## 1. Risk Identification

**Case in Point:**

A devastating heat wave struck Ahmedabad, India from April to May in 2010.The heat wave lasted for multiple days with temperatures reaching maximum highs between 44.5-46.8°C. Ahmedabad is the sixth largest city in India, with a population of 5.5 million and boasts an ideal warm and dry climate favorable for heatwaves.2 The 2010 heat wave caused an additional 1,344 deaths; a 43% increase in mortality above the same period in 2009 and 2011.

Mention the Ahmedabad HAP?

1 (Azhar et al 2014)

2 (Ahmedabad Municipal Corporation (AMC) 2015)

Heat waves, or hot weather that lasts for several days, can have a significant impact on society and are associated with a rise in morbidity and mortality.[[1]](#endnote-1)[[2]](#endnote-2) The impact of heat waves on human health can be catastrophic, as seen in the thousands of excess deaths[[3]](#endnote-3) recorded in Europe during the summer of 2003[[4]](#endnote-4)[[5]](#endnote-5)[[6]](#endnote-6) and in the Russian Federation in 2010.[[7]](#endnote-7)2 Between 1994 and 2013, extreme temperatures affected 93 million people and caused 160,000 deaths around the world.[[8]](#endnote-8)

**Health impacts**

Heat waves are an emerging public health problem. By increasing heat load and core body temperature, heat waves can give rise to a number of heat-related illnesses or death. Most heat related deaths are related to an exacerbation of preexisting health conditions, and are thus not caused by the physical increase in body temperature. Heat related illnesses include:

* severe dehydration
* acute cerebrovascular accidents
* heat cramps
* heat exhaustion,
* heat syncope (fainting)
* heat edema (swelling)
* heat stroke
* Exacerbation of preexisting chronic conditions (e.g. cardiovascular, cerebrovascular, kidney disorders and respiratory diseases)

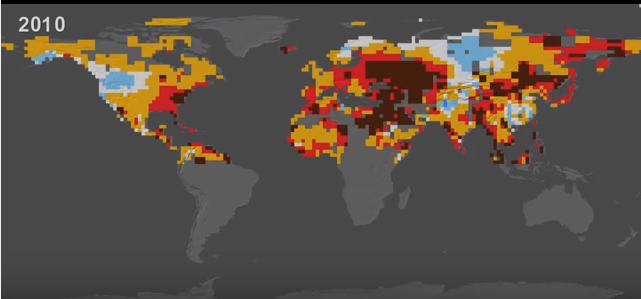
**Mechanisms**

Hot environments can overwhelm the body’s heat-dissipating mechanisms, resulting in a rise of core temperature. When exposed to high temperatures, the body undergoes a physiological process to increase blood flow to the skin and initiate sweating. The evaporation of sweat helps the body cool off and maintain a safe body temperature. This physiological response can strain the cardiovascular system,3causing a number of negative health impacts, or even death in persons with impaired cardiovascular systems due to existing health conditions. Additionally, heatwaves can exacerbate ozone smog causing harm to people with respiratory illnesses, such as asthma.[[9]](#endnote-9)

**Where is extreme heat a health problem?**

Periods of extreme heat are a global problem, however southern and eastern Asia, Europe,3**Error! Bookmark not defined.** parts of the United States,**Error! Bookmark not defined.** and Australia have been particularly impacted by a significant number of excess deaths from heatwaves.3 The area affected by heatwaves has increased over the past few decades and the duration and frequency of extreme temperature events is expected to increase with climate change.2 Large urban areas are at heightened risk due to the Urban Heat Island (UHI) effect,3[[10]](#endnote-10) which causes temperatures to be multiple degrees higher in cities (average of 3.5-12°C higher)**Error! Bookmark not defined.** than surrounding areas. The UHI phenomenon is especially important as the majority of the world’s population lives in cities.[[11]](#endnote-11)

Extreme summer heat events around the world[[12]](#endnote-12)



**Who is at risk?**

Extreme heat events can occur anywhere in the world and over large geographical areas. Urban areas are at increased risk to heat waves due to the Urban Heat Island effect, making populations living in cities especially vulnerable. Populations that are more exposed to heat and are unable to adapt due to socioeconomic factors, such as the urban poor or indoor and outdoor workers, may also be at increased risk of suffering health consequences of heat waves. 113 However, most significant risk factors are physiological and age-related. The elderly have reduced thermoregulatory responses, age-related physiological changes, and often consume less water, all of which contribute to a heightened risk of heat related illnesses. Furthermore, chronically ill persons suffering from cardiovascular disease, peripheral vascular diseases or respiratory diseases are at heightened risk. Some studies have suggested that certain population groups that are dependent on others for care (such as the physically disabled, or children) may , face heightened risks to heat-related illnesses when they are unable to seek protective behavior.3**Error! Bookmark not defined.**[[13]](#endnote-13)

**Illnesses associated with extreme heat exposure[[14]](#endnote-14)[[15]](#endnote-15)**3

* Severe dehydration
* [Heat cramps](http://www.bt.cdc.gov/disasters/extremeheat/faq.asp)
* Fatigue
* Heat syncope (fainting)
* Heat edema
* Heat Exhaustion
* Death
* Heat stroke
* Heat rash

**2. Extreme Heat Monitoring and Forecasting Tools useful for Health Risk Assessment**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Risk Monitoring Tools | | Global | Regional | National | Health |
| [Heat-Health Watch – UK](http://www.metoffice.gov.uk/public/weather/heat-health/%20-%20?tab=heatHealth) | Service operates annually between June and mid-September to forecast maximum day and nighttime temperatures and monitor temperatures. Once a heat threshold is passed, warnings are sent to health professionals and updated on their website |  |  | ● | ● |
| [France’s Heat Health Watch Warning System](http://vigilance.meteofrance.com/) | Advisories and monitoring of high temperatures occurs in France between June and August. The Met service coordinates and collaborates with the Ministry of Health to issue warnings about potential heatwaves. |  |  | ● | ● |
| [Heatwave Service for Australia – Bureau of Meteorology](http://www.bom.gov.au/australia/heatwave/) | National heatwave monitoring and forecasting service for Australia. Provides monitoring from the past two three day periods and forecasts heatwaves for the next three to five days. |  |  | ● | ● |
| [National Weather Service – National Oceanic and Atmospheric Administration](http://www.nws.noaa.gov/om/heat/ww.shtml) | Heat-health warning system for the U.S. Each NWS Forecast Office issues a specific one for their region. They also provide a contiguous [U.S. forecast map](http://graphical.weather.gov/sectors/conus.php) of maximum and minimum temperatures in real-time and [maximum heat index forecasts](http://www.wpc.ncep.noaa.gov/heat_index_MAX.shtml). |  |  | ● |  |
| Risk Forecasting Tools | | **Global** | **Regional** | **National** | **Health** |
| [Extreme Heat Risk Map (EEA)](http://www.un-spider.org/links-and-resources/data-sources/extreme-heat-risk-map-eea) | Online interactive GIS map of the heatwave risk of European cities based on historical data and climate change projections. |  | ● |  |  |
| [EuroHEAT](http://www.euroheat-project.org/dwd/index.php) | Medium range heatwave forecasts for Europe for 1-9 day lead times. Forecasts are updated each day and issued for the next 9 days. The forecasts from the past nine days are also available so users can monitor the development of the event. |  | ● |  |  |
| [Meteoalarm](http://www.meteoalarm.eu/?lang=en_UK) | Provides extreme heat warnings and alerts for Europe. Information is displayed on an interactive map with available reports and warnings that can be downloaded for each country that have high alerts. |  | ● |  |  |
| [Climate Prediction Center - NOAA](http://www.cpc.ncep.noaa.gov/products/predictions/threats/threats.php) | Provides forecasts for excessive heat and above normal temperatures for the United States at 3-7 day lead times. |  |  | ● |  |

## 3. Resources for Health Risk Management during Extreme Heat

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Risk Management and Communication Tools | | Global | | Regional | National | Health |
| Guidance Documents |  |  |  | |  |  |
| [Communicating the Health Risks of Extreme Heat Events](http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/climat/heat-chaleur/heat-chaleur-eng.pdf) | Document for health professionals and emergency managers about how to best communicate the risks of extreme heat. |  |  | | ● | ● |
| [Heatwave Plan for England](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/429384/Heatwave_Main_Plan_2015.pdf) | Provides information about extreme heat and health in England so that people can prepare for, know where to find alerts, and prevent health issues associated with heatwaves. |  |  | | ● | ● |
| [Heatwave Plan Ahmedabad India](http://www.nrdc.org/international/india/extreme-heat-preparedness/files/ahmedabad-heat-action-plan.pdf) | Document discusses how to build awareness, initiate warnings and coordination, build capacity in the health sector, and reduce heat exposure in India. |  |  | | ● | ● |
| [WHO/WMO Heatwaves and Health: Guidance on Warning-System Development](http://www.who.int/globalchange/publications/heatwaves-health-guidance/en/) | Guidance document for practitioners, National Meteorological and Hydrological Services (NMHSs), and National Health Services (NHSs) surrounding extreme heat and how to prepare for and develop heat health warning systems. | ● |  | |  | ● |
| [WMO Guidelines on Biometeorology and Air Quality Forecasts](https://www.wmo.int/pages/prog/amp/pwsp/pdf/TD-1184.pdf) | Guidance document for NMHSs on methods of incorporating biometeorology and air quality forecasts into their products and services. | ● |  | |  |  |
| [WHO/WMO Atlas of Health and Climate](http://www.who.int/globalchange/publications/atlas/report/en/) | Provides scientific information on the connection between weather and climate and health challenges. |  |  | |  |  |
| [WHO Heat Health Action Plans](http://www.euro.who.int/en/publications/abstracts/heathealth-action-plans) | Guidance document for improving public health response to heatwaves through the development of heat-health action plans. | ● | ● | | ● | ● |
| [CDC’s Climate Change and Extreme Events](http://www.cdc.gov/climateandhealth/pubs/ClimateChangeandExtremeHeatEvents.pdf) | Provides information of how to prepare and respond to extreme events, including extreme heat. |  |  | | ● | ● |
| Web Resources |  |  |  | |  |  |
| [Extreme Heat Toolkit for Health Sector (HealthCanada)](http://www.hc-sc.gc.ca/ewh-semt/pubs/climat/index-eng.php#toolkit) | Provides information about extreme heat and health including brochures, reports, and guidebooks. | ● |  | | ● | ● |
| [CDC's Extreme Heat and Your Health](http://www.cdc.gov/extremeheat/index.html) | Supplies information on how individuals can protect themselves from extreme heat as well as provides resources for public health professionals. | ● |  | | ● | ● |
| [Disaster Information Management Research Center](https://sis.nlm.nih.gov/dimrc/extremeheat.html) | Provides resources and information pertaining to extreme heat and health. | ● |  | | ● | ● |
| [Environmental Protection Agency](http://www.epa.gov/natural-disasters/extreme-heat) | Tips and resources for preparing for and dealing with extreme heat. |  |  | | ● | ● |
| [National Oceanic and Atmospheric Administration](https://toolkit.climate.gov/topics/human-health/extreme-heat) | U.S. Climate Resilience Toolkit – Extreme Heat. Presents information on the background of extreme heat in the U.S. and its impacts on health. Provides links to featured tools and case studies in the U.S. |  |  | | ● | ● |
| [Natural Resources Defense Council (NRDC) – Extreme Heat](http://www.nrdc.org/health/climate/heat.asp) | Provides information on extreme heat and health, along with maps of the U.S. depicting heat exposure, and resources on the topic. [Future risks to health](http://www.nrdc.org/globalwarming/killer-heat/). |  |  | | ● | ● |
| Key Relevant Programs and Partners |  |  |  | |  |  |
| [World Meteorological O](https://www.wmo.int/pages/themes/climate/applications_health.php)rganization | Supports the health sector with weather and climate science tools, services, and resources. | ● |  | |  |  |
| [World Health O](http://www.who.int/topics/climate/en/)rganization | Provides support to improve health outcomes for countries around the world. | ● |  | |  | ● |
| [Centers for Disease Control and Prevention](http://emergency.cdc.gov/disasters/extremeheat/) | Provides health information in relation to extreme heat and guidance on how to prepare, respond, and stay safe during heatwaves |  |  | | ● | ● |
| [Health Canada](http://www.hc-sc.gc.ca/index-eng.php) | Provides sound scientific knowledge and communicates public health threats to promote and support healthier lives. |  |  | | ● | ● |
| [National Oceanic and Atmospheric Administration](http://cpo.noaa.gov/AboutCPO/IntegratedInformationSystems/NIHHIS/NIHHISResources.aspx) | Climate Program Office seeks to understand, communicate, and educate the risks associated with extreme heat. |  |  | | ● | ● |
| [UK MET Office](http://www.metoffice.gov.uk/health/public) | Provides health forecasts for health conditions that are affected by weather in order to help people take preventative action. |  |  | | ● | ● |

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