

Public Health Impact of and Response to Climate Change in South Africa

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This chapter reviews recent developments relating to the impact of climate change on health and health services in South Africa. Since the COP-17 meeting in Durban in 2011, climate change policy developments have increased in all three tiers of government. Policies have mostly been general in scope and have not focused specifically on the health sector, with a few notable exceptions. A national climate change and health adaptation policy has been finalised. At least two provinces, the Western Cape and KwaZulu-Natal, have climate change strategy documents, and the City of Cape Town and eThekweni municipalities have specific climate change and health adaptation policies.

As the southern African region becomes hotter and drier, climate-sensitive aspects of the burden of disease are being identified. Analysis of disease trends and linkage of climate scenarios to future health impacts allows predictions according to which health systems responses can be planned. The climate readiness of health and related facilities and emergency responses is starting to be audited by government. Additional stress on the health system due to climate change underscores the importance of health system strengthening, primary health care re-engineering and the rolling out of the National Health Insurance system. Responses to climate change, whether by mitigation of its effects or adaptation to them, will require strong and effective intersectoral organisation and effort within government at all levels along with interdisciplinary research and prevention efforts. Examples of the implementation of these responses are provided by the Western Cape Province and City of Cape Town.

Additional stress on the health system due to climate change underscores the importance of health system strengthening, primary health care re-engineering and the rolling out of the National Health Insurance system.

Introduction

Reflection on public health responses to climate change in South Africa (SA) provides a gauge of whether or not health is truly playing a central role in the climate change arena. Chapter 12 of the 2010 *South African Health Review* (SAHR) set the stage for consideration of global and South African impacts of climate change on health and health services.¹ McMichael, in his chapter on Climate change and human health, included in a Commonwealth Health Minister's Update publication in 2009, puts it succinctly "human health can – indeed should – be viewed as the real 'bottom line' of climate change consequences".²

In recent years increasing attention has been paid to the risks related to health, and subsequently health services. The most notable in terms of global developments was the hosting of the first Global Climate and Health Summit organised by Health Care Without Harm³ at the Conference of the Parties (COP)-17 in Durban. This Summit culminated in the Durban Declaration on Climate and Health⁴ and the sounding of an urgent call to action from the health sector.⁵ The Durban Declaration (Box 1) highlighted the need to recognise the health benefits of climate mitigation and to take steps to reduce global greenhouse gas emissions; ensure greater health sector representation on national delegations; and actively include

the participation of women and youth and indigenous people in the climate change process. A global call whereby public health practitioners, healthcare professionals and health government officials, among others, are called to endorse the Call to Action and to take concerted effort was also made (Box 2).

As alluded to above there is an increasing focus on the carbon footprint of health care. The Sustainable Development Unit of the United Kingdom's National Health System has developed valuable guidance materials relevant for SA for reducing carbon emissions from health care.⁶ 'Greening' the health sector is an increasingly articulated goal worldwide, and Health Care Without Harm has set up a global 'green' hospital network with a detailed global agenda for action that is pertinent to the South African health sector.⁷

The 2012 Climate Vulnerability Monitor report of the Climate and Health Alliance entitled *Cold Calculus for a Hot Planet* estimates the cost of failure to act on climate change at US\$ 1.2 trillion, with 400 000 excess deaths annually and an increase in this number to 700 000 by 2030.⁸ To put this in perspective, the World Health Organization (WHO) estimates that there are 80 000 malaria-, 60 000 extreme weather event-, 2.2 million diarrhoea-, and 3.5 million undernutrition-related deaths annually.⁹ AIDS, which has

Box 1: Durban Declaration on Climate and Health, Durban, 4 December, 2011

The World Health Organization predicts that unmitigated climate change will lead to significant increases in illness and death brought on by environmental changes. These include the spread of cholera, malaria, dengue and other diseases; the compromising of agricultural production and food security; an increase in extreme weather events, floods, droughts, heat waves and more. The health of many communities is already suffering as a consequence of climate change.

Indeed, according to the Lancet, climate change is the greatest global health threat of the 21st century.^a

At the same time, there is strong evidence that action on climate change can deliver significant and immediate benefits to health. For instance, lowering greenhouse gas emissions from fossil fuels will also simultaneously reduce harmful air pollution that negatively impacts the health of millions of people around the world.

Here in Durban, at the UNFCCC's 17th Conference of the Parties, the world's governments have an opportunity to confront this threat and agree upon solutions. Governments can commit to reduce greenhouse gas emissions in a manner that is equitable, as well as economically and ecologically viable. Such effective and immediate action to mitigate climate change would protect and advance global public health.

An agreement that aims to avoid dangerous climate change, keeping global temperature rise below 2 degrees Celsius, must promote a transition from fossil fuels to clean, renewable energy and low carbon economies. It must foster major emissions reductions from those who pollute the most, while providing support for those least responsible for the crisis to develop a low carbon pathway that meets peoples' needs. Such an agreement would have the added benefit of protecting local communities and large urban populations from the immediate health impacts of fossil fuel production and combustion, thereby reducing healthcare costs and saving lives.

Without such an agreement, climate change will increase the global burden of disease and deepen health inequities between and within countries. This will raise health care costs worldwide, while undermining and overwhelming public health infrastructure in both rich and poor countries. The overwhelming burden will fall on the most vulnerable – those living in poor countries, who have contributed least to greenhouse gas emissions.

Having gathered at the first Global Climate and Health Summit, in Durban on December 4, 2011, we—as health professionals, public health advocates, and healthcare policy makers from more than 30 countries—hereby call on national delegations to the UNFCCC's 17th Conference of the Parties to:

- ❖ Recognize the health benefits of climate mitigation and take bold and substantive action to reduce global greenhouse gas emissions in order to protect and promote public health.
- ❖ Ensure greater health sector representation on national delegations as well as within key mechanisms of the UNFCCC, recognizing the role of the World Health Organization as the voice for public health within the UN system.
- ❖ Actively include the participation and empowerment of youth, women and indigenous peoples in the climate change processes.
- ❖ Adopt a strong second commitment period of the Kyoto Protocol which currently includes emission reduction targets for the time until 2012, to protect and continue the only binding climate law the world has;
- ❖ By 2015, negotiate a fair, ambitious and binding agreement that, consistent with the Prescription for a Healthy Planet, endorsed by more than 130 health organisations in Copenhagen in 2009:
 - Places the protection of human health as a primary objective of any agreement.
 - Establishes an ambitious fair shares framework to reduce global emissions (based on the principles of Equity and Common but Differentiated Responsibilities and Respective Capabilities) in order to avoid a global public health disaster.
 - Fosters both energy efficiency and clean, renewable energy that protects public health by reducing both local and global pollution.
 - Provides the immediate necessary resources to operationalize the Green Fund, and in the longer term, appropriate mitigation and adaptation funding required to address the health impacts of climate change, assuring all countries' Rights to Sustainable Development and their ability to pursue a low carbon development pathway.

a "Managing the Health Effects of Climate Change" The Lancet, Volume 373, Issue 9676, Pages 1693-1733, 16 May 2009.

a major impact on the health system, has claimed at least one million lives annually in sub-Saharan Africa since 1998. A large proportion of these deaths occurred in SA – the country with the largest number of HIV-infected people in the world. In 2010, 5.6 million people were infected with the virus.¹⁰ Thus in SA, the impact of climate change is thought to be significant and will undoubtedly further stretch the capacity of the country to cope with an already high burden of disease that absorbs substantial public and private sector health resources

This chapter sets out to examine the impact of climate change on health and health services in SA. The conceptual approaches to examining the impact of climate change are first explored, followed by a presentation of findings from key literature on the topic, and a review of recent publications and activities since the 2010 edition of the SAHR. Public health sector responses, including integration approaches, and barriers and enablers are presented. The chapter concludes with a set of recommendations.

Conceptual approaches to examining the impact of climate change

Assessing the responses of SA's health services to the health-related vulnerabilities associated with climate change necessitates a conceptual framing of health in relation to climate change. It also requires an understanding of some key concepts in terms of addressing climate change, namely *mitigation*, which is the primary prevention of climate change and mainly focuses on

reducing greenhouse gas emissions and modified use of land, and *adaptation*, which is the term used to describe strategies and activities aimed at slowing down the impact of climate change.¹¹ "Vulnerability" refers to the physical, social and economic aspects of a system¹² and in the context of climate change the concept of vulnerability to climate change integrates exposure, sensitivity, health impacts and adaptive capacity as outlined in Figure 1.

Vulnerability = f (Exposure, Sensitivity, Adaptive Capacity)

Robert T. Watson, Chair of the Inter-Governmental Panel on Climate Change, defines vulnerability as:

the extent to which a natural or social system is susceptible to sustaining damage from climate change, and is a function of the magnitude of climate change, the sensitivity of the system to changes in climate and the ability to adapt the system to changes in climate. Hence, a highly vulnerable system is one that is highly sensitive to modest changes in climate and one for which the ability to adapt is severely constrained.¹³

More simply put, the greater the exposure or sensitivity in terms of climate exposure, the greater the vulnerability. Furthermore adaptive capacity is inversely related to vulnerability.¹² The Know Climate Change web resource poses an example illustrating that reducing vulnerability would for example be attempting to reduce exposure to adverse climate through implementing specific measures such as building a dyke in the case of a rise in sea level, whereas increasing adaptive capacity would encompass implementing activities that are closely aligned with development

Box 2: Protecting Public Health From Climate Change – A Global Call to Action Launched in Durban, South Africa – 4 December, 2011

We know that, according to The Lancet, climate change is the greatest global health threat of the 21st century.^a

As leading healthcare providers, professionals and organizations, we know that the health impacts of climate change, such as the spread of vector-borne diseases, and the consequences of heat waves, droughts and extreme weather events are already being felt around the world, particularly in sub-Saharan Africa, where more people die as a consequence of climate change than anywhere else.

We are profoundly concerned that as greenhouse gas emissions continue to rise unabated, dangerous climate change will magnify existing health crises, deepening and broadening the global burden of disease. This will in turn raise health care costs worldwide, while undermining and overwhelming public health infrastructure everywhere. The overwhelming burden will fall on the most vulnerable – those living in poor countries, who have contributed least to greenhouse gas emissions.

We also know that what is good for the climate is good for health, and that an equitable resolution to climate change will result in major health benefits worldwide. Given the gravity and urgency of the situation – and the opportunity to promote public health by addressing climate change we call on our colleagues in public health organizations, health professional associations, hospitals, health systems and ministries of health around the world to endorse this Call to Action and take concerted action.

Having convened at the first Global Climate and Health Summit in Durban, South Africa, we hereby commit to:

1. **Provide Leadership:** As representatives of our organizations, we will drive the agenda for climate and health, promoting this Call to Action throughout the world.
2. **Engage and Inform:** We will engage and inform our constituencies of millions of doctors, nurses, public health workers, hospitals, health systems and health policy makers about the health risks from climate change, and the health benefits of climate action. As health professionals, we will also serve as messengers to our patients, our communities and our governments about the major health impacts of climate change and the steps they can take to reverse their impact.
3. **Mitigate:** We will lead by example and reduce the carbon footprint of our own institutions, practice and activities. We will strive to make our hospitals greener and healthier by reducing waste, investing in energy efficiency and clean energy sources, while promoting sustainable transport and resource consumption. By doing so, we commit to demonstrating how our societies can move toward carbon neutrality.
4. **Adapt:** We will strive to make our health systems more resilient and capable of withstanding and responding to the human toll of natural disasters, growing under-nutrition and the shifting burden of disease.
5. **Advocate Locally and Nationally:** We will work within our countries to advocate for emissions reductions and/or low-carbon development strategies that promote both a healthy climate and public health. We will call for solutions that reduce the local health impacts of fossil fuels; solutions that foster clean energy and social justice; solutions that save lives and money while protecting public health from climate change.
6. **Advocate Globally:** We will advocate for a fair and binding global agreement, as articulated in the Durban Declaration on Climate and Health, that:
 - Places the protection of human health as a primary objective of any agreement.
 - Establishes an ambitious fair shares framework to reduce global emissions (based on the principles of Equity and Common but Differentiated Responsibilities and Respective Capabilities) in order to avoid a global public health disaster.
 - Fosters both energy efficiency and clean, renewable energy that protects public health by reducing both local and global pollution.
 - Provides the immediate necessary resources to operationalize the Green Fund, and in the longer term, appropriate mitigation and adaptation funding required to address the health impacts of climate change, assuring all countries' Rights to Sustainable Development and their ability to pursue a low carbon development pathway.

^a "Managing the Health Effects of Climate Change" The Lancet, Volume 373, Issue 9676, Pages 1693-1733, 16 May 2009.

priorities.¹² Thus better adaptive capacity leads to less vulnerability.

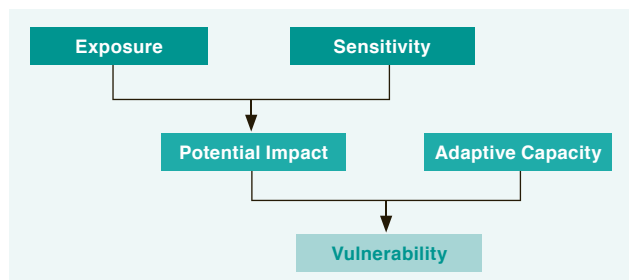


Figure 1: Components of vulnerability

Source: Government of Western Australia, 2008.¹⁴

Figure 2 shows that climate and climate change exposures are determinants of health and in terms of proximity are situated 'upstream' of individual biological and behavioural and societal determinants of disease. For instance, an extremely hot climate exposure can impact the cardiovascular system, particularly of the aged who are more sensitive, and who may be unable to modify their behaviour to remain cool, or be unable to afford or access a cool built environment (infrastructural changes) leading to an increased risk of stroke or heart attack fatality. The concept of risk factors as presented in the conceptual model presented in Figure 2 is expanded upon in Figure 3.

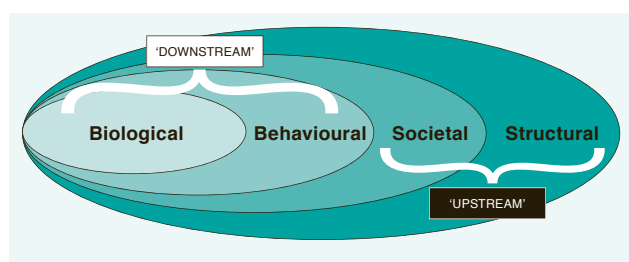


Figure 2: Conceptual model of risk factors for disease

Source: Western Cape Burden of Disease Reduction Study, 2008.¹⁵

Figure 3 provides a useful conceptual model that shows the complex causal connections between climate-related exposures, and direct and indirect adverse health outcomes. Moving from left to right across the columns the possibility of complex causal links from climate change variables like temperature can be seen to act *directly* and more simply on health in the form of a heat-related stroke, or more *indirectly* through causing change in the quantity and quality of water leading to an increase in mosquitoes and increasing the risk of infectious diseases like malaria. Socio-economic factors like wealth of the individual or society will modulate this causal chain by interrupting it. Figure 3 can be used to systematically understand the health implications of climate change.¹⁶

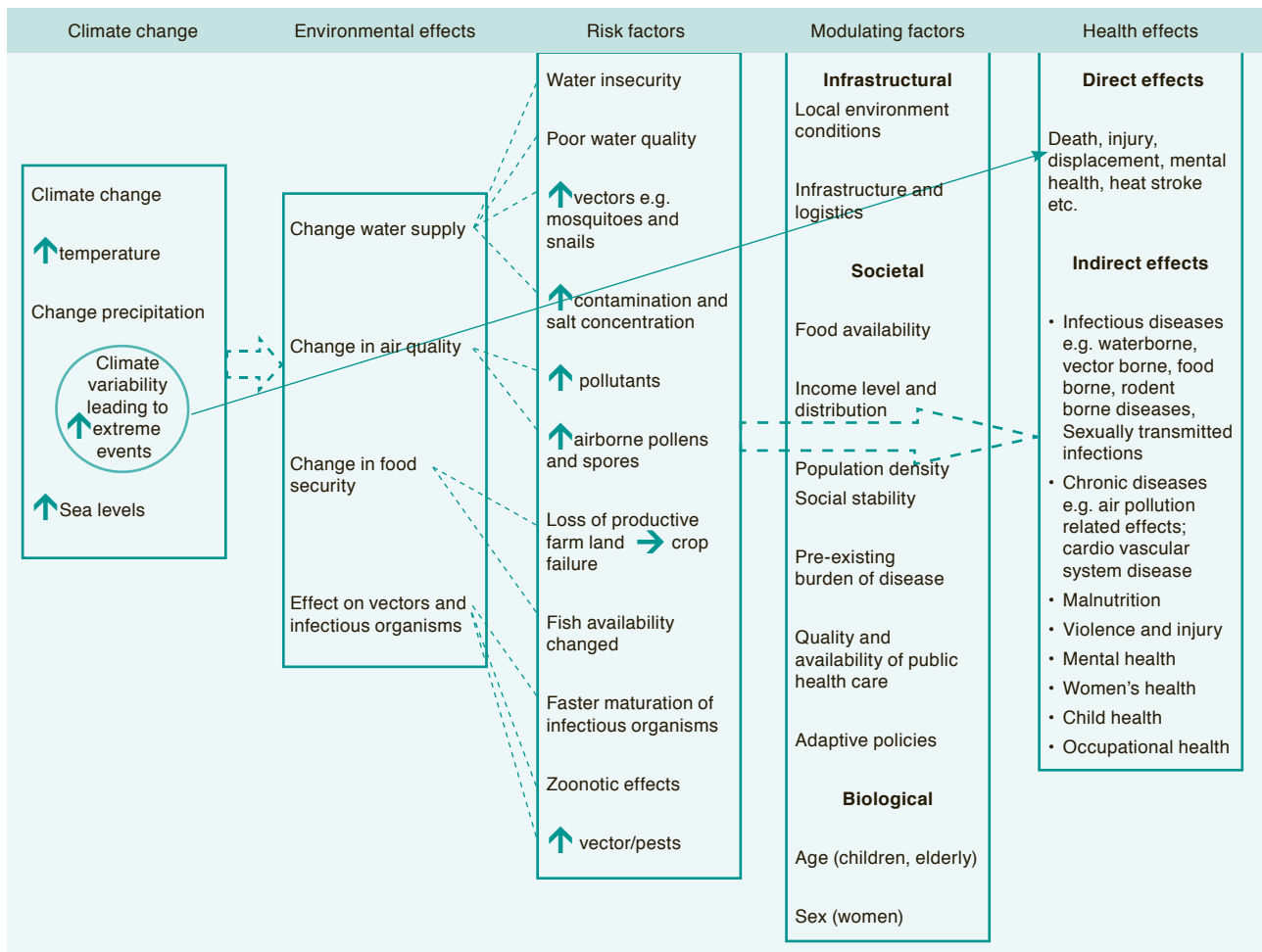
SA is described as having a quadruple burden of disease that consists of four epidemics – the major infectious diseases (HIV and tuberculosis), intentional and unintentional injury, chronic disease (including mental health disorders) and maternal and child mortality.¹⁷ The current distribution of the burden of disease in SA is a useful starting point for considering the potential impact of climate change exposure on the future burden in this country. An article outlining a public health approach to the impact of climate change on health in southern Africa discusses the indirect negative effects of climate change on conditions that plague the public health systems of these countries, such as infectious diseases, violence and injury, mental health, chronic diseases, malnutrition, women's and child health, and occupational health.¹⁸

When considering how to address climate change and its potential impacts, it is important to recognise that both health outcomes and exposure risks are amenable to prioritisation. For instance, a particular geographical area might be particularly susceptible to drought. If the health profile of the population in that area is known this will provide an indication of the priority health issues, which might be aggravated by a bout of or increasing drought. It is then possible to consider how individuals and society might adapt to optimally reduce the impact of the changed climate and prevent anticipated worsening of health status in that area. Thus the ability to prioritise climate exposures and the consequent health outcomes helps to identify principal vulnerabilities in a group living within that geographical area. This would therefore create opportunities to identify potentially modifiable risks and, as part of mitigation or adaptation strategies, implement proven or promising preventative interventions. An example could be that drought might be modified by developing an irrigation scheme, and the ability to do so is an example of the capacity for adaptation (see Figure 1) to limit potential negative health impacts. Health services constitute a key aspect of adaptive capacity as a consequence of primary and secondary preventive interventions to limit adverse health impacts, along with other individual and social responses.¹⁹

Box 3: Examples of adaptation strategies

- ❖ Establish/improve surveillance/early warning systems
- ❖ Disaster preparedness
- ❖ Better urban planning and housing design (climate-proofing, insulation, mosquito control)
- ❖ Improve infectious disease control programmes (vaccines, vector control, case detection and treatment).
- ❖ Institute community-based neighbourhood support activity
- ❖ Mobilise community partnerships and actions to identify and solve health problems.
- ❖ Ongoing monitoring & evaluation of adaptation strategies.

Figure 3: Impact of climate change on health



Source: Myers et al., 2011.¹⁶

Given the availability of health and climate data, and statistics for different geographical localities, it becomes possible to examine the associations between health status and climate exposures as these change over time. It would then be possible to determine which adverse health conditions are climate-sensitive and which in turn help to predict adverse health impacts and likely future demands on the health and social services under different future climate scenarios.

Findings from the literature

There have been several recent publications relevant to climate change and health. As referred to above, an overview of climate change and health in southern Africa was published in 2010.²⁰ A public health approach to health and climate change in SA,¹⁸ the elaboration of a potential research agenda,²¹ and a special issue of the journal *Continuing Medical Education (CME)*²² appeared in 2011. The CME issue integrated broader sustainability and public health issues with the impacts of climate change on health systems, health and lifestyle interventions and the practice of clinical medicine at the primary care level. The implications for community involvement in health care facilities in adapting to climate change were examined. Smit et al.²³ examined climate change and health in the context of urbanisation and the built environment.

More specific health impacts of climate variability and change are increasingly being studied in SA, focusing on climate-sensitive health outcomes like diarrhoeal, respiratory, cardiovascular and vector-borne infectious diseases (e.g. malaria). High and low temperatures, along with high precipitation and drought, have been shown to influence morbidity as measured by hospital admissions and mortality.²¹ Scovronick and Armstrong provide evidence for housing type modifying temperature-mortality relationships. Specifically, informal housing was associated with higher temperature-related mortality while traditional housing in rural areas was more protective than informal urban housing.²⁴ Mathee et al. found decreased productivity in outdoor workers exposed to high temperatures.²⁵ Modelling predicts no overall increase in malaria incidence for sub-Saharan Africa, but rather a shift of vectors and malaria infection incidence from west to the south and east as climate change impacts with increasing temperatures and precipitation.^{26,27} However, the incidence of malaria cases in SA has been declining over recent years as a result of a shift in preventative interventions targeting mosquitos, such as the reintroduction of DDT and its replacement of vector-resistant products such as Deltamethrin.

Significant limitations in the published research include unavailability of data²⁸ (especially at a small scale for both climate determinants and health outcomes), lack of a clear conceptual model for causal pathways from climate exposures to health outcomes, a lack of integrated or complex assessment methods, as well as poorly developed intersectoral perspectives and interdisciplinary engagement and experience in government and academia.¹⁸

Recent breakthroughs in the mechanistic understanding of tuberculosis (TB) susceptibility and vitamin D deficiency have shown seasonal and hence climate sensitivity.²⁹ It might be that increasing temperatures and less precipitation will increase resistance to TB in the southern part of SA.

Public health sector responses

Societal responses to adverse health impacts of climate change will be driven by anticipated changes in the burden of disease. They will also be limited by current and future service delivery capacity in the health and social services. It is anticipated that there will be many extra demands on these services due to climate change over and above the usual demands.³⁰

Prevention as the core activity of public health is multi-layered. Primary prevention of adverse health effects of climate change targets its root cause. This involves mitigation activities such as the reduction of greenhouse gases in the atmosphere. The health sector is increasingly being recognised as an important site of mitigation interventions, especially where both public and private sectors are substantial, as in SA, and where the size and reach of the health sector is set to expand with the introduction of National Health Insurance.⁶

Secondary prevention of climate change health impacts involves adaptation in anticipation of likely health impacts of expected climate changes, such as the provision of accessible cool facilities in communities on extremely hot days or once these changes have already occurred (e.g. better insulation of homes).⁹

Primary mitigation interventions are longer-term global solutions. More local adaptation interventions as secondary prevention of adverse health impacts would seem to be the major social response activity in the short- to medium term. To this end, an adaptation policy is being taken seriously by the South African Government at all levels and recent policy developments have occurred at national, provincial and municipal levels that have given rise to climate change and health adaptation plans. For example, in the Western Cape Province, there is an existing municipal climate change and health adaptation plan³⁰ and a provincial climate change adaptation strategy covering health since 2008,³¹ which is currently undergoing revision. The National Climate Change and Health Adaptation Policy³² was finalised in October 2012.³⁴ The eThekweni municipality in KwaZulu-Natal has a well-developed climate adaptation plan, which covers adaptation for health. Other provincial governments and local authorities (with some exceptions in the Eastern Cape) by contrast do not yet appear to have given systematic attention to the climate change health adaptation policies. Thus the response rate measured by provincial preparedness for addressing climate change in health terms is slow.

Table 1 integrates likely climate-related health outcomes (health vulnerability) with the health system responses required for successful adaptation to prevent these outcomes. Principal health systems adaptation activities involve data collection and the capacity to monitor population health and health facility readiness for anticipated climate-related impacts. Early warning systems for extreme weather events and effective response capacity at emergency services, health services and community levels will be critical. Disaster management stands out as a key response capacity, given anticipated extreme weather events that include heat waves, floods, droughts and storm surges.

Table 1: Health vulnerability determinants, facilities readiness, surveillance, monitoring and evaluation

VULNERABILITY/HEALTH IMPACT ASSESSMENT				ADAPTATION INTERVENTION EVALUATION				
FACILITIES READINESS ASSESSMENT				ADAPTATION INTERVENTION EVALUATION				
Climate change exposures	Environmental effects	Sensitivity	Adaptive capacity	Health impact	Current adaptive practices	New/proposed adaptation interventions	Monitoring & surveillance	Evaluation
Temperature	Water – insecurity, quality, vectors, pollutants, contamination, salinisation, sanitation	Quadruple Burden of Disease – HIV, Infectious Disease, Chronic Diseases, injury and violence	Structures and Policies in place for climate change and health adaptation	Direct:	Readiness for disasters and projected increases	Enhance readiness of at-risk facilities	Disease surveillance system	Audit to identify non-robust clinics at risk from climate change effects
Precipitation – shifts in frequency, intensity and seasonality	Air – quality (indoor and outdoor), pollution, pollens, spores, increased temp. inversions	Disrupted infrastructure of health care, water and sanitation	Implementation possibilities and assessment tools	Death, injury, displacement, heat stress, hypothermia, mental health, burns, drownings	Disaster and risk management policies and emergency plans (water and power supply; cold chain; transport routes)	Service level agreement with provinces to provide uncompromised health care despite climate change effects	Service load surveillance system	Review policies and plans regularly in the light of anticipated climate change effects
Extreme events, weather and wind, floods, fires, storms	Food security – productive land decrease, crops and fish decline	Nutritional status, food security, food hunger	Infrastructure and Logistics,	Indirect:	Public sector clinic services	Service level agreement with provinces to provide uncompromised health care despite climate change effects		Annual review of service level agreements
Sea level rise	Vectors and infectious organisms: faster growth, bigger populations, zoonoses, rats, birds	Demand overload on public health care due to disasters, and/or migration from other disaster areas	Facilities readiness (tools)	HIV +/-increase	Capacity to deal with climate-related diseases	Increase capacity eg. Annual diarrhoeal disease plan overseen by climate change committee; follow-up of notifiable diseases; Expanded Programme on Immunisation	Disease notification system	
		Major infectious diseases HIV, TB	Emergency services readiness – water, food, energy	TB increase	Capacity to deal with climate-related water-related disease vectors	City-wide plan for management of all significant water bodies; framework policy on urbanisation	Monitoring of water quality; reuse removal; sanitation	

VULNERABILITY/HEALTH IMPACT ASSESSMENT				ADAPTATION INTERVENTION EVALUATION		
Climate change exposures	Environmental effects	FACILITIES READINESS ASSESSMENT		Health impact	Monitoring & surveillance	Evaluation
		Sensitivity	Adaptive capacity			
		Informal housing/ settlements, poor ceiling insulation and ventilation, damage in extreme events	Income	Waterborne enteric disease increase (diarrhoeal diseases)	Extend: handwashing campaigns, health and hygiene projects, health promotion outreach, diarrhoeal disease prevention and treatment. New training in air quality management (cooking fuels and heating)	Level of public awareness of the dangers, prevention and response to climate-related illnesses
		Poor basic services water supply in dwellings, sanitation, energy	Equity	Air pollution respiratory disease increase (asthma, allergic rhinitis)	Air quality and climate change relationship (UCT);	
		Indoor/outdoor air pollution	Crowding density	Food-borne diseases Malnutrition	Research collaborations eg. Academic institutions, Medical Research Council, Centres for Disease Control, Western Cape Department of Health, National Institute for Communicable Disease	Changes in epidemiology of vector-borne diseases (National Institute for Communicable Disease; Promed; Western Cape Department of Health); air quality monitoring; impacts of extreme events
		Lack of social amenities, health services, security services, communal, recreational	Quality and availability of public health services	Vector-borne – Malaria, dengue fever increase		
		Socio-economic stress/poverty/ inequity	Quality and availability of ancillary services	Injury and violence – traffic crashes		
		Extremes of age – children and elderly		Mental health disorders, substance abuse, suicide		
		Women/single parent households		Cardiovascular diseases.		
		Nutrition-infection interactions		Special risk groups – children, women and the elderly		
				Occupational health for emergency. Outdoor and hot processes workers		
				Environmental chemicals/pesticides		

At the time of COP-17 in November 2011, a draft national climate change and health adaptation plan was available. It underwent significant change between 2011 and 2012 and was finalised in October 2012.³¹ The previous exclusive focus on infectious disease was extended to cover all direct and indirect outcomes comprehensively. The plan outlines national intersectoral administrative structures and a course of action that links global and local knowledge to action at various levels of government.

In the Western Cape Province, an early climate change strategic plan that also covered health impacts was crafted as early as 2008, but the actual health content was limited.³² The provincial plan is currently being revised in a process spearheaded by the Department of Environmental Affairs and Development Planning with a concurrent process of sectoral plan development in the different departments, including health. In 2011 the City of Cape Town produced health-sector-based climate adaptation plans of action (CAPA) in much greater depth and breadth than the national and provincial plans showed. The City of Cape Town plan explicitly envisages the requisite intersectoral linkages key to promoting health and preventing adverse health impacts (e.g. the sectors managing water and air quality).

Integration

There are problems of integration across levels of government with little communication in the generation of national, provincial and municipal climate change and health adaptation policy development and planning. Similarly, there are challenges involved in working intersectorally across departmental silos within each level of government when it comes to climate change adaptation. Lack of integration is also reflected in academic institutions where climate change research and teaching are similarly silo-based and where the scope of activity is typically limited to disciplinary as opposed to interdisciplinary perspectives. For the health sector this is not new. Ever since the birth of the concept of Primary Health Care at the Alma Ata conference in 1978, progress in crossing sectoral divisions has been elusive.

However, the experience of the abovementioned provincial government shows that it is possible to institute the requisite transversal structures to facilitate and implement programmes that involve multiple sectors.³³ The province has set up a number of cross-sectoral structures that correspond to principal provincial strategic objectives. One of these transversal structures deals in a transversal manner with mitigation and adaptation responses to climate change and is headed by the Department of Environmental Affairs and Development Planning. The Provincial Department of Health has an active climate change committee, which has already contributed to its 2020 Health Plan and is currently embarking on a climate change readiness audit of its facilities. The audit will be guided by the considerations arising from knowledge of the provincial burden of disease^{15,16} and expected climate change and disease patterns under these changes for the province. Similar audit work is being conducted for mitigation interventions across the province and within each of its departments. The transversal nature of these structures ensures that the health sector is an integral part of a "whole-of-government" approach to mitigation and adaptation and plays an important role in advancing a "health in all policies" approach. This provides a working example of what a provincial

government can do.

Slow progress with intersectoral action in government has its counterpart in the academic community where inter-disciplinary climate change research is still in its infancy. Lack of integrated assessment methodologies according to which researchers using different approaches from different disciplines can pool their knowledge and gain greater understanding of the impacts of climate change is a limitation.

There is currently little evidence-informed adaptation activity in the health sector. Risk assessment for climate change has not yet been implemented apart from in the cities of Cape Town and eThekweni. Isolated local examples of green healthcare facilities exist such as the management practices at the Lentegeur Psychiatric Hospital in Mitchell's Plain and the green design Khayelitsha Hospital in Cape Town.

Barriers and enablers

Barriers to adaptive climate change interventions include weaknesses in public sector service delivery, economic and financial constraints, a culture of poor service provision, and disorganisation at community level. Intersectoral approaches and local community organisations are enablers, but attempts to get all these agencies working together are not often successful.³³

Conclusions

McMichael has pointed out that climate change will not add wholly new dimensions to the burden of disease or demands on the capacity of health systems to address these.² Health impacts of climate change will in all likelihood be closely linked with the current distribution of the burden of disease. Climate change will amplify those components that are in any way climate sensitive. Wholly novel health threats are not anticipated.² Climate change, however, will aggravate existing problems besetting a weak health sector, and will alter the distribution of demands on the health system. Unexpected positive and adverse health impacts may arise directly or indirectly from climate change, such as more ultraviolet radiation improving vitamin D status of dark-skinned populations in the southernmost regions of the country. They may also arise as unintended results of mitigation or adaptation interventions. Health service capacity development (e.g. PHC re-engineering) will consequently need to be aligned with anticipated and actual impacts of climate change, thus necessitating adaptation plans in all provinces.

There is a growing availability of useful guidelines and tools aimed at mitigation of carbon emissions from the health sector. These can be usefully applied in SA at all levels of health facilities from the primary care level through to tertiary hospitals. There are useful local examples of green healthcare facilities that could be used as test cases and emulated if successful.

Key priorities for adapting to climate change in the health sector emerge from a consideration of the modifiability of the burden of disease and its associated health determinants for which data exist currently only at national level and for one province at provincial level. These data need ultimately to be available at the most local level for effective prevention.

There is little current research into climate change and health. This remains a difficult area limited by poor data availability and the complexity of the chain of causation along with uncertainties inherent in predicting climate change, especially at fine resolution in different localities around the country. For example, reliable climate predictions are currently limited to large areas and are not accurate for districts, suburbs or neighbourhoods. The same applies to health data, which are typically only available in the aggregate at provincial level. Important limitations include weak or absent data, lack of structural support for interdisciplinary thinking and research, intersectoral policy development and implementation. The silo mentality in government at all levels and the disciplinary nature of most academic research constitute strong barriers to vulnerability reduction.

The current South African national energy and transport policy is at odds with climate change and is likely to contribute negatively to both global and local health impacts. This is another example of the need for intersectoral collaboration both at the policy and intervention levels.

The situation with regard to other southern African countries is even less promising with regard to climate change health adaptation.¹⁵ SA could be an example for other countries, if adaptation interventions are successfully implemented nationally, provincially and at the local level.

Recommendations

In SA as well as globally we need to move as rapidly as possible to gain a better understanding of climate change and health. This involves better understanding of current climate-related fluctuations in morbidity and mortality, and the quantum of the burden of disease that is climate sensitive. Climate-sensitive burden of disease needs to be put together with climate scenarios modelled from local climatological data at the finest scale available to fully understand the health equity implications of likely changes. All this requires access to reliable and valid mortality and morbidity data, which currently are only available at national level, to some extent at the provincial level, but little of which is available at the level of the district and sub-district. Policy support is required for better institutional data acquisition and surveillance systems to be constructed.

Society's response in the health and health-related sectors needs strengthening. Transversal or cross-sectoral organisational structures and perspectives are essential as vehicles for policy development and especially implementation. An example of provincial buy-in and support exists, with policy makers and management being proactive in developing a series of transversal structures to match its strategic objectives, which involves the whole of government as well as partners outside of government. Such structures are essential for developing successful adaptive interventions and need to be further supported and implemented. The operating principle of "health in all policies" lays the foundation for intersectoral thinking from the point of view of the health sector.

Climate change health adaptation policies are still at an early stage of development at all levels of government and have a long way to go in order to be implemented by integration into the normal operations of public services. Data are critically important for the necessary monitoring and evaluation functions that track policy

implementation. Early warning systems of climate stressors, early identification of climate-sensitive conditions, early mobilisation of disaster and emergency response services and continuous evaluation are key ingredients for successful adaptation.

While much may be learnt from the results of research, policy and service development, particularly in the developed world, local preventive interventions will need to be appropriate for less developed and resource-constrained conditions and realities. Much more local research is needed, but there should be few illusions about the difficulties in linking upstream climate-related health determinants to health outcomes at the end of the causal chain.

There is considerable scope for research, development and collaborative work between academic institutions and the health system. More specifically, the biggest contributors to the burden of disease, their climate sensitivity and the modifiability of their associated risk factors should be targeted for priority attention.

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