

NATIONAL HEAT HEALTH ACTION GUIDELINES

Guide to extreme heat planning in
South Africa for the human health sector



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Disclaimer

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Responsible National Department of Health Unit

The cluster responsible for co-ordination of the National Heat Health Action Guidelines is Environmental Health and Port Health.

Dissemination Plan

The plan will be circulated to provinces and municipalities after the approval by the Director-General through emails and hard copies. Communication will assist with loading the plan into the departmental website where the clients/ members of the public and officials can be able to access the document. Provinces and municipalities will be capacitated on the document for implementation

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Dr SSS BUTHELEZI

Director-General: Health

Climate change, the biggest health threat of this century, is caused by human activities releasing greenhouse gases which trap heat in the Earth's atmosphere. This increases the Earth's temperature and leads to extreme weather events such as heat waves, droughts, floods and wildfires. South Africa has been experiencing heat waves late 2019 and early 2020. Mortality and morbidity increase considerably during periods of high temperatures, especially among vulnerable groups, and those with cardiac or respiratory conditions.

The National Department of Health (NDoH) has thus prepared these National Heat Health Action Guidelines, which will assist Provincial Departments of Health, District Health Services and Municipalities to reduce the burden of disease from heat exposure. The guidelines support the design and implementation of World Health Organization's Heat Health Action Plans, and outline the prevention and management of heat-associated illnesses.

These guidelines are aligned to the Sustainable Development Goals (SDG's), the Paris Agreement, the Constitution of the Republic of South Africa, and the National Climate Change and Health Adaptation Plan and other related legislations. These guidelines are to be implemented by health professionals not only in prevention but also management of the heat related illnesses. The guidelines thus address both types of heat exposure. The health sector is the lead agency on the Heat Health Action Plan, responsible for coordinating across other departments and stakeholders, including those outside of government.

We would like to thank everyone who has participated in the development of this guideline.

A handwritten signature in black ink, appearing to be 'S. Buthelezi', written over a horizontal line.

DR SSS BUTHELEZI
DIRECTOR-GENERAL: HEALTH
DATE: 15 June 2021

Executive Summary

Climate change can result in health impacts which can occur on isolated days of extreme heat (maximum temperature >35°C) or during heat waves, defined as 3 consecutive days when the maximum temperature is 5°C above the mean maximum for the hottest month in that area.

The guidelines thus address both types of heat exposure. Extreme heat can cause dehydration, heat cramps, heat exhaustion and heat stroke which manifests as damage to the brain, kidneys and other organs. The majority of deaths and other health conditions during extreme heat are, however, not from heat stroke, but from exacerbations of chronic medical conditions or in frail elderly people. Extreme heat can also affect mental health, including worsening of anxiety, irritability, interpersonal violence and gender-based violence.

Extreme heat also indirectly influences health through outbreaks of food- and water-borne infections, enlarging the areas affected by malaria and other vector-borne infections, increasing evaporation from dams and rivers, and damaging crops.

The size of the impact depends on the intensity and duration of a temperature event, and the adaptability of the population and health system. Some groups have higher exposures to heat, or are more physiologically or socio-economically vulnerable to heat stress.

The elderly, infants and young children are at highest risk. Pregnancy raises the vulnerability of women to heat exposure and has been linked with preterm birth and stillbirth. People with chronic medical conditions, especially cardiac, respiratory, and cerebrovascular disease, diabetes-related conditions, kidney disorders and HIV infection often have limited ability to respond to heat stress. Exposure to extreme heat can cause severe dehydration and other stressors on the body, exacerbating these conditions.

People living in poor households or homeless also have high risks, as they may have limited access to cold water and fans, for example, or even to shaded areas. Urban heat islands are hotter than surrounding areas as concrete and tar absorb heat. Tin sheeting in informal settlements is unable to reflect heat and provides little insulation. Indoor temperatures in poorly constructed houses, clinics and schools can be 4°C warmer than outdoors. Urban environments may lack trees and other vegetation that provide shade and increase cooling through evaporation. High temperatures in outdoor and indoor workplaces impact on workers' health, through sunburn, dehydration and exhaustion, and can reduce labour productivity.

Demand for health services rises during extreme heat, including for primary health care, hospital admissions and emergency medical services. Heat exposure also causes fatigue, drowsiness and irritability in health workers, affecting their performance. Additionally, heat stress in schools reduces concentration and affects health in both pupils and teachers, reducing educational performance.

Heat Health Action Plans

A package of practical, feasible, and low-cost interventions at the individual and community level can assist people to adapt to high temperatures. The health sector is the lead agency on the Heat Health Action Plan, responsible for coordinating across other departments and stakeholders, including those outside of government. Within the Department of Health, the plan will be led by Environmental Health (EH) and Emergency Medical Services (EMS) (Disaster Management), with the Health Promotion and Communication Directorate acting as a key partner. Provinces and municipalities need to develop heat health plans informed by these guidelines. Ward-Based Outreach Teams (WBOT), Community Development Workers (CDW) and Community Health Workers (CHW) are key for building community awareness and ensuring effective responses during heat extremes. An operational plan needs to set out the specific procedures that clinics and hospitals should take before and then during periods of extreme heat. Health workers require training on how to prevent the impacts of heat, and to recognise and treat patients with heat-related illnesses, such as heat exhaustion or stroke.

The action plan consists of several elements. Heat-health Warning Systems use weather forecasting to identify when a dangerous temperature level will be exceeded. Warnings then trigger a set of actions, which depend on whether the anticipated heat levels are 'stressful', 'dangerous to health' or at 'the highest-level'. Alert messages are shared with government departments, the media and public. Research is presently evaluating whether the current heatwave definition actually represents the point at which negative health outcomes occur, which depends on the ability of the built environment to protect people from extreme heat.

The Heat Health Information Plan needs to deliver useful, timely, accessible, consistent and trustworthy information to their target audience, with a focus on vulnerable populations.

Knowledge around climate change in general is low in South Africa and many policy makers and health workers are not even aware that heat is a major public health problem. High temperatures are often seen as something to be tolerated, rather than a major health risk. Educating the public on the risks of extreme heat and the actions that

are needed is thus a major priority. Messaging should cover the practical measures needed to keep a home cool, ways of seeking cool environments, how to keep safe if one is outdoors, the importance of hydration, what to do to help others, and what to do when they or others feel unwell.

Heat adaptation services should target services at vulnerable groups. Patients with chronic conditions need advice on fluid intake and the specific actions to take during periods of extreme heat. Adequate hydration and reduced heat exposure are key for people doing outdoor sports or school activities. These activities may need to be cancelled or shifted to the cooler parts of the day.

Regulatory frameworks and labour standards around heat are required for controlling heat hazards in the workplace. Measures could include adjusting working hours to start earlier in the day, lengthening break times, protection against direct sunlight, such as through exterior shaded areas or an indoor 'cool space', having cool water readily available, increased ventilation, misting ventilation systems and use of wide-brimmed hats for outdoor workers. Lightweight, light-coloured loose-fitting clothing is optimal.

Long-term initiatives are a central part of the action plan. Most importantly, renewed efforts to prevent further greenhouse gas emissions need to underpin all climate change activities. Initiatives are also needed to reduce indoor heat exposure in homes, health facilities, workplaces, schools, prisons and other types of buildings. Air conditioning is effective in reducing high temperatures, but is energy-intensive, expensive and adds to greenhouse gas emissions, further worsening climate change. Cooling of buildings can be achieved using natural ventilation, electric or solar-powered fans, and cooling systems with water sprays, which may also be placed outdoors. Public shaded areas, shelters or 'cool rooms' are required in each community. Changes to the built environment are especially important for pupils, teachers and health workers who spend time in buildings made from converted shipping containers.

People generally shelter indoors during hot weather. The indoor climate is thus particularly important for longer-term policy interventions, including improved urban planning and housing construction. Painting roofs and walls white increases reflection of sunlight, enhancing cooling. Insulation keeps the heat in when it is cold and keeps the heat out when it is hot. Increasing green spaces and 'greening' in general is central to all heat-health plans. Growing trees and leafy plants near windows act as natural air conditioners. Green roofs covered with vegetation help reduce average temperature. Parks reduce urban temperatures and planting trees provides solar protection to buildings and has important psychological benefits.

As with all health plans it is important to monitor and evaluate their implementation and effectiveness. Timely health data are required for monitoring, including data on all-cause mortality, and the number of hospital admissions, primary health clinic visit, ambulance calls and visits to casualty departments during periods of extreme heat. "On-line" programmes or applications ("apps") could be used for monitoring purposes. Monitoring can include assessing temperatures in informal settlement housing, clinics, schools and prisons. Periodic evaluation of the effectiveness of the plan is needed, including assessment of knowledge levels of the population about what actions to take during periods of extreme heat.

Abbreviations

CDC	Centres for Disease Control and Prevention
CDC	Communicable Disease Control
CDW	Community Development Worker
CHW	Community Health Worker
CMS	Chronic Medical Services
COPD	Chronic obstructive pulmonary disease
COP	Conference of Parties
CSIR	Council for Scientific and Industrial Research
DBE	Department of Basic Education
DOH	Department of Health
EH	Environmental Health
EHP	Environmental Health Practitioner
EHS	Environmental Health Services
EMS	Emergency Medical Services
FPS	Forensic Pathological Services
GPs	General Practitioners
HHWS	Heat Health Warning System
HIV	Human Immunodeficiency Virus
IPCC	Intergovernmental Panel on Climate Change
NDP	National Development Plan
NCCRP	National Climate Change Response Plan
ORT	Outbreak Response Team
PHC	Primary Health Care
PM	Particulate Matter
PPPs	Public-Private Partnerships
SAMRC	South African Medical Research Council
SAWS	South African Weather Services
SDGs	Sustainable Development Goals
SMS	Short Message Service
TB	Tuberculosis
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
WASH	Water, Sanitation and Hygiene
WBOT	Ward-Based Outreach Team
WC	Western Cape
WHO	World Health Organization
WMO	World Meteorological Organization
CO ₂	Carbon Dioxide
°C	Degrees Celsius
µm	Micrometre

1 Introduction

Climate change is considered the biggest global health threat of the 21st century¹ and according to the United Nations it is the 'greatest challenge facing this generation'². Climate change is caused by human activities releasing greenhouse gases which trap heat in the Earth's atmosphere, causing a steady increase in the global average temperature, and in the frequency, intensity and duration of heat waves.

In the past 100 years the average temperature of the world has risen by 1°C and the average temperature has increased by as much as 2°C in many parts of South Africa³. If greenhouse gas emissions are not reduced, temperatures may increase by more than 4°C over the interior of Southern Africa by 2100, and by more than 6°C over the western, central and northern parts of the country³. Currently, it is expected that provinces like the Northern Cape, North West and Limpopo will have between 20 and 40 very hot days each year, defined as days where the maximum temperature is above 35°C. At those temperatures, wildfires become more common and can cause considerable loss of life and a range of negative impacts on health. Wildfires also have long term health impacts through the malnutrition and poverty that occur when fires burn crops, livestock, housing and damage infrastructure.

Indoor temperatures in houses, clinics and schools are about 2 to 4°C warmer than outdoors if these structures are made of steel, are painted dark colours, or have little or no heat insulation in the roof or walls⁴⁻⁶. Exposure to heat extremes is particularly dangerous in areas with high levels of air pollution or within homes where air quality is affected by burning coal, wood, or paraffin for cooking. The combination of air pollution and heat can exacerbate health effects. This is concerning as air pollution levels in some cities of South Africa are among the highest worldwide and around a quarter of households in rural areas make use of coal, wood or paraffin for cooking⁷.

There is little awareness among policy makers and the public that heat is a major public health problem. Many people see heat as a nuisance to be tolerated, rather than something that can have major negative effects on health. In fact, many of the temperatures presently being recorded in South Africa are close to the temperature limits at which humans can survive. Exposure to extreme heat can cause death by inducing heatstroke, which damages the brain, the kidneys, and other organs. But, more commonly, exposure to heat can increase one's chances of succumbing to a heart condition, a stroke, or respiratory problems in those already living with chronic conditions. The size of the health impacts largely depends on the vulnerability of the affected population.

The changing climate in South Africa has affected health in a number of ways aside from increases in temperature⁷ (Figure 1), including through extreme weather events, such as droughts, floods, storms, tornados and fires⁸. These events cause major health problems, such as:

- Loss of life from injuries or drowning
- Health consequences for survivors of extreme weather, such as the negative effects from population displacement or increased poverty
- Water-borne diseases caused by a scarcity of fresh water for washing and hygiene, water pollution and unsafe drinking water due to damage to infrastructure
- Mental health conditions such as post-traumatic stress and depression are very common after these events
- An increase in respiratory, cardiac and allergic illnesses due to worsening air pollution from wildfire

Melting of ice glaciers owing to global warming is causing sea levels to rise. Sea level rise and storm surges can lead to a range of health and social problems, such as:

- Loss of livelihood and food insecurity as a result of changes to fisheries, and agriculture in low-lying areas
- Population displacement – for example, some islands in the Pacific have been submerged by rising sea levels, and some populations in low-lying areas of South Africa may also be displaced as the sea rises in future

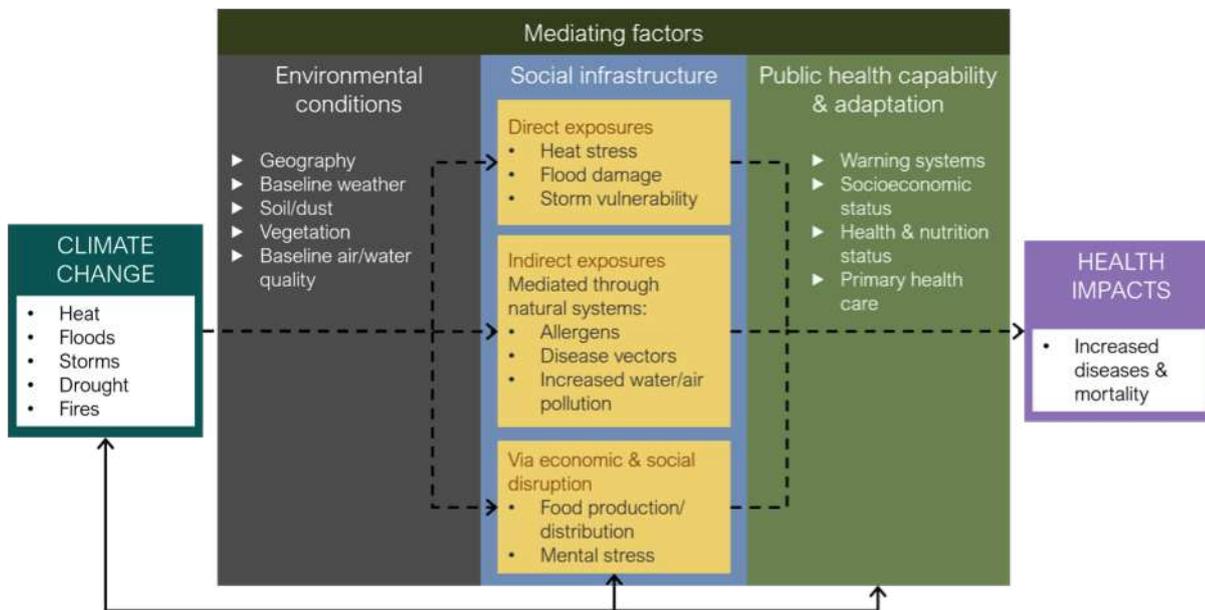


Figure 1: Climate change and factors that mediate the impact of climate change on health. Adapted from Smith et al, 2014.⁹

The environmental consequences of climate change can also affect health indirectly through increasing levels of poverty, damage to infrastructure, additional stress on health systems and breakdown in social protection systems⁷. High temperatures, droughts and other changes in climate may undermine crop growth and quality, and the health of livestock, reducing food security^{10, 11}.

Unless concerted action is taken, climate change will jeopardize the considerable progress made in South Africa, not only in health, nutrition, and water and sanitation, but also in health systems strengthening and improved living standards more broadly. As part of the steps that the South African government is taking to protect the country from climate change, the National Department of Health has prepared National Heat Health Action Guidelines for the Health Sector. These guidelines aim to assist the Health Sector to prepare for the impacts of extreme heat in South Africa.

Extreme heat exposure can occur both on very hot days (days when the maximum temperature exceeds 35°C), as well as during heat waves, which the South African Weather Service (SAWS) defines as three consecutive days when the maximum temperature is 5°C higher than the mean maximum for the hottest month in that particular place. It is also important to acknowledge that sizable health impacts can even occur at temperatures below 35°C in certain population groups or urban areas, for example¹². The term extreme heat is used in these guidelines to mean both ‘heat waves’ and very hot days (maximum temperature >35°C).

2 Purpose of the Guidelines

The purpose of the guidelines is to ensure that the health sector is prepared to effectively respond to rising temperatures across South Africa. The guidelines are aimed at Provincial Departments of Health, District Health Services and Municipalities to support them in designing, implementing and improving Heat Health Action Plans to prevent the negative effects on health caused by increasing temperatures and heatwaves.

Specifically, the guidelines cover:

- The types of health conditions that may occur with exposure to high temperatures
- The population groups that are vulnerable to heat extremes and the specific health risks associated with each group
- Prevention and management of heat-associated illnesses
- The development of effective strategies and response planning to shape a Heat Health Action Plan that addresses heat-health risks
- Strategies to ensure the involvement of stakeholders and coordination across different government departments
- The evaluation of the health sector response to extreme heat and the monitoring of implementation of these guidelines

The guidelines has been developed based on guidance from the World Health Organization and World Meteorological Organization^{13, 14}, and related guidelines in several other countries¹⁵.

3 Existing legislation into which these Guidelines fit

Legislative mandate

International

1. Sustainable Development Goals (SDGs), including Goal 13 which focuses on taking urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy. <https://sustainabledevelopment.un.org/post2015/transformingourworld>
2. The Paris Agreement, which was made within the United Nations Framework Convention on Climate Change (UNFCCC), and covered greenhouse-gas-emissions mitigation, adaptation, and finance, signed in 2016. <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>
3. The Intergovernmental Panel on Climate Change (IPCC) Reports (<https://www.ipcc.ch/reports/>)

Local

1. The Constitution of the Republic of South Africa. (<https://www.justice.gov.za/legislation/constitution/SACConstitution-web-eng.pdf>) Section 24 stipulates that: Everyone has the right
 - a. to an environment that is not harmful to their health or well-being; and
 - b. to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:
 - i. prevent pollution and ecological degradation;
 - ii. promote conservation; and
 - iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.
2. National Building Regulations and Building Standards Act 103 of 1977
3. National Health Act 61 of 2003
4. National Environment: Air Quality Act 39 of 2004
5. National Climate Change Response Policy (NCCRP) 2011 https://www.environment.gov.za/sites/default/files/legislations/national_climatechange_response_whitepaper.pdf
6. National Environmental Health Policy 2013
7. National Environmental Health Norms and Standards for Premises and Acceptable Monitoring Standards for Environmental Health 2015

PART A

This Part outlines the potential impacts of extreme heat on health and health systems in South Africa. Thereafter, Part B describes the priority actions that can be taken to reduce these impacts.

4 Impacts of heat on health in South Africa

High temperatures, combined with other conditions, give rise to heat waves that can claim the lives of thousands of people and cause a range of serious health conditions. During periods of extreme heat the overall mortality rates in South Africa increase considerably, especially deaths from cardiac and respiratory conditions^{16,17}. Mortality related to extreme heat in the country is highest among children under five years and elderly people. Heat exposure can also cause substantial mental stress and raise levels of violence, including homicide, and possibly suicide and gender-based violence^{8,18}.

The total amount of heat that the body is exposed to depends on the amount of external heat from the environment, but also on the internal body heat that is made. Internal heat can be increased by activities such as manual labour and sports, and in patients with fever. The exact temperature when health impacts may occur also varies by factors such as humidity and wind, level of vulnerability of the particular population, acclimatization and preparedness for heat conditions in each setting. Overall, the size of the impact will depend on the timing, intensity and duration of a temperature event, and the adaptability of the population, infrastructure and health system.

Though the guideline focuses on heat waves, it is important to acknowledge that sizable health impacts occur even on isolated days which have high temperatures, but do not fulfil the SAWS definition of a heatwave. It is for this reasons that these guidelines cover both 'heatwaves' and shorter periods of very high temperatures.

Health consequences of extreme heat can be immediate or occur several days later. The impacts of extreme heat can also be both direct, affecting the body's physiological functions, as well as indirect, by decreasing food security and increasing outbreaks of gastroenteritis, for example⁸. Extreme heat conditions can also alter the transmission of infectious diseases, and impact on health service delivery, air quality, and critical infrastructure such as electricity, water and transport. Rising temperatures also heighten demand for water and electricity for cooling, which can cause 'blackouts'¹⁹. Clinic visits and hospital admissions can increase, often at rates that overwhelm the capacity of the health system.

Figure 2 summarises the range of health problems that can occur during heat events. When health systems are inadequately prepared to cope with heat extremes, the most vulnerable can suffer major consequences. These include the elderly, infants and children, pregnant women, outdoor and manual workers, people living in informal settlements, people with mental health conditions, athletes and the poor. Temperature extremes worsen chronic conditions, including cardiovascular, respiratory, and cerebrovascular disease and diabetes-related conditions. It is very important to note that most of the deaths and other health conditions that occur during extreme heat are not from heat stroke, but rather from exacerbations in patients with chronic medical conditions or in frail elderly people.

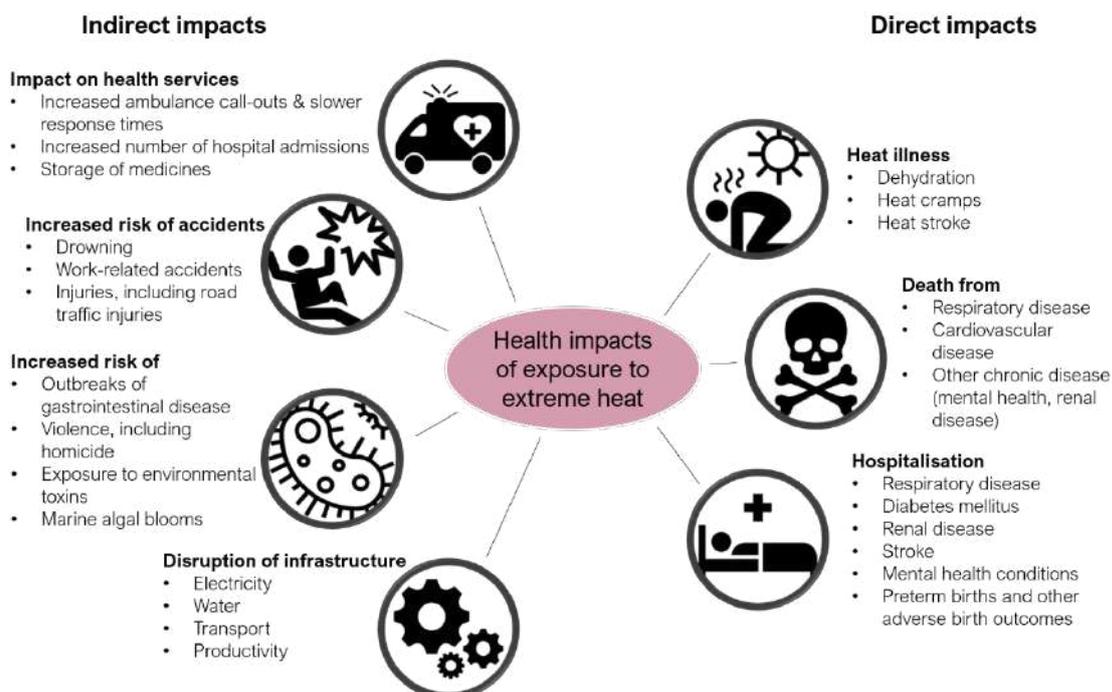


Figure 2: Extreme heat events can directly impact on health, make other health problems worse or indirectly impact on health through behavioural changes, infections and impacts on health services and infrastructure. Adapted from WHO, n.d.¹³

4.1 Direct impacts of extreme heat

Heat cramps, heat exhaustion and heat stroke

Heat cramps are painful muscle spasms in the abdomen, arms or legs, usually following sports or manual labour during hot weather. Heat exhaustion is a heat-related illness that can occur after a person has been exposed to high temperatures, and it often is accompanied by dehydration. When excessive heat exposure overwhelms the body's ability to maintain its temperature at around 37°C, then the core body temperature increases, causing hyperthermia. This can lead to a range of health effects, the worst of which is heat stroke, which is life threatening. Table 1 in the Appendix describes the signs, symptoms and medical management of people with heat-related medical conditions.

Exacerbation of existing conditions

Only a few heat-related deaths and illnesses are directly caused by elevations in body core temperature – deaths due to heatstroke – while many more are related to the worsening of existing health conditions²⁰. Exposure to extreme heat can cause severe dehydration and other stressors on the body, and thereby worsen chronic respiratory conditions, cardiac conditions, kidney disorders, including renal stones, mental health conditions and HIV-infected people who have WHO Stage III and IV diseases, such as TB and Pneumocystis carinii pneumonia. Elderly people and pregnant women with existing conditions are especially vulnerable.

Other direct impacts of extreme heat

Extreme heat can have sizable impacts on mental health, as with all the manifestations of climate change. Violence and road traffic injuries increase during hot weather as high temperatures increase irritability and aggressive thoughts, especially among men¹⁸. Heat stress in schools can also reduce concentration and learning, cause dehydration, fainting and aggression, and raise risks for heat stroke during sports²¹. Impacts of heat on specific vulnerable population groups, such as outdoor workers, are described in detail below.

4.2 Indirect impacts of high temperatures on health

Extreme heat also has important effects which indirectly influence health. Many health conditions are climate-sensitive and can become more frequent or severe with an increase in temperature or humidity, for example.

Food- and water-borne infections are more common at higher temperatures, causing an increase in gastrointestinal illnesses and visits to primary health care facilities for diarrhoea^{22, 23}. Outbreaks of typhoid and cholera are most concerning. High-temperature could also potentially increase the number of listeriosis cases²⁴.

Increases in temperature over time can enlarge the geographical range of vectors, potentially increasing the number of people exposed to vector-borne infections. For example, the mosquitos that carry diseases such as malaria, dengue fever and Rift Valley Fever²⁵, can now survive in areas that were previously too cold for them. The geographical range of rodents and thus rodent-borne diseases also depends on temperature. Outbreaks of plague have occurred in South Africa and neighbouring countries, and have been linked to spikes in temperature.

Extreme heat raises evaporation from water sources, damages crops and can harm livestock, raising risks of malnutrition.

4.3 Vulnerable groups

Rising global ambient temperatures affect all age groups and populations. However, some groups are more exposed to these heat increases, or more physiologically or socio-economically vulnerable to heat stress and exacerbations in their existing illnesses. Gender can play an important role in determining heat exposure and vulnerability to heat-related conditions.

Risks may be raised due to the particular characteristics of individuals, such as age or co-existing health conditions; risks due to living in certain types of housing and residential areas, and risks due to low ability to adapt to hot weather conditions due to socioeconomic and community risk factors (Figure 3).

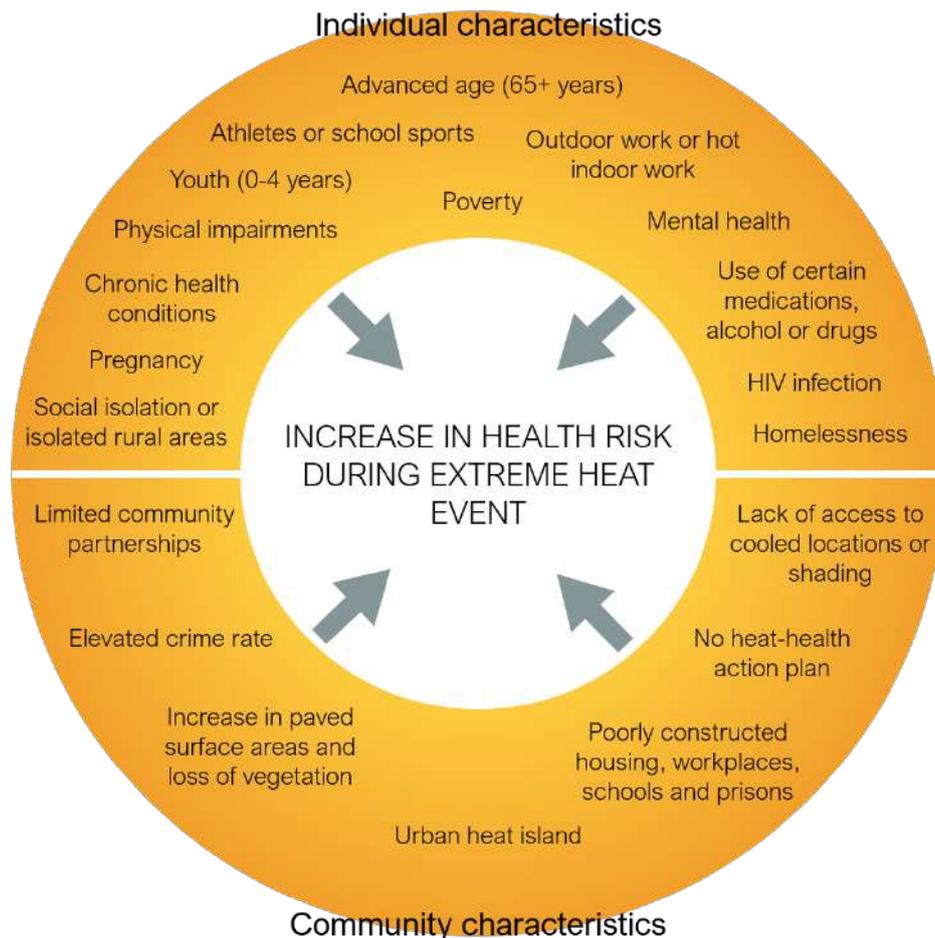


Figure 3: Individual and community characteristics that increase the risk of morbidity and mortality during exposure to extreme heat. Adapted from CDC, 2011.²⁶

The elderly, young children and youth

Advanced age (those above 65 years) constitutes the most significant risk factor for heat-related deaths worldwide. The elderly often have multiple health conditions which raise their risk. Risk is particular high in elderly people with physically disabilities, or mental health conditions, including dementia.

Infants and young children are also sensitive to the effects of high temperatures because they rely on others to regulate their thermal environments and to provide adequate fluids for hydration. Babies or young children left in cars, even for brief periods, have extremely high risks of heat stroke. Youth may be vulnerable to heat stroke during school sports or extra-mural activities, or due to inadequate fluid intake or wearing inappropriate clothing²¹. Sports activities during extreme heat pose particular risks for all age groups.

Pregnant women

Pregnancy raises the vulnerability of women to environmental hazards, including heat. During pregnancy internal heat production rises with foetal and placental metabolism, and with increased body mass and the physical strain that results. Additionally, pregnancy and having a young child often increases the socioeconomic vulnerability of women in South Africa, reducing their ability to adapt to extreme heat (Figure 4)²⁷. Exposure to extreme heat has been linked with preterm birth, stillbirth, infections such as Group B streptococcus and mastitis, and with lifelong health consequences. Pregnant women who have co-morbidities or are above 35 years old have especially heightened vulnerability.

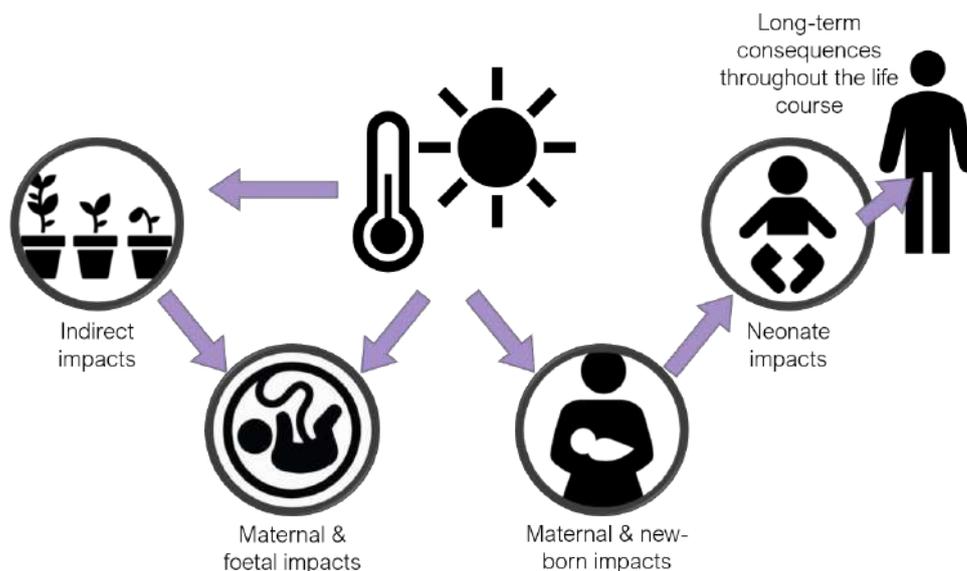


Figure 4: Impacts of extreme heat on pregnant women and new-borns (figure made in-house).

People with chronic medical conditions

People with chronic medical conditions, especially non-communicable diseases, often have limited ability to respond to heat stress. These people may develop heat conditions, such as heat exhaustion at lower temperatures than other population groups. But, most importantly, heat stress can exacerbate pre-existing chronic diseases, especially cardiac, respiratory and renal conditions.

Conditions which may increase the risk of heat-related disease during periods of extreme heat include:

- Cardiovascular disease, hypertension and coronary artery disease
- Diseases of the respiratory system, chronic obstructive pulmonary diseases, bronchitis and asthma
- TB and HIV infection
- Diseases of the renal system, especially renal failure
- Diabetes mellitus and other metabolic and endocrine disorders
- Mental health conditions, especially schizophrenia, depression and dementia
- Addiction to alcohol or other substances
- Malnourished people, both those undernourished and those with obesity
- Physical or mental disabilities

Risks can also be higher in people taking certain medications for chronic conditions, such as antihypertensive drugs or sedatives.

Socio-economically disadvantaged people

People living in poverty or social isolation have higher risks for heat-related conditions, as they may have less ability to cope with heat extremes because of their exposure to multiple hazards and their limited ability to access resources and services. Many people in poor households and groups such as the homeless cannot afford to take measures to reduce their exposure to heat, such as drinking cold water, using electric fans and even finding access to shaded areas.

People living in cities, informal settlements or rural areas

Increased urbanisation has led to the development of urban heat islands whereby densely built urban areas, such as inner cities and informal settlements, are significantly hotter than surrounding areas. Concrete and tar in cities absorb heat and temperatures can remain high throughout the night. Tin sheeting commonly used in informal settlements is unable to reflect heat and provides little insulation against heat. Rates of deaths during extreme heat are highest among people living in informal settlements in South Africa²⁸. Many low-cost houses in South Africa are also poorly resistant to heat⁵. Urban environments may lack trees and other vegetation that provide shade and that increase cooling through evaporation.

Though people in urban areas may experience longer and more severe periods of extreme heat than those living in rural areas, some groups in rural areas can have raised vulnerability to heat-health impacts. The millions of people living in rural areas are amongst the poorest in South Africa and have a low resilience to cope with disaster risks, including heat extremes²⁹. Rural residents may also face challenges in accessing health services due to transport and other costs.

People who work outdoors or in hot indoor areas

High temperatures in workplaces impact on workers' health and can reduce labour productivity³⁰. Workers in outdoor settings such as agriculture and construction, commonly experience sunburn, sleeplessness, irritability and exhaustion. These groups are especially vulnerable because of the physical nature of their work and as they are mainly outdoors in direct sunlight. Self-employed or subsistence farmers may be even more at risk than those in formal employment.

Workers in factories, workshops and hot indoor places such as laundries and kitchens also often have heightened risks³¹. Increases in temperature in South Africa has already resulted in higher rates of internal migration of workers in the country³².

5 Effects of heat on provision of health services

Episodes of extreme heat have the potential to impact on the health system and infrastructure in general. Increased demand for services at primary health care clinics and casualty departments may mean additional personnel are needed and waiting times within these facilities are longer. The demand for emergency medical services also increases substantially during heat waves, with more people requiring emergency care and transport in the community, and more people needing transport from primary health clinics to hospitals. During periods of extreme heat, an increased number of patients will require admission to hospital, especially to general medical wards. These patients may have heat-related illnesses such as heat stroke, but also may require care for chronic diseases which have been aggravated by heat exposure, especially cardiac and respiratory conditions. Demand also rises for mental health services as heat exposure is linked with depression, stress, tiredness, substance use, aggression and suicide. Outbreak response and disaster management are important parts of heatwave responses and may be called upon to assist with controlling food-borne infection outbreaks, for example. High temperatures may also damage heat-sensitive drugs such as insulin in health facilities and in patients' homes and can compromise the cold chain for vaccines, for example. During hot weather, the performance of health workers can be affected due to increased fatigue, drowsiness and irritability.

Figure 5 shows how climate change can affect the delivery of health services and the overall functioning of the health system. Overall, the health consequences of exposure to extreme heat and the resources needed to prevent these consequences may influence the availability and allocation of resources, financial planning and budgeting, and equitable service delivery. They will also challenge ethical aspects of allocation and of the delivery of health and related services.

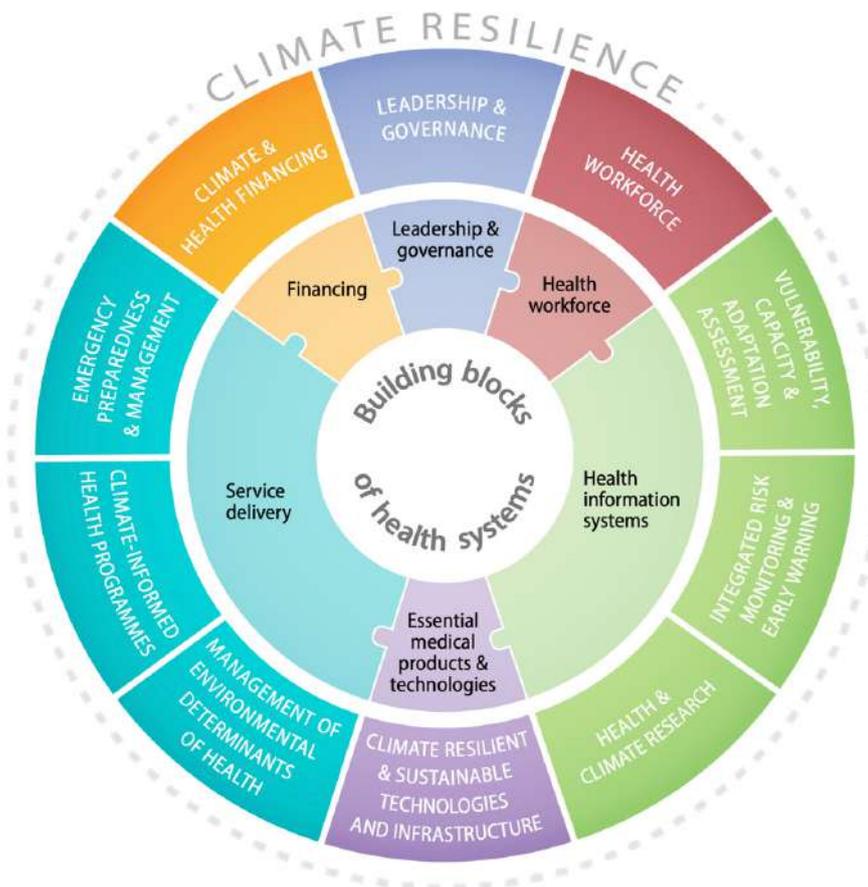


Figure 5: Six building blocks of health systems (WHO, 2015)³³

PART B

Heat Health Action Plans

6 General Principles of Heat Health Action Plans

The negative health consequences of extreme heat are largely preventable if exposure and sensitivity to heat can be minimised. There is much that can be done to reduce the impacts of heat on health and to assist people to adapt to high temperatures. Coping with heat also includes physiological acclimatisation to high temperatures, where the body “learns” to better tolerate exposure to high temperatures, psychological adaptation and behaviour adjustment of individuals. Each of these aspects can be supported by a set of practical, feasible, and often low-cost interventions delivered at the individual, community and population level.

Heat Health Warning Systems provide alerts that a period of extreme heat is anticipated, based on weather forecasts. Those alerts then feed into the Heat Health Action Plan which is the set of actions that are needed to respond to the alert.

The general principles of emergency response for heat and health are:

- **Use existing systems and link to general disaster plans.** Many of the approaches to planning for and responding to heatwaves draw on principles of disaster management.
- **Be broad.** Nearly all emergency plans require a multi-agency and intersectoral approach, and this is also the case for heatwaves and extreme heat.
- **Communicate effectively.** The effectiveness of any action plan depends on the ability of those responsible for implementation of the Heat-health Warning System and the Heat Health Information Plan to deliver useful, timely, accessible, consistent and trustworthy information to their target audience and especially to vulnerable populations.
- **Adopt a long-term approach.** There are important long-term actions that are needed to prevent further greenhouse gas emissions and a worsening of climate change. There are also other long-term actions that can reduce the impact of extreme heat by, for example, adapting the built environment so that it provides better protection against heat exposure.
- **Ensure that responses to heatwaves do not exacerbate the problem of climate change.** It would be easy to assume that the solution is widespread use of air-conditioning. While air conditioning can be protective for vulnerable populations, it is very energy intensive and expensive and adds to greenhouse gas emissions. There are many other ways to adapt the environment and buildings, and to protect individuals that are not energy intensive.
- **Monitor and evaluate.** As with all health plans it is important to monitor progress with implementation and effectiveness, and to periodically evaluate the services.

7 Core Elements of Heat Health Action Plans

A Heat Health Action Plan describes the actions needed to reduce the health risks associated with extreme heat events and heatwaves. It consists of seven core elements³⁴, namely:

1. Health Sector leadership and coordination of stakeholder inputs
2. Heat-health Warning Systems
3. A Heat-health Information Plan
4. Reduced exposure to Heat in Indoor settings
5. Particular Care for Vulnerable Groups
6. Preparedness of Health and Social Services
7. Monitoring and Evaluation (including real-time surveillance)

Each of these elements is described below.

7.1 Health sector leadership and coordination of stakeholder inputs

The health sector is the lead agency on the Heat Health Action Plan in all spheres of government (national, provincial and local). As the lead, the sector needs to coordinate a multipurpose collaborative mechanism across other relevant departments, stakeholders and institutions, and to direct the response if an emergency occurs. Within the Department of Health, the plan will be led by Environmental Health and EMS (Disaster Management). Environmental Health will work with other sectors as required. The implementation of the plan will take place at the provincial and local level, with oversight from national level. The plans should be included in the disaster management plans as per sphere, hence the involvement of district municipalities in disaster management must be kept in mind when constituting response teams.

The Health Promotion and Communication Directorate/Division should be included as a key stakeholder in different spheres and included in the response teams. All information that goes to the community needs to go through the communication and/or health promotion directorate/division. Provinces and municipalities should consider inclusion of WBOT, CDW and CHW in their plans to assist with community education and awareness. They should also be capacitated to provide the correct messages and to take the necessary steps to assist vulnerable groups during periods of extreme heat.

Environmental Health Practitioners (EHPs) are located at the interface between government and communities. With first-hand community engagement, they are potentially well positioned in relation to climate change adaptation and mitigation implementation³⁵. These Practitioners can contribute to the shaping of local strategies aimed at supporting vulnerable communities to adapt to extreme heat exposure. They will require additional training to optimise their contribution to the Heat Health Action Plan.

The health risks posed by climate change require the health sector to work with other relevant sectors, and key collaborative partners, both at the national and global level and with institutions such as the SAWS, the South African Medical Research Council (SAMRC), the Council for Scientific and Industrial Research (CSIR), institutions of higher learning and other organisations. Through these partnerships, the Health Department will be able to make use of existing tools, for example, the Heat-Health Warning Systems developed by SAWS.

The role of provinces and municipalities is to develop heat health plans informed by these guidelines. The key areas they need to focus on are: 1) longer-term development and planning to build resilience against high temperatures in their areas; 2) preparation activities before the warm seasons; 3) prevention during the warm season; 4) specific responses during heatwaves or on very hot days; and 5) monitoring and evaluation of areas 1-4.

7.2 Heat-health Warning Systems

A Heat-health Warning System is a weather-based alert and a central part of the overall Heat Health Action Plan. The System uses weather forecasting to identify when a temperature threshold will be exceeded. The temperature thresholds are chosen based on the temperature level beyond which negative health consequences occur.

The SAWS issues warnings about heat waves and warnings based on a 'Discomfort Advisory' system that considers temperature, humidity, and other weather variables. When the forecasted weather exceeds the stipulated temperature or 'Discomfort' thresholds, a set of actions are triggered. These actions include warning alert messages that are shared with decision-makers at different levels of government, as well as the media, public and other stakeholders, using the SAWS website and through email and SMS platforms. Different 'grades' or 'levels' of warning categories can be used to differentiate between a) 'stressful' heat levels, b) temperature levels which may be dangerous to health, and c) the highest-level alarm.

Some research is being done in South Africa to consider whether the South African definition of a heatwave adequately represents the point at which negative outcomes for human health begin to occur. The thresholds selected are based on outdoor temperatures and need to consider the indoor temperatures that people in the country will experience and the ability of the built environment to protect people from extreme heat. People generally stay indoors during heat extremes, but in many housing, occupational and school buildings, the indoor temperature may exceed outdoors by several degrees.

7.3 Heat Health Information Plan

Many policy makers, health workers and people in the general population are not aware that heat is a major public health problem. High temperatures, even 'extreme heat' is often seen as a nuisance to be tolerated, rather than something that has major negative effects on health. Knowledge around climate change in general is low in South Africa^{36 37}. Educating the public on the risks of extreme heat exposure and communicating the actions that need to be taken during periods of extreme heat is thus a major priority.

The Heat Health Information Plan gives guidance on who, how, when and which messages to communicate. These messages aim to provide people with a set of strategies that will enable them to self-manage their responses to extreme heat. Messages should thus be developed that give guidance to the community on what they need to do in the event of a heat wave or period of high temperature. The Department of Health needs to work with relevant stakeholders to develop the messages, which are tailored to different heat events and communities. The messages are then shared with everyone in need of the information. The language used in the Heat Health Warnings and advice on how to avoid negative health outcomes should be simple and easily comprehensible, and issued in the local languages of people living in different areas.

A communication strategy is a key part of the Heat Health Information Plan. The information plan should be developed in consultation with the communication unit and the health promotion unit as well as with the involvement of other key stakeholders. The plan needs to be actionable and all role players fully aware of their responsibilities in executing the plan. In different spheres, all information that goes to the community has to go through the communication and/or health promotion directorate/division. Provinces and municipalities should consider inclusion of WBOT, CDW and CHW in their plans to assist with community education and awareness.

It is important to be consistent about messages within a community once the messaging has been decided. For example, if schoolteachers are advised to ask children to remove their shoes and socks, or jerseys in very hot weather, then parents or caregivers should receive the same information to avoid conflicting messages.

There are five main categories of messages to include in information materials for the public:

1. How to keep a home cool:

- Keep windows and doors closed during the day, especially those that face the sun
- Hang curtains, sheets or shade awnings on windows that face the sun during the day to help reduce indoor temperatures. Dark materials absorb heat, warming the room, while light ones reflect heat.
- Turn off lights and electrical devices if possible, these generate heat
- Try to stay in the coolest room in the dwelling, especially at night
- Open all windows during the night (if it is safe to do so) so that cooler air during the night and early morning can cool your home
- Keep indoor plants and place bowls of water inside the house as evaporation from these helps to cool the room
- Electric fans may provide relief, but when temperatures are above 35°C they may not prevent heat-related illness and in fact may increase the body's temperature, cause dehydration and become dangerous. Fans do not actually cool the air, but raise evaporation from the skin if the air temperature is below 35°C
- If it is not possible to keep your home cool, find a cool place to spend 2-3 hours of the day, such as an air-conditioned building, such as shopping malls or community centres

2. How to keep out of the heat if you must be outdoors:

- Avoid exercise and strenuous activity during very hot weather and apply sunscreen
- Stay in the shade
- Never leave anyone, especially children, the elderly and animals in parked vehicles, even for short periods
- Wear light, cool, loose fitting clothing and a wide brimmed hat
- Avoid going outside during the hottest time of day ("siesta time")
- Drink plenty of water

3. How to keep the body cool and hydrated:

- Take cool showers, baths or body washes. Sprinkle water over the skin or clothing, use cold packs and wraps, place a damp cloth or towels on the back of your neck, and use sponging and foot baths with cool water.
- Wear light, loose-fitting clothes of natural materials. If you go outside, wear a wide-brimmed hat or cap and sunglasses.
- Use light bed linen and sheets, and no cushions, to avoid heat build-up.
- Drink regularly, but avoid alcohol, hot drinks, tea, coffee and sugary drinks
- Eat small meals and eat more often. Avoid foods that are high in protein.
- Spend a few hours in a cool place such as an air conditioned shopping mall or community centre

4. How to help others when it is hot:

- Promote community involvement as a critical strategy for ensuring the health of vulnerable individuals during extreme heat
- Check on family and friends, especially vulnerable people, in case they need assistance. Elderly or sick people living alone need to be visited at least twice daily
- Talk with family and friends about what to do when it is hot
- If someone is taking medication, they should ask a health worker whether they need to do anything differently when it is hot. Some medicines may need to be changed during very hot weather. Make sure medicine is stored at the correct temperature (read the instructions on the packaging)
- Reading pamphlets, notices and other types of media from the Department of Health can help you learn how to respond to extreme heat

5. What to do when you or others feel unwell when it is hot:

- Move to a cool place and drink some water
- Measure your temperature
- Seek care if you feel dizzy, weak or anxious, have intense thirst and headache, or a raised temperature
- Rest and drink oral rehydration fluids if you have muscular spasms or heat cramps
- If someone has hot dry skin and confusion, fits or is unconscious, call an ambulance immediately or arrange transport for the person to a health facility urgently. While waiting for help, move the person to a cool place, put her or him in a horizontal position and elevate the legs and hips, remove clothing and begin external cooling, for example, by placing cold packs on the neck, the arm pit and groin, fanning continuously and spraying the skin with water at 25 to 30°C. Measure the body temperature. Do not give aspirin or paracetamol. Position an unconscious person on her or his side

Useful advice and materials for specific settings, scenarios and vulnerable groups have been developed by the Centres for Disease Control and Prevention (CDC)³⁸, WHO^{13, 34}, and Barnet Council³⁹ and the Public Health England¹⁵. Examples of heat health awareness materials developed by the National Department of Health that can be used in communication campaigns are provided in Annexure A.

7.4 Reduce Indoor Heat Exposure

Reducing indoor heat exposure is not only important at homes, but also in health facilities, workplaces, schools, prisons and other types of buildings. Housing quality and characteristics can modify heat-mortality relationships. Risks of heat-related deaths in South Africa are highest in informal settlements²⁸. Heat Health Warning Systems rely on outdoor temperatures, which can be quite different from indoors. In different parts of the world the thresholds used to determine at which temperature level to issue warnings is thus based both on the outdoor temperatures and the likely indoor temperatures in different kinds of housing in a country.

Air conditioning is very effective in reducing high temperatures, but is very energy-intensive, expensive and a significant source of greenhouse gas emissions. Air conditioning systems powered by solar energy are increasingly becoming available and may be an option in the future. Passive cooling of existing buildings can be achieved using natural ventilation, evaporative cooling, raising the thermal mass (the higher the thermal mass the more the temperatures in a building remains stable, and only changes slightly as temperatures fluctuate outdoors) and using night ventilation that allows cooling of structural elements during the night. Other options include electric or solar-powered fans, and cooling systems with water sprays, which may also be placed outdoors.

Public shaded areas, shelters or 'cool rooms' are required in each community to complement efforts to reduce indoor temperatures. External shading outside windows can lower indoor temperatures. Growing trees and leafy plants near windows act as natural air conditioners.

There is a particular need to monitor and reduce heat in settings other than homes. These include school classrooms, where indoor temperatures can exceed 40°C in South Africa, depending on the types of building material used. Shipping container classrooms can be especially hot⁶. Some clinics are also being built from shipping containers. Clear guidance, and regulations on building standards to reduce indoor heat exposure may help to minimise adverse heat health impacts for people who spend time in container buildings. Examples of different kinds of cooling interventions in schools is shown in Figure 6.

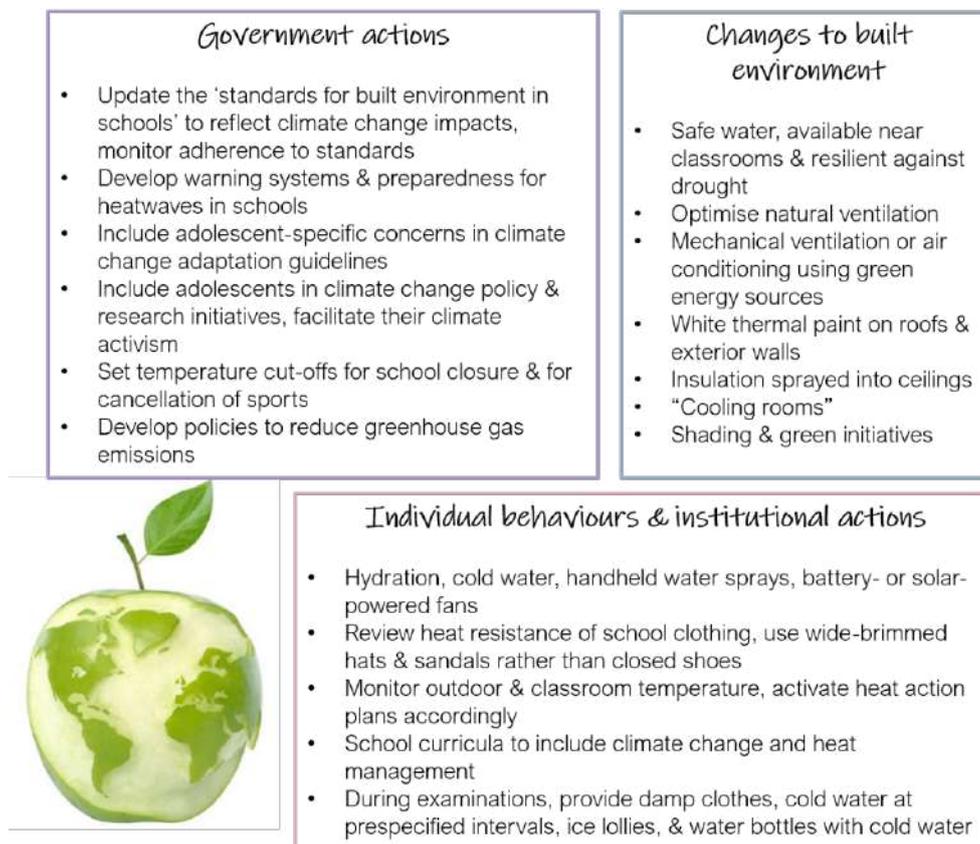


Figure 6: Possible interventions to reduce heat exposure in schools. Adapted from Chersich et al, 2019.²¹

Since people spend most of their daily lives indoors and tend to shelter indoors during hot weather, the indoor climate is of particular importance for longer-term policy interventions. Heat adaptation plans thus need to focus on improving urban planning, housing construction and reducing urban heat islands and indoor heat stress. 'Climate-smart' urban planning needs to become the norm.

Solar radiation absorbed by the city structure raises its surface temperature and contributes to an increase in ambient temperature. Lowering surface temperatures by painting roofs and walls white, for example, increases reflection of sunlight and heat, which can have significant impacts on cooling in urban areas. Insulation in roofs keeps the heat in when it is cold and keeps the heat out when it is hot.

Increasing green spaces and 'greening' in general is central to all heat-health plans. Trees enhance outdoor thermal comfort. Parks can reduce urban temperatures, depending on the park size and the distance to the park. Planting trees provides solar protection to buildings during the warm seasons while evapotranspiration from trees can reduce urban temperatures. Protection from solar radiation using trees has a large physiological and psychological effect in reducing heat stress. Planted and green roofs can contribute substantially to decreased urban temperature. Alternative types of shading, such as use of shade cloths adjacent to building also offer protection from the sun.

7.5 Particular Care for Vulnerable Groups and in Occupational Settings

Vulnerable groups identification is key to ensure proper planning and targeting of services. In South Africa, key vulnerable groups are the elderly, infants and the young children, pregnant women (Figure 7) and people with chronic conditions or working in hot environments as indicated in Part A.

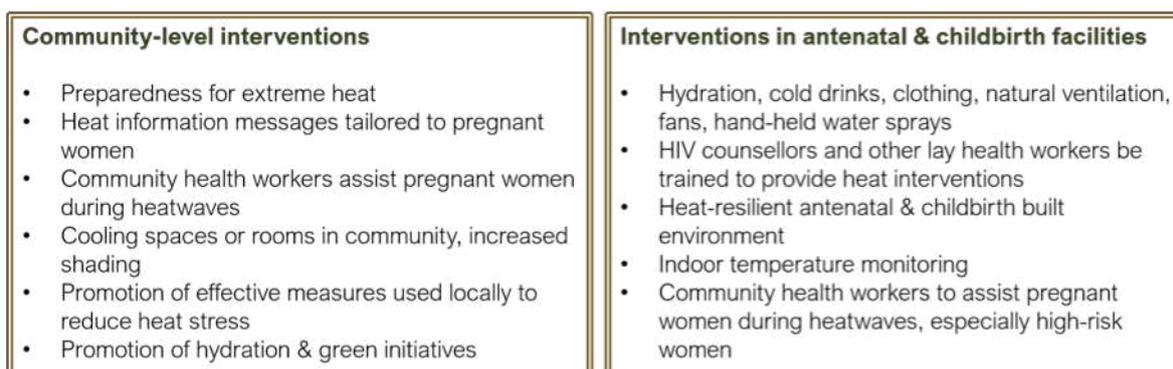


Figure 7: Possible interventions to reduce impacts of extreme heat on pregnant women (figure made in-house).

While many of the things that are done to keep indoor areas cool apply to all populations, some groups have particular needs and require specific interventions. As an example, the priority interventions to reduce the negative impacts of extreme heat on pregnant women is given in Figure 7. Similarly, sets of interventions adapted to the specific needs of other key vulnerable groups could be developed.

Routine check-up visits for patients with chronic conditions can be used to help prepare them for heat events. These patients could be given advice on fluid intake and the specific actions to take during periods of extreme heat, for example. Health workers may need to review medications that could increase risk for heat-related conditions and then consider adjusting drug dosages during hot weather.

Special attention is needed to ensure adequate hydration and reduced heat exposure in people doing outdoor sports or school extra-mural activities. The cut-off temperature when sports and other outdoor activities need to be postponed or cancelled must be defined, and clear guidance provided to schools and organisers of sporting events. It may be necessary to shift the start times for such events to the cooler parts of the day, and take longer breaks in team sports, for example.

There are major challenges to preventing heat-related diseases in the workplace. In terms of the Occupational Health and Safety Act, the employer is responsible for ensuring that an employee is protected against high temperatures and related exposures. Government, business and unions need to work together to develop regulatory frameworks and labour standards pertain specifically to heat hazards in the workplace. Workers affected by heat may be eligible for injury benefits. The costs of treatment of heat stress exposures should be borne by employers (via the workers' compensation insurance programs) and not shifted to the health system or to the workers themselves. When heat stress is identified as a hazard in a particular workplace then employers need to take action to reduce the hazard and to minimise the risk by implementing a series of control measures.

Potential interventions include adjusting working hours to start earlier in the day, allowing workers to choose flexible working hours, making changes to the dress code, worker rotation where workers alternate between working in warm and cool areas, having sufficient break times, and the monitoring of temperatures in the workplace, together with frequent risks assessments. Supervisors and first-aid teams should be trained to recognise early signs of heat-related illnesses. Outdoor workers could be given increased protection against direct sunlight, such as through exterior shaded areas, having a source of cool water close by, or arranging for drinks to be brought to the workers, encouraging workers to drink before they are thirsty, and ensuring sufficient breaks that are taken in cool or shaded areas. Clothing that provides protection from the sun, but allows airflow to the body is cooling, as is protection of one's head with a hat. Lightweight, light-coloured loose-fitting clothing is optimal.

In indoor settings, options to reduce heat stress include reducing lighting, making specific cool spaces in the workplace, increased ventilation and misting ventilation systems. Increased shading of windows through shutters, curtains or window films can also reduce indoor heat levels. Using light colours, especially white, for the walls and roof of workplaces increases the amount of heat that is reflected, while dark colours absorb heat, warming the building. Green roofs are covered with vegetation and help reduce average temperature.

7.6 Preparedness of Healthcare and Social Services

An operational plan needs to be devised setting out the specific procedures that clinics, hospitals, care centres for vulnerable people and prisons should take before and during the warm seasons and then during periods of extreme heat. Actions taken needs to reflect the different levels of heat–health warnings provided by SAWS. Care centres for elderly, those with severe mental or physical illnesses and other vulnerable groups need guidance on the steps to take during heat extremes, and a defined set of standards for addressing heat–health concerns, including the provision of a 'cool space or room'. It is important to ensure that health workers know what to do to prevent the health impacts of heat on vulnerable population groups and individuals at particular risk. Training is needed for health workers on these guidelines and to recognise and treat patients with heat-related illnesses, such as heat exhaustion or stroke (Annex 1).

7.7 Monitoring and evaluation of the heat-health plan

Monitoring during periods of extreme heat

During the heatwave or period of very high temperature, communication and collaboration between different levels of government and departments, as well as other stakeholders are important. This communication needs to cover progress and challenges with implementing the heat-health plan and the number of deaths or serious illnesses that have occurred. Timely health data is required (less than 48 hours) for monitoring the health impacts of extreme heat and the effectiveness of the interventions. Data can include all-cause mortality data, and number of hospital admissions, calls to helpline calls, primary health clinic visit records, ambulance calls, fire brigade interventions and visits to casualty departments.

Real time reporting structures should be set up at national, provincial and district level to enhance rapid response, data collection, planning, monitoring and evaluation. “On-line” programmes or applications (“apps”) could be developed at national level as heat events often cover multiple provinces or districts at the same time.

Monitoring and evaluation of the overall Heat Health Action Plan

Monitoring can assess routinely recorded data about inputs and outputs of the health-health action plan.

Evaluations can be either process- or outcome-focused. In process evaluations, the focus is on whether the plan was implemented as planned and to the expected standards. Doing this can involve surveys of partner agencies to explore their awareness of the plan, what they did and whether this was in accordance with the plan. Evaluation might include assessing knowledge levels of the population about what actions to take during a period of extreme heat; did the warning messages reach communities, and what factors facilitated or hindered the taking of action on those messages. Qualitative research could assess the message content and its appropriateness. To do so would require an understanding of: how do people understand the health risks of heat waves; what are the levels of knowledge, attitudes and behaviours among high-risk groups towards extreme heat; and the acceptability and appropriateness of messages within the lived reality of their lives.

Given the importance of indoor temperatures and the relation of that to deaths or health consequences of heat waves, it may be useful to systematically monitor indoor temperature levels in informal settlements, clinics and schools made of materials that are poorly heat resistant (i.e. measure temperature of informal settlement housing and shipping container schools as a means of measuring actual temperature experienced by people and pupils at school; outdoor temperature measures only “expected” temperature).

Outcome evaluations assess the results and impact of specific elements of the plan, such as the heat-health warning system, heat information plan or changes to the built environment, for example. Overall effectiveness measures then observe whether changes have occurred over time in the number of deaths or hospital admissions for heat-related conditions that occur during consecutive heatwaves for example. Reductions in deaths or heat-related admissions might be attributed to the plan, if further supportive evidence is available to support that claim. Changes in mortality can be used to evaluate the effectiveness of the prevention programmes and adaptation strategies.

8 Conclusion

Extreme heat and heatwaves are becoming more common in South Africa, as the climate changes. Heat Health Action Plans, incorporating Heat Health Warning Systems are important adaptation strategies to manage the health risks associated with extreme heat and heatwaves.

Efforts to advance and implement Heat Health Warning Systems are critical. Also heat Health Actions Plans are essential to protect vulnerable groups and ensure health and wellbeing in all communities.

9 Annexure 1

Annexure A presents an example of a heat and health resource that can be used in the South African curriculum to educate young learners about ways to protect themselves against heat. These resources are available from the NDOH. Annexure B also outlines the short- and long-term plan of action for heat health guidelines implementation in South Africa.



Table 1: Heat-related medical conditions, symptoms, and management

Medical condition	Signs and symptoms/mechanism	Management
Heat rash	Small, red, itchy papules appear on the face, neck, upper chest, under breast, groin and scrotum areas. This can affect any age but is prevalent in young children. Infection with Staphylococcus can occur. It is attributed to heavy sweating during hot and humid weather.	Rash subsides with no specific treatment. Minimize sweating by staying in an air-conditioned environment, taking frequent showers and wearing light clothes. Keep the affected area dry. Topical antihistamine and antiseptic preparations can be used to reduce discomfort and prevent secondary infection.
Heat syncope (fainting)	This involves brief loss of consciousness or orthostatic dizziness. It is common in patients with cardiovascular diseases or taking diuretics before acclimatization takes place. It is attributed to dehydration, peripheral vasodilation and decreased venous return resulting in reduced cardiac output.	The patient should rest in a cool place and be placed in a supine position with legs and hips elevated to increase venous return. Other serious causes of syncope need to be ruled out.
Heat cramps	Painful muscular spasms occur, most often in the legs, arms or abdomen, usually at the end of sustained exercise. This can be attributed to dehydration, loss of electrolytes through heavy sweating and muscle fatigue.	Immediate rest in a cool place is advised. Stretch muscles and massage gently. Oral rehydration may be needed, using a solution containing electrolytes. Medical attention should be sought if heat cramps are sustained for more than one hour.
Heat exhaustion	Symptoms include intense thirst, weakness, discomfort, anxiety, dizziness, fainting and headache. Core temperature may be normal, subnormal or slightly elevated (less than 40°C). Pulse is thready, with postural hypotension and rapid shallow breathing. There is no alteration of mental status. This can be attributed to water and/or salt depletion resulting from exposure to high environmental heat or strenuous physical exercise	Move the patient to a cool, shaded room or air-conditioned place. The patient should be undressed. Apply cold wet sheet or spray cold water and use fan if available. Lay the patient down and raise his or her legs and hips to increase venous return. Start oral hydration. If nausea prevents oral intake of fluids, consider intravenous hydration. If hyperthermia is above 39°C or impaired mental status or sustained hypotension occurs, treat as heatstroke and transfer the patient to hospital.
Life-threatening heat-stroke	Exposure to heat stress (heatwave, summer season and/or strenuous exercise). Body temperature rapidly increases to greater than 40°C and is associated with central nervous system abnormalities, such as stupor, confusion or coma. Hot, dry skin, nausea, hypotension, tachycardia and tachypnoea are often present.	Measure core temperature (rectal probe): if > 40°C, move to a cooler place, remove clothing, initiate external cooling: cold packs on the neck, axillae and groin, continuous fanning (or keep ambulance windows open) while skin is sprayed with water at 25–30°C. Position an unconscious patient on his or her side and clear airway to minimize risk of aspiration. Administer oxygen 4 l/min and isotonic crystalloid (normal saline) solution. Transfer rapidly to an emergency department.

Table 2: Short- and long-term plan of action for heat health guidelines implementation in South Africa.

Source: WHO/WMO 2015²⁰

	Action	Expected results	Responsible and participating institutions
Short-term actions	Assessment of heatwave definition and then finalise a set of messages about heat and health	Consistent messaging	DOH Research institutions SAWS
	Assessment of health system preparedness for heat-health impacts	Identify strengths and weaknesses and plan of action	DOH Research institutions
	Activate heat health warnings with heat wave warnings	Heat health warning messages to the public Evidence-based health messaging developed	DOH SAWS SAMRC
	Heat health material into school curricula Develop curriculum material based on South African evidence	Children know about heat and health	DOH DBE
	Develop and implement heat-health (climate change) indicators	Increased surveillance of heat health impacts	DOH SAWS Research institutions
Medium-term actions	Set a temperature threshold above which sports events, school sports etc. will not be permitted to occur. Such events would need to be postponed and re-scheduled during cooler weather	Safer conditions for schoolchildren, athletes, marathon runners etc. during hot weather	Sports DOH DBE
	Assess state of adequate and ease of access to drinking water, hygiene and sanitation in schools especially during extreme heat and heatwave (overcrowding in classrooms exacerbates heat-health impacts)	Hydration of schoolchildren for health and productivity	DOH Research Institutions
	Review school classroom thermal comfort	Regulations for thermal comfort in classrooms	DOH DBE Buildings
	Review healthcare facilities thermal comfort	Regulations for thermal comfort in healthcare facilities	DOH Buildings /Settlement
	Implement climate change indicators Surveillance activity met	Monitor and evaluation from baseline and assess interventions	
Long-term actions	Review school uniforms for heat health implications	Cooler schoolchildren who can work comfortably and safely	
	Review regulations around personal protective equipment for outdoor occupational workers	Cooler outdoor workers who can work comfortably and safely	
	Urban planning to provide heat interventions	Cooler city spaces, access to water and shade	

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