



1st Global Forum on Heat and Health

Summary Report

December 2018 / Hong Kong, China

About the Global Heat Health Information Network (GHHIN)

The Global Heat Health Information Network is an independent, voluntary, and member-driven forum of scientists, practitioners, and policymakers focused on enhancing and multiplying the global and local learning regarding resilience-building for heat health.

The Network is spearheaded by the World Health Organization and World Meteorological Organization Joint Office for Climate and Health and the United States National Oceanic and Atmospheric Administration (NOAA) and it includes health and meteorological practitioners and scientists from all populated continents.

www.ghhin.org

Global Health Health Information Network, 2019

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of WMO or WHO concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The mention of specific companies or products does not imply that they are endorsed or recommended by WMO or WHO in preference to others of a similar nature which are not mentioned or advertised.

Forum photos: Robbie Parks, Hunter Jones





Contents

Acronyms	3
Executive Summary	4
Opening Statements	11
Keynote Presentations	13
Regional Heat Health Perspectives	15
Europe	16
Continental North America	17
Africa	19
Australia / Oceania	21
Caribbean & South America	22
South and South-East Asia	23
North and East Asia	24
Heat Health Thematic Priorities	25
Theme 1: Partnerships and capacity to building heat health management networks	26
Theme 2: Understanding Risk and Predicting Health Outcomes	28
Theme 3: Weather and Climate Information to Facilitate Action	31
Theme 4: Managing heat risk: actions, interventions and effectiveness	34
Theme 5: Communications for Heat Action	36
Local Learning in Hong Kong	41
Conclusions and Next Steps	49
Annex 1: Posters	52
Annex 2: Member Survey	53
Annex 3: Participants	54
Annex 4: Agenda	56
Annex 5: Acknowledgements	65

Acronyms

CCOUC	Collaborating Centre for Oxford University and CUHK for Disaster and Medical Humanitarian Response
CUHK	Chinese University Hong Kong
DRR	Disaster Risk Reduction
GHHIN	Global Heat Health Information Network
HHAP	Heat Health Action Plan
HHWS	Heat Health Warning System
HKO	Hong Kong Observatory
IPCC	Intergovernmental Panel on Climate Change
JCSPHPC	JC School of Public Health and Primary Care (Chinese University of Hong Kong)
MERCOSUR	Southern Common Market of South America
NGO	Non-governmental organization
NIHHIS	United States National Integrated Heat Health Information System
NOAA	United States National Oceanic and Atmospheric Administration
SCHSA	Senior Citizen Home Safety Association of Hong Kong
UNDRR	United Nations Office for Disaster Risk Reduction
WBGT	Wet Bulb Globe Temperature
WHO	World Health Organization
WMO	World Meteorological Organization

Extreme heat poses
challenges around the world,
but heat-related deaths are
largely preventable.



EXECUTIVE SUMMARY

The 1st Global Forum on Heat and Health (Hong Kong, China, 17-20 December 2018) brought together over 150 interdisciplinary experts and practitioners from 33 countries.

The Forum formally launched the Global Heat Health Information Network - its parent inter-agency coordination body and governance mechanism - and informed a global common action agenda for heat risk management to human health.

This inaugural biannual event provided an international platform to promote the integrated use of climate, weather, and health information for evidence based policy and actions to improve the management of extreme heat risks. The Forum enabled a global community of experts and practitioners to share experiences, identify priorities, and strengthen interdisciplinary cooperation to develop the capacity of governments, organizations, and professionals to protect populations from the avoidable health risks of extreme and ambient heat.

What is heat health?

Heat Health is the term used to express the concept of the multiple dimensions which characterize the “direct human health risks of ambient heat exposure”.

This includes conditions contributing to vulnerability, which include physiological and social vulnerability, place-based exposure; acclimatization rates and adaptive capacity; and environmental conditions which determine the exposure (e.g. extremes, humidity, daytime vs. nighttime exposures, long term change, urban heat islands, indoor vs. outdoor exposures; as well as compounding factors such as air quality). This risk is recognized to function across multiple timescales - from days, to seasonal, to annual and beyond.

Origins

Climate change is pushing communities worldwide quickly into a warmer world, where extreme temperatures are placing all populations, young and old, rich and poor at greater risk of poor health. Concerned by these clear trends, leading health, weather, and climate experts¹ convened in Chicago in July 2015 to discuss for the first time current practices around the world to address the growing global problem of extreme heat and its health impacts.

The workshop focused on the application of both weather and climate information, identified the basis for a common framework, and produced an action plan wherein participants agreed to work together on an integrated approach to extreme heat. Participants agreed to reconvene within 2 years to discuss progress and the way forward in an international context. In April 2016, the first South Asia Climate Services forum for Health, also focused on extreme heat issues in the region, following a similar agenda.

The First Global Forum on Heat and Health is a response to these workshops, with the launch of GHIN as a mechanism to fulfil the identified needs and accelerate implementation of heat-health priority actions.

Host City

Hong Kong was chosen to host the first Forum because the city suffers significantly from the consequences of the urban heat island effect, and local partners, including the Hong Kong Observatory (HKO), are world-leaders in innovative and collaborative approaches to understanding and managing extreme heat risks to health.

Objectives

Objectives of the Forum included the following:

- Provide the opportunity for national, regional, and international sharing and networking between heat health experts;
- Share experiences and identify emerging issues across common thematic areas;
- Provide a learning platform for understanding and communicating heat risks;
- Improve capacity to communicate heat risk by engaging local and global media in heat health communications;
- Review and codify a global technical agenda;
- Achieve international agreement on the highest priority gaps in research, information, and action to address extreme heat risk..

Interdisciplinary design

The forum was designed to break the mold of scientific conferences by bringing interdisciplinary practitioners together with researchers to provide fresh, real-world perspectives on heat health risk management across diverse fields, such as medical science, epidemiology, urban planning, meteorology, and economics.

Experts from national meteorological and hydrological services reviewed trends in extreme heat across world regions; and explored key actions and innovations.

¹ Experts who participated in the 2015 Chicago consortium included representatives from the US National Oceanic and Atmospheric Administration (NOAA), German Deutscher Wetterdienst (DWD), the US Centers for Disease Control and Prevention (CDC), the World Meteorological Organization (WMO) and the Global Framework For Climate Services (GFCs) and many other research and operational health partners from India, the United Kingdom, Australia, Canada, and Sweden.

Call to Action

Key Messages

Heat stress is a serious and urgent health threat for humans

It is a leading cause of weather-related death, and can result in permanent damage to the brain, central nervous system, and other internal organs exacerbating cardiovascular, respiratory, and psychological distress, injuries, and infectious disease.

Extreme heat waves cause disasters

Similar to hurricanes, tsunamis, and earthquakes, they can result in significant mortality and morbidity, as well as economic damages and destruction of property that can overwhelm response systems.

Dangerous heat conditions can also manifest during heat spells outside the hot season, prolonged periods of locally relevant elevated daytime and night time thermal conditions, and in specific microclimates.

Heatwaves are increasingly accompanied by cascading environmental or socio-economic impacts from heat triggered wildfires and drought to food, energy, water, and transport infrastructure failures. The true global scale and magnitude of the impacts of heat on society are recognized to be under-reported and underestimated.

All populations are affected by rising ambient temperatures

However, some populations are more vulnerable to heat stress and increased risk of death or illness due to a combination of high exposure, physiological preconditions and socioeconomic status. These include the rural and urban poor, populations in regions that are already very hot and humid, regions with colder climates that are facing warmer summers, older adults, infants and children, pregnant women, indoor and outdoor labourers, athletes, attendees of outdoor events, and those with some pre-existing medical conditions.

Occupational heat strain directly affects workers' health

Impacts include elevated risk of dehydration, kidney disease, work accidents, and lost work productivity. Heat may be indirectly influencing global health in significant ways, as the loss of productivity and income hinders individual ability to live healthy and productive lives.

Urban environments magnify heat exposures

This is due to dense and vertical constructions, extensive use of heat retaining materials, limited vegetation cover, and heat generation from energy use in cooling and transport, that all contribute to urban heat island effects. Urban Heat Islands, and micro-heat islands within cities, increase exposure risk to local inhabitants.

The mental health impacts of heat are an emerging area of interest

Heat influences brain functioning and behaviour, and people with mental health issues and/or prescribed medications which limit the body's natural cooling functions are especially vulnerable. Social connectivity is important for risk reduction.

Heat-related problems are destined to increase for decades to come

This is due to greenhouse gases already in the atmosphere that are rapidly warming the earth's climate. The degree and rate of future warming and impacts beyond 2100 will depend on the success of climate change mitigation efforts. Taking appropriate action and preparedness to face a warming world is imperative and urgent.

Solutions

Prevention

Detrimental impacts of extreme heat can be markedly reduced if appropriate strategic planning, early warning systems, public preparedness, urban design and engineering solutions, legislation, and health interventions that focus on prevention are effectively implemented.

Information and solutions should be derived and applied across the broad range of disciplines, time scales, and actors already making important strides to manage heat risks.

Preparedness

Seasonal and sub-seasonal preparedness, complemented by short-term heat early warning systems, are key components of heat action plans, health interventions and emergency response actions.

All well-functioning action and alert systems rely on strong cross-disciplinary and multi-agency collaboration, with effective communication between stakeholders including national and local governments, universities, media, healthcare and social protection systems, NGOs and humanitarian actors, as well as, affected populations.

Location and context specific risk management

Epidemiological studies, social science, risk assessment and heat forecasting capabilities are fundamental to incorporate the differentiated needs of vulnerable groups into risk planning, and to inform appropriate and effective responses.

Multi-disciplinary understandings of the risk context and perceptions are critical to effective intervention design.

Development planning

Strategic and environmentally sustainable urban and rural development planning that accounts for energy-efficient technical and biophysical solutions are essential for long-term heat risk management. This includes cost-effective improvements to the built environment, especially housing and building design.



L-R: X; Linwei Tian, C.M Shun, Joy Shumake-Guillemot, Juli Trtanj, Chris Webster, Donald Li, Hunter Jones

Challenges

Inadequate recording and monitoring of heat risks and impacts

This limits research and underlies an insufficient awareness and appreciation of the urgency and magnitude of the cumulative and systemic impacts of extreme heat on people, society, health, wellbeing, and local economies; the complex dependencies and risks of cascading system failures; and the concomitant risks of poor air quality, drought, water stress, and poorly planned urbanization that all place society at greater risk.

Further investment in monitoring and evaluation capabilities, including meteorological observations, health surveillance of heat-related mortality and morbidity, and other measures such as impacts on productivity, worker safety, and economics are imperative to improve our understanding of vulnerability and how short and long-term prevention can be strengthened.

Inadequate access to appropriate tools and information

Low levels of preparedness and planning are compounded by inadequate availability and access to appropriate tools and information to confront current and future impacts of extreme heat to human health, wellbeing, and society.

Challenges transforming evidence to policy, and poor risk communication

Current evidence is not being translated in a timely manner to application and policy, and poor risk communication is resulting in inadequate efforts to improve public health and disaster management laws, policies and frameworks.

Furthermore, the efficacy of interventions is inadequately measured, and heat related risks remain outside many mechanisms that could prevent avoidable impacts including the disaster risk management cycle.

System fragmentation

Many countries and communities lack effective integrated systems and have fragmented and insufficient expertise and capacity to address the scale and complexity of current and future heat risks. Harmonization and standards are lacking in many technical areas, and the sharing of scientific knowledge and collaboration on implementation of good practices - particularly at a regional scale and across disciplines - is critical.

Action Agenda

Launch the Global Heat Health Information Network

The Network is expected to facilitate the sharing of scientific and operational information, methods and tools for more effective management and evaluation of heat's health effects, and to become a global resource for the dissemination of good-practice procedures.

A network approach will enable the Network to leverage the strengths of members, amplify solutions and impacts through peer learning; facilitate engagement and collaboration between a wide range of professions, institutions, and the public; and foster translation of local knowledge and actions into collective global knowledge and response.

Transform knowledge to action

The Network will accelerate the assembly and transmission of knowledge for action, through five common goals:

1. urgently improve awareness of the disaster that increasing extreme heat poses to human health, wellbeing, and productivity worldwide;
2. catalyze and sustain interdisciplinary partnerships and co-learning between research and practitioners across relevant government, academic, private sector and civil society bodies;
3. synthesize and advance science and technology available for decision making and risk reduction across sectors and time scales;
4. improve access to expert resources and opportunities for learning, exchange, and engagement;
5. identify and promote action to address critical gaps in research, knowledge and action.

Create a coordination function

The Network is expected to establish a coordination function to respond to the need for normative and technical guidance, knowledge sharing, and collaboration at the global and regional levels, and to support the implementation of agreed actions.

An advisory and oversight mechanism that reflects the needs and values of the network should also be established, appropriate to the agreed upon structure and mechanisms of the network. An action plan, including key priorities, future directions and targets, should be developed by mid-2019; and the 2nd Global Forum on Heat and Health should be organized no later than 2020 and be informed by regional or local meetings which may be organized prior.

Be inclusive

The Network should welcome participation from all parts of the world, all relevant research areas, and all public or private organizations working to improve individual and public health in the face of a warming world.

Ensure the Network is flexible, interdisciplinary and agile

The Network should be flexible, interdisciplinary and agile to adaptively learn and respond to the needs of the community. Where possible, it should draw upon existing mechanisms and structures to provide scientific and normative guidance.

GHHIN should engage and partner with key actors including WMO, WHO, the International Federation of Red Cross and Red Crescent Societies, and other international and regional bodies and professional societies¹, to support and engage demand driven research and action for heat risk management.

Leverage institutional processes to support global policy frameworks

Network partners will be encouraged to leverage institutional processes and appropriate authorities to implement the Sendai Framework for Disaster Risk Reduction 2015-2030, the Paris Agreement for Climate Change, the Global Framework for Climate Services, and the Sustainable Development Goals.

Foster research, innovation and collaboration

The Network will create opportunities and an enabling environment to cultivate an understanding of research and operational requirements for heat prediction and advisory, and for enhanced collaborative innovations, research, and interventions (such as support to innovation platforms, technical cooperation, sharing of good practice, novel networking approaches, personnel and scholar exchanges, pilot programming and partnerships) that will facilitate interdisciplinary learning and action at global, regional, and local levels.

Identify and address gaps

The Network will identify and advocate for action to address specific gaps in areas of occupational health, understanding and managing complex heat exposures in urban contexts, enhancing global heat prediction capabilities across timescales, evaluating intervention effectiveness, developing effective communication practices; and developing standards for collection and management of relevant health and environmental data.

Facilitate co-design and co-production of tools and information

The Network will adopt an integrated systems approach to facilitate the co-design and co-production of information and tools across varied disciplines. A holistic five pillar framework will guide actions of the network, under the following work streams:

- Partnerships and capacity building;
- Data, science, and research for understanding health risks of heat;
- Climate and weather information for decision-making and action;
- Effective interventions to prevent heat exposure and negative health outcomes;
- Communications and outreach.

Understand and invest in current and future needs

The Network recognizes that considerations across timescales are vital in all research and interventions, as is simultaneous investment to address both current and future health risks of extreme heat.

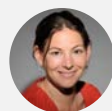


OPENING STATEMENTS

Opening statements were given by honorary guests, while welcome and introductory statements were provided by the WHO/WMO Climate and Health Joint Office.

Opening the Forum, **Joy Shumake-Guillemot** called for global knowledge and solutions to address the challenges of extreme heat and human health, noting the tremendous amount of research, action happening around the world, as well as the gaps. Introducing the new Global Health Health Information Network (GHHIN), she said:

“We believe that collectively we have the tools and the solutions to address this problem together. We don’t have time to waste, the WMO has just reported that the hottest 20 years have occurred in the last 22 years.”



Joy Shumake-Guillemot,
WHO/WMO Joint Office for Climate and Health



Chris Webster, Faculty of Architecture,
University of Hong Kong



Linwei Tian, School of Public Health,
University of Hong Kong



Chi-Ming Shun,
Director, Hong Kong Observatory



Elena Manaenkova,
Deputy Secretary-General,
World Meteorological Organization

Chris Webster:

As the world is urbanizing and many highly population-dense locations emerge, planning and building will be a fundamental part of securing our global future.

The climate arguments that make an impact are either about energy or health, and climatologists recognize the health space as an impactful endpoint. The idea of linking science to action is important and inescapable.

Linwei Tian:

Climate change and global warming are long term trends – reiterating that this mechanism represents preparedness, common sense and good public health.

Hong Kong's high population density makes it vulnerable to the urban heat island effect, with its aging population being especially vulnerable. The effects of climate change are not uniform as temperatures can vary by up to 8 degrees – spatial and temporal variations help us to study how heat impacts health.

The interdisciplinarity of public health researchers, urban planners and architects represents an extremely positive example of working together. Working with the Hong Kong Observatory, Hong Kong looks to WHO, WMO and NOAA for examples and are pleased that the organizations are collaborating to set up this network.

Chi Ming Shun:

Hong Kong is witnessing the highest heat records in the history of the observatory's 135 year existence. Hong Kong's high population and building density, as well as its aging population, mean we need to innovate to combat climate change in coming years.

The heat stress information service for the population of Hong Kong uses health data from partners, hospital authorities and other key stakeholders. There is a need to get more data and install micro climate stations at the street level, as has already been employed in certain districts to obtain micro-scale data to support urban design and other applications. There is also a need to capitalize on effective communication with the public for effective warning for them to take action in the case of typhoons and heat waves.

Elena Manaenkova:

New international agreements, including those which exist between WMO and WHO, address the priorities of health, air quality and heat extremes, including heat waves and their impact on health.

The Intergovernmental Panel on Climate Change (IPCC) has declared that more heat waves and higher temperatures are being observed in all of the inhabited regions of the world. The WMO State of Climate Report found that 2018 will be the 4th hottest year on record, resulting in an increased number of temperature extremes and heat waves which lead to fatalities and wildfires. UNDRR recently released a 20 year statistical report on disasters which found that 98 million people will soon be impacted by heat stress, and that the average duration of heat waves will increase.

When we produce alerts and warning we will be able to save lives. In order to do this we need to increase our efforts to predict risks, common alerting and global warming systems so that the data is available to those who can use it.



Joy Shumake-Guillemot. Photo: Robbie Parks, 2018



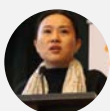
Donald Li, President, World Organization of Family Doctors (moderator)



Facing the Future of a Warming World
Kristie Ebi, Lead Author of IPCC SR1.5, Director of the Center for Health and the Global Environment, University of Washington, USA



Making a difference in the context of DRR
Virginia Murray, Head of Disaster Risk Reduction, Public Health England, UK



Heat-related Health Impacts in Subtropical Cities: Global Overview and Research Frontiers in Hong Kong
Emily Chan, Director of the Centre for Global Health, Chinese University of Hong Kong, China

Keynote speakers highlighted the realities of heat impacts on public health in Hong Kong, discussed the long-term global impacts climate change poses to managing heat risk, and explored how disaster risk reduction policies and approaches can be leveraged to manage heat risks to health now and in the future.

Donald Li

Family doctors need to understand the relationships between environmental change and human health risks. Risk assessment, preparedness and addressing issues is essential to maintain regular services during emergencies – especially for non-communicable diseases. It is important for doctors to monitor and be aware of local environmental issues such as heat waves.

The opportunity presented during clinical consultation is more than just handling a complaint between physician and patient - doctors can act as trusted communicators of information on food sources, reproductive

health, connecting to nature, and engagement in the community. Health professionals can influence broader government policies, and health arguments can be an important policy driver, especially at the city level. Health actors have not been mobilized traditionally, and seem to be disconnected with public health programs.

Emily Chan

Hong Kong has experienced a significant increase in all-cause mortality related to heat, with hospitalizations increasing by 4.5% for every 1C degree increase in mean daily temperature above 29 in certain urbanized areas.

CUHK, along with Oxford University, is working closely with architects to understand the impact of the built environment, and identified a gap in modelling on how vertical communities (high rise buildings) can impact health, as well as gaps in knowledge on how extreme temperatures can lead to changes in impact of disease.

Through service enhancement, temperature warning systems, and risk awareness we can collaborate to reduce the impacts of extreme heat on human health.

Kristie Ebi

Global mean surface temperature has been increasing steadily since the pre-industrial era. The change is significant and the costs are real: by the end of the century, the coldest day in the summer will be hotter than the hottest day today.

Occupational heat exposure is increasing, associated with reduced productivity and increased economic impacts across the world. Looking towards solutions, we can reduce risks if we are more efficient and effective with adaptation – with early warning as the primary method.

Virginia Murray

The Network is aligned with the Sendai Framework for Disaster Risk Reduction, and there are ample opportunities for synergies in implementation, including, developing common indicators on heat risks for better tracking the risks and damages of extreme heat to society.

The Sendai Framework can be used as a driver for every research project on heat, and we should be aiming to have early warning for all people by 2030 in a way that they can understand, use and act upon. The Framework is also a mechanism through which we can engage countries, as they have agreed to its contents including the need to produce national risk registers.

The global disparity in the coverage of heat health plans, with 35 countries in Europe implementing heat preparedness and response planning, and none reported from Africa, shows the work we have ahead of us.

Other areas for improvement include the need to build strategies and mechanisms for cooperation to allow for efficient planning, and to create common information systems and exchange good practices. Better data and communications are also needed to prevent deaths from extreme heat.

REGIONAL HEAT HEALTH PERSPECTIVES

Europe

Andreas Matzarakis, Research Centre Human Biometeorology of the German Meteorological Service (DWD), Germany

Hans-Guido Mücke, German Federal Environment Agency (Umweltbundesamt/UBA), Germany

North America

Melissa McDonald, Environment and Climate Change Canada, Canada

Juli Trtanj, National Oceanic and Atmospheric Administration (NOAA), USA

Africa and Middle East

Ousman Ndiaye, Department of Meteorology (ANACIM), Senegal

Rachid Wahabi, Ministry of Health, Morocco

Australia-Pacific

John Nairn CF, University Adelaide, Bureau of Meteorology, Australia

Leigh Wilson, University of Sydney, Australia

Caribbean and South America

Cedric Van Meerbeeck, Caribbean Institute for Meteorology & Hydrology (CIMH), Barbados

Natalia Herrera, National Meteorological Service, Argentina

Francisco Chesini, Ministry of Health Argentina

South and South-East Asia

Subhash Bhan, India Meteorology Department (IMD), India

Liviu Vedrasco, World Health Organization, Thailand

North and East Asia

Gabriel Lau, Chinese University of Hong Kong, China

Gloria Chan, Chinese University of Hong Kong; also on behalf of National Institute for Environmental Health, Chinese Center for Disease Control and Prevention, Beijing, China.

Asuka Suzuki-Parker, University of Rissho, Japan

In a series of presentations covering two sessions, speakers introduced regional perspectives on heat health from around the world.

During the first panel, experts presented regional updates on meteorological conditions observed across seven geographic regions, describing global heat trends and the state of the science in forecasting and relevant applications in their region. This session provided an understanding of regional nuances and commonalities, drivers of heat conditions, specific issues and concerns related to temperature, as well as key products and services available, and innovations.

During the second panel, experts shared regional examples of policies, innovations and interventions which are addressing and managing heat risks, including policy changes, new protective regulations, heat health action plans/heat management plans, novel partnerships with NGOs or media, private sector action, major research programmes, and urban and social planning and programmes.

For all seven regions reviewed there has been a significant shift in climatology, with a strong trend toward increasing frequency, intensity, and duration of heat events. Most experts relayed concern regarding the trends in warming in available evidence, and worrying lack of evidence in some areas.

Europe

Regional Climate Trends

The European region has an important history in confronting severe heatwaves, recently marked by the immense impacts of the 2003 heatwave, which shocked the continent into preventive action to prevent so many excess deaths from happening again. Europe is seeing an important increase in temperature trends, and has experienced a significant rise in the number of days over 30 degrees.

Heat Interventions

66% of European countries have implemented heat health action plans since 2005. Guidance on heat action plan implementation is being updated by WHO, based on review of evidence and good practice in the region. The web-based platform [European Monitoring of Excess Mortality for Public Health Action](#) is monitoring excess mortality in 18 countries.

Near real-time health surveillance systems in Italy and France show the benefits of having a rapid mortality knowledge system, allowing the Ministry of Health to publish weekly mortality statements throughout the heat season. Mobile phone based application [Extrema](#), showcased how to communicate with affected populations and provide live updates on risk levels and actionable protective measures that can be taken.

In France, heat information is provided directly to decision makers at the local level.

Presentations

[Regional Perspectives of Heat Risks](#)

Andreas Matzarakis, Research Centre Human Biometeorology of the German Meteorological Service (DWD), Germany

[Innovations and Actions](#)

Hans-Guido Mücke, German Federal Environment Agency (Umweltbundesamt/UBA), Germany

Frontiers of Heat Management

Evidence reviews of intervention effectiveness and current practice. Update of available guidance for heat health planning and warnings. Research on interactions of air quality and heat.

Key Challenges

In Western Europe, challenges exist around aging populations, managing urban heat stress in cities, confronting risks to workers and labour productivity, and capacity development.

Lack of residential air conditioning across the European Region increases indoor heat exposure, including in critical care facilities.

Effective risk communication to vulnerable populations to encourage protective behaviors is also a challenge.

Hans-Guido Mücke



Continental North America

Regional Climate Trends

In 2017, North America had warmer than average annual temperatures across much of the continent. The mean temperature in 2017 for Canada, the United States, and Mexico ranked among the 10 hottest years on record for each country.

In Canada the annual average temperature in 2017 was 0.7 °C above the 1981-2010 average.

In the United States, with the exception of Washington, every state in the country experienced warmer than average annual temperatures, with record high temperatures in Arizona, New Mexico, North Carolina, South Carolina, and Georgia.

Mexico experienced its hottest year on record, at 1.6 °C above the 1981-2010 average.²

Impacts of Heat on Health

Elevated ambient temperatures over the last few decades and an increasing frequency and severity of heatwaves have resulted in thousands of cases of heat-related illness (HRI) across North America.

The CDC [National Environmental Public Health Tracking Network](#) maps state-level public health and environmental data. It includes data for HRI emergency department visits, hospitalizations, and mortality in 20 US states. Findings from the tracking program include:

- 28,000 hospitalizations for HRI between 2001-2010
- The majority of HRI hospitalizations were male and ≥ age 65 years
- The highest HRI hospitalization rates occurred in the Midwest and Southern United States
- Between 2001-2010, the rate of HRI hospitalizations increased by 2%-5%

Presentations

[Regional Perspectives of Heat Risks](#)

Melissa McDonald, Environment and Climate Change Canada, Canada

[Innovations and Actions](#)

Juli Trtanj, National Oceanic and Atmospheric Administration (NOAA), USA

The 2018 North American Heat Wave affected millions of people in Canada, the United States, and Mexico. At least 90 people died in Quebec due to heat-related illnesses, with a majority of deaths reported deaths in Montreal. In Los Angeles, elevated temperatures were followed by a surge in air conditioner usage, which resulted in power outages affecting over 30,000 individuals. In Mexico, temperatures were elevated to over 49 °C in some communities, with states of emergency declared in 573 municipalities across 22 states.

Heat Interventions

Numerous heat-health interventions have been established in North America at both the national and subnational levels (see: [Environment & Climate Change Canada](#); [Health Canada](#); [US National Integrated Heat Health Information System](#)).

The US National Integrated Heat Health Information System (NIHHIS) uses 122 offices in the United States to produce climate services to reduce heat risk, while Canada's Heat Alert Response System provides national monitoring of heat impacts.

² https://www.ametsoc.net/sotc2017/Ch07_RegionalClimates.pdf

Frontiers of Heat Management

A number of emerging heat-health interventions are currently being tested and evaluated in Canada, the United States, and Mexico.

A pilot project to enhance syndromic surveillance of HRI in Canada, the United States, and Mexico has been established by the [Commission for Environmental Cooperation](#) to develop an operational, real-time syndromic surveillance system for extreme heat events (EHEs) in three selected at-risk communities in Canada, Mexico and the United States and to highlight best practices and lessons learned on developing such a system.

NOAA is currently testing the [National Weather Service HeatRisk forecast system](#), which assigns heat risk scores at high spatial resolution across the United States, incorporating temperature, climate, and temporal data.

The CDC's National Institute for Occupational Safety and Health (NIOSH) is evaluating the use of [Wet Bulb Global Temperature \(WBGT\) sensors](#), which are instruments designed to adjust temperature measurement by detecting and combining factors of humidity, air movement, and radiant heat data, which more accurately reflect human exposure conditions.

Decision calendars provide a framework to support planning by organizing information about user context in decision making, i.e., what needs to be known when, by whom, and to what degree of certainty in order to effectively reduce heat health risk. NIHHS facilitates calendar interviews, focus groups, and workshops in affiliated pilot cities across the country to support local decision makers.



Melissa McDonald

Key Challenges

Not all health systems are participating in syndromic surveillance. In the United States, only 25 states participate in the heat health surveillance system. Heat-related morbidity and mortality estimates are further limited by numerous and redundant data sources (workplace incidents; death certificates; the news; syndromic surveillance).

There is still much uncertainty in seasonal and sub seasonal meteorological predictions. City-level meteorological data is currently limited. While multiple research groups are downscaling predictions to the city-level, approaches vary significantly. There is also a lack of guidance and consensus on heat indices (e.g., wet bulb temperature versus NWS heat index).

Mexico in particular is not equipped to adequately manage heat health given limited resources for both prediction and remediation activities.

The evidence base for the efficacy of heat health interventions is limited; impact assessments of heat health interventions are warranted.

Africa

Regional Climate Trends

Africa is experiencing more extreme heat events, with Central Africa expected to witness the greatest increase in average warming and extremely high temperatures in the region.

Impacts of Heat on Health

Heat is affecting populations in Africa, but limited studies have been conducted. However, where studies are conducted such as in Senegal, strong correlations between temperatures and health outcomes are documented. In rural Senegal the apparent temperature threshold is higher than in Europe, indicating that communities are sensitive to heat but at higher apparent temperatures. The risk of visiting a health facility for cardiovascular problems and malaria increases with extreme heat and duration of exposure to extreme heat.

For example, when considering the effect of intensity and duration of exposure of heat on mortality and morbidity between 1984 and 2014 in Senegal:

- The mortality risk increased beyond 37°C maximum daily apparent temperature. Deaths increased by 1.3% per additional degree. During the dry and warm season, the threshold occurred at the daily optimal temperature of 44°C and the rate of increase in mortality is 1.08% per additional degree.
- Over a month, a 10% increase in the average apparent temperature causes a 9.3% increase in the number of deaths in the same month.
- The probability of visiting a health facility increased beyond the 36 °C threshold and medical consultations increased by 7.4% per degree above 36°C. After 2008, medical visits increased faster (12.4%) per added degree above 37°C than before 2008 (5.8%).

Presentations

Regional Perspectives of Heat Risks

Ousmane Ndiaye, Department of Meteorology (ANACIM), Senegal

Innovations and Actions

Rachid Wahabi, Ministry of Health, Morocco

Heat Interventions

Few African countries have heat forecasting, preparedness, and management plans. Morocco and Egypt shared their experiences.

Sahelian countries have been working through the ACASIS project to characterize heat conditions to better forecast and develop early warning systems.

The National Meteorological Office of Morocco Weather Vigilance System provides early warning for public authorities, with forecasting and monitoring tools and outputs, including a Weather Vigilance Map (48 hour, colour coded) which describes level of risk 24/7. Temperature thresholds are being defined to split the country into 4 zones based on similar climate and local characteristics, and a multi-risk plan for public health emergency and response was developed using WHO STAR Assessment Tool, which identified heat waves as a public health risk.

Frontiers of Heat Management

Trends in innovation include geographic information systems and multi-agency dissemination of information, as well as zoning by risk factors.

Enhancing heat forecasting for the Sahel region and developing heat health forecasting and warning system.

Understanding intervention appropriateness and effectiveness in Africa, such as housing, behaviour, and cooling options.

Key Challenges

Limited work has been undertaken to understand the full scale of ramifications of extreme heat on African populations.

Rapid urbanization and urban-population growth will drive population vulnerabilities to heat in the future. Understanding urban climates and drivers of urban population vulnerability in Africa is urgent.

Rain-fed agriculture drives seasonal and interannual prevalence trends of malnutrition and some vector-borne diseases. Increasing temperatures and more frequent heatwave will only exacerbate the range of climate-related diseases that are already wide-spread in Africa.



Ousmane Ndiaye

Australia

Regional Climate Trends

The frequency of heatwaves in Australia has increased significantly since the 1980s, with the region experiencing continental heatwaves. The region is experiencing changes in heatwave and climate spectrum distribution based on spatial factors, and temperatures in the wet tropical coast of Australia recently rose to 43°C, resulting in unprecedented wildfires. Fire behaviour is far exceeding observed averages with flame heights of 10-20m vs. 1-2m average and fire speeds exceeding previous records.

Impacts of Heat on Health

In Australia, the impact of heat individuals, livestock and fire risk is under investigation.

Heat Interventions

Heat wave mapping is conducted in collaboration with local government council areas. Australia's HeatReady study is observing the impact of heat on health in aged care facilities, and a residential aged care service heat wave readiness resource is in use.

Predictive capacities used by heat wave services use publicly-available geographic information systems and colour-coding to denote heat wave severity for previous two and following five three-day periods, with a digitized forecasting system and region-specific public information service currently in development.

Warning decision support is using heat wave evaluations based on long and short term daily temperature anomalies with severity categories as a function of the 85th percentile of heat wave intensity climate distribution.

Presentations

Regional Perspectives of Heat Risks

John Nairn CF, University Adelaide, Bureau of Meteorology, Australia

Innovations and Actions

Leigh Wilson, University of Sydney, Australia

Frontiers of Heat Management

Regional trends in innovation include information and decision support tools for readiness in vulnerable populations, multi-sector risk mapping, aging populations readiness assessments, and urban planning and high-risk risk assessments.

Australian research on the impact of high rise development on health during extreme heat events, particularly for older and lower income populations underway.

Research to develop an evidence-based extreme heat policy for children and youth, due to sport-related deaths.

A novel visualization system is in development in collaboration with the Swedish Meteorological Service for the global users of the Copernicus Climate Change Service.

Caribbean and South America

Regional Climate Trends

South America has exhibited an upwards trend in the number of warm nights, which remains consistent with strong regional and sub-regional trends of warming in the region. Increases in warm nights are particularly marked in Brazil, with an 18% increase of warm nights in western Brazil.

A 15% increase in the frequency of warm days and nights in the Caribbean region has been observed, with consistent average temperatures of 25-32 °C except for those days during tropical cyclones.

Heat Interventions

Argentina has developed a heat health warning system and heat action plan.

A Mercosur Action Strategy was developed to protect human health from climate change through evidence, knowledge, alliances, resources and adaptation. In support of this strategy, the first regional Training Institute on Climate and Health was organized, where participants from Mercosur member countries were trained for 2 weeks, regional working teams of climate

Presentations

Regional Perspectives of Heat Risks

Cedric Van Meerbeeck, Caribbean Institute for Meteorology & Hydrology (CIMH), Barbados

Natalia Herrera, National Meteorological Service, Argentina

Innovations and Actions

Francisco Chesini, Ministry of Health Argentina

and health professionals were established, and research projects to address climate sensitive issues on health were presented as a means to strengthen and build regional cooperation networks and empower participants.

Both Chile and Brazil have established action plans to address the challenges posed by climate change.

Frontiers of Heat Management

Trends in regional innovation include coordinating mechanisms and multi-stakeholder interest groups, as well as the development of Heat Health Action Plans.



Natalia Herrera

South and South-East Asia

Regional Climate Trends

South and Southeast Asia have exhibited strong trends in warming which are in line with global trends since the 1970s, though there is evidence of cooling in limited 'pockets' in two locations in Eastern and Western India. Nepal, Bangladesh and Pakistan have exhibited very strong warming when compared with previous averages.

Maximum temperature trends remain consistent with global averages with years 2014-2018 being the hottest years on record.

Seasonally, temperatures begin to rise in March with peak temperatures observed towards the end of May/early June with southern parts of the region experiencing anomalous heating due to monsoon activity.

Impacts of Heat on Health

Across India, during the heatwave in 2015 more than 2000 people died. There are reports in India of significant amounts of neonates experiencing renal failure during hot days, though the incidence of this is unknown.

Heat Interventions

Heat action plans exist in just 5/13 countries, but proactive measures exist across the region, including provincial and sub-provincial interventions.

Thailand and Sri Lanka are both using heat health warning systems that involve surveillance, data and multi-sector interventions.

Community-based interventions in Thailand deploy radio broadcasts and first aid kits for cooling in extremely high temperatures.

Presentations

[Regional Perspectives of Heat Risks](#)

Subhash Bhan, India Meteorology Department (IMD), India

[Innovations and Actions](#)

Liviu Vedrasco, World Health Organization, Thailand

Frontiers of Heat Management

Key challenges noted at the Forum included the cost and scale up of interventions throughout the region, and cost concerns around having unique early warning systems for multiple hazards.



Subhash Bhan

North and East Asia

Regional Climate Trends

There are positive trends in all average measures of heat wave frequency and intensity (defined by temperatures exceeding 90th percentile variable with duration > 3 days).

Warming trends in China are more markedly observable since 2010, with Southern China experiencing an increase in the number of heatwaves with an earlier onset and later end of the heatwave season.

Impacts of Heat on Health

Japan has reported an increase in heat stroke, which is now the #1 weather-related injury. The aging population, with over 25% of the total aged over 60 years, is heavily impacted by warming trends.

Heat Interventions

In Hong Kong, HKO is collecting evidence to establish a Very Hot Weather Warning and has developed a comprehensive weather information app. A large scale telephone survey has been conducted on co-benefits to understand the relationship between reduction behaviours and health, and a Weather acquisition study has established the preferred channels of communication to receive weather warning information (smart phone apps are preferred).

There is a global pilot project to advance the climate warning system in China, and scientific investigations into climate-sensitive diseases are underway - encompassing 25 sensitive diseases including chronic, communicable disease, parasite, injury and mental illness.

In Japan, urbanization temperature simulations are being used to indicate the influence of urbanization on warming. The Japan Climate Adaptation Act provides a mandate to collect and synthesize

Presentations

Regional Perspectives of Heat Risks

Luo Ming, Lau Ngar-Cheung, Chinese University of Hong Kong

Innovations and Actions

Gloria Chan, Chinese University of Hong Kong; also on behalf of National Institute for Environmental Health, Chinese Center for Disease Control and Prevention, Beijing, China.

Asuka Suzuki-Parker, University of Rissho, Japan

climate change data in various sectors. National and prefectural centers have been established for the collection/distribution of climate data for multiple stakeholders. Data is available publicly on the environment ministry website, and text message alerts provide warning to the public. Real-time forecasts on trains is made possible through a partnership between the Japan Weather Association and private companies.

Frontiers of Heat Management

Regional trends in innovation include urbanization sensitivity models to predict ambient temperature increases, personal adaptation analyses and smart phone apps and alert systems.

In Japan, watering asphalt is a traditional method of environmental cooling, proven to assist in cooling, as does providing cool spots (wet mist, leafy vegetation, shade).

Key Challenges

Western progression of the subtropical high is known to influence heat waves by reducing cloud cover and reducing rainfall, thus exacerbating vulnerability.

Urbanization is shown to influence warming, with urbanized areas exhibiting a 3 °C increase in temperature between 1970-2015 vs. 2 °C in rural areas.



HEAT HEALTH THEMATIC PRIORITIES

The Global Heat Health Information Network is organized around five key areas of work and inquiry that are essential for addressing heat risks. These areas - listed here - formed the basis of the Forum's five thematic sessions.

Day 1 technical keynotes presented the global state of the science on key areas heat and health knowledge and action. Facilitated thematic sessions during days 2 and 3 took deeper dives to explore frontline research and experiences, and identify pressing key issues, priorities, challenges, and innovations. A full day of discussions and activities focused on risk communication.

1. Partnerships and capacity building
2. Data, science, and research for understanding health risks of heat
3. Climate and weather information for decision making and action
4. Interventions to prevent heat exposure and negative health outcomes
5. Communications and outreach

Theme 1: Partnerships and Capacity Building

Session Co-Chairs

Glenn McGregor, University of Durham, United Kingdom

Juli Trtanj, NOAA, USA

Presentations

Building Heat Health Management Networks: Partnerships and capacity

Julie Arrighi, Red Cross Red Crescent Climate Centre/American Red Cross

[Opportunities for Global Impact – Working with Family Doctors](#)

Donald Li, World Organization of Family Doctors (WONCA), Hong Kong, China

[Japan: Heat Health Warning System](#)

Michihiko Tonouchi, Japan Meteorological Business Support Center, Japan

[Governance and Difference: Lessons from northern Australia](#)

Elsbeth Oppermann, Technical University of Munich, Germany

[Argentina collaboration between Ministry of Health and Social Development and the National Meteorological Service](#)

Francisco Chesini, Ministry of Health and Social Development, Argentina

Natalia Herrera, National Meteorological Service, Argentina

[Integrated Systems Approaches: The US National Integrated Heat Health Information System \(NIHHIS\)](#)

Hunter Jones, National Oceanic and Atmospheric Administration (NOAA), USA

Shubhayu Saha, Centers for Disease Control and Prevention (CDC), USA

[Working with Community Based Organizations - Opportunities for Impact and Capacity Building](#)

Julie Arrighi, Red Cross Red Crescent Climate Centre/American Red Cross

[England Heat Plan](#)

Virginia Murray, on Behalf of Emer O'Connell, Interim Head of Extreme Events and Health Protection, Public Health England

[Address on forging Partnerships in India to scale up heat related policy](#)

Sujata Saunik, Indian Administrative Service, India

Theme 1 Outcomes Presentation

To address the multifaceted and multidimensional risks extreme heat poses for health and healthy societies, building capacity to develop and drive diverse partnerships from global and local levels is critically needed.

No single discipline or institution can tackle this issue alone. City planners, health professionals, epidemiologists, meteorologists, media, volunteer services, government agencies, researchers, businesses and others all need to work together to understand, communicate and reduce risks.



Juli Trtanj

Due to the changing climate, communities are confronting new challenges in communicating risks, developing early warning systems, and working together for protective interventions, often without clarity on who should be playing what role and how to organize and collaborate. Working across disciplines and institutions is challenging. However, climate risk management systems both assume institutional and multidisciplinary integration can enhance adaptive capacity through integrated planning, preparedness, response, and recovery activities -- and that capacity is autonomously available at a variety of levels, from the individual worker through to whole of institution to do this. The reality is far from true.

Discussion of capacity building for partnerships identified some of the opportunities, constraints and barriers to 'working together' to develop more effective heat-health management systems.

Presentations explored different approaches to bring together actors: from implementing Heat Health Warning Systems in Japan and Argentina; opportunities to leverage family doctors on the frontline of public health; utilizing a “sociology of heat” to understand who is affected and how for more effective policy and interventions; social media approaches to reach community members in Bangladesh; and initiatives such as the UK Natural Hazards Partnership or the US Integrated Systems Approach of the National Integrated Heat Health Information System that bring systems and institutions together for common missions.

Across these varied experiences participants considered the needs and priorities to strengthen institutional capacity needed to collectively address heat risk as a society, noting needs and good practices in identifying and building partnerships across disciplines and organizational boundaries.

Advances and Observations

- The need for partnerships resides in the complexity of the heat-health problem. No one discipline/ agency/group can understand or address this issue alone;
- Examples of effective interdisciplinary partnerships in research (integrated data), policy and action spaces exist and provide good practices to learn from;
- Multi-sectoral partnerships need to expand, particularly with the emergency services sector, to prevent and address risks across timescales before emergencies arise; with the urban planning, energy, cooling, built environment, and housing sectors; and with media and communication experts.
- Regional partnerships may be effective for knowledge transfer across borders where risk contexts may be similar;
- Clear governance and protocols are key in facilitating effective partnerships.
- Establish clearer mandates for both action and interdisciplinary/inter-sectoral engagement;
- Engage across the UN system to raise awareness of the importance of heat-health on global agendas and need for stronger partnerships: Specific opportunities include:
 - Events and processes to highlight findings of GHHIN and make links to the implementation of the Sendai Framework for Disaster Risk Reduction, WMO Multi-hazard Early Warning System Conference (Geneva 2019); High Level Forum for the SDGs; IPCC and UNFCCC Climate Action;
 - Engage with UN Habitat - Urban Adaptation Forum; International Labor Organization and others where heat is a concern
- Develop engagement model and specific criteria for partnerships, based on Red Cross and other partner experience;
- Engage clinical community, with new partners such as WONCA, including participating in their environment working group; developing capacity building materials, scoping out a work plan of engagement that involves both the core members and some of their key partner organizations;
- Build a global map that indicates appropriate heat-health tools and products sensitive to different climate-regions e.g. mid-latitude temperate versus wet tropics (heat index v. WBGT);
- Create opportunities for regional partnership discovery and collaboration (such as regional Network workshop/node/meeting/consultations);
- Consider development of regional partnership tool or other online platform resources to identify experts and partners.
- Identify 2-3 case studies that describe the ‘journey’ taken by a set of partners in establishing an effective multi-agency approach to managing heat. (See local lessons section, GHHIN Case Studies)

Next Steps for Action Plan

Theme 2: Data, science, and research for understanding health risks of heat

Session Chair

Sari Kovats, London School of Hygiene and Tropical Medicine, UK

Presentations

[Association between temperature and health outcomes of population in Thailand](#)

Benjawan Tawatsupa, Ministry of Public Health, Thailand

[Analysis of mortality during heat waves in 2013-2014 summer in Argentina](#)

Francesco Chesini, Ministry of Health and Social Development, Argentina

[Recent trends in temperature, vulnerability and heat-attributable mortality in Europe](#)

Joan Ballester, Barcelona Institute for Global Health (ISGlobal), Spain

[Identifying and attributing heat effects in rural Bangladesh](#)

Peter Kim Streatfield, International Centre for Diarrhoeal Disease Research, Bangladesh

[Impacts of occupational heat strain on health and productivity: systematic review](#)

Andreas Flouris, University of Thessaly, Greece

[Meta-analysis to evaluate the effectiveness of heat injury reduction measures](#)

Jason Lee, National University of Singapore, Singapore

[Should electric fans be used in a heatwave?](#)

Ollie Jay, The University of Sydney, Australia

[Personal heat protective measures during the 2017 heatwave in Hong Kong: a telephone survey study](#)

Holly Lam, Chinese University of Hong Kong, China

[Identifying and engaging with groups vulnerable to heat risks](#)

Ashley Ward, Carolinas Integrated Sciences and Assessments (CISA), USA

[Theme 2 Outcomes Presentation](#)

During her technical overview, Sari Kovats of the London School of Hygiene and Tropical Medicine reviewed the dangers of heat to human health and wellbeing, and presented an overview of global research on heat impact, including findings related to the relationship between heat and mortality, ambulance calls, urban vulnerability factors, occupational deaths, and chronic kidney disease of unknown origin. Calling attention to knowledge gaps, Kovats called for more attention on assessing the cost and impact of the heat burden, and more research on high risk groups in terms of who is most affected and who would benefit most from interventions.



Joan Ballester

Building on this overview, theme 2 participants considered the needs and priorities to improve risk and impact research, including impact assessment, vulnerability modeling and mapping, understanding extreme heat exposure mechanisms, impact forecasting, and the challenge of translating research into practice.

Key points included the importance of systematic evidence reviews for synthesis and identifying gaps in the evidence which are stifling better interventions, and the clear need for a mechanism to update available guidance.

Advances and Observations

- Multi-disciplinary work/research is essential to properly understand and contextualize the complex risks of heat;
- Public engagement is essential in enabling research and practice to be impactful by understanding public perception of risk;
- Evaluation methods must be improved to better understand risk and improve prediction capabilities;
- Systematic reviews and meta-analyses of heat mitigation interventions from personal levels to social policies at macro levels, and across timescales.
- Better protocols are required on risk and outcomes activities;
- Understanding the urban heat island and the role of the built environment on heat exposure is needed to understand the characteristics of heat risk in a rapidly urbanizing and warming world.
- More research is required to understand trends in heat risks;
- Occupational heat stress is a global health problem. 1 in 3 individuals working in hot conditions experiences high levels of hyperthermia or more serious symptoms of heat illness.

Operational Gaps

- Certification and registration of heatstroke related deaths remains an operational failure, with good practices evident but efforts must focus on trying to address under-reporting [US, Canada process];
- Individual and evidence-based guidance on personal protective measures is required;
- Guidance for workers that is context specific to job and region/country is needed;
- Consistent and evidence-based guidance for sport events is required;
- Iterative evaluation for new technologies (e.g. apps) and meaningful use of new technologies, such as personal, and indoor/outdoor sensors;
- Improved surveillance systems for occupational heat stress, which will provide a basis for public health policy, health-care planning, and resource allocation for occupational heat strain prevention;
- Public engagement in research and interventions remains an operational priority to build awareness;
- Guidance for non-domestic buildings which could inform policy – i.e. shopping mall should turn off the air conditioning at night.
- Assessments of existing legal and regulatory policies and effectiveness for keeping spaces heat health safe is needed, i.e. nursing homes must be capable of keeping residents cool if the electric grid fails; standards and regulatory measures that limit when utilities are able to cut off power during high risk periods, school heat standards, etc.



L-R: Hannah Nissan; Julie Arrighi; Sari Kovats

Evidence Gaps

- Evidence for air conditioning vs fans vs other cooling methods (e.g. evaporative coolers) in daily use vs extreme events usage conditions;
- Evidence is still lacking regarding chronic conditions and high risk groups, e.g. impacts on newborns, maternal health, kidney disease;
- More research is needed into the interaction of extreme heat with air quality, including fire risk and ozone;
- New technology needs to be evaluated in a more systematic way to determine applications and effectiveness;
- Evidence is needed on the economic costs of extreme heat events, including household costs, costs to local economy, health costs, etc. These should be rolled into existing reports on economic costs or extreme events.
- Impacts on heat sensitivity of indigenous populations remains a research priority, and impacts on migrants, especially migrant workers must be examined more thoroughly due to multiple factor causality;
- What is the role of urban heat islands in modifying risk, what interventions are possible, and how can decision makers prioritize actions?;
- How do indoor temperatures affect morbidity, especially in low quality housing;
- Outcome metrics are required for the health impacts of extreme heat so that they can be used in disaster risk reduction.

Next Steps for Action Plan

- Help identify training needs and resources for climate risk research;
- Epidemiological methods need to be developed, especially where there is limited health data;
- Develop climate indices for epidemiologists;
- Develop guidance for regional Network meetings (between now and next forum);
- Collate evidence reviews:
 - Updating WHO/WMO guidance on heat health warning systems and heat action plans;
 - Facilitate expert groups, e.g. physiological evidence, leading to clinical guidelines;
- Work to construct Global Heat Health Repository that includes:
 - Framework of interventions
 - Good practice examples (for practitioners);
 - Population surveys (as often not published, but in grey literature);
 - Research methods and tools, e.g. questionnaires, study protocols;
 - Evaluations
- Expand Network for greater participation of
 - IGOs, humanitarian NGOs;
 - urban/town planners;
 - private sector, especially related to cooling, technology, and data



L-R: Shubhayu Saha, Margaret Harris, Juli Trtanj, Hannah Nissan, Julie Arrighi, Sari Kovats

Theme 3: Climate and weather information for decision making and action

Session Chair

Weather and climate information to facilitate action
Hannah Nissan, International Institute of Climate and Society (IRI) USA

Presentations

[Weather and Climate Information for Heat Health Management Systems](#)

Glenn McGregor, Dept. of Geography, Durham University, UK

[Heat Forecasting, Advancing our Capabilities and Knowing our Limitations](#)

Melissa MacDonald, Environment and Climate Change Canada (ECCC), Canada

[Heatwave Early Warning System in Argentina](#)

Natalia Herrera, National Meteorological Service, Argentina

[Indian heat early warning system, scale-up and operational issues](#)

Subash Bhan, India Meteorological Department, India

[Providing heatwave early warning in a region with low predictability - a Caribbean approach](#)

Cedric Van Meerbeeck, Caribbean Institute for Meteorology & Hydrology (CIMH), Barbados

Panel: Weather & Climate Information to Facilitate Action

Serge Janicot, L'Institut de recherche pour le développement (IRD), France

Melissa MacDonald, Environment and Climate Change Canada (ECCC), Canada

Inoka Suraweera, Ministry of Health, Sri Lanka

Wassila Thiaw, National Oceanic and Atmospheric Administration (NOAA), USA

Panel: The Future of Heat Information Products

Lap-Shun Lee, Hong Kong Observatory, China

Sarah Klassen, START Network, UK

Atul Kumar Sahai, Indian Institute of Tropical Meteorology, India

Shubhayu Saha, Centers for Disease Control and Prevention (CDC), USA

[Theme 3 Outcomes Presentation](#)

Hannah Nissan presented on how weather and climate information can facilitate heat action, including an assessment of global and seasonal weather forecasts, and highlighted a data divide where certain regions lack data and quality forecasts for appropriate action. Decision-makers need guidance on forecast quality, but meteorological services do not routinely publish forecast evaluations. Guidance is also needed on how to present and interpret forecast confidence.

Climate services that support seasonal action plans are a critical first step in building heat resilience.



Wassila Thiaw

The needs and priorities to improve observations, forecasts, and information products required for operational heat risk monitoring and prediction were discussed. Building on operational decision needs, discussions focused on identifying opportunities and obstacles to improve the generation and uptake of data, surveillance and forecast products, including risk monitoring and forecasting for heat risk management and early warning.

Advances and Observations

- Cross-sectoral highlights:
 - Release of humanitarian funding for heat wave preparedness in Pakistan and other countries based on forecasts;
 - Bi-monthly climate & health bulletins are being co-developed in the Caribbean;
 - Local-level meteorology-health partnerships are being fostered by the federal government in the US from climate and health grant programs from the CDC and NOAA;
 - Sub-seasonal heat outlooks are being provided in India: feedback needed on uptake and accuracy;
- Tailoring of information for decision-makers:
 - Expressing heat risks in context of climatology: at weather (Canada, USA) and seasonal (Caribbean) timescales;
 - Health-climate portal developed on spatial scales relevant to health practitioners (USA);
 - Seasonal forecasts for frequency of heat extremes (Caribbean);
- Emerging consensus on best practices:
 - Actionable information must be simple, yet still scientifically correct and applicable in the health context. This cannot be achieved without sustained cross-sectoral engagement and co-development with intended users;
 - Thresholds: a simple temperature-based threshold is often the best predictor of mortality and the most predictable climate/ weather variable with least-demanding data requirements, as well as being more understandable to a range of users.

Operational Gaps

- Data and forecasts:
 - Insufficient meteorological stations to provide spatial density, continuity of records, proximity of stations to populations at risk;
 - Need integrated surveillance data (both heat and health impacts) to facilitate risk monitoring and forecasting;
 - Cost of meteorological data needed is prohibitive to practitioners;
 - Inclusion of Urban Heat Island effects to better forecast urban microclimate heat risks.
- Heat indices & thresholds:
 - Lack of guidance on appropriate heat indices and suitable health relevant thresholds as determined in public health studies;
 - How to balance health-relevance with data availability, predictability and lack of guidance?
 - Setting health-relevant warning thresholds remains an unmet need.
- Sectoral engagement:
 - There remain few examples of climate/ weather services co-developed with and for the health/emergency sectors;
 - There is no clear mandate for meteorological services to work with health/emergency sectors and vice-versa;
 - There is a lack of capacity among meteorologists/climatologists and public health practitioners to collaborate effectively;
 - Staffing and funding requirements for sustained, tailored climate services remain a priority;

Next Steps for Action Plan

- Provide a forum to share case studies and experiences;
- Develop and support demonstration projects and pilots, such as:
 - Develop seasonal bulletins for heat, building on model developed by CIMH Caribbean Climate-Health Bulletin;
 - Identify 2-3 pilot regions for integrating seasonal heat information into humanitarian and/or local-regional planning efforts, such as those led by the Red Cross Societies;
 - Promote the use of existing forecast and decision products to take action and share lessons learned: what works, what doesn't, how can we feed back to meteorological services for improved and tailored products? e.g. START-LSE project;
- Advocate for improved observational capacity and development of integrated datasets;
- Advocate for revision of the WMO Heat Health Warning System Guidance document, to reflect learning as well as best practices for developing effective warnings for diverse environments including urban, tropical, across timescales etc.
- Systematically incorporate heat outlooks into the Regional Climate Outlook Forums (traditionally focused on precipitation), with regular updates from Regional Climate Centres;
- Respond urgently to persistent challenges in co-developing useful weather & climate information with health and emergency/humanitarian sectors:
 - High level: improve enabling environment such as mandates and funding to work together across sectors on concrete projects and long-term planning and design
 - Operational level: capacity building of meteorologist and practitioners to engage effectively, and responding to iterative learning needs, such as sustainable platforms and dialogues for interaction.

L-R: John Nairn; Melissa McDonald; Gabriel Lau; Andreas Matzirakas



Theme 4: Managing heat risk: actions, interventions and effectiveness

Session Co-Chairs

Actions to manage heat risks - interventions and effectiveness

Shubhayu Saha, Centers for Disease Control and Prevention, USA

Presentations

Understanding Risk and Predicting Health Outcomes

Sari Kovats, London School of Hygiene and Tropical Medicine, UK

[NYC: Household interventions on A/C distribution](#)

Kaz Ito, New York City Department of Health, USA

[Arizona: Cooling shelters](#)

Dave Hondula, Arizona State University, USA

[Pakistan: heat intervention for healthcare providers](#)

Junaid Razzak, John Hopkins University School of Medicine, USA

[Japan: community trials](#)

Yasushi Honda, University of Tsukuba, Japan

[Europe: Occupational heat stress mitigation](#)

Lars Nybo, University of Copenhagen, Denmark

[Hong Kong: Sustainable Urban and Environmental Design](#)

Chao Ren, Faculty of Architecture, University of Hong Kong, China

[Vietnam: Forecast Based Financing](#)

Jerome Faucet, German Red Cross, Vietnam

[Canada Heat Alert and Response System \(HARS\)](#)

Tom Kosatsky, British Columbia Centre for Disease Control, Canada

[India: Ahmedabad heat action plan](#)

Dileep Mavalankar, Indian Institute of Public Health, Gandhinagar, India

[Theme 4 Outcomes Presentation](#)

This session highlighted that interventions to manage heat risks can be categorized in various ways: (i) implementing agency: health or non-health agencies (e.g. landscape planning, housing, transportation etc.); (ii) spatial scale: local to regional to national; (iii) observing impacts now (cooling shelters) compared to those over time (landscape modifications). There was substantial interest in in-depth examination of the cost-effectiveness of these interventions.



David Hondula

A wide range of cooling and health prevention interventions were shared to stimulate discussion. These included lessons from the use of domestic air conditioning in New York City, to cooling shelters in Arizona, the impact of home-care in Pakistan on reducing hospital admissions of high risk populations; community messaging for hydration and cooling in Japan; the effectiveness of different personal behaviors, garments, hydration and other cooling approaches for workers, long-term urban Climatic Planning Actions for major cities such as Hong Kong, and the implementation of early action based on heat wave forecasting in Vietnam.

Participants considered the needs and priorities required to upscale solutions to heat health risk management across timescales - from emergency management to municipal heat health action plans, to planning cities to reduce the Urban Heat Island effect.

Advances and Observations

- There are a range of available interventions, across varying spatial scales: individual > household > community > city > country;
- Practitioners who should be engaged in actions to reduce risk include occupational health and healthcare providers;
- There is exploding interest in multi-disciplinary, multi-agency collaborations around developing early heat health warning system;
- The development and implementation of heat action plans is improving in most regions, but this is not being tracked effectively at a global scale to facilitate learning;
- There is a need to mobilize economic instruments/incentives to induce behaviour change.

Information and Operational Gaps

- There is need to expand the range of health outcomes affected by heat from mortality to a range of morbidity outcomes (hospital admissions, emergency medical care);
- Estimation of mortality remains an unmet priority for creating effective interventions;
- There is a need to better understanding the dynamics of exposure (Who? Where? When?);
- The effectiveness of interventions in different contexts (specifically for costly interventions);
- When possible, implement heat warnings customized for specific vulnerable groups;
- Make health data available at suitable spatial and temporal resolution to be used in the retrospective heat health risk assessment or real-time heat health warnings.

Evidence Gaps

- Attribution of health interventions to specific health benefits;
- Challenges in estimating the costs of interventions;
- Varied health outcomes and attribution to heat events;
- Heat action plan effectiveness and viability in future climates;
- Process and outcome evaluation efforts on heat health interventions

Next Steps for Action Plan

- Create a knowledge repository of heat interventions;
 - Provide a typology / key word search e.g target group/ climate zone / timescale;
 - Good practice vs evidence of effectiveness (with potential notice of quality control);
 - Recommendation of good practices;
 - Where possible, include contact information of those implementing interventions for lessons learned;
- Develop communication material for policymakers summarizing the benefits of heat health interventions and harness the power of storytelling in conveying good practice;
- Identify measurable goals/objectives that align with international commitments (Sendai Framework) made by national governments;
- Update the Heat Health Action Plan Inventory.

Theme 5: Communications for Heat Action

Theme Overview

[Taking Action: Engagement, Outreach, and Communication](#)

Margaret Harris, Emergency Communications Advisor (WHO)

Presentations

How we can use broadcast meteorology to save lives?

Alex TS Tsoi, Broadcast Meteorologist and HKO Scientific Officer, China

[Engaging communities to reduce risk](#)

Candy Yeung, Deputy Secretary-General, Hong Kong Red Cross, China

[How the media can communicate to reduce risk?](#)

Jason Gale, Senior Editor, Bloomberg News, Australia

[Perspectives on communicating risk from a doctor](#)

Yu Fat Chow, World Association of Family Doctors, and Hong Kong Jockey Club, China

John Nairn, Bureau of Meteorology, Australia

The Great Heat Health Resilience Debate

Moderator

Roop Singh, Red Cross Red Crescent Climate Centre

Responding to acute heatwave events

Virginia Murray, Head of Disaster Risk Reduction at Public Health England, UK

Long-term preparedness and city actions

Chao Ren, Faculty of Architecture, University of Hong Kong, Hong Kong

Building long-term resilience

Ousmane Ndiaye, Senegal Meteorological Department (ANACIM)

MasterClass: Communicating for Future Resilience

KL Lee, Hong Kong Observatory

Sujoud Gallab, Ministry of Health, Saudi Arabia

Candy Yeung, Deputy Secretary-General, Hong Kong Red Cross, China

Virginia Murray, Head of Disaster Risk Reduction at Public Health England, UK

Simulation Exercise

Led by Lucas Scherdel, Margaret Harris

Margaret Harris spoke on engagement, outreach, and communication of heat health risks, stating that risk communication is an essential part of effective response, and dialogue needs to be from the bottom up starting at the community level and reaching the top. Gaps in knowledge include public perceptions of heat as a health risk and whether or not they take action.

Building on Margaret Harris's Day 1 presentation, day 3 of the forum was dedicated to heat risk communication, including keynote and expert presentations, a debate, masterclass, and simulation exercise.

A session-opening presentation from Harris explored the topic of Communicating Risk: Lessons from global outbreaks and emergencies. She defined risk communications as providing people with clear information and actionable strategies to protect themselves, their families and their communities from a defined threat, and emphasized that it should be a dialogue, a catalyst for behaviour change, and an educative process for authorities. There is a need for risk messages to be actionable and targeted to people at risk: "Risk communication is a process that needs to start before an emergency."

As a fundamental pillar of emergency responses, risk communication failures have played a significant role in amplification of outbreaks, including with Ebola in Sierra Leone in 2014, and the 2015 MERS outbreak in South Korea. WHO research on communicating risk in public health emergencies assesses evidence from the last decade, finding that effective risk communications needs to focus on 3 areas:

1. Building trust and engaging with affected populations;
2. Integrating emergency risk communications into health emergency responses;
3. Applying evidence to planning, monitoring, messaging and the use of communications channels.

A panel discussion on 'Communicating for Action' kicked off with works from Alex TS Tsoi, Broadcast Meteorologist and HKO Scientific Officer, who presented on 'How we can use broadcast meteorology to save lives.'

Candy Yeung, Deputy Secretary General of the Hong Kong Red Cross presented on 'Engaging communities to reduce risk,' through increasing awareness on disaster preparedness and resilience, and provided an overview of several project case studies and the Red Cross Disaster Preparedness App (RCDP) as examples.

Jason Gale, Senior Editor at Bloomberg, presented on 'How the media can communicate to reduce risk,' explaining how the audience can leverage public concern about a specific event to disseminate relevant, timely, useful information through working with the press by ensuring public service announcements are wrapped as news, and are timely, use credible, authoritative voices, outside experts with alternatives sources of opinion, have a clear message and use supporting data/evidence.

Finally, Yu Fat Chow of the World Association of Family Doctors and Hong Kong Jockey Club Disaster Preparedness and Response Institute presented on 'Perspectives on communicating risk from a family doctor,' highlighting risks of extreme heat to health, risk factors and recommendations for the public and for family doctors, perspectives on Heat Action Plans, and the link between climate change and the resurgence of infectious diseases. Next, the Hong Kong Jockey Club Disaster Preparedness and Response Institute was presented as a global partnership working on capacity building on disaster preparedness and response.

Panel discussion on 'Communicating for Action.'
L-R: Alex TS Tsoi; Candy Yeung; Yu Fat Chow; Jason Gale; John Nairn.
Photo: Robbie Parks, 2018



The Great Heat Health Resilience Debate

A debate was held on heat health resilience moderated by Roop Singh, Climate Risk Advisor, Red Cross Red Crescent Climate Centre, asked the question:

“Given limited resources and time, which timescale should we be focusing our efforts for building resilience to extreme heat in the next 5-10 years?”

Discussants and the audience made the following arguments:

1. Short term, heat-health early warning systems

Heat health early warning systems are quick to communicate immediate risks directly to the community. They also meet Sendai framework requirements and are a way to engage people at every level.

2. Seasonal preparedness

While less accurate than early warning systems, seasonal forecasts provides much-needed time for governments to mobilize resources, and prepare populations for the heat season and heat events. They provide valuable response time in places that don't have many resources or effective systems, and provides time to engage all the necessary stakeholders, without it being a rush. They also allow us to better understand the impacts of our interventions.

3. Long term, urban planning

Urbanization of 55% of the world today, and 70% by 2050 means that urban planning is important for shaping the lives of most of the planet. It enables a “visionary investment” to be made for long-term positive (or negative) impacts on health and the sustainability of cities. Greater access to green space and water bodies can reduce urban heat islands, while providing tangible health co-benefits and spaces people can see, feel, and interact with.



Roop Singh

Voting during the Great Heat Health Resilience Debate. Photo: Robbie Parks, 2018



Masterclass: Communicating for Future Resilience

A masterclass in heat health communications was held with key experts from:

- World Health Organization
- Hong Kong Observatory
- Thomson Reuters
- Global Center for Mass Gatherings Medicine, Ministry of Health of Saudi Arabia
- Public Health England

Participants discussed best practices, challenges, gaps and recommendations for GHHIN. Challenges included a lack of understanding of target audiences, lack of direct contact avenues and inability to follow up in the long run, while behavioural change is a long term process. Lack of trust between vulnerable communities and city governments may prevent successful communication between them.

Best practices included involving vulnerable groups in spreading messages amongst their own networks, and adapting our messages to the needs, preferences and capacities of the communities we are trying to reach. Focusing on one behavior at a time rather than overwhelming them with a long to-do list may help.

Providing practical assistance in neighbourhoods on a voluntary basis and encouraging cooperation between generations may be a useful approach, especially for the 'hidden elderly' population.

Lessons for disaster communicators tell us that people are unlikely to make changes unless they believe they themselves are at risk, so this needs to be communicated clearly. At the policy level, the government has a role to play in driving behavioural change as well, for example through voucher systems.

Recommendations for GHHIN included establishing a working group to determine what behaviour change actually is, and creating an online space for users to share experience and knowledge in driving it.

Simulation Exercise: Communicating to Save Lives in a Heat Emergency

A scenario based exercise produced by WHO was conducted to simulate an extreme heat event with many casualties in a fictional country. Participants were equipped with practical experience of effective communications strategies to save lives in a heat emergency.

Simulation Exercise



Outcomes and Messages

Key outcomes and messages from the communications sessions included the following:

Advances

- Personal warning systems using smart phones and mobile technologies are being used effectively in some areas;
- Human bio-monitoring wearables for occupational exposures are being developed in some contexts (for miners).

Information and Operational Gaps

- Alignment of public health messaging;
- Systematic review of communication interventions in heat health;
- Alignment of geographic and temporal forecasting capabilities with communications capacities for harm reduction;
- Standard communications operating protocol for prolonged ambient heat and heat emergencies;
- Multi-hazard messaging protocols for simultaneous events such as heat and wildfires, water stress, pollutant exposures etc.

Evidence Gaps

- How do we effect behaviour change relating to messaging and personal protective measures?
- What is the effectiveness of communication and public messaging as a risk reduction intervention?

Next Steps for GHHIN Action Plan

- Further development and refinement of the Simulation exercise, in collaboration with Health Canada and Public Health England, with the aim of creating training materials and guidance;
- Develop a conceptual framework for risk communications for heat over timescales, pull out and define from previous work such as Health Canada;
- Create an informal/virtual Community of Practice on heat risk communication;
- Prioritize a communication Toolkit including a communications material inventory;
- review of multi-hazard risk communication messaging, particularly for cascading and simultaneous risks at different timescales.





LOCAL LEARNING

Hong Kong faces unique challenges from environmental hazards, such as climate change and variability, due to its densely populated and almost entirely urbanized living environment. An increased vulnerability to the urban heat island effect means that its inhabitants are more susceptible to the harmful, and sometimes deadly, health effects of extreme heat.

Hong Kong's urban communities are particularly vulnerable to climate-related health impacts due to the high incidence of highly dense and often unauthorized living arrangements, such as sub-divided flats. The sub-divided flats may lack fresh air, appropriate cooling systems or access to essential services (such as energy and water). Hong Kong also has an incredibly high proportion of citizens over 65 years of age, with this population-based figure expected to rise to 27% by 2033.

The Forum leveraged the expertise and diverse experiences of partners in Hong Kong to help participants better understand and manage heat risk in a subtropical metropolis. This section outlines the Forum's key messages from presentations and discussions surrounding heat health in Hong Kong

"By bringing together local and global experts, the Forum galvanized local actions and raised awareness of the policy implications of the current scientific evidence in Hong Kong."

Emily YY Chan

Director, Collaborating Centre for Oxford University and CUHK for Disaster and Medical Humanitarian Response



Public Health Research in Action

Hong Kong has a rich network of public health research on climate-sensitive health impacts which include extreme heat. One of the research institutions is the Collaborating Centre for Oxford University and CUHK for Disaster and Medical Humanitarian Response (CCOUC) at the Chinese University of Hong Kong - a research centre that acts as an intermediary for research partners.

Recent research under the Hong Kong Weather Acquisition Study examined Hong Kong citizens' health and carbon-reduction behaviours to understand the practices of reducing electricity consumption, including curtailing the use of air conditioners, along with the impact of these measures on health perceptions and protective behaviours. This research found the best methods for communicating weather-related risk information among its population. Much of this cutting edge work is enabled by the availability of high quality and tailored climate and meteorological information through the Hong Kong Observatory (HKO) and innovative research partnerships. A considerable portion of this work has informed Hong Kong's Climate Action Plan 2030+.

The Hong Kong Observatory

HKO, established in 1883, is the meteorological authority responsible for monitoring and forecasting weather, issuing warnings on weather-related hazards and providing climate services in Hong Kong, amongst others. Given the uniquely vulnerable demography and the known link between weather conditions and public health in Hong Kong, HKO has been studying, in collaboration with others, the impact of weather on public health with a particular focus on thermal stress. Moreover, HKO has been evolving continuously to ensure the delivery of people-oriented quality services to meet the increasing need of special users and various sectors in the community and to enhance the society's capability in natural disaster prevention, such as those vulnerable to extreme heat.

Hong Kong Heat Index

To enhance the heat stress information services, HKO and the Chinese University of Hong Kong collaborated to develop the Hong Kong Heat Index for use in hot and humid climates. Based on the study of hospitalization data and heat stress measurement data, two reference criteria for the Index were identified to establish a two-tier approach for the enhancement of the heat stress information service.

Caring for Senior Citizens

Previous studies suggest that thermal stress under cold and hot weather conditions is strongly linked with higher mortality and hospitalization rate in Hong Kong, particularly among the elderly. With the goal to provide better care for the elderly people in Hong Kong, HKO has been working closely with the Senior Citizen Home Safety Association (SCHSA). The association is a self-financing and not-for-profit organization which provides a 24-hour personal emergency support and caring service through the use of weather and climate information, including the study of health impacts of weather and climate on senior citizens.

Some of these services include: real time weather information services, developing the new version of "Weather Information for Senior Citizens" webpage, annual joint press conferences to promote proactive and timely assistance for the elderly when very hot or cold weather is expected, and the "Sky of Silver Age" weather photo competition and cloud appreciation workshops to encourage elderly people to adopt an outdoor lifestyle by maintaining an active interest in weather that affects them. The decade-long collaboration between HKO and SCHSA in using climate information for elderly caring services has also been documented in the WMO-WHO Joint Office for Climate and Health publication [Climate Services for Health](#).

Urban Planning and Building Environment Design

The design and development in a high-density city like Hong Kong may have significant impacts on the urban climate (e.g. urban heat island effect, lower wind speed etc.) resulting in uncomfortable living conditions and an increase in cooling energy consumption.

To help mitigate these negative effects and improve the quality of living environment, climatic considerations have been integrated in to urban planning and design. HKO provides meteorological data and expert advice to local planning department and its consultants, as well as other professional bodies, to establish guidelines to assess and regulate the impact of potential city/community, and building developments on urban ventilation and micro-climate.

Furthermore, Hong Kong's urban climatic map has been created through analyzing and evaluating climate data together with different geometric and urban development data to classify Hong Kong into different urban climatic zones, each with recommended design actions and development strategies. This has informed decision making at the community level, including for new town planning and old town renewal in the Hong Kong 2030+ long-term planning strategies.

Public Engagement

Hong Kong's civil society and non-governmental organizations represent a world-leading example of public engagement. The Hong Kong Red Cross engages the public and volunteers to provide a set of auxiliary services to the government during emergencies. This includes local community care services, humanitarian education, first aid, and health training.

Increased public awareness of heat risk is achieved through a dedicated disaster preparedness mobile app, and vulnerable communities are provided with targeted information on preparedness and risk reduction via educational initiatives. Volunteer

community responders are deployed by the Hong Kong Red Cross to visit vulnerable elderly populations and provide heat wave related information.

The HKO also utilizes different channels, including media (TV, radio and newspaper), Dial-a-Weather service, webpages, mobile platforms and social media, to engage the public and disseminate various weather information, forecasts and warnings of HKO to different sectors.

The online information service and location specific weather services offered by HKO's "MyObservatory" mobile app and website allow urban dwellers to access various first-hand weather information anywhere and anytime. HKO also launched its Facebook page and Instagram platform to enhance communication with the public in March 2018, with encouraging responses. Facebook posts on various weather phenomena and services, including heat stress information services and other heat health information, were released regularly to enhance public understanding of the weather and related risk.

Local Action, Global Network

The Forum provided a platform for a broad exchange of research and good practices from Hong Kong's diverse range of actors in heat health, and provided a forum for increased political commitment to reduce the drivers of heat risk both locally, and globally. The forum allowed for the unique expertise and experience in Hong Kong to be shared globally, and for new partnerships to be formed with Hong Kong-based experts to further galvanize action to reduce the risks of extreme heat.

Hong Kong Heat Project Site Visits

Hong Kong has experienced increasing extreme temperatures for many decades. As a highly urbanized city with high population density, Hong Kong experiences heightened heat risk from many factors, including sub-divided housing units, an intense Urban Heat Island effect, an ageing society, and a large number of elderly residents living in care facilities. Hong Kong is a world leader in managing these issues—actively advancing interdisciplinary research, city management, planning and design, as well as public engagement and NGO efforts.

On the final day of the Forum, participants took a rare look into the heat health management challenges and solutions of Hong Kong.

1. Senior Citizen Home Safety Association

In September 1996, the Senior Citizen Home Safety Association (SCHSA) was founded as a self-financing, not-for-profit organization providing 24-hour personal emergency support and caring service to elderly citizens in Hong Kong. SCHSA enhances quality of life for older populations through the use of technology, people-oriented services, and innovative methods, including special weather forecasts and information for the elderly.

2. Hong Kong Housing Authority Exhibition Centre

The Hong Kong Housing Authority Exhibition Centre is a showcase of public housing development in Hong Kong, as well as their work and achievements over the years. This visit began with a short talk from the Chief Architect of the Hong Kong Housing Authority, who introduced their successful practical experience on microclimate design since 2004.

In the compact 1,000-square-metre venue, there are informative display panels, building models, mock-up flats and myriad collections of photos and videos of Hong Kong's public housing.

Nearly half of Hong Kong's residents live in some form of public housing. As prices of these accommodations have risen, many residents have begun to seek accommodation in sub-divided flats or bedspace apartments. These small, makeshift spaces are often not properly ventilated or cooled, contributing to the heat health crisis in the city.

Photo: Temperature reading in urban housing units



3. Hong Kong Observatory

The Hong Kong Observatory is the government department responsible for monitoring and forecasting weather, as well as issuing warnings on weather-related hazards. The Observatory also monitors and assesses radiation levels in Hong Kong, and provides other meteorological and geophysical services to meet the needs of the public and the shipping, aviation, industrial and engineering sectors.

Amidst the hustle and bustle of Tsim Sha Tsui, the Observatory Headquarters enjoys a serenity uncharacteristic of this hectic business area. It is surrounded by rich fauna and flora, some of which is uncommon in Hong Kong. The guided tour took visitors backward in time to trace the development of the Observatory in the past 130 years to see how weather forecasts are made and how technology is put to use.

4. Energy poverty Lab - Simulated Subdivided Flat tour

This field trip involved a trip to a simulation of Hong Kong's subdivided flats at the 'Energy Poverty Lab', built by the World Green Organisation (WGO), a non-profit concerned with the environmental conservation and its relation to livelihood and economic affairs. Through interactive household activities, this field trip to Hunghom provided a glance into how families may live in apartments less than 70 square feet.

Photos (clockwise from top):

1. Subdivided flat / Hunter Jones
2. Hong Kong Observatory / Joy Shumake
3. Hong Kong Observatory / Rosa Barciela



Ongoing work in Hong Kong: Presentations

Heat-related Health Impacts in Sub-tropical Cities: Global Overview and Research Frontiers in Hong Kong

Emily YY Chan, Director of the Centre for Global Health, Chinese University of Hong Kong;
Chi-Ming Shun, Director, Hong Kong Observatory

Regional Perspectives of Heat Risks in North and East Asia

Gabriel Lau, Chinese University of Hong Kong

Regional Perspectives of Heat Action and Innovation in North and East Asia

Gloria KW Chan, Deputy Director, CCOUC, Chinese University of Hong Kong

The Future of Heat Information Products

Lap-Shun Lee, Senior Scientific Officer, Hong Kong Observatory

Personal Heat Protective measures during the 2017 heat wave in Hong Kong: a telephone survey study

Holly CY Lam, Postdoctoral Fellow, Chinese University of Hong Kong

Institutional capacity building through partnerships

Donald Li, President Elect of World Association of Family Doctors and Chairman of Hong Kong Jockey Club Disaster Preparedness and Response Institute

Urban Heat Island Mitigation, Heat Risk Mapping

Chao Ren, University of Hong Kong Faculty of Architecture

Communicating Weather Hazards in the Digital Era

Alex Tsoi, Scientific Officer, Hong Kong Observatory

Communicating through vulnerable communities

Candy Yeung, Hong Kong Red Cross

Perspectives on communicating risk from a family doctor

Yu Fat Chow, World Association of Family Doctors and Hong Kong Academy of Medicine

Ongoing work in Hong Kong: Posters

A vertical approach to monitoring microclimates of urban street canyons

Paulina PY Wong, Lingnan University

Urban Heat Islands in Hong Kong: Statistical Modeling and Trend Detection

Weiwen Wang, Wen Zhou, Edward Yang Yung Ng, Yong Xu;
Jinan University, Chinese University of Hong Kong, City University of Hong Kong

Heat Stress in Future Hong Kong

KY Cheung, PW Chan, W Zhou
City University of Hong Kong, Hong Kong Observatory

Effects of high temperature on existing allergic symptoms among adults: an exploratory cross-sectional telephone study

Emily YY Chan, Holly CY Lam, Asta YT Man;
CCOUC, Chinese University of Hong Kong

Personal Heat Protective Measures During the 2017 Heatwave in Hong Kong: A Telephone Survey Study

Emily YY Chan, Holly CY Lam, Asta YT Man;
CCOUC, Chinese University of Hong Kong

The development of Hong Kong Heat-Health Warning System

Chao Ren, TC Lee; University of Hong Kong, Hong Kong Observatory

Energy Poverty, Heat Stress, Bacterial Concentration and IAQ

William Yu; World Green Organisation

Summary of key partners and projects addressing heat health in Hong Kong

Partner	Role	Links
Hong Kong Observatory (HKO)	Weather and climate monitoring; weather forecasts for different timescales; weather warnings and alerts; research; public education	www.hko.gov.hk www.hko.gov.hk/wservice/warning/coldhot.htm www.hko.gov.hk/wxinfo/ts/display_element_hkhi_e.htm
Department of Health	Public health advice	www.chp.gov.hk/en/static/90064.html
Labour Department	Public health Advice; guidelines on risk assessment for heat stroke prevention at work	www.labour.gov.hk/eng/public/oh/heat.pdf www.labour.gov.hk/eng/public/oh/HeatStress.pdf
Home Affairs Department	Heat shelters	www.had.gov.hk/en/public_services/emergency_services/emergency.htm
Education Bureau	Guidelines on physical education	www.edb.gov.hk/attachment/en/curriculum-development/kla/pe/references_resource/safety-guidelines/Safe_e.pdf
Senior Citizen Home Safety Association (SCHSA)	24-hour personal emergency support and caring service for elderly citizens.	www.schsa.org.hk/en/home/index.html
Occupational Safety and Health Council	Promoting occupational safety and health in the community; education and training; research and strategy development	www.oshc.org.hk/eng/main/hot/Heat
Collaborating Centre for Oxford University and CUHK for Disaster and Medical Humanitarian Response (CCOUC)	Research; providing scientific evidence for tackling heat health impact Developed a set of animations describing the main research outcomes were produced and targeted for primary and secondary school children in Hong Kong	ccouc.org/publications ccouc.org/video
Hospital Authority	Public hospitals services; Research; Community engagement	



Heat health collaborations and research in Hong Kong

Research subject and research body/bodies	Purpose and links
Series of Heat-health association studies on mortality and morbidity [CCOUC, JCSPHPC (CUHK)]	Establishing heat-health associations, identifying vulnerable groups and evaluating urban heat island effects on health. A list of publications of research findings can be found in the "Climate change and health research" section at ccouc.org/publications
Help seeking behaviors among the older population in Hong Kong during hot days [CCOUC, JCSPHPC (CUHK) and SCHSA]	Understanding the patterns, including proportions and thresholds, of the help seeking behaviors of the older populations in Hong Kong during hot seasons. Help seeking behavior was measured by counting the number of emergency calls to the Hong Kong Senior Citizen Home Safety Association. Published paper: www.ncbi.nlm.nih.gov/pubmed/21761264
Collaboration in developing the Hong Kong Heat Index [HKO and JCSPHPC (CUHK)]	Enhance heat stress information services in Hong Kong. Published paper: www.ncbi.nlm.nih.gov/pubmed/26546311
Telephone survey study assessing risk perception and the uptake of heat protective measures in Hong Kong population. [CCOUC, JCSPHPC (CUHK), London School of Hygiene and Tropical Medicine]	Understanding the patterns of the uptake of heat-protective measures and associated factors in Hong Kong. A comparison study with a UK collaborator is also being conducted to compare the perception and heat-related behavior patterns between Hong Kong and the United Kingdom. Manuscripts under preparation.
Joint study on the effect of weather on the health of elderly and their help-seeking behaviour [HKO and SCHSA]	Use Hong Kong Observatory climate data and the number of users activating SCHSA's personal emergency and caring service and requiring subsequent hospitalization to study the impact of weather on the elderly. Paper published: Mok, H.Y. and B. Leung, 2009 : The impact of cold and hot weather on senior citizens in Hong Kong, Hong Kong Meteorological Society Bulletin, 19, August 2011.
Study on the impact of extreme heat events [HKO and Institute of Future Cities (CUHK)]	Study the spatial variations of prolonged high temperature events and their impacts on public health.



CONCLUSIONS AND NEXT STEPS

Final sessions of the forum considered how the Network will address the broad range of identified challenges and opportunities. Future directions for the Global Heat Health Information Network were presented by Joy Shumake-Guillemot and Juli Trtanj, followed by summaries of the Network's technical areas, and results of a member survey (annex 4) which both helped to identify key interests and needs, and validate future functions and priorities of the network.

Finally, participants were invited to share additional ideas and suggested actions, whereby many members stepped forward with commitments to actions that will contribute to achieving the ambitions of the Network. The forum closed with thanks and acknowledgements to all participants and organizers, and an open invitation for all members to remain engaged and active in heat preparedness and prevention.

Closing Presentations

- [Closing Statement and Presentation](#)
- [Member survey final synthesis](#)
- [Theme 1 Outcomes: Capacity and Partnerships](#)
- [Theme 2 Outcomes: Understanding Risk and Predicting Health Outcomes](#)
- [Theme 3 Outcomes: Weather and Climate Information to Facilitate Action](#)
- [Theme 4 Outcomes: Actions to Reduce Health Risks from Extreme Heat](#)

Commitments

- Develop meeting and synthesis report;
- Increase heat risk awareness by disseminating outcomes in various publications, media engagements, conferences and side-events in 2019;
- Publish consensus statement and share recommendations with WMO, WHO, and other relevant international partner organizations (launch at UNDRR Global Platform);
- Follow up with partner organizations identified at the Forum on specific collaborative activities;
- Develop an Action Plan;
- Develop the WHO/WMO Online Climate and Health Science Portal's Heat Focused Community to support the Network Community;
- Advance the formalization of the institutional structure of the Network;
- Hold webinar to update Network on progress and announce the location for the second forum;
- Work toward 2nd Global Forum in 2020, and possible regional or technical events;
- Better inventory action plans and heat risk management interventions.

Commitments to advance the Network agenda in 2019-2020

Commitments and ideas	Progress as of 1 September 2019
Organize a heat meeting during the United Nations High Level Political Forum on Sustainability (HLPF, July 2019, New York)	Red Cross Heatwave Guide for Cities launched at HLP meeting week
WHO Disaster Platform to support integration of heat into disaster community	Presentations of GHHIN made, call to action launched
Activities to highlight the gap of extreme heat in disaster preparedness and multi-hazard early warning systems at the Global Platform for Disaster Risk Reduction in Geneva in May 2019. <i>E.g. A side-event on Heat at MHEWs Conference, launch of Network Call to Action, presentations on GHHIN</i>	Presentations of GHHIN made, call to action launched
Inventory of Interventions – virtual contact group	White paper and plans for heat action platform developed
Advance the applications of the Global Hazard Maps or similar tools for heat event monitoring and prediction.	Needs follow up
Training Center – DWD to communicate with WMO on becoming a global training center for heat	
Training for public health - CUHK	
WMO to request its Members for secondments to support GHHIN and heat	Junior Professional Officers sought – Jan 2019

Commitments and ideas

- WMO to pursue joint action plan with WHO to strengthen integrated health services;
- Implementation of the WMO Urban Services Guide, notably in Hong Kong as a Case Study of heat and health;
- Expert Health Input to WMO State of the Climate – January 2019;
- Committed 2nd Global Forum 2020 University Copenhagen, sponsored by EC and WHO Regional Office for Europe;
- Activities to engage WHO in heat related risk management, including:
 - WHO/WMO to publish a new factsheet on heat;
 - WHO-EURO Review of Heat Health Action Plans and New Guidance (2019-2020);
 - WHO/WMO Technical Report on Heat in Occupational Setting– EC - 2019;
 - WHO Heat SimEx training guide – led by WHO;
 - WHO to strengthen monitoring of heat action plans in the WHO Climate and Health Country Survey;
- Red Cross to pursue a good practices toolkit in communications;
- Pilot communities: Urban heat island mapping (NOAA);
- Explore training opportunities with WONCA.

Other relevant actions taken since the Forum by Network members or on behalf of the Network:

- Submission of proposals: Lorentz proposal, Accelnet proposal , Belmont proposals
- Red Cross Global Conference: Heat Session
- PAHO Heat Guide: Member State Collaboration
- PAHO / GHHIN Workshop Chile (August 2019)
- Future Earth Heatwave Brief

ANNEX 1. POSTERS

Posters are available for viewing on the virtual poster session at www.ghhin.org/ghhin-forum-info/virtual-posters-platform

Reducing Residential Air-Conditioning (AC) Use in the Tropics: Systems Dynamics Scenarios of Climate Sensitive Buildings in Malaysia

David Tan / United Nations University

Reducing the adverse public health effects of heat waves on Hanoi's most vulnerable populations

Jerome Faucet & Tran Dinh Trong / German Red Cross & IMHEN

Is heat stress really a human health problem in hot countries? Heat acclimatization and vulnerabilities of people living in the Sahel. The case of Senegal

Richard Lalou / MERIT / IRD-Université Paris-Descartes

Heat Wave Warnings: Thresholds, Customization, Dissemination and Cooperation in India

Subhash Chander Bhan / India Meteorological Department, New Delhi

Heatwaves in the Sahel: Comparison of thermal indices and physical processes

Kiswendsida Hyacinthe GUIGMA / University of Sussex

Development of impact-based forecasting system for heat waves in South Korea, integrated with Limited-area ENsemble prediction System (LENS)

Miloslav Belorid / NIMS/KMA

Building scale Heat-stress and health impact assessment by land cover based on BioCAS-PT

Ji-Sun LEE / NIMS/KMA

The Korean Heat-Health Warning System (HHWS) on a national and an urban scale

Changbum CHO / NIMS/KMA

The Impact of Global Warming on Permafrost-locked Pathogens

V. Anne Burg / Rollins College

Occupational Exposure to Heat Stress and Hot Environments

Brenda Jacklitsch / Centers for Disease Control & Prevention (CDC)
National Institute for Occupational Safety & Health (NIOSH)

A vertical approach to monitoring microclimates of urban street canyons

Paulina PY Wong, Lingnan University

Urban Heat Islands in Hong Kong: Statistical Modeling and Trend Detection

Weiwen Wang, Wen Zhou, Edward Yang Yung Ng, Yong Xu;
Jinan University, Chinese University of Hong Kong, City University of Hong Kong

Heat Stress in Future Hong Kong

KY Cheung, PW Chan, W Zhou
City University of Hong Kong, Hong Kong Observatory

Effects of high temperature on existing allergic symptoms among adults: an exploratory cross-sectional telephone study

Emily YY Chan, Holly CY Lam, Asta YT Man;
CCOUC, Chinese University of Hong Kong

Personal Heat Protective Measures During the 2017 Heatwave in Hong Kong: A Telephone Survey Study

Emily YY Chan, Holly CY Lam, Asta YT Man;
CCOUC, Chinese University of Hong Kong

The development of Hong Kong Heat-Health Warning System

Chao Ren, TC Lee; University of Hong Kong, Hong Kong Observatory

Energy Poverty, Heat Stress, Bacterial Concentration and IAQ

William Yu; World Green Organisation

ANNEX 2. MEMBER SURVEY

During the Forum, Network members were surveyed in order to provide intelligence on the demographic and disciplinary origin of the Network's membership, and opinions on strategic priorities of the network.

94% of those surveyed (N=48) agreed that the Network's strategic priorities are the right ones in order to improve the capacity of governments, organizations, and professionals to protect populations from the avoidable health risks of extreme ambient heat.

Feedback on Network Strategic Priorities

- 93% strongly believe the Network should be creating opportunities for networking and information exchange across heat and health decision makers, scientists and practitioners by providing regional or global meetings and workshops and other opportunities;
- 86% believe that the Network should focus on raising awareness of governments and donors of problems and solutions;
- 83% believe that the Network should focus on translating and synthesizing evidence into actionable guidance;
- 75% believe that the Network should be building training and research capacity in the field;
- 71% of respondents believe the Network should provide a platform for developing authoritative technical guidance;
- 60% believe the Network should be supporting the creation of user-driven norms and standards.

Actions to make member's work more effective

Members stated that the following would be the most useful in making their work more effective:

1. an expanded interdisciplinary network;
2. greater access to project funding; and,
3. greater opportunities for collaboration.

Engagement Motivation

60% of members listed their top motivation for engaging with GHHIN as finding an opportunity to connect with others in the field.

Network Services

Members stated that the top 3 services which they would find important are:

1. A synthesis report;
2. A global exchange programme;
3. Evidence reviews and inventories of best practice.

ANNEX 3. PARTICIPATION

The Forum hosted 150 experts from 33 countries.

1. ABUTALUB Mwafaq, Saudi Ministry of Health (Saudi Arabia)
2. AL GHAMDI Khalid, Saudi Ministry of Health (Saudi Arabia)
3. ARRIGHI Julie, American Red Cross & Red Cross Red Crescent Climate Centre (USA)
4. BALLESTER Joan, Barcelona Institute for Global Health (IS Global) (Spain)
5. BAN Jie, Chinese Center for Disease Control and Prevention (China)
6. BARCIELA Rosa, UK Met Office (UK)
7. BELORID Miloslav, Korean Meteorological Agency (Republic of Korea)
8. BHAN Subhash, India Meteorological Department, New Delhi (India)
9. BURG Victoria, Rollins College (USA)
10. CHAN Emily Ying Yang, the Chinese University of Hong Kong (Hong Kong, China)
11. CHAN Gloria Kwong Wai, the Chinese University of Hong Kong (Hong Kong, China)
12. CHAN Mike, University of Hong Kong (Hong Kong, China)
13. CHARLES-AYINDE Makyba, American Association for the Advancement of Science (USA)
14. CHESINI Francisco, Ministry of Health and social development (Argentina)
15. CHO Changbum, NIMS/KMA (Republic of Korea)
16. CHOY C.W., Hong Kong Observatory (Hong Kong, China)
17. DE COCK Marc, European Commission (Belgium)
18. DIENE Papa Daouda Amad, Institut de Recherche pour le Développement (Senegal)
19. FAUCET Jerome, German Red Cross (Vietnam)
20. FLOURIS Andreas, University of Thessaly (Greece)
21. GHALLAB Sujoud, Saudi Ministry of Health (Saudi Arabia)
22. HARRIS Margaret, Independent (Hong Kong, China)
23. HERRERA Natalia, Servicio Meteorológico Nacional (Argentina)
24. HO Janice Ying-en, The Chinese University of Hong Kong (Hong Kong, China)
25. HO Kin Fai, The Chinese University of Hong Kong (Hong Kong, China)
26. HONDA Yasushi, University of Tsukuba (Japan)
27. HONDULA David, Arizona State University (USA)
28. HUANG Jiang, University of Hong Kong (Hong Kong, China)
29. ITO Kazuhiko, New York City Department of Health (USA)
30. JANICOT Serge, IRD (France)
31. JANOWCZYK Beata, Government Centre for Security (Poland)
32. JAY Ollie, The University of Sydney (Australia)
33. JONES Hunter, NOAA Climate Program Office (UCAR Affiliate) (USA)
34. KIM Ejn, Seoul National University (Republic of Korea)
35. KLASSEN Sarah, The Start Network (United Kingdom)
36. KOLLI Rupa Kumar, World Meteorological Organization (Switzerland)
37. KOSATSKY Tom, British Columbia Centre for Disease Control (Canada)
38. KOVATS Sari, LSHTM (UK)
39. KUBIAK Marek, Government Centre for Security (Poland)
40. KYSELY Jan, Institute of Atmospheric Physics CAS (Czech Republic)
41. LALOU Richard, IRD (French National Research Institute for Sustainable Development) (France)
42. LAM Holly, The Chinese University of Hong Kong (Hong Kong, China)
43. LAU Gabriel, The Chinese University of Hong Kong (Hong Kong, China)
44. LAU Kevin, The Chinese University of Hong Kong (Hong Kong, China)
45. LEE Jae-Young, Seoul National University (Republic of Korea)
46. LEE Jason, National University of Singapore (Singapore)
47. LEE Ji-Sun, KMA (Republic of Korea)
48. LEE L.S., Hong Kong Observatory (Hong Kong, China)
49. LEE T.C., Hong Kong Observatory (Hong Kong, China)
50. LEISA Nikola, Government Centre for Security (Poland)
51. LEUNG Czarina, The Chinese University of Hong Kong (Hong Kong, China)
52. LI Donald, World Organization of Family Doctors (WONCA) (Hong Kong, China)
53. LI Walton, Greenpeace East Asia (Hong Kong, China)
54. LI Wing Sum, Public Health Trainee (Hong Kong, China)
55. LI Xinwei, The University of Hong Kong (Hong Kong, China)
56. LICERIO Maraida, GIZ/UP (Philippines)
57. LIU Zhen, Chinese University of Hong Kong (Hong Kong, China)
58. MACDONALD Melissa, Environment and Climate Change Canada (Canada)
59. MAN, Asta The Chinese University of Hong Kong (Hong Kong, China)
60. MASON, Kerry Forensic Science SA (Australia)
61. MATTHEWS-TRIGG Nathaniel, City of Auburn Emergency Management & Washington Service Corps (USA)
62. MATZARAKIS Andreas, Research Center Human Biometeorology, German Meteorological Service (Germany)
63. MAVALANKAR Dileep, Indian Institute of Public Health, Gandhinagar (India)
64. MCGREGOR Glenn, Durham University (UK)
65. MING Luo, The Chinese University of Hong Kong (Hong Kong, China)
66. MOSTAFA Amira, Egyptian Meteorological Authority (EMA) (Egypt)
67. MÜCKE Hans-Guido, German Environment Agency (Germany)
68. MURRAY Virginia, Public Health England (UK)
69. NAIRN John, Bureau of Meteorology Australia (Australia)
70. NDIAYE Ousmane, ANACIM (Senegal)
71. NG Edward, The Chinese University of Hong Kong (Hong Kong, China)
72. NISSAN Hannah, International Research Institute for Climate & Society (IRI), Columbia University (USA)
73. NYBO Lars, University of Copenhagen (Denmark)
74. OPPELMANN Elspeth, Technical University of Munich (Germany)
75. PARKS Robbie, Imperial College (UK)
76. POTAPOHN Manoj, Chiang Mai University (Thailand)
77. RAZZAK Junaid, Johns Hopkins University School of Medicine (USA)
78. REN Chao, The Hong Kong University (Hong Kong, China)
79. SAHA Shubhayu, US Centers for Disease Control and Prevention (USA)
80. SAHAI Atul Kumar, Indian Institute of Tropical Meteorology (India)
81. SCHERDEL Lucas, WHO (UK)

82. SHRIVASTAVA Abhay, Haryana Institute of Public Administration, Gurugram (India)
83. SHUMAKE-GUILLEMOT Joy, WHO/WMO (Switzerland)
84. SHUN C. M., Hong Kong Observatory (Hong Kong, China)
85. SINGH Roop, Red Cross Red Crescent Climate Centre (UK)
86. SRATONGNO Karnrawee Chiang Mai University (Thailand)
87. STREATFIELD Peter, ICDDR, B, Bangladesh (Bangladesh)
88. SURaweera Inoka, Ministry of Health (Sri Lanka)
89. SUZUKI-PARKER Asuka, Risho University (Japan)
90. SZMAJDZINSKI Andrzej, Government Centre for Security (Poland)
91. TAM Francis, The Chinese University of Hong Kong (Hong Kong, China)
92. TAN Tat Ui David, United Nations University International Institute for Global Health (Malaysia)
93. TAWATSUPA Benjawan, Ministry of Public Health (Thailand)
94. THIAW Wassila M., National Oceanic and Atmospheric Administration (USA)
95. TIAN Linwei, The University of Hong Kong (Hong Kong, China)
96. TONOUCHI Michihiko, Japan Meteorological Business Support Center (Japan)
97. TRAN Trong, Vietnam Institute of Meteorology, Hydrology and Climate Change (Vietnam)
98. TRTANJ Juli, NOAA (USA)
99. UNGARVI MARTIN Judit, American Association for the Advancement of Science (USA)
100. VAN MEERBEECK Cedric, Caribbean Institute for Meteorology and Hydrology (Barbados)
101. VEDRASCO Liviu, World Health Organization (Thailand)
102. WAHABI Rachid, Ministry of Health (Morocco)
103. WANG Dan, The Chinese University of Hong Kong (Hong Kong, China)
104. WARD Ashley, CISA (Carolinas Integrated Sciences and Assessments) (USA)
105. WARD Nicola, Red Cross Climate Centre (UK)
106. WEBSTER Chris, The University of Hong Kong (Hong Kong, China)
107. WILSON Leigh, University of Sydney (Australia)
108. WIN Ei Mon, International Labour Organization (Thailand)
109. WONG Paulina PY, Lingnan University (Hong Kong, China)
110. YASSIN Yara, Global Center for Mass Gatherings Medicine/Ministry of Health (Saudi Arabia)
111. YIM Steve, The Chinese University of Hong Kong (Hong Kong, China)
112. YU William, World Green Organization (Hong Kong, China)
113. ZHANG Xuyi, The Chinese University of Hong Kong (Hong Kong, China)
114. ZHOU Wen, The Chinese University of Hong Kong (Hong Kong, China)

REMOTE PARTICIPANTS

115. AGUILAR ALCALA Pablo, Pan American Health Organization (USA)
116. BATH Sean, NOAA/UCAR (USA)
117. BRAY Marianne, Thomson Reuters Foundation (Hong Kong, China)
118. BRETTLE Meagan, Health Canada (Canada)
119. CHAN Doris, Faculty of Architecture (Hong Kong, China)
120. CHIANG Soting, freelance health news reporter (Hong Kong, China)
121. DE GUSMAO-SOERENSEN Diogo, European Commission (Belgium)
122. DELUCA SILBERBERG Anna, ISGlobal (Spain)
123. EBI Kristie, University of Washington (USA)
124. GALAPPATHTHI Himan, Ministry of Health Sri Lanka (Sri Lanka)
125. INGOLE Vijendra, ISGlobal (Spain)
126. IOANNOU Leonidas, FAME Laboratory, University of Thessaly (Greece)
127. JACKLITSCH Brenda, CDC/NIOSH (USA)
128. JOHNSON Veronica, WJLA TV (USA)
129. KJELLSTROM Tord, Health and Environment International Trust (New Zealand)
130. LI Rebecca, Urban Renewal Authority (Hong Kong, China)
131. LIU Sabei, HKU (Hong Kong, China)
132. LYNN Deborah, Glendale Baptist Church (USA)
133. MALIK Maria, Health Canada (Canada)
134. MENDIS Kusal, Sampath Bank PLC (Sri Lanka)
135. MENDIS Thisali, IUCN (Switzerland)
136. MEUNIER Michael, Health Canada (Canada)
137. NAROCKI Claudia, ISTAS-CCOO (Spain)
138. NELSON Maureen, CPAESS (USA)
139. NICKELO Vanessa, Nova Scotia Health Authority - Health Protection (Canada)
140. OYENUGA Christianah, Harris County Public Health (USA)
141. RAHMAN Mofizur, ICDDR,B (Bangladesh)
142. ROCA BARCELO Aina, Imperial College London (UK)
143. RUUHELA Reija, Finnish Meteorological Institute (Finland)
144. SAUNIK Sujata, Indian Administrative Service (India)
145. SCANNELL Claire, Met Office (UK)
146. SRATONGNO Karnrawee, Chiang Mai University (Thailand)
147. THOMPSON Erica, LSE (UK)
148. VANOS Jennifer, Arizona State University (USA)
149. VILLA Citlali (Mexico)
150. VILLALOBOS PRATS Elena, WHO (Switzerland)
151. ZHANG Xuyi, HKU (Hong Kong)

ANNEX 4. AGENDA



FIRST GLOBAL FORUM ON HEAT AND HEALTH

GLOBAL HEAT HEALTH INFORMATION NETWORK
HONG KONG, DECEMBER 17-20, 2018

AGENDA

Day 1: Monday Morning 17 December 2018	Understanding the Context of the Heat Health Issue	
08:00 – 08:30	Registration, Breakfast & Coffee	
08:30 – 09:00	Opening and Welcome Statements	Plenary
	<ul style="list-style-type: none"> - Joy Shumake-Guillemot, WHO/WMO Climate and Health Joint Office - Chris Webster, Faculty of Architecture, University of Hong Kong - Linwei Tian, School of Public Health, University of Hong Kong - Chi-Ming Shun, Director of Hong Kong Observatory - Elena Manaenkova, Deputy Secretary-General, World Meteorological Organization 	
09:00 – 10:15	Keynote Presentations Moderator: Donald Li, President of the World Organization of Family Doctors	Plenary
	<div>Heat-related Health Impacts in Subtropical Cities: Global Overview and Research Frontiers in Hong Kong</div> <div>Emily Chan, Director of the Centre for Global Health, Chinese University of Hong Kong, China</div>	
	<div>Facing the Future of a Warming World</div> <div>Kristie Ebi, Lead Author of IPCC SR1.5M Director of the Center for Health and the Global Environment, University of Washington, USA</div>	
	<div>Making a difference in the context of DRR</div> <div>Virginia Murray, Head of Disaster Risk Reduction at Public Health England, UK</div>	
10:15 – 10:45	Group Photo Coffee & Networking Break	
10:45 – 12:00	Global Status of Heat Knowledge and Action Moderator: Juli Trtanj, National Oceanic and Atmospheric Administration (NOAA) USA	Plenary
	<div>Building Heat Health Management Networks: Partnerships and capacity</div> <div>Julie Arrighi, Red Cross Red Crescent Climate Centre/American Red Cross</div>	
	<div>Understanding Risk and Predicting Health Outcomes</div> <div>Sari Kovats, London School of Hygiene and Tropical Medicine, UK</div>	
	<div>Weather and climate information to facilitate action</div> <div>Hannah Nissan, International Research Institute for Climate and Society, USA</div>	
	<div>Actions to manage heat risks - interventions and effectiveness</div> <div>Shubhayu Saha, Centers for Disease Control and Prevention, USA</div>	
	<div>Taking Action: Engagement, Outreach, and Communication</div> <div>Margaret Harris, World Health Organization</div>	
	Panel Discussion with experts	
12:00 – 13:00	Catered Lunch	Dining Hall (P3)



FIRST GLOBAL FORUM ON HEAT AND HEALTH

GLOBAL HEAT HEALTH INFORMATION NETWORK
HONG KONG, DECEMBER 17-20, 2018

AGENDA

Day 1: Monday
Afternoon
17 December 2018

Heat and Health Around the World

13:00 – 15:00

What's Hot? Panel 1: Regional Perspectives of Heat Risks

Moderator: Glenn McGregor, University Durham, UK

Plenary

Europe

Andreas Matzarakis, Research Centre Human Biometeorology of the German Meteorological Service (DWD), Germany

North America

Melissa McDonald, Environment and Climate Change Canada, Canada

Africa

Ousman Ndiaye, Department of Meteorology (ANACIM), Senegal

Australia-Pacific

John Nairn CF, University Adelaide, Bureau of Meteorology, Australia

Caribbean and South America

Cedric Van Meerbeeck, Caribbean Institute for Meteorology & Hydrology (CIMH), Barbados
Natalia Herrera, National Meteorological Service, Argentina

South and South East Asia

Subhash Bhan, India Meteorology Department (IMD), India

North and East Asia

Gabriel Lau, Chinese University of Hong Kong, China

Facilitated Discussion and Q&A

15:00 – 15:30

Coffee & Networking Break

15:30 – 17:00

What's Hot? Panel 2: Regional Perspectives of Heat Action and Innovation

Moderator: Joy Shumake-Guillemot

Plenary

Europe

Hans-Guido Mücke, German Federal Environment Agency (Umweltbundesamt/UBA), Germany

North America

Juli Trtanj, National Oceanic and Atmospheric Administration (NOAA), USA

Africa and Middle East

Rachid Wahabi, Ministry of Health, Morocco

Australia-Pacific

Leigh Wilson, University of Sydney, Australia

Caribbean –South America

Francisco Chesini, Ministry of Health Argentina

South and South East Asia

Liviu Vedrasco, World Health Organization-Thailand

North and East Asia

Gloria Chan, Chinese University of Hong Kong; **Asuka Suzuki-Parker**, University of Ritssho – Japan,

Facilitated Discussion and Q&A

17:00 – 17:30

Wrap up

Plenary

17:30 – 19:30

Welcome Reception

Foyer



FIRST GLOBAL FORUM ON HEAT AND HEALTH

GLOBAL HEAT HEALTH INFORMATION NETWORK
HONG KONG, DECEMBER 17-20, 2018

AGENDA

Day 2: Tuesday Morning 18 December 2018	GHHIN Thematic Areas for Managing Heat Health Risk	
08:00 – 08:30	Coffee & Networking Break	Foyer
08:30 – 09:00	Opening Technical Day 2	Plenary
	Announcements & Technical Kick-off Juli Trtanj , National Oceanic and Atmospheric Administration (NOAA), USA	
Morning Parallel Breakouts		
09:00 – 12:30	Theme 2: Understanding Risk and Predicting Health Outcomes Chair: Sari Kovats, London School of Hygiene and Tropical Medicine, UK	Room P5-01
09:00 – 10:15	Part 1. Population Based Studies.	Room P5-01
	Association between temperature and health outcomes of population in Thailand Benjawan Tawatsupa , Ministry of Public Health, Thailand	
	Analysis of mortality during heat waves in 2013-2014 summer in Argentina Francesco Chesini , Ministry of Health and Social Development, Argentina	
	Recent trends in temperature, vulnerability and heat-attributable mortality in Europe Joan Ballester , Barcelona Institute for Global Health (ISGlobal), Spain	
	Identifying and attributing heat effects in rural Bangladesh Peter Kim Streatfield , International Centre for Diarrhoeal Disease Research, Bangladesh	
	Discussion	
10:15 – 11:00	Part 2. Physiological Studies/Occupational Health	Room P5-01
	Impacts of occupational heat strain on health and productivity: systematic review Andreas Flouris , University of Thessaly, Greece	
	Meta-analysis to evaluate the effectiveness of heat injury reduction measures Jason Lee , National University of Singapore, Singapore	
	Should electric fans be used in a heatwave? Ollie Jay , The University of Sydney, Australia	
	Discussion	
11:00 – 11:30	Coffee & Networking Break	Foyer
11:30 – 12:00	Part 3. Studies on Health Perceptions and Behaviour	Room



FIRST GLOBAL FORUM ON HEAT AND HEALTH

GLOBAL HEAT HEALTH INFORMATION NETWORK
HONG KONG, DECEMBER 17-20, 2018

AGENDA

		P5-01
	Personal heat protective measures during the 2017 heatwave in Hong Kong: a telephone survey study	Holly Lam, Chinese University of Hong Kong, China
	Identifying and engaging with groups vulnerable to heat risks.	Ashley Ward, Carolinas Integrated Sciences and Assessments (CISA), USA
12:00 – 12:30	Part 4. Key Messages Facilitated Discussion	
12:30 – 14:00	Catered Lunch Break and Technical Poster Session	Foyer
09:00 – 12:30	Theme 3: Weather and climate information to facilitate action Chair: Hannah Nissan, International Institute of Climate and Society (IRI) USA	Room P5-03
09:00 – 09:35	Opening Presentations	
	Weather and Climate Information for Heat Health Management Systems	Glenn McGregor, Dept. of Geography, Durham University, UK
	Heat Forecasting, Advancing our Capabilities and Knowing our Limitations	Melissa MacDonald, Environment and Climate Change Canada (ECCC), Canada
09:35 – 10:05	Global Perspectives on Climate and Meteorological Information.	
	Heatwave Early Warning System in Argentina	Natalia Herrera, National Meteorological Service, Argentina
	Indian heat early warning system, scale-up and operational issues	Subash Bhan, India Meteorological Department, India
	Providing heatwave early warning in a region with low predictability - a Caribbean approach	Cedric Van Meerbeeck, Caribbean Institute for Meteorology & Hydrology (CIMH), Barbados
10:05 – 11:00	Panel: Weather & Climate Information to Facilitate Action	
	<ul style="list-style-type: none"> - Serge Janicot, L'Institut de recherche pour le développement (IRD), France - Melissa MacDonald, Environment and Climate Change Canada (ECCC), Canada - Inoka Suraweera, Ministry of Health, Sri Lanka - Wassila Thiaw, National Oceanic and Atmospheric Administration (NOAA), USA 	
11:00 – 11:30	Coffee & Networking Break	Foyer
11:30 - 12:30	Panel: The Future of Heat Information Products	P5-03
	<ul style="list-style-type: none"> - Lap-Shun Lee, Hong Kong Observatory, China - Sarah Klassen, START Network, UK - Atul Kumar Sahai, Indian Institute of Tropical Meteorology, India - Shubhayu Saha, Center for Disease Control and Prevention (CDC), USA 	
12:30 – 14:00	Catered Lunch Break and Technical Poster Session	Foyer



FIRST GLOBAL FORUM ON HEAT AND HEALTH

GLOBAL HEAT HEALTH INFORMATION NETWORK
HONG KONG, DECEMBER 17-20, 2018

AGENDA

Day 2: Tuesday
Afternoon
18 December 2018

Parallel Technical Workshops on Thematic Areas for Managing Heat Health Risk

	Theme 1: Partnerships and Capacity to building heat health management networks Chairs: Glenn McGregor, Univ. of Durham, United Kingdom, and Juli Trtanj, US-NOAA	
14:00 – 15:30	Heat Health Partnerships in Action	Room P5-01
	Opportunities for Global Impact – Working with Family Doctors	Donald Li , World Organization of Family Doctors (WONCA), Hong Kong, China
	Japan: Heat Health Warning System	Michihiko Tonouchi , Japan Meteorological Business Support Center, Japan
	Governance and Difference: lessons from northern Australia	Elsbeth Oppermann , Technical University of Munich, Germany
	Argentina collaboration between Ministry of Health and Social Development and the National Meteorological Service	Francisco Chesini , Ministry of Health and Social Development, Argentina and Natalia Herrera , National Meteorological Service, Argentina
	Integrated Systems Approaches: The US National Integrated Heat Health Information System (NIHHIS)	Hunter Jones , National Oceanic and Atmospheric Administration (NOAA), USA and Shubhayu Saha , Centers for Disease Control and Prevention (CDC), USA
15:30 – 16:00	Coffee & Networking Break	Foyer
16:00 – 16:15	Working with Community Based Organizations - Opportunities for Impact and Capacity Building	Room P5-01
	England Heat Plan	Virginia Murray , on Behalf of Emer O'Connell, Interim Head of Extreme Events and Health Protection, Public Health England
16:15 – 17:30	Breakout Session	Room P5-01
	Address on forging Partnerships in India to scale up heat related policy	Sujata Saunik , Indian Administrative Service, India (recorded)
	Breakouts	Moderators Montira Pongsiri, Glenn McGregor, Juli Trtanj, Hunter Jones, Andreas Matzarakis
	Report Back from Break Out Groups and Plenary Discussion	Glenn McGregor



FIRST GLOBAL FORUM ON HEAT AND HEALTH

GLOBAL HEAT HEALTH INFORMATION NETWORK
HONG KONG, DECEMBER 17-20, 2018

AGENDA

Day 2: Tuesday
Afternoon
18 December 2018

Parallel Technical Workshops on GHHIN Thematic Areas for Managing Heat Health Risk

	Theme 4: Managing heat risk: actions, interventions and effectiveness Chairs: Shubhayu Saha, Centers for Disease Control and Prevention, USA	
14:00 – 15:30	Heat Health Interventions	Room P5-03
	NYC: Household interventions on A/C distribution	Kaz Ito , New York City Department of Health, USA
	Arizona: Cooling shelters	Dave Hondula , Arizona State University, USA
	Pakistan: heat intervention for healthcare providers	Junaid Razzak , John Hopkins University School of Medicine, USA
	Japan: community trials	Yasushi Honda , University of Tsukuba, Japan
	Europe: Occupational heat stress mitigation	Lars Nybo , University of Copenhagen, Denmark
	Hong Kong: Sustainable Urban and Environmental Design	Chao Ren , Faculty of Architecture, University of Hong Kong, China
	Vietnam: Forecast Based Financing	Jerome Faucet , German Red Cross, Vietnam
	Moderated Discussion	Shubhayu Saha , Centers for Disease Control and Prevention (CDC), USA
15:30 – 16:00	Coffee & Networking Break	Foyer
16:00 – 17:30	Part 2 - Evaluation of the Effectiveness of Interventions	Room P5-03
16:00 – 16:15	Canada Heat Alert and Response System (HARS)	Tom Kosatsky , British Columbia Centre for Disease Control, Canada
16:15 – 16:45	Moderated Discussion	Shubhayu Saha , Centers for Disease Control and Prevention (CDC), USA
16:45 – 17:55	Development of a Heat Action Plan	Room P5-03
	India: Ahmedabad heat action plan	Dileep Mavalankar , Indian Institute of Public Health, Gandhinagar, India
	Moderated Discussion	Shubhayu Saha , Centers for Disease Control and Prevention (CDC), USA
	Session Wrap Up	



FIRST GLOBAL FORUM ON HEAT AND HEALTH

GLOBAL HEAT HEALTH INFORMATION NETWORK
HONG KONG, DECEMBER 17-20, 2018

AGENDA

Day 3: Wednesday Morning 19 December 2018			Communications for Heat Action
08:00 – 08:30	Coffee & Networking Break		
08:30 – 08:35	Announcements & Technical Kick-off		Plenary
08:35 – 09:00	Keynote: Evidence-based Health Risk Communications Margaret Harris, WHO Emergency Communications Advisor		
09:00 – 10:30	Plenary Panel Discussion: Communicating for Action Moderator: Margaret Harris		
	How we can use broadcast meteorology to save lives?	Alex TS Tsoi, Broadcast Meteorologist and HKO Scientific Officer, China	
	Engaging communities to reduce risk	Candy Yeung, Deputy Secretary-General, Hong Kong Red Cross, China	
	How the media can communicate to reduce risk?	Jason Gale, Senior Editor, Bloomberg News, Australia	
	Perspectives on communicating risk from a doctor	Yu Fat Chow, World Association of Family Doctors, and Hong Kong Jockey Club, China	
10:30 – 11:00	Coffee & Networking Break		Foyer
11:00 – 12:30	The Great Heat Health Resilience Debate Moderator: Roop Singh, Climate Risk Advisor, Red Cross Red Crescent Climate Centre		Plenary
	Responding to acute heatwave events	Virginia Murray, Head of Disaster Risk Reduction at Public Health England, UK	
	Long-term preparedness and city actions	Chao Ren, Faculty of Architecture, University of Hong Kong, Hong Kong	
	Building long-term resilience	Ousmane Ndiaye, Senegal Meteorological Department (ANACIM)	
12:30 – 13:30	Lunch		Dining Hall (P3)



FIRST GLOBAL FORUM ON HEAT AND HEALTH

GLOBAL HEAT HEALTH INFORMATION NETWORK
HONG KONG, DECEMBER 17-20, 2018

AGENDA

Day 3: Wednesday
Afternoon
19 December 2018

Parallel Sessions on Communications for Heat Action

	Communications for Heat Action	
13:30 – 15:00	Masterclass: Communicating for Future Resilience	Plenary
	Plenary Panel Discussion: Communicating for Action	P5-01
	<ul style="list-style-type: none"> - KL Lee, Hong Kong Observatory - Sujoud Gallab, Ministry of Health, Saudi Arabia - Candy Yeung, Deputy Secretary General, Hong Kong Red Cross, Hong Kong - Virginia Murray, Head of Disaster Risk Reduction at Public Health England, UK 	
15:00 – 15:30	Coffee & Networking Break	Foyer
	Simulation Exercise: Communicating to Save Lives in a Heat Emergency Scenario Moderator: Lucas Scherdel and Margaret Harris (WHO), Jason Gale (Bloomberg News)	
13:30 – 15:50	Delivered by the World Health Organization, this interactive exercise will engage participants in a role playing simulation to manage the communications and actions during an extreme heat event with many casualties in a fictional country. Participants will gain practical experience of creating effective communication strategies to save lives in a heat emergency.	Room P5-03
16:00 – 16:45	Future Directions and Closing Plenary Moderators: Joy Shumake-Guillemot (WMO/WHO) and Juli Trtanj (NOAA)	Plenary
	Key Messages and Outcomes of the Forum	
	Results and Findings from Technical Themes	Interim Steering Committee
	Future Directions for the Global Heat Health Information Network	
16:45 – 17:00	Closing and Thank You	Interim Steering Committee

Free Evening to Explore Hong Kong



Day 4: Hong Kong Heat Project Site Visits

Further information on signup and logistics available at registration.

Visit 1: Hong Kong Housing Authority - Exhibition Centre

Visit 2: Senior Citizen Home Safety Association

See how the Senior Citizen Home Safety Association enhances the living quality of the elderly in the community through the use of technology, people-oriented services, and innovative methods

Visit 3: Hong Kong Observatory Tour

The guided tour will take the visitors back in time to trace the development of the Observatory over the past 130 years. Visitors can see how weather forecasts are made and how technology is put to use.

Visit 4: Energy poverty Lab - Simulated Subdivided Flat tour

Experience for yourself what it is like for the many residents of Hong Kong to live in cramped quarters, cooking, relaxing, and sleeping in a small room with inadequate cooling.

ANNEX 5. ACKNOWLEDGEMENTS

The Network team wishes to warmly acknowledge the support of the Interim Steering Committee members, the local organizing team of Hong Kong, and the sponsoring and participating institutions:

- World Meteorological Organization
- World Health Organization
- NOAA
- University Corporation for Atmospheric Research
- National Science Foundation
- International Research for Development
- University of Hong Kong
- Hong Kong Observatory
- Hong Kong University School of Public Health
- Hong Kong University Faculty of Architecture
- Chinese University of Hong Kong (School of Public Health, Environment, Energy, and Sustainability, and Institute of Future Cities).
- Hong Kong City University
- Hong Kong Red Cross
- Red Cross Red Crescent Climate Centre
- World Organization of Family Doctors
- Hong Kong Housing Authority
- Senior Citizens Home Safety Association
- Energy Poverty Lab

Local Hong Kong organizing team

- Prof Chao REN
- Emily Chan
- Dr T C LEE
- Mr C W CHOY
- Ms Gloria Kwong Wai CHAN
- Miss Asta Yi Tao MAN
- Mr Mike CHAN
- Prof Jianxiang HUANG
- Prof Linwei TIAN
- Dr Wen ZHOU

Special thanks to:

Brian Jackson, Lucas Scherdel, Robbie Parks, Nathaniel Matthews-Trigg, Margaret Harris, Judit Ungvari Martin, Makyba Charles-Ayinde, Jason Gale, Mark Shapiro, Peter Berry, Shawn Donaldson, WHO-WPRO, WHO-SEARO, WHO-EURO, PAHO, Roop Singh, Nicola Ward, Tim Yeung, Lau Yat To Scott; Wong Chiu Hang; Tang Ho Lun; Kwok Yee Hang, Anson; King Chin Hang, Christy; Wu Siu Yeung; Mak Yuen Ling; Zhang Xuyi; Li Xinwei; Guo Mengdi; Sun Yimin ; Hao Tongping; Emma Peng; Doris Chan.

Interim Steering Committee



Joy Shumake-Guillemot,
WMO/WHO Joint Office



Dileep Mavalankar,
Public Health Foundation
of India



Juli Trtanj, NOAA,
Climate Program Office



Julie Arrighi, Red Cross
Red Crescent Climate
Centre



Hunter Jones, NOAA,
Climate Program Office



Kumar Kolli, WMO,
Climate Prediction and
Applications



Kristie Ebi, University of
Washington School of
Public Health



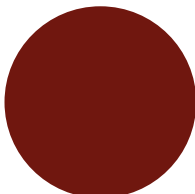
Hannah Nissan, Columbia
University International
Research for Institute for
Climate and Society



Shubhayu Saha, US
Centers for Disease
Control



Glenn McGregor,
Durham University



Emer O'Connell,
Public Health England



Yolanda Clewlow,
UK Met Office



Kim Knowlton,
Natural Resources
Defence Council



Rosa Barciela,
UK Met Office



Pat Kinney,
Boston University



Andreas Matzarakis,
Deutscher Wetterdienst
(DWD) Research Centre



Virginia Murray,
Public Health England



Ren Chao,
University of Hong Kong

