Gender Equity, Agriculture and Food Security are some of the challenges faced in the 21st century. Therefore, IRADe research covers these, as well as policies that affect them. IRADe's focus is effective action through multidisciplinary and multi-stakeholder research to arrive at implementable solutions for sustainable development and policy research that accounts for the effective governance of techno-economic and socio-cultural issues. Learn More: www.irade.org

About IDRC

Part of Canada's foreign affairs and development efforts, IDRC invests in knowledge, innovation, and solutions to improve the lives of people in the developing world. The research we support builds evidence to break the cycle of poverty, reduce inequalities and vulnerabilities, and help people live healthier and more sustainable lives. Learn More: www.idrc.ca

Contact Us

Integrated Research and Action for Development (IRADe)
C-80 Shivalik, Malviya Nagar, New Delhi - 110017
Tel.: 91 (11) 2667 6180, 2667 6181, 2668 2226
Email ID: r.magotra@irade.org

@IRADeNewDelhi @IRADe_Delhi Web: www.irade.org, www.climateandcities.org