

Expert Committee Recommendations for a Heat Action Plan based on the Ahmedabad Experience



Introduction

Higher daily peak temperatures and longer, more intense heat waves are becoming increasingly frequent globally due to climate change.¹ Extreme heat events already have a significant impact in India, where summer temperatures are historically high. After a deadly heat wave hit the city of Ahmedabad in May 2010, the Ahmedabad Municipal Corporation (AMC) has taken the initiative to develop a comprehensive heat action plan for extreme heat events, the first city in India to do so.

The Indian Institute of Public Health, Public Health Foundation of India, Natural Resources Defense Council, Mount Sinai School of Medicine, and Emory University Schools of Medicine and Public Health have partnered with the AMC to protect and prepare Ahmedabad for extreme heat events. This activity has included epidemiological analysis of the public health effects of heat exposure among Ahmedabad's residents, examination of specific vulnerability factors among slum dwellers and highly exposed occupational workers, exploration of longer-term forecasting options to give earlier warnings, heat illness management training for health professionals, and a systematic review of heat action plans around the world.

From this work it is clear that coordinated action is needed among government departments and organizations on the municipal level to reduce the devastating health effects of heat stress on the local population. A practical heat action plan of targeted policy interventions can increase information-sharing, communication, preparedness, and response coordination to improve the most vulnerable populations' resilience to rising temperatures.

An expert committee developed the following recommendations as proposed actions for the local government and other stakeholders to consider adopting in formulating the heat action plan for the city of Ahmedabad.

Purpose

The purpose of this Heat Action Plan is to provide a framework for the implementation, coordination, and evaluation of extreme heat response activities in Ahmedabad that aim to reduce the negative health impacts of extreme heat. The Plan's primary objective is to alert those populations most at risk of heat-related illness that extreme heat conditions are either imminent or currently exist, and to take appropriate precautions.

Heat wave planning includes²:

- identifying vulnerable population groups and the health risks specific to each group;

¹ IPCC, "Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation," March 8, 2012: <http://www.ipcc-wg2.gov/SREX/>.

² State of Victoria Department of Human Services, "Heatwave Planning Guide: Development of heatwave plans in local councils in Victoria [Australia]," 2009, <http://www.health.vic.gov.au/environment/climate/heatwave.htm>.

- developing effective strategies, agency coordination, and response planning to shape a Heat Action Plan that addresses heat-health risks;
- implementing and activating the Heat Action Plan; and
- evaluating and updating the Heat Action Plan regularly.

Preliminary evaluation of the 2013 and 2014 Heat Action Plans is already showing positive outcomes in reducing mortality during the hottest months of the year.

Ahmedabad Background

One of India's fastest growing cities, Ahmedabad is the economic center of the state of Gujarat. Ahmedabad district, including the surrounding suburban and rural areas, is home to 7.2 million people.³ Ahmedabad is predicted to be one of the world's nineteen fastest growing urban areas in the coming decade, according to Forbes magazine.⁴ Located in the arid Northwest region of India, Ahmedabad's warm, dry conditions are conducive to heat waves. While summer is defined as spanning March, April, and May, Ahmedabad's hottest temperatures can run from March through June, with temperatures generally peaking in May and warm days through November.⁵ Across India, higher daily peak temperatures and longer, more intense heat waves are becoming increasingly frequent globally due to climate change; thus the deadly extreme heat events already impacting Ahmedabad are expected to increase in intensity, length, and frequency in the coming decade.⁶

Recommendations of Proposed Activities for the Ahmedabad Heat Action Plan

Successful implementation of a Heat Action Plan (HAP) in Ahmedabad requires coordinated action between many diverse stakeholders, including government departments at the municipal, state, and national levels; health care professionals including emergency medical personnel, health center staff, and hospital staff; and community groups. Following the forecasting of a heat wave, immediate notification of the public and all those participating in the response is critical to ensure the plan is activated.

The following phased approach aims to minimize the health impacts of extreme heat through:

1. Coordinated city-wide response to heat waves; and
2. Consistent community-wide understanding of the health impacts of extreme heat and how to protect oneself and help others.

³ Office of the Registrar General & Census Commissioner, "Census of India 2011: Provisional Populations Totals, Ranking of Population Districts, 2001-2011," Government of India: http://www.censusindia.gov.in/2011-prov-results/prov_data_products_gujarat.html (last accessed July 26, 2012).

⁴ Kotkin, Joel, "The World's Fastest Growing Cities," Forbes, October 7, 2010:

<http://www.forbes.com/2010/10/07/cities-china-chicago-opinions-columnists-joel-kotkin.html>.

⁵ See "Weather and Climate in Ahmedabad," Maps of India: <http://www.mapsofahmedabad.com/general-information/weather.html>.

⁶ IPCC, "Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation," March 8, 2012: <http://www.ipcc-wg2.gov/SREX/>.

The AMC has appointed an **AMC Nodal Officer** to head the Heat Action Plan. The appointed nodal officer is responsible for coordinating and communicating ahead of, and during, extreme heat events, and provide support staff through the Nodal Office as necessary. The AMC Nodal Officer should convene key agency leaders to help with reliable communication, timely dissemination of health-relevant information, and strong working relationships among various government agencies.

The expert committee recommends the AMC Nodal Officer consider adoption of the following preparations under Ahmedabad's Heat Action Plan.

Phase 1: Pre-Summer Preparation (Annually from January through February)

- *Preventative training and outreach efforts* for health workers, link workers, school children, and the local community could be organized by the AMC Nodal Officer ahead of the summer heat season in conjunction with the AMC Health Department.
 - *Provide a train-the-trainers session* for primary medical officers so they can offer heat-specific advice (symptoms, diagnosis, and treatment, including self-monitoring and hydration) to their medical staff. Trainings could provide informational materials to healthcare providers that include how to counsel patients, when to increase staffing to handle potential increases in patient demand, and surveillance protocols to prevent and reduce mortality and morbidity.⁷
 - *Train link workers and community health workers* about heat danger and offer prevention tips for outreach and community-based surveillance for heat illness in slum communities.⁸ In the inaugural training, half of the link workers could be intensively trained, and the other half could receive a more passive educational intervention. Therefore, at the end of the summer heat season, a comparison of the rate of heat illness experienced by the populations they serve can help evaluate the relative benefit to patients of different levels of link worker training, before future summers.
 - *Train community leaders* to be prepared to help the elderly, pregnant women, and children during heat waves, and create a “buddy system” in which neighbors check on each other during heat waves.
 - *Train school board committees* to teach children about how to avoid heat stress before summer break begins.⁹ Lead child-friendly educational preventative trainings and distribute heat protection materials at local schools. For example, potentially design a “Teach the Teachers” workshop

⁷ As a part of this training, one focus could be increasing heat stress outreach and education for women in maternity wards before leaving the hospital, since newborns make up a high proportion of heat-related deaths. For an international best practices resource, please see NYC Department of Health and Mental Hygiene, “Heat Illness Information for Health Care Providers: Information for Health Care Providers on Heat-Related Morbidity and Mortality,” available at: <http://www.nyc.gov/html/doh/html/epi/epi-heat-factsheet.shtml>.

⁸ There is currently no training on heat hazards offered in link worker trainings.

⁹ Steering Committee members could consider existing materials such as a comic book for students in Vietnam, on climate change & preparedness, and an article about a comic artist from India who works on climate issues.

- designed to equip teachers with knowledge with heat protection tips and materials that they can disseminate in classrooms on heat protection, and activities that can engage students on health dangers of extreme heat.
- *Conduct training workshops and outreach sessions with community groups* and mobilizers such as Mahila Arogya Samiti, Self-Employed Women's Association (SEWA), ASHA workers, *aanganwadis*, and municipal councils to help inform and get vulnerable communities more actively involved. Incorporate other sectors such as higher education, non-profits, and community leaders to increase reach to communities.
 - *Enhance targeted training programs, capacity building efforts and communication on heat illness for medical staff* at local hospitals and Urban Health Centres (UHCs), based on the Framework of AMC Medical Professionals and Health Workers (*see attachment*). These efforts could include nursing staff, paramedics, field staff and link workers, and consider the susceptibility of particular wards.
- *Multilingual pamphlet*, in English, Gujarati, and Hindi, could be distributed by the AMC Nodal Officer, with the Health Department, on heat stress prevention and tips for health protection during heat waves. Focus outreach efforts in identified high-risk areas.
 - *Project knowledge partners* could continue issuing the media fellowship to focus on these efforts.
 - *Free “Heatline” call center* could be created by the AMC Nodal Officer to provide public informational support during heat waves, and to publicize the service within slum communities. The Heatline could have an information system to provide emergency medical response to heat stroke victims and tips on heat-related illness prevention.¹⁰
 - *Reusable soft plastic ice packs could be purchased and distributed* for the citywide UHCs, 108 emergency centres, ambulances and hospitals.
 - *Creation of ice pack dispensaries could be explored* to increase access to vulnerable communities.
 - *Internal communication among state and local agencies:* AMC Nodal Officer could reengage state and local agencies such as the AMC, the Met Centre, health officials and hospitals, emergency response communities, community groups, and media outlets to facilitate formal and efficient communication channels ahead of forecasted heat waves.
 - *Hospitals could update their admission and emergency-case records* to add the category of “heat stress” and add information regarding the patient’s occupation

¹⁰ The Met Centre currently has a “108 Emergency Service” number to call for temperature information, but it is not widely operational, without staff to answer public.

- and locality within the city to correlate these factors with potential heat stress conditions.
- *Hospitals could update their admissions and emergency case records to track heat-related morbidity and mortality. Hospital staff could be trained to improve expedience of recording of cause of death certificates. Creation of simple, user-friendly means to track daily heat-related data and behavioral change impacts could be explored. The training could also include recording information education & communication (IEC) efforts.*
 - *Ahmedabad Labor and Employment Department could increase heat-health training (including self-monitoring and hydration) for employers, laborers, and workers whose occupations require intensive work outdoors during extreme heat events and/or workers in close proximity to heat sources (e.g., rickshaw drivers, street vendors, traffic police, construction workers, and kiln and quarry workers).*
 - *Ahmedabad Labor and Employment Department could utilize maps of construction sites to identify more high-risk outdoor workers. Potentially overlay with irradiation map from IMD or heat island map. Conduct publicity campaigns during high-risk days to these specific areas.*
 - *AMC could site and install additional temperature gauges across the city before summer begins to measure heat and humidity in different wards' microclimates, with the Met Centre and the Department of Climate Change.*
 - *AMC could increase the number of LED scrolling boards to publicly display temperature and weather forecasts to warn people during heat waves so unessential travel or work can be avoided on the hottest predicted days. High-traffic site locations where most people can view the information and highly-vulnerable sites where the possibility of heat island effect is magnified due to lack of trees, dense vehicle traffic, large amounts of paved area, and local heat generating sources should be prioritized.*
 - *Map of community resources could be created by the Steering Committee in conjunction with CEPT University, Ahmedabad by March, including public parks and green space, health centers and hospitals, homeless shelters, temples, Bus Rapid Transit System (BRTS) routes, and public libraries, to increase awareness of extreme heat safety resources and adaptation strategies for vulnerable communities. These maps can be distributed to Steering Committee member agencies as a valuable resource for vulnerable communities, especially during the heat season.*
 - *AMC Nodal Officer could create a list of the high-risk areas of the city vulnerable to heat waves for more focused activities on heat prevention.*

- *AMC could distribute the Heat Action Plan* before the extreme heat season begins, including posting it on AMC’s website or on a dedicated, internal-use Steering Committee website (where the notes from the Committee’s meetings and conference calls can also be posted). The Steering Committee could also hold one public media event to raise general awareness about heat-health vulnerability.
- *AMC Nodal Officer could arrange for the Steering Committee to meet every two weeks* to help coordinate government agency communications and begin the heat season planning process annually.
- *Steering Committee could organize and hold traveling caravan workshops (“miking”)* among the most heat-vulnerable communities (slums, elders, schoolchildren, mothers of very young) to raise specific awareness of heat-health risk reduction.
- *Knowledge partners could circulate request for proposals for non-governmental organizations to increase outreach and communication with the city’s most at-risk communities each year.*
- *Community groups and individuals could encourage individuals’ discussion of the early signs of heat exhaustion with their local doctor or Urban Health Centre. Inform fellow community members about how to keep cool and protect oneself from heat.*

Phase 2: Launch of Heat Season (Annually in March)

- *Initial public messaging to the public* about the dangers of heat-related illness and how to recognize and treat the symptoms could be disseminated through an AMC Heat-Health Nodal Office press conference or other media in March.
- *Increase link worker and community health worker outreach:* Public health officials and link workers could raise awareness within slum communities and caution all patients about potential health effects of high temperatures at the start of summer, and continue this messaging throughout the heat season during routine rounds in the communities and possibly microphone announcements from auto-rickshaws. Link workers could also distribute informational pamphlets and verbal or other audio messages in slum communities during their regular rounds beginning in March.¹¹ During regular rounds, link workers could collect information from their households about the incidence of heat illness symptoms and conduct surveillance and provide referrals as indicated.
- *Multilingual pamphlets and posters* with tips to prevent heat stress could continue to be distributed by the Steering Committee in March to hospital workers, to schools, through labor unions and professional associations, particularly for at-

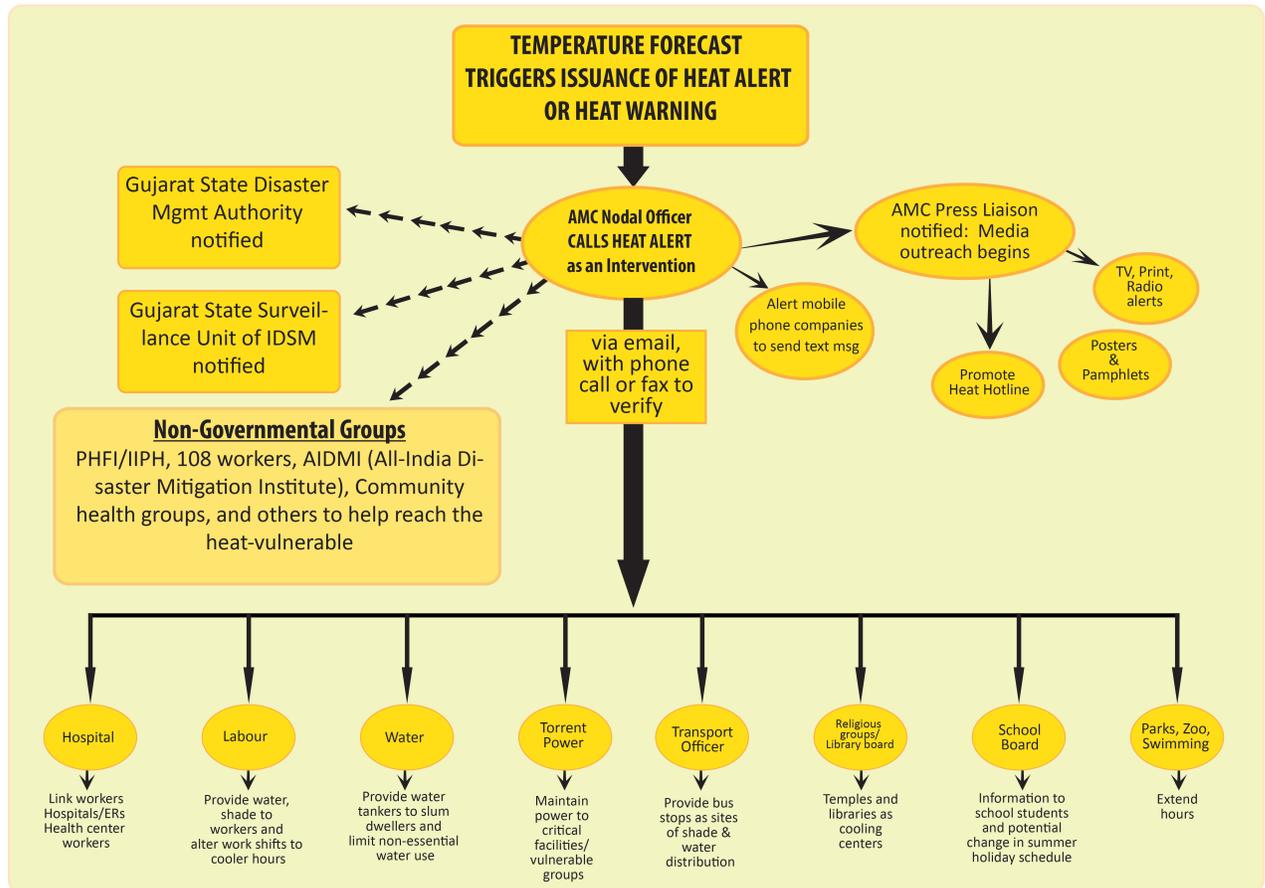
¹¹ Such pamphlets could use language and tips specifically tailored for slum populations.

- risk occupational workers, and to community groups with a focus on heat-vulnerable neighborhoods.
- *Post heat-related illness prevention tips and how to stay cool* in urban health centres and hospitals starting in March, to be left up throughout the heat season.
 - *Local press and media outlets*, including newspapers, radio, and television, could coordinate with the AMC Nodal Officer and AMC Press Liaison to publicize heat warnings and produce ads on heat-health awareness, the available “Heatline,” and protection strategies in March.
 - *AMC Nodal Officer could begin surveillance monitoring* of the weather and temperature forecast in March and continue through the summer, coordinating probabilistic forecasting¹² and deterministic forecasting from the Met Centre.
 - *Continue having heat-focused examination procedures at local hospitals and urban health centres*: AMC Health Department could encourage routine examination of admitted patients for signs and symptoms of heat-related illnesses, adding a brief procedure during the peak-heat summer months, at a minimum.
 - *AMC Nodal Officer could receive weekly reports of the public health impact* during the heat season from health officials (at a minimum, the mortality and morbidity rate), to be delivered to members of the Steering Committee at their weekly meetings.
 - *AMC Nodal Officer could increase access to places to cool off throughout the city* in collaboration with AMC Deputy Municipal Commissioners, including parks, lakes, swimming pools, public libraries, shopping malls, and the BRTS routes.¹³ The map of community resources created by the Steering Committee can be referenced.

¹² Probabilistic temperature forecasts to be provided by experts at Georgia Tech.

¹³ Currently, most cooling spaces – parks, lakes, swimming pools, public libraries, shopping malls, and the BRTS routes – are centered on the northwest part of Ahmedabad, which is not easily accessible to the poorer populations who do not live there. Cooling spaces could be extended throughout the city.

Figure 2. Communication Plan When Heat Wave is Forecast



Phase 3: Heat Wave Events

- *The AMC Nodal Officer could activate a **Heat Alert (7 days to 1 day prior to the forecasted heat wave)** to local government departments, the Met Centre, health officials and hospitals, emergency response communities, community groups, and media outlets, activating the local heat wave response citywide. The alert could be issued in the following order, in accordance with **Figure 2** above:*
 - o Forecast: Using probabilistic forecasting, the forecast of the likely development of a heat wave or extreme heat event in Ahmedabad could be determined up to 7, but at least 2 days, before it is expected to impact the city.¹⁴ The forecaster could directly contact the AMC Nodal Officer immediately through phone, email, or both with the heat wave warning, triggering the **Heat Alert**.

¹⁴ Experts at Georgia Tech University can determine the probabilistic forecasts. A probability threshold must be set (e.g. a 60% to 75% probability of exceeding the monthly trigger temperature threshold from the Met Centre, shown in Figure 1, in the next 48 hours; or at least a 50% probability, 30%, etc.) and a temperature threshold (e.g., 43°C). A threshold may be derived from an epidemiological analysis; or the standard thresholds from the Met Centre can be used.

- Activation: The AMC Nodal Officer could activate the **Heat Alert** by immediately notifying the Steering Committee, AMC Deputy Municipal Commissioners overseeing the relevant local departments, Gujarat State Disaster Management Authority, Gujarat State Surveillance Unit of Integrated Disease Surveillance Project (IDSP), and key non-governmental groups such as community health groups and IIPH-G, via email listserve, and verifying receipt by phone calls.
 - Internal Notification: The AMC Deputy Municipal Commissioners, including those overseeing hospitals, labor, water, transportation, schools, libraries, and pools, could in turn immediately alert their relevant stakeholders. For example, the Health Department could in turn notify hospitals, health centers, and link workers, of an upcoming heat wave via email, SMS text, or both.
 - Public Notification: The AMC Nodal Officer could also contact the AMC Press Liaison to disseminate public service announcements and health warnings through the media (TV, radio, newspapers) within one day of the **Heat Alert** notification regarding the current heat wave and how to stay safe and healthy.¹⁵
 - Deactivation: The **Heat Alert** could be deactivated when local forecast daily maximum temperatures fall below the local relevant threshold trigger temperature. After conferring with the Steering Committee members, the AMC Nodal Officer could call for the deactivation via email listserve and verify receipt by phone calls.
- *Nodal Officer could monitor and increase the **heat alert** level when necessary to match the severity of the forecast and threshold established, and have the Municipal Commissioner convene a special meeting with key agency leaders.*
 - *AMC Press Office could circulate warnings via text alerts or WhatsApp mobile messages, in collaboration with private sector telecom companies, in addition to traditional media including television, if possible, with warnings about the **Heat Alert** and tips to avoid heat stress.¹⁶*
 - *AMC Press Office could circulate warnings in bulk to the public via centralized email databases during a **heat alert**.*
 - *AMC could develop an SMS alert system to send direct messages to private practitioners in addition to the medical professionals at public hospitals and UHCs.*
 - *AMC could utilize local radio FM broadcasts to disseminate heat protection tips*

¹⁵ The media could be encouraged to provide low or no cost space in their venue for public interest announcements.

¹⁶ Some AMC agencies have used text message alerts in the past for special health campaigns run by the AMC. Appendices to this Draft Heat Action Plan provide an example of information that a short text message might include.

and high temperature warnings to the city's at-risk populations during a **heat alert**.

- *AMC could explore other means of communications*, such as broader use of social media, for example, Facebook, Twitter and the WhatsApp mobile application.
- *Community leaders and neighborhood “gatekeepers” identified and instructed by local community outreach groups could disseminate heat warnings and information in slums prior to the arrival of heat wave conditions, coinciding with the **Heat Alert** notification.* These individuals can help activate community networks to spread the word, warning slum residents and providing information on protecting individuals during a heat wave.
- *Community outreach groups could have community leaders initiate the “buddy system” in which neighbors check on each other while **Heat Alert** is in effect, particularly in at-risk neighborhoods such as slum communities.*
- *AMC Nodal Officer could activate “cooling centers” (such as temples, public buildings like libraries, malls) and/or AMC-run temporary night shelters in the city as shelters for protection against extreme heat while **Heat Alert** is in effect.* At a minimum, shaded or covered structures offering protection out of direct sun for at-risk residents could be made available during the heat wave.
- AMC could expand access to shaded areas for outdoor workers, slum communities, and other vulnerable populations. For example, confirm that night shelters stay open all day for migratory populations during a **heat alert**.
- *AMC could keep large public parks open later during periods of extreme heat to provide cool resting spaces for the public while **Heat Alert** is in effect.*¹⁷
- *AMC Nodal Officer could increase efforts to distribute fresh drinking water to the public.* For example, expand potable water access during a **heat alert** at religious spaces including temples and mosques, BRTS transit stations, pouch handouts to the poor, and high-risk areas (identified by the mapping of high-risk areas).
- AMC could have zonal health officer visit UHCs to confirm proper preparation has been made for heat-related illness and conduct case audits during heat season.
- *AMC could commit tankers to solely deliver drinking water to ensure no other materials compromise the safety of the drinking water quality while **Heat Alert** is in effect.*¹⁸ AMC Water Project Department could perform periodic inspections of

¹⁷ Currently, the larger parks close at 7 pm in the city; the smaller parks of the city are not manned and are open 24-hours a day.

¹⁸ In the past, there have been unfortunate instances of tankers that previously transported hazardous chemical compounds later being used for water deliveries, thus contaminating drinking water. If the AMC

- tanked-in drinking water throughout the heat season to ensure the safety of drinking water deliveries.
- *AMC could provide safe drinking water fountains*, preferably cold water, in bus stops near major crossroads, gardens, and public places while **Heat Alert** is in effect.
 - *Ahmedabad Labor and Employment Department could encourage employers to shift work hours of outdoor workers to cooler times of day* (e.g., rickshaw drivers, street vendors, traffic police, construction workers, and kiln and quarry workers) and encourage outdoor workers to avoid heavy labor during the hottest part of the day (appx. 12-6 p.m.) while **Heat Alert** is in effect.
 - *School board committees could consider school closures* in the peak afternoon heat while the **Heat Alert** is in effect.¹⁹
 - *Transport officers could implement a protocol to offer reduced or free bus fare* while the **Heat Alert** is in effect to help avoid excess walking outside during the heat wave.
 - *AMC Deputy Municipal Commissioners could increase frequency of weekly reports to daily reports* to the Steering Committee, while the **Heat Alert** is in effect.
 - *Steering Committee could hold a daily conference call* to discuss AMC Deputy Municipal Commissioner reports and breaking developments.
 - *AMC Nodal Officer could ensure that the service and channels of communication* between the AMC, Health Department, the Met Centre, and other relevant stakeholders continue to be operational for the entire duration of **Heat Alert**.
 - *Met Centre and State Government can create special control rooms*: The mandate and capacity of the “special control rooms” (which have been created as central round-the-clock offices for residents to report issues and receive help during monsoon season) can be extended to include provision of relief while **Heat Alert** is in effect, particularly near slum communities.²⁰

has water tankers that provide water deliveries through the year, perhaps these tankers can be re-directed during the Heat Alert.

¹⁹ This recommendation could be further discussed with local experts, to make sure that students’ health will be better protected out of school during heat waves, rather than staying in school (i.e. are homes & street hotter than schools?).

²⁰ The Met Centre currently sends monsoon forecasts to the state-level control rooms, which then send the information and high-rainfall alerts to concerned commissioners and district officials across the state. The Met Centre and State Government can follow a similar forecast dissemination process for extreme heat warnings to inform concerned health officials and commissioners.

Phase 4: Complex Heat Emergency

- *The AMC Nodal Officer could issue a **Severe Heat Warning (extended or severe heat wave or complications requiring additional response such as water or power shortages)** to local government departments, the Met Centre, health officials and hospitals, emergency response communities, community groups, and media outlets, activating a scaled-up response citywide. These conditions may become increasingly frequent due to a changing climate.*
 - Forecast or Notification: If the experts at Georgia Tech forecast an extended or intensified heat wave, and the AMC Deputy Municipal Commissioners overseeing city water levels or provision of the power supply simultaneously identify a water or power shortage, they each shall notify the AMC Nodal Officer immediately.²¹
 - Activation: The AMC Nodal Officer could immediately activate a **Severe Heat Warning** through the same communication channels illustrated in **Figure 2**, notifying the necessary groups to activate emergency plans to scale the response appropriately.
 - Deactivation: The **Severe Heat Warning** could be deactivated when local forecast daily maximum temperatures fall below the local relevant threshold trigger temperature. After conferring with the Steering Committee members, the AMC Nodal Officer could call for the deactivation via email listserv and verify receipt by phone calls.

- *AMC Water Project Department could implement a protocol for continuance of all essential uses of water (drinking, keeping cool) and to enforce termination of non-essential use of water during the event of water shortage while the **Severe Heat Warning** is in effect.*

- *Local utilities could implement protocol to prioritize maintaining power to critical facilities (such as hospitals and urban health centres) and vulnerable groups (such as elderly) during power shortages through generators or otherwise while the **Severe Heat Warning** is in effect.*

- *Community outreach groups could mobilize community leaders to check on and assist vulnerable individuals in targeted locations and assist as needed while the **Severe Heat Warning** is in effect.*

- *AMC Nodal Office could open temporary emergency centers for residents without water or power for extended time while the **Severe Heat Warning** is in effect.*

Phase 5: Post Summer (Annually in July through September)

- *Annual Evaluation of the Heat Action Plan at the end of each summer heat season, to evaluate the process of executing the HAP (“process evaluation”), its effect on decision-making (“impact evaluation”), and whether the predicted health*

²¹ The Severe Heat Warning matches with the Met Centre’s current definition of a “severe heat wave” defined above in the section “**Current Definition of a Heat Wave in Ahmedabad.**”

outcomes were correct (“outcome evaluation”).²² Such evaluation procedures could provide information about improving the HAP to increase its impact, and determine best practices for future heat planning. Have all relevant stakeholders actively participate in evaluation and monitoring of the process to ensure maximum benefit for investment.

- *Process Evaluation:* IIPH and NRDC, along with the Steering Committee, could evaluate the process to determine how the Plan was carried out, who was involved, and how smoothly the Plan was executed. Did the Plan’s actions occur within acceptable timeframes and reach the desired populations (e.g., did the vulnerable communities receive heat warning and heat illness prevention information as intended)? What resources were used and at what cost? Were the recommendations properly formulated and prioritized?
- *Impact Evaluation:* IIPH and NRDC, in coordination with the Steering Committee, could track whether the recommendations made in the HAP were implemented by the decision-makers, and if not, why not (e.g., protocol and policy changes recommended by the Plan)? Was there meaningful public participation?
- *Outcome Evaluation:* The Steering Committee, along with IIPH and NRDC, could evaluate whether the predicted long-term health impacts were achieved by the Plan. This evaluation could require collecting baseline data ahead of the Plan’s implementation in addition to collection of outcome data after the Plan has been launched. In coordination with the AMC Health Department, the following three outcome evaluations specifically could be conducted:
 1. *AMC Health Department could conduct epidemiological case review* to link heat death, risk factors and illness cases to daily and weekly temperatures, based on general hospital and emergency room admission information and neonatal care records. Geomapping and spatial analysis of the ongoing summer heat-related deaths and illness cases, which started being tracked in 2010, could be conducted to give the Health Department information to conduct more descriptive epidemiological studies.
 2. *Hospitals and urban health centres could measure the morbidity and mortality outcomes* before and after they adjust vulnerable ward locations in hospitals and health centres, to help the AMC Health Department evaluate the effectiveness of this intervention.
 3. *AMC Health Department could create randomized intervention of link workers* in coordination with IIPH and Emory University by

²² Active Living Research, “Health Impact Assessment Resources: Evaluation Powerpoint,” <http://www.activelivingresearch.org/resourcesearch/hia> (last accessed December 28, 2012).

randomizing link workers to intensive or passive training and surveillance efforts during the first year of the program to compare efficacy of passive vs. intense training on the incidence of heat-related illness and prevention by analyzing heat illness impact retroactively. Adjust future link worker trainings in accordance with this outcome evaluation.

- *Post updated plan to the AMC website ahead of the 2016 heat season and distribute to relevant stakeholders by end of September.*
- *AMC could build on the “Green Cover” activity to establish tree-plantation campaign in hotspot areas such as roadsides and during plantation festival in June. Incorporate student volunteers or incentivize builders to plant trees to help effect this effort.*
- *AMC could discuss establishing cooling center facilities in high-risk areas around city.*
- *Revise the current heat wave and severe heat wave threshold definition in coordination between the Met Centre, AMC Nodal Officer, and Georgia Tech experts, if indicated by seasonal evaluation, after consultation with the Health Department about what temperatures trigger mortality and morbidity in Ahmedabad. Steering Committee could establish a process of yearly reevaluation of the heat wave advisory threshold based on the mortality and morbidity data collected during the heat season.*
- *AMC Nodal Officer and Steering Committee could consider the interventions and recommendations listed in **Appendix I** for potential adoption and to enhance climate change adaptation in future heat seasons.*

Appendix I

Interventions and Recommendations for Future Heat Seasons

- *Increase preparedness to treat patients during heat waves:* Work with the State Government and AMC Health Department to develop hospital staffing plans and protocols to treat an increased number of patients during heat waves. Currently, the State Government issues a circular to the municipal hospitals with disease epidemic warnings and sends a special team to the hospitals in the event of an epidemic, but heat-related illnesses are not included. For certain epidemics and diseases, the State Health Department creates an epidemic wing. AMC could work with the State Government to include heat-related illnesses as part of the epidemic warnings issued by the State Government.
- *Create a dedicated weather channel* as planned to share information on extreme weather with the public, and provide access to online sources of weather data, including from the Met Centre, to help inform the public of forecasted extreme heat events.²³
- *Analyze historical data available for the last 100 years* and work closely with the Met Centre to determine the local trend in daily maximum, minimum, and average temperatures for Ahmedabad to create a rigorous database for city temperature variations, which will inform the heat-health threshold advisory definition.²⁴
- *Health care staff could identify and relocate the most vulnerable patient wards* (e.g., the neonatal ward) from the top floor of hospitals and health centres where the temperatures are highest. Optimize cooling opportunities by moving patients to cooler parts of the building, or provide air conditioning or fans in key areas of the hospitals and health centres. Additionally, water supply and shower facilities could be provided on the premises.
- *AMC Health Department could establish an air-conditioned treatment room or ward in each hospital*, and measure before and after installation effects in both patient and health care worker populations. Determine if having 1 to 2 hours per day of cool air improves healthcare worker productivity levels.
- *Ahmedabad Municipal Transport Services could install additional traffic booths or covered boxes for traffic police* to stand in during their shifts in hot weather, and equip traffic police with oxygen to help reduce their exposure to poor air quality at the street-level.²⁵

²³ Meteorological Centre, Ahmedabad, Pamphlet, 4: <http://www.imdahm.gov.in/#> (click on About MC Tab) (last visited July 30, 2012).

²⁴ See id. for summary of this information, but the original dataset has not been included for analysis.

²⁵ Higher temperatures can dramatically worsen ground-level ozone smog concentrations, especially for traffic police who are exposed to high-pollution concentrations from vehicle emissions.

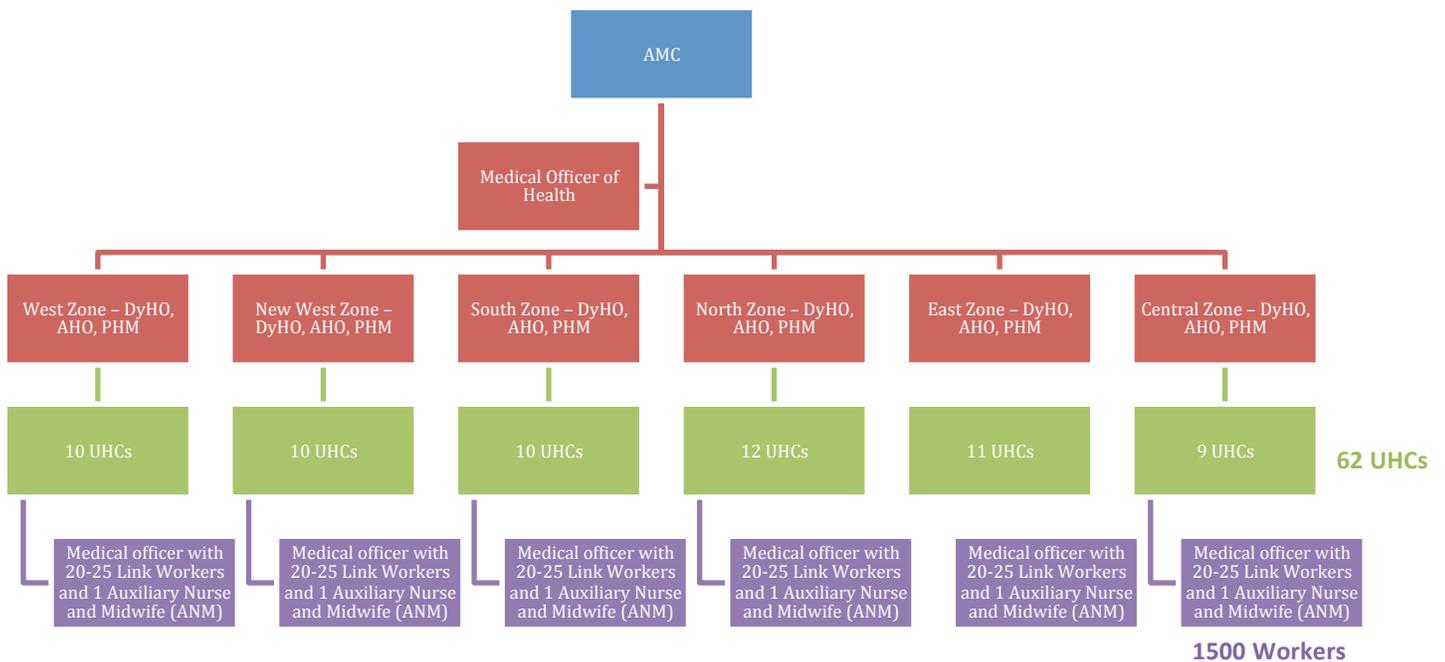
- *Install shaded bus stations with drinking water:* Ahmedabad Municipal Transport Services or civil society organizations could install shaded bus stations that protect slum residents and other passengers from the heat, and extend the bus route eastward where more vulnerable slum populations reside. Potable drinking water could be provided at local bus stations during heat waves as well.
- *Ahmedabad Labor and Employment Department could incentivize local businesses* to provide cool water (and potentially fans²⁶) to occupationally at-risk workers, shift time of work to cooler hours, and organize a training and educational workshop to help workers be able to recognize and react to heat-related illness.
- *Ahmedabad Labor and Employment Department could increase the number of government officials and inspectors* overseeing construction sites, quarries, factories and other vulnerable worksites, particularly during high temperature periods, to enforce labor laws related to heat safety.
- *Create a Cool Roofs or White Roofs Initiative:* AMC could initiate urban planning programs: these could include a cool roofs initiative to paint roofs white or cover them with light-colored tiles; create vegetated green roofs and walls; and plant and nurture the growth of trees in and around slum neighborhoods to provide shade and help keep streets cool.²⁷ Incentive mechanisms can be implemented to accelerate green urban planning initiatives. A strategy to evaluate the efficacy of these initiatives and determine the highest-priority locations for intervention could help target limited resources.
- *Post billboard ads with heat-related illness prevention tips, how to stay cool, and the available “Heatline”* around the city starting in March, to be left up throughout the heat season.

²⁶ Fans should be installed with caution. If interior air temperatures are hotter than outdoors, using indoor fans without outside ventilation can harm health by creating a convective oven-like environment.

²⁷ For an example of another cool roof initiative, see New Delhi Municipal Council’s program rolled out in August 2012; Geeta Gupta, “Cool Roofs mandatory for all new buildings,” *The Indian Express*, August 16, 2012: <http://www.indianexpress.com/news/-cool-roofs--mandatory-for-all-new-buildings/988898>.

Framework of AMC Medical Professionals and Health Workers

This organizational mapping serves as a framework to coordinate communication of heat protection tips and early warnings of heat wave response among of medical workers and health clinics involved in the Heat Action Plan. This framework shows the linkages between the AMC as the nodal government institution down to grassroots-level response teams of medical officers, link workers, and auxiliary nurse and midwives in urban health centres located in each of the six city’s geographic zones. This map of actors can help guide trainings and future action based on the susceptibility of particular wards.



Partnering Organizations

Climate & Development Knowledge Network

This publication was funded by the Climate & Development Knowledge Network (CDKN), which is supported by the UK Department for International Development (DFID) and the Netherlands Directorate-General for International Cooperation (DGIS) for the benefit of developing countries. CDKN supports and promotes innovative thinking and innovative action on climate change and development issues.

Ahmedabad Municipal Corporation

The Ahmedabad Municipal Corporation (AMC) is the municipal governing body of Ahmedabad, responsible for the city's civic infrastructure and administration. Led by its mayor and commissioner, AMC has pioneered the development of heat vulnerability reduction strategies and an early warning system for extreme heat events to protect its residents. <http://www.egovamc.com/>

Public Health Foundation of India

The Public Health Foundation of India (PHFI) is a public-private partnership structured as an independent foundation. PHFI is the hub of teaching, research, sharing knowledge and experiences in areas at the cutting-edge of public health in India. PHFI has launched four institutes of public health, including IIPH-Gandhinagar. <http://www.phfi.org>

Indian Institute of Public Health, Gandhinagar

The Indian Institute of Public Health, Gandhinagar (IIPH) is a leader on public health education, advocacy and research on public health. IIPH pushes the mandate of equity in public health, applying strategy, resources and networks to the issues and practice of public health in India. IIPH's programs aim to make education and research activities relevant to India in content and context.

Rollins School of Public Health of Emory University

Founded in 1990, the Rollins School of Public Health is one of the United States' top public health schools and offers 22 degree programs in a wide range of health areas including Global Environmental Health. Rollins benefits greatly from its location in Atlanta, Georgia, home to the Centers for Disease Control and Prevention and several other organizations that work in the public health space. The School strives to educate the world's future public health leaders and offers students unique opportunities to gain practical experience and work in the field during their coursework. <http://www.sph.emory.edu/cms/index.html>

Mount Sinai School of Medicine

The Mount Sinai School of Medicine is internationally recognized as a leader in groundbreaking clinical and basic science research and is known for its innovative approach to medical education. With a faculty of more than 3,400 in 38 clinical and basic science departments and centers, Mount Sinai is a top-ranked medical school based in New York City. <http://www.mssm.edu/>

Natural Resources Defense Council

The Natural Resources Defense Council (NRDC) is one of the most effective environmental groups, combining 1.3 million members and online activists with the expertise of more than 350 scientists and other professionals. NRDC is a leader in public health research, policy, and advocacy- including building resilience in local communities and fighting climate change. In 2009, we launched our India Initiative focused on climate change and clean energy with projects on climate change preparedness and adaptation and energy efficiency. With our partners, we advocate for increased policy development and implementation to protect communities from environmental threats. <http://www.nrdc.org>