

Rising Temperatures, Deadly Threat:

Recommendations for Health Professionals in Ahmedabad



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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.

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www.nrdc.org

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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 had a significant impact in India, where summer temperatures are historically high. On the municipal level, trained and prepared health professionals at hospitals and Urban Health Centers and within poorer communities are key to preventing and reducing the devastating health effects of heat stress. Targeted policy interventions that increase information sharing, communication among government departments and health professionals, training and preparedness, and coordination are essential to increase resilience in local communities to rising temperatures in India.

Through the Ahmedabad Municipal Corporation (AMC), Ahmedabad is leading as the first Indian city to create a comprehensive early warning system and preparedness plan for extreme heat events. The Indian Institute of Public Health (IIPH), Public Health Foundation of India (PHFI), Natural Resources Defense Council (NRDC), Mount Sinai School of Medicine, and Rollins School of Public Health at Emory University have partnered with the AMC to protect and prepare Ahmedabad for extreme heat events. This brief is one of four published to provide specific recommendations for leading stakeholders and the most vulnerable residents who will be impacted by extreme heat: key government agencies, health care professionals, outdoor workers, and slum communities.

Ahmedabad Snapshot

One of India's fastest growing cities, Ahmedabad is the economic center of the state of Gujarat. The Ahmedabad district, including the surrounding suburban and rural areas, is home to 7.2 million people.² Ahmedabad is predicted to be one of the world's 19 fastest-growing urban areas in the coming decade, according to *Forbes* magazine.³

Ahmedabad is located in the arid northwest region of India, where 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.⁴ Ahmedabad's average monthly maximum summer temperature from March through June is 38.8°C (101.8°F); in winter, November through February, the average monthly high is 28°C (82°F). The average monthly minimum temperature is 24°C (75°F) in the summertime and 15°C (59°F) in the winter.⁵ Temperature peaks in Ahmedabad can be extreme, as experienced during the May 2010 heat wave when the temperature spiked to 46.8°C (116°F).

REDUCING EXTREME HEAT VULNERABILITY IN AHMEDABAD

During the historic May 2010 heat wave in Ahmedabad, temperatures reached 46.8°C (116°F). Estimated daily mortality rates increased substantially during the heat wave.⁶ IIPH and NRDC are further investigating the epidemiological impacts of this extreme heat period. With climate change fueling higher temperatures in Ahmedabad and elsewhere, a new scale of coordinated action among municipal and other government agencies is needed to address and prevent the health effects of heat stress. It is critical to first identify which populations are most vulnerable to extreme heat, including their places of residence and work. It is also necessary to identify and prioritize policies and programs to address current and projected future health risks. In addition to these assessment steps, creating and maintaining collaborative systems within the different government departments (e.g., emergency response, emergency management, health agencies, and meteorological services) is essential to ensure streamlined coordination, create successful early warning communications, promote data sharing and health education, and identify service gaps, as a foundation for an effective early warning system before extreme heat events.

Heat Stress Symptoms and Impacts

Extreme heat can lead to dangerous, even deadly, health consequences.

Signs and symptoms of heat-related illnesses include:⁷

- Heat cramps, edema (swelling), and syncope (fainting). These conditions are accompanied by fevers generally under 39°C (102°F) and are readily treatable; however, they are important warning signs to immediately move the affected individual to a cool location and provide first aid.
- Heat exhaustion, which is marked by fatigue, weakness, dizziness, headache, nausea, vomiting, muscle cramps, and sweating.
- Heatstroke, defined as a core body temperature of 40°C (104°F) or greater, with the presence of altered mental status such as delirium, seizures, or coma. It can be fatal.

Severe long-term health impacts of heatstroke include:

- Renal insufficiency, kidney malfunction and failure.
- Neurological defects, headaches, and blurred vision.
- Cardiac ailments, chest pain, and heart attacks.
- Increased mortality risk for years following heat stroke for those who survive.

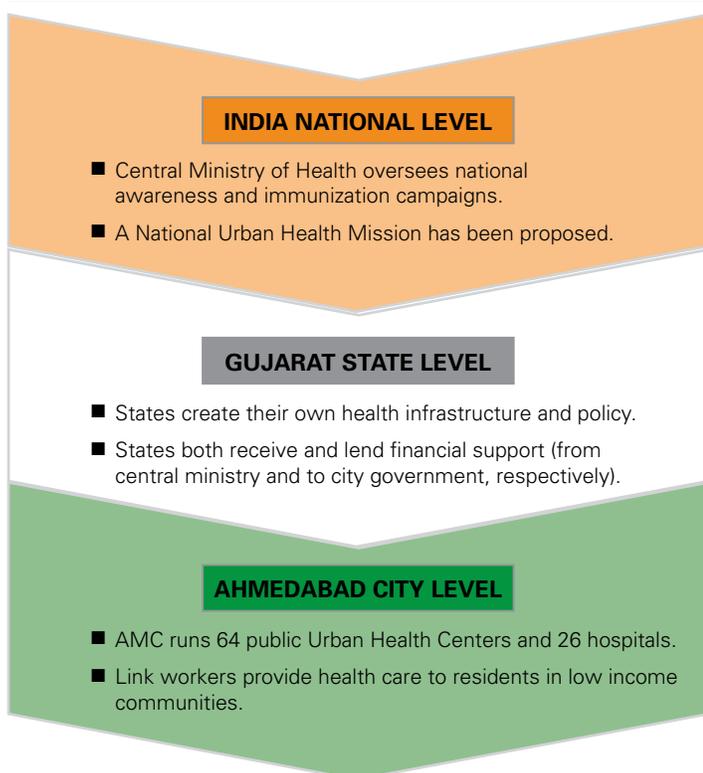
ROLE OF HEALTH CARE PROFESSIONALS IN AHMEDABAD

In India, each state creates and oversees its own health policy and develops corresponding health care infrastructure.⁸ The central Ministry of Health and Family Welfare's Department of Health, based in New Delhi, ensures consistency of state-level policies by overseeing national health programs, such as awareness and immunization campaigns and the National Rural Health Mission. There is currently no national or state-level health program that addresses heat vulnerability, including in the state of Gujarat.

The Ahmedabad Municipal Corporation is responsible for 64 Urban Health Centers (UHCs), which essentially function as outpatient departments. In addition, 26 hospitals serve the health care needs of Ahmedabad residents, including inpatient care, birth and death registration, disease surveillance, and family planning.⁹ Medical consultations are free at the AMC health care facilities, but patients pay for medicines and surgical procedures.¹⁰

The Urban Health Centers are staffed by doctors, nurses, pharmacists, and other support staff, including link workers. Link workers act as a critical and frontline mode of communication between the community and the health care system in the urban and suburban centers where they are located (see Figure 1 for Ahmedabad's medical officer structure).¹¹ Roughly 1,100 link workers are employed by the Ahmedabad Municipal Corporation to provide direct health care assistance to about two million Ahmedabad residents, most of whom live in slums.¹² Link workers perform HIV outreach, polio vaccinations, and medicine distribution. Currently, heat-related maladies are not addressed in an organized way, but they could be integrated into the UHC structure.

Figure 1: Overview of India's Medical Officer Structure



What Defines a Heat Wave in Ahmedabad?

The Met Centre currently determines whether to declare a heat wave once the daily maximum temperature exceeds 40°C (104°F).¹³ A heat wave is declared if the normal maximum temperature should be 40°C or lower and the forecast maximum temperature is actually 5°C to 6°C above normal; it is also declared if the forecast maximum is higher than 45°C (113°F) regardless of the normal maximum. A severe heat wave is declared if the forecast maximum temperature is 7°C higher than the normal maximum.¹⁴ A heat wave is forecast 48 hours in advance and can be declared for a single day.¹⁵

Urban Health Centers and link workers could be key to addressing heat vulnerability on the local level because of their direct access to the public and the long-term relationship of trust they have built.¹⁶ This existing infrastructure can be utilized to implement interventions aimed at reducing residents' vulnerability to heat, thus strengthening the overall existing health system. Crafting

targeted strategies that increase information sharing, communication between government departments and health professionals, heat-related illness surveillance, training and preparedness, and coordination is vital to increase vulnerable populations' resilience to rising temperatures in India.

Taking Heat Seriously: Health Care Professionals Respond

Following IIPH and NRDC's March 2011 workshop on heat vulnerability and adaptation, the AMC replaced the black tar roof of the Smt. Shardaben General Hospital, which treats mostly children, with a reflective white china mosaic roof—providing for cooler indoor temperatures. The hospital also moved its maternity ward from the top floor to the ground floor during the summer to reduce exposure of vulnerable newborns and new mothers to high temperatures. Doctors have observed noticeably cooler temperatures on the top ward and lower infant mortality rates after these changes.¹⁷ About seven of the 64 urban health centers have now installed china mosaic roofs.

Following the March 2012 workshop, many health care professionals were galvanized to take action and expressed commitment to addressing heat vulnerability in Ahmedabad. As one health care professional said, "We will motivate our patients toward this cause...[and] educate them about the heat waves."

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Focus Groups' Findings Regarding Extreme Heat and Health Professionals

To determine the best means of improving the response of Ahmedabad's health professionals to the city's rising heat vulnerability, the current health care infrastructure's approach to extreme heat and the current level of awareness among the general public and health care professionals regarding climate change and heat vulnerability must be assessed. In March 2012, the AMC in partnership with IIPH, NRDC, the Mount Sinai School of Medicine, and the Climate and Development Knowledge Network (CDKN) held two focus group discussions with health care professionals in Ahmedabad to discuss the effects of climate change and the general public's existing response to heat waves. As part of an associated workshop, the project partners held a session on the health effects of extreme heat and climate change and surveyed health care professionals regarding available resources to treat heat-related illnesses, heat stress advice delivered to their patients, and the most heat-vulnerable groups within the city.

The workshop survey found that:

- Over 50% of workshop participants were aware of climate change.
- Over 90% of workshop participants indicated that doctors are residents' primary resource for medical advice during heat waves.
- The top three strategies to avoid heat stress that workshop participants currently recommend to the public are:
 - staying hydrated;
 - dressing appropriately for the heat; and
 - avoiding the direct sun and outdoors if possible.

The following six findings were formulated about heat vulnerability in Ahmedabad based on the focus groups, surveys, and workshop described in the text box on page 5:¹⁸

- **Most medical professionals in Ahmedabad have a general awareness about climate change.** There is a mixed understanding of its causes, but a general consensus that weather patterns locally and nationally are perceptibly shifting.
- **Health care centers currently have limited institutional strategies to address heat vulnerability.** Very few specific initiatives are geared toward raising awareness of excessive heat and its negative health consequences in Ahmedabad. Health care professionals do offer advice to patients on heat-related visits, such as to drink more water and wear light, cotton clothing. Many health centers lack greenery and shade, and most dispensaries are located outside. Currently health care staff and their patients receive little to no communication of weather forecasts from the AMC or the Meteorological Department.¹⁹
- **Health professionals lack training and resources to care for patients with heat illnesses.** Medical professionals in Ahmedabad identified three related layers of challenges to addressing the health impacts of extreme heat: 1) diagnosing heat-related illness, like heat stroke; 2) having the equipment and facilities necessary to triage patients quickly, such as ice or an air-conditioned “cool room;” and 3) treating heat-related illness. Additionally, the records collected by the Integrated Disease Surveillance Project (IDSP)—a government initiative that tracks epidemic-prone diseases like malaria, gastroenteritis, and jaundice—do not document heat-related illness at outpatient departments.
- **Health care capacity may be lowest at the peak of heat vulnerability.** The hottest months include the traditional summer holiday period, including school break from April to June. Many health care professionals may be out for holidays at the same time temperatures are hottest, severely diminishing the health care system’s capacity to deal with increased cases of heat illnesses. During this time, new medical residents start their training and may not be adequately prepared to fill the staffing gap. Power outages and water shortages are also more likely during heat waves and drought, further impairing the health care infrastructure.
- **Traditional cooling methods are already employed by Ahmedabad’s citizens despite the lack of publicly available information about heat vulnerability.**²⁰ Such traditional cooling methods include covering one’s head with a cap, scarf, or cloth; using umbrellas to block sunlight; frequently drinking water, buttermilk, or raw mango juice; sprinkling water outside homes and on roofs; staying indoors during peak heat; planting trees to create shade; using mats made of grass or twigs (which



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Dr. Perry Sheffield of the Mount Sinai School of Medicine leads a focus group discussion with local medical professionals at the March 2012 “Health Effects of Heat in Relation to Climate Change” workshop in Ahmedabad



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A doctor diagnoses a patient at the Beherampura Urban Health Centre in South Zone, Ahmedabad. January 2013



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Patients in line at the tuberculosis registration counter. Beherampura Urban Health Centre in South Zone, Ahmedabad. January 2013

Figure 2: Traditional Cooling Methods in Ahmedabad

Clockwise from top left: Watering the street to cool the air; wearing head scarves; working in the shade; drinking lemonade or buttermilk (chaas).



Images © Nilesh Vilas Thube

are cooler than other materials); and filling jute bags (bags made from natural fibers) with water and placing them under fans (some of these methods are illustrated in Figure 2). While some of these cooling methods have yet to be scientifically validated, their prevalence can be a useful entry point for intervention.

- **Link workers do not currently receive training on heat illness, but they represent an important opportunity to reduce heat vulnerability.** Link workers' lack of preparation regarding heat vulnerability is a missed opportunity to make progress in informing local communities about extreme heat and protecting them from its effects. Link workers directly interact and communicate with poorer communities whose members are unable to reach health centers. Therefore, link workers are well positioned to inform those communities ahead of, and during, extreme heat events. Other groups that have a stake in improving the general health of the population, including resident welfare associations, NGOs, and other civil society organizations and volunteers, could also support these efforts.

POLICY RECOMMENDATIONS: BUILDING RESILIENCE TO EXTREME HEAT IN AHMEDABAD

Although basic institutional infrastructure exists and initial activities supporting public health preparedness for extreme heat in Ahmedabad are under way, more needs to be done to create sustained interventions that will positively impact public health. The AMC can implement strategies to improve interagency communication, collaboration, and project implementation. Coordinated early action among health officials, government departments, and other stakeholders to prepare for extreme heat events is one of the most effective ways to build resilience and protect resident health.²¹ These recommendations, based on IIPH and NRDC's work with partners and public health experts follow a three-pronged approach: 1) increasing public awareness of heat vulnerability and steps residents can take to protect themselves; 2) improving health providers' and the public's access to daily weather reports and forecasts; and 3) capacity-building within the existing health care infrastructure.

Figure 3: Informational pamphlets with tips on keeping cool in Gujarati (left) and English (right), circulated to the public during Ahmedabad's hottest months in 2012



Increasing Public Awareness of Heat Vulnerability

Ahmedabad's routine high temperatures contribute to a lack of appreciation of heat as a serious health concern.²² The AMC should engage its health care professionals to inform the public about the health dangers of heat, the existence of upcoming heat waves, and ways they can protect themselves during an extreme heat event.

- **Assess and prioritize heat-vulnerable communities:** Health care professionals should provide expertise to AMC to help identify the most heat-vulnerable neighborhoods in Ahmedabad by assessing heat risk factors such as high numbers of elderly residents, limited water service, and a history of high incidence of heat-related illness. They should prioritize these locations for educational outreach by link workers and implementation of heat vulnerability reduction measures.
- **Disseminate more information on the health effects of heat.**
 - *Distribute informational pamphlets.* The Health Department should work with AMC to create a multilingual pamphlet on heat stress prevention, in English, Gujarati, and Hindi, for distribution to the public via hospital workers, particularly targeting workers in

at-risk occupations, community groups in vulnerable neighborhoods, and schools.²³ An initial pamphlet with tips and illustrations for keeping cool was circulated to the general public in English and Gujarati during Ahmedabad's hottest months in 2012 (see below).

- *Launch a "heat line" call center.* Health care professionals should support AMC's creation of such a center to provide public support during heat waves, possibly by adding capacity to the existing emergency service.²⁴ The heat line should have an information system to provide heat advisories, tips on heat stress prevention, and advice on what to do if someone is a victim of heat stroke.
- *Develop Heat Health Early Action Response Strategies.* Health care professionals should aid AMC's development of Heat Health Early Action Response Strategies for the community, informed by heat vulnerability assessments. The effort should identify the cooperating agencies, the agency that will take the lead, the heat-vulnerable communities to target, and appropriate materials for distribution. Mobile phone service providers can play an important role in sending text messages as alerts.²⁵

Heat Increases Risk of Infectious Disease

The risk of water-borne diseases, such as jaundice from hepatitis A and gastroenteritis, increases in high temperatures. Most of the underground water pipelines in Ahmedabad are made of plastic or PVC. High heat compromises the pipes' stability, risking infiltration by pollutants and thus, infectious disease.



Ahmedabad residents, August 2011

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- *Involve link workers in heat health campaigns.* Link workers can disseminate heat vulnerability and health protection strategies during their visits with community members. Past successful campaigns that could serve as models include recorded messages on auto-rickshaws that remind the public about the national immunization date for polio and street dramas used to create awareness of tuberculosis.
- **Disseminate public service announcements and health warnings** as soon as a heat wave is anticipated—and ideally at least two to five days in advance of a heat wave—on the radio and in newspapers, in coordination with the Met Center and the AMC Health Department.²⁶ Help set up email listservs to notify relevant stakeholders, and work with private-sector telecom companies on text alerts to circulate warnings.
- **Form partnerships and heat health preparedness networks.**
 - *Deepen engagement with local stakeholders.* Develop a network of multidisciplinary professionals, including public health professionals, clinical medical specialists, urban planners, environmental experts, occupational health experts, and administrators, locally and internationally, to develop actionable heat health programs.
 - *Work with other cities and states to build a heat health preparedness network.*
 - *Support the integration of heat early warning systems into India's Integrated Disease Surveillance System.*

Improving Access to Weather Data and Heat Warnings

Knowing the temperature is vital for action. Without receiving warnings of forecast heat waves, neither the public nor health care providers can take proactive measures to prevent the negative health impacts of extreme heat. It is critical to create a heat early warning system, an organized network of communication similar to an emergency alert system, that can be used during heat waves.

- **Increase communication channels between the Met Center, AMC, and the Health Department**, including Urban Health Center and link workers, to send heat-related health alerts and deepen network collaboration to share data on impending extreme heat events and resulting health effects.
- **Work with the AMC and state government to install displays for temperature and weather forecasts**, so people can avoid unessential travel on the hottest predicted days. Select high-traffic locations where many people can view the information and sites in highly vulnerable neighborhoods where the possibility of the heat island effect is magnified due to lack of trees, dense

vehicle traffic, large amounts of paved area, and local heat-generating sources. Health centers should also post current temperatures and a forecast with at least a three-day outlook. Additionally, physicians and medical officers should advise all patients of the dangers of heat, regardless of the reason for their visit to the health center.

- **Revise the current heat wave advisory threshold** after consultation with the Health Department about what temperatures trigger mortality and morbidity in Ahmedabad. A process of yearly reevaluation of the heat wave advisory threshold should be established, based on the mortality and morbidity data collected as part of the heat early warning system.

Building Capacity in the Health Care Infrastructure

Through its initial heat preparedness steps, Ahmedabad is leading among Indian cities in developing an early warning system. In addition to increasing awareness and access to information about the threat of rising temperatures, certain structural and physical changes to the health care infrastructure are also crucial to the city's medical response to more severe heat waves. To facilitate the health care system's growing capacity to address patients' heat vulnerability, health professionals should be trained to recognize and address early signs of health complications like heat stroke.

Heat Health Preparedness Plans Around the World

CANADA: After a heat wave in 2009, the city of Vancouver formed an Extreme Heat Committee and implemented a Heat Preparedness and Response Plan. This plan identified key responders in the community—including health workers—to promote heat awareness, specifically targeting vulnerable populations.

CUBA: Family doctors and nurses, community-based polyclinic staff, and members of the public are trained in weather and health emergency response as part of a coordinated plan to address health emergency preparedness and extreme weather events. Cuba's Civil Defense Organization, the Institute of Meteorology, the Ministry of Public Health, and the Ministry of Science, Technology, and Environment are among the agencies that collaborate to provide updated information. The public, including young schoolchildren, has access to watch or listen to local weather predictions. Citizens are also taught how to protect their own health and safety, how to do the same for their elderly neighbors, and what to do for pregnant mothers when extreme weather strikes the island.

UNITED ARAB EMIRATES: Abu Dhabi's "Safety in the Heat" program was developed by the UAE's Health Authority to provide guidelines to people who oversee construction laborers and other employees working in extreme heat. Workers and employers were educated about the dangers of working in extreme heat and the precautions to take to protect themselves. As a result, companies have made great strides in decreasing heat-related illnesses among employees.

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■ Conduct heat vulnerability reduction trainings to increase awareness and diagnosis of heat illnesses:

- *Provide a train-the-trainers session for primary medical officers* so they can offer heat-specific advice (symptoms, diagnosis, and treatment including self-monitoring hydration) to their medical staff.
- *Create a training program or multiday workshop for health care providers, ward leaders, and paramedics* on extreme heat and health, as well as specific heat case management and diagnosis, especially during heat waves.²⁷
- *Conduct training programs for link workers* to increase outreach and community-based surveillance for heat illness in slum communities. Link workers should receive informational materials that cover how to counsel patients, what threshold temperatures apply for different levels of treatment, and surveillance protocols.
- *Work with the GVK Emergency Management and Research Institute (EMRI)* to train 108 emergency service professionals on responding to extreme heat emergency cases.²⁸
- *Increase heat stress outreach and education for women in maternity wards* before they leave the hospital, since newborns are particularly vulnerable to heat stress.

- **Identify and relocate the most vulnerable hospital wards** (e.g., the maternity or neonatal ward) from the top floor of hospitals, where the temperatures are highest. Move patients to cooler parts of the building. Measure wards' morbidity and mortality rates before and after location change to evaluate the effectiveness of intervention.
- **Create and implement heat health guidelines** on the diagnosis and treatment of heat stress, heat exhaustion, and heat stroke to reduce and prevent mortality and morbidity. Use materials extensively for training and communication, including posters and pamphlets that inform patients about upcoming heat warnings and offer tips to prevent heat stress.
- **Adopt heat-focused examination procedures at local hospitals and Urban Health Centers:** Examination of admitted patients for signs and symptoms of heat-related illnesses could become routine, adding a brief procedure during the peak-heat summer months at a minimum. The basic statistics of such patients should also be recorded to identify the locations, occupations, and sociodemographics of Ahmedabad's residents who are most vulnerable to heat stress and illness.

- **Work with the state government to issue heat-related illness warnings and increase preparedness to treat patients during heat waves:** Assess hospital staffing plans and protocols to determine adequacy for treating an increased number of patients during heat waves that correspond with staff vacation periods.²⁹ 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 should work with the state government and health officers to include heat-related illnesses as part of the epidemic warnings issued by the state government.

- **Create ongoing heat-related illness surveillance to understand impacts and improve interventions:**

- *Update hospital admission and emergency-case forms* to add information regarding patients' occupations and localities within the city to correlate these with heat stress.

- *Work with private hospitals*, where most residents go for medical services, to collect data prospectively on heat-related cases. Also coordinate with Urban Health Centers, which collect daily case data at the household level for patients who do not go to the public hospitals, to gather data on heat-related illnesses.

- *Work with medical colleges* to share and correlate data on morbidity, mortality, ambulance use, and weather.

- *Conduct studies from 2013 onwards of heat-related illness and death*, setting up systems to gather information from the AMC's emergency medical service calls, clinic visits, hospital emergency departments, hospital admissions, and labor and neonatal wards.

- **Establish an air-conditioned treatment room or ward in each hospital**, and measure its effects in both patient and health care worker populations by comparing data from before and after installation. Determine if having 1 to 2 hours of cool air per day improves health care worker productivity. Also, encourage tree planting at dispensaries and Urban Health Centers that lack proper shade.

- **Conduct an in-hospital drill of a simultaneous heat wave and disease outbreak scenario** after conducting heat health training to ensure proper preparation among hospital workers.

- **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. This analysis will identify more specific factors leading to heat vulnerability in Ahmedabad's residents, so that future strategies can target and reduce these vulnerabilities.



Beherampura Urban Health Centre in South Zone, Ahmedabad. July 2013

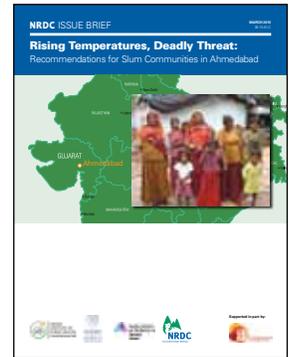
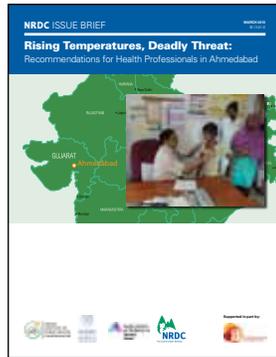
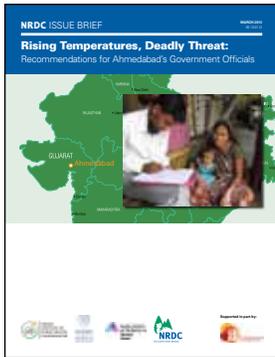
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CONCLUSION

With peak daily temperatures and the frequency and intensity of heat waves predicted to increase with climate change, targeted policy interventions coordinated across multiple levels are needed to reduce the devastating health effects of heat stress in India. Under the Ahmedabad Municipal Corporation, Ahmedabad is leading as the first Indian city to create a comprehensive early warning system and preparedness plan for extreme heat events, but more remains to be done. This report's recommendations aim to identify tangible actions that health care professionals, along with the AMC and other relevant government departments and organizations, can take to increase residents' resilience to rising temperatures within Ahmedabad, including increasing information sharing, communication, preparedness, and coordination. Looking ahead, these extreme heat adaptation strategies can be adjusted for other at-risk regions within and beyond India, helping to protect people from the increasingly severe effects of climate change.

Endnotes

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- 10 The central government announced in 2012 that free essential medicines will be provisioned across all public health care facilities.
- 11 Link workers provide health care to those for whom hospitals and clinics are out of reach due to long distances, short operating hours, or long wait times.
- 12 "AMC Link Workers Shout Slogans Against Civic Body, Held" *Daily News & Analysis*, October 12, 2011. www.dnaindia.com/india/report_amc-link-workers-shout-slogans-against-civic-body-held_1598719; "Link Workers' Issue May Prove Fatal for Anti-Malaria Drive," *Times of India*, June 23, 2009. articles.timesofindia.indiatimes.com/2009-06-23/ahmedabad/28179904_1_anti-malaria-drive-workers-disease.
- 13 India Meteorological Department, Terminologies and Glossary. www.imd.gov.in/doc/termglossary.pdf.
- 14 In seasons when normal maximum temperature exceeds 40°C, a heat wave is declared upon a departure from the normal maximum of 4°C to 5°C. If the forecast maximum temperature is 6°C (or more) higher than the normal maximum, a severe heat wave is declared. For additional information, contact: Director Meteorological Centre, RS/RW Building, Airport Colony, Ahmedabad; Toll free number:1-800-180-1717; email: mcahm@rediffmail.com.
- 15 Discussion at the Heat-Health Roundtable with representatives from the Met Centre, NHL Municipal Medical College, Health and Family Welfare Department, IIPH, and NRDC, Ahmedabad, September 2012.
- 16 Tran, Kathy. "Assessing Vulnerability to Extreme Heat Among Residents of Urban Slums in Ahmedabad, India," (master's thesis, Rollins School of Public Health at Emory University, 2012), p. 5. <http://pid.emory.edu/ark:/25593/br127>
- 17 Such medical perceptions have yet to be scientifically studied.
- 18 "Health Effects of Heat in Relation to Climate Change: Protecting Local Residents From Increasing Extreme in Ahmedabad." NRDC workshop, March 14, 2012.
- 19 The Meteorological Department alerts the state government about upcoming heat waves and other extreme weather forecasts, but health care facilities in specific communities are not part of the chain of communication.
- 20 Dexter Consultancy. Report on Focus Group 1 discussion, March 14, 2012.
- 21 Ebi, Kris, and Knowlton, Kim. Summary of presentation, March 2011 Kickoff Workshop, Ahmedabad, India. Workshop presentation data included in IIPH, NRDC report, "Climate Change and Health Preparedness in India: Protecting Local Communities in Ahmedabad, Gujarat From Extreme Heat," March 2012. www.nrdc.org/international/india/india-health-report.asp.
- 22 NRDC workshop. "Health Effects of Heat in Relation to Climate Change—Building Resilience to and Protecting Local Residents From Increasing Extreme in Ahmedabad." March 14, 2012.
- 23 Providing written materials raises literacy issues. Developing alternative approaches to communicate with the illiterate population warrants further discussion, but this is beyond the scope of this report.
- 24 The Met Department currently has an emergency service number to call for temperature information, but it is not widely operational.
- 25 Some AMC agencies have used text message alerts in the past for special health campaigns run by the AMC.
- 26 Currently, Ahmedabad has a weather forecast capability of 48 hours. For medium range forecast ability, the National Center for Medium Range Weather Forecast will need to be involved.
- 27 Link workers are contractual employees within Ahmedabad's health department who provide visiting or in-home nursing care. Link workers' duties include visiting individual homes to administer medicines to patients and carrying out door-to-door surveys to monitor the city's health.
- 28 The current emergency service is not widely operational, lacking staff to answer calls from the public. This must be remedied to make this an effective intervention. GVK EMRI Emergency Management and Research Institute. www.emri.in/index.php?option=com_content&task=view&id=42&Itemid=65.
- 29 To avoid overburdening an already stretched health staff, such a procedure could be adopted during the peak summer months at a minimum.



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