

Acknowledgement

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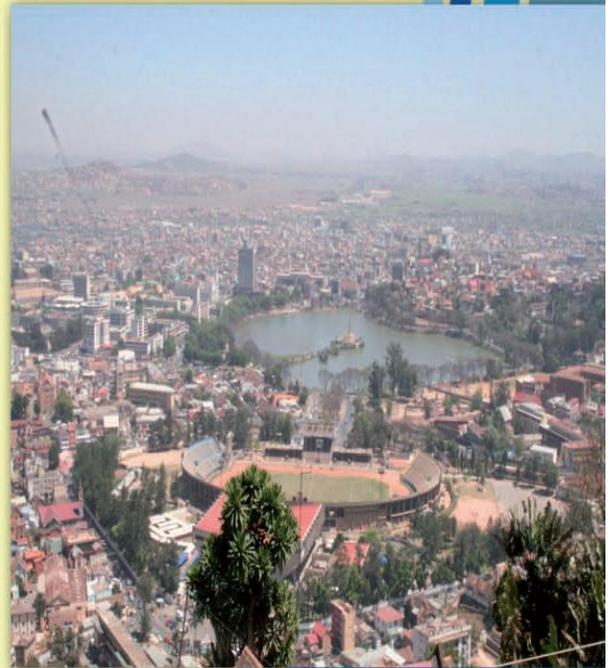
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Enabling research-to-policy dialogue for adaptation to climate change in Africa

Research and Policies for Climate Change Adaptation in the Southern Africa Urban Sector SUMMARY



Miriam Joshua,
Abdulai Jalloh
and Sepo Hachigonta



Mao A. Amis¹, Abdulai Jalloh² and Sepo Hachigonta³

¹ Executive Director , African Centre for a Green Economy (Africege) , Tokai Village Centre, 11 Vans Road, 7945 Cape Town, South Africa.

² Programme Manager, Natural Resources Management Programme, Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles/West and Central African Council for Agricultural Research and Development (CORAF/WECARD), 7 Avenue Bourguiba, BP 48, cp 18523 Dakar, Senegal

³ Climate Change Programme Manager, Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), 141 Cresswell Street, Weavind Park 0184, Pretoria, South Africa; Postal address: Private Bag X813, Silverton 0127, Pretoria, South Africa

Acronyms and Abbreviations

COMESA	Common Market for Eastern and Southern Africa
COP	Conference of Parties to the UNFCCC
GDP	Gross Domestic Product
HDI	Human Development Index
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome
IPCC	Intergovernmental Panel on Climate Change
NAPA	National Adaptation Programme of Action
NGO	Non-governmental Organization
RISDP	Regional Indicative Strategic Development Plan
SADC	Southern African Development Community
UNFCCC	United Nations Framework Convention on Climate Change

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1. Introduction

According to the Intergovernmental Panel on Climate Change (IPCC 2007), there is significant warming occurring in the Southern African Development Community (SADC) region. Whilst this warming is not uniform throughout the region, there is an observed increase in the number of warm spells and a decrease in extremely cold days. This temperature fluctuation has major implications for the health sector in Southern Africa, and understanding the evidence base for this climate feature will be critical for developing response strategies in the region. The risks associated with climate change in the region are now recognised and several efforts are under way to develop mitigation and adaptation strategies to cope with this threat.

In 2011, the International Development and Research Centre (IDRC) assigned the West and Central African Council for Agricultural Research and Development (CORAF/WECARD) to manage the pan-African research-to-policy platform, AfricaInteract. With funding from IDRC, AfricaInteract and CORAF/WECARD commissioned a desk review of research and policies related to climate change adaptation in the health sector in Africa. The review assessed the existing knowledge base on the impact of climate change on the health sector of Sub-Saharan Africa and documented current research and the state of

knowledge of climate change impact on disease burden and related threats. The extent to which health concerns are mainstreamed into broader climate change policies and how health policies address climate change issues were also reviewed. Specifically, the review was conducted to seek answers to the following key questions:

- What is the role of climate change challenges in the context of the multiple challenges and opportunities facing the health sector in the region?
- What is the current state of knowledge on adaptation to climate change in the health sector in the region?
- What is the current state of knowledge on whether and how research findings are integrated in health sector policies in the region?
- What are the major gaps in research on adaptation to climate change in the health sector?
- What is needed to ensure that research findings are better integrated into health sector policies?
- What is the current state of understanding on key stakeholders involved with research and policy on adaptation to climate change in the health sector in the region, and how can stakeholder involvement be improved?

This Southern African study covered countries in the SADC region, with Zimbabwe, South Africa and Malawi as case studies. This publication is a Summary of the main report published by CORAF/WECARD and Future Agricultures.

2. Overview of the Southern Africa Health Sector

Fourteen Southern Africa countries make up the SADC community with a population of 230 million people, (World Bank 2011). The region has an average population growth rate of 2.1 percent, though it ranges widely from 0.4 percent in Mauritius to 4.2 percent in Zambia. SADC countries with the highest Human Development Index (HDI) are Mauritius, South Africa, Botswana and Namibia. The economy of the region has been growing steadily; with an average gross domestic product (GDP) growth of 4.9 percent compared to the global average of 3.8 percent. Countries that experienced the highest growth during this period include Zimbabwe, Mozambique and Zambia. Life expectancy for most countries in the SADC region has improved significantly in the last 10 years, although there are significant variations between states (SADC 2013). The average life expectancy at birth between 2000 and 2009 was 52.8.

Health conditions in Southern Africa vary depending on the economic situation of the country, and health expenditure appears to mirror economic conditions. Countries like South Africa, Botswana and Mauritius with relatively high per-capita GDP, also have relatively high per-capita health expenditure. The burden of disease in the SADC region is attributed to communicable and infectious diseases, which are exacerbated by malnutrition, poor health services, inadequate infrastructure and rapid population growth. HIV/AIDS, malaria and tuberculosis are the main contributors to the burden of disease in the

region. Approximately 30 percent of the population is infected with HIV, representing the highest proportion globally, and 40 percent of people infected with HIV are co-infected with tuberculosis (AfDB 2006). Malaria accounts for 30 percent of outpatient visits and 40 percent of in-patients in Southern Africa. HIV/AIDS rates are however showing a declining trend, except Swaziland, where the rate has increased (SADC 2013). The latest statistics show that in several Southern Africa countries including South Africa, Botswana, Malawi and Namibia, the incidence rate of new infections in children has been reduced by up to 50 percent (UNAIDS 2013).

National Governments in the region have developed strategic plans to control these diseases (AfDB 2006). However, massive resource constraints limit the potential of SADC countries to respond effectively to health challenges. Other diseases that impact the region as a result of changes in lifestyle include cancer, sugar diabetes and cardiovascular disease.

Climate change projections for Southern Africa: Numerous climate change projections which rely both on downscaled global circulation models (GCMs) and regional climate models (RCMs) have been carried out for the Southern African region. In particular, the Council for Scientific and Industrial Research (CSIR) and the Climate Systems Analysis Group (CSAG) at the University of Cape Town have played significant roles in advancing our knowledge on climate science and developing new tools to better project future climates in the region. Most of the models project drier conditions as a result of increased warming for most parts of the region (Boko et al. 2007). Increased episodes of extreme climate events are also projected for some parts of the region, such as flooding in the Mozambican floodplains.

Rainfall is projected to decrease across Southern Africa for the summer months of September, October and November, which also coincide with the start of the rainy season in the region, suggesting reduction in early season rainfall (Christensen et al. 2007). Rainfall in the region is strongly influenced by El Niño Southern Oscillation (ENSO) events, a variation in surface temperature in the Pacific Ocean which can cause extreme weather conditions. Climate change is projected to increase the frequency of the warm phases of ENSO, which will result in frequent drought episodes in Southern Africa.

Most of the projected drying in the region occurs in winter, which corresponds to the dry season in most parts of Southern Africa except for the southwest region that receives winter rainfall. As a result, the projected winter drying does not contribute to the bulk of mean drying (Christensen et al. 2007). The southwest region is projected to experience drying due to processes that result in increased moisture divergence and a systematic poleward shift of storm tracks, affecting winter rains. This drying trend may however be interrupted by strong orographic forcing that might alter conditions locally, resulting in rainfall (Christensen et al. 2007).

3. Research Related to Climate Change in the Southern Africa Health Sector

Over the last few years, significant progress has been made in our understanding of the linkages between climate variability and change and its impacts on health, although less research work has been conducted in the health sector in the Southern Africa region. (Christensen et al. 2007; Patz et al. 2005). Research has shown that increases in temperature and changes in precipitation patterns result in increased occurrence of malaria, cholera and other diseases such as strokes, dehydration and skin

cancers. The impact of climate change on the health sector varies according to the geographic location and economic circumstances. In Southern Africa the impact of climate change on the health sector is likely to be manifested through three major pathways, namely (i) through food and water borne diseases, (ii) vector borne diseases and (iii) HIV/AIDS.

3.1 Food and Water Borne Diseases

Food and Water borne diseases can be caused by pathogenic microorganisms and toxic contaminants found in water used for activities such as drinking and recreation. Such contamination can result in illnesses that include cholera and schistosomiasis. Food contamination can happen at various stages of the food supply chain, right from production through transportation to consumption (Portier 2008). The incidence of food poisoning is projected to increase as a result of rising temperatures since higher temperatures create suitable conditions for microbes to multiply. Insects that are responsible for food contamination such as flies and other pests have a better survival chance during warmer weather, increasing the chances of food contamination (Menne et al. 2008). In addition to warmer temperatures, poor refrigeration facilities in many communities increase food poisoning incidence.

Studies have been conducted on the link between climate change and water and food borne diseases. Most of these studies, however, have not been conducted in the Southern African region. The most reliable scientific evidence for understanding of the implications of climate change on food and water borne diseases comes from the latest IPCC report (Confalonieri et al. 2007). There is a strong association between high temperatures and increased episodes of diarrhoeal diseases in adults and children. In Zambia, a study that investigated the incidence of diarrhoeal incidence in children during a specific rain season, found that 18 percent of the children infected resulted from contamination of drinking water (Nchito et al. 1998) A similar study in the Limpopo river basin found that children were also adversely impacted by climate related ailments. The most prevalent diseases were diarrhoea, respiratory infections, asthma and malaria (Thompson et al. 2012).

Southern Africa is burdened by four main types of diseases: emerging infectious disease such as HIV/AIDS, old infectious diseases like tuberculosis, chronic diseases such as asthma and injury linked to climate events. The risk of outbreaks of water borne diseases increases where water, sanitation and personal hygiene standards are low (Menne et al. 2008).

Vulnerability to food and water borne diseases is affected by several factors, including pre-existing conditions such as weak public health care systems and limited access to primary health care. Such conditions result in a weak adaptive capacity of the system, resulting in a more severe impact of climate change. It is clear that more research is required in the region to understand the magnitude and distribution of climate change impacts on water and food borne diseases. In a study of climate change vulnerability and adaptation preparedness in Zimbabwe, Chagutah (2010) found that 'disease often also deprives households of labour during critical periods, adding to vulnerability'. The most vulnerable groups include elderly populations (especially women), orphans and urban residents.

3.2 Vector borne Diseases

According to Portier and Thingpen (2010), Vector borne and zoonotic diseases (VBZD) are infectious diseases whose transmission cycles involve animal hosts or vectors. Vector borne diseases are those in which organisms, typically blood-feeding arthropods (insects, ticks, or mites), the vectors, carry the

pathogen from one host to another, generally with amplification (increased virulence in the recipient host) (for example, malaria). Zoonoses are diseases that can be transmitted from animals to humans by either contact with animals or by vectors that can carry zoonotic pathogens from animals to humans (for example, avian flu). Domestic animals and wildlife, including marine mammals, fish, sea turtles, and seabirds may play roles in VBZD transmission by serving as zoonotic reservoirs for human pathogens or by means of interspecies transmission of pathogens. In Southern Africa, transmission patterns of vector borne diseases are changing, including changes in historical season of transmission as a result of climate change. For example, patterns of malaria distribution will change significantly without increasing their incidence rate.

One of the main challenges in Southern Africa is the lack of adequate health and demographic data for quantifying the impact of climate change on human health. However significant progress has been made in understanding the impact of climate change on some major vector borne diseases such as malaria, which has been most studied. One comprehensive study on malaria involved mapping its risk in several African countries, showed that climatically suitable areas for malaria increase with climate change depending on the region (Thomas et al. 2004).

In the Southern African region, studies have shown that changes in temperature and precipitation alter the geographic distribution of malaria in Zimbabwe, with areas that were previously unsuitable for malaria becoming affected (Hartmann et al. 2002). The areas suitable for malaria in the region will extend further south, presenting new challenges for South Africa, which was previously not at the epicentre of malaria infections. According to the IPCC, long term trends of malaria in Southern Africa show no significant association with climate, although seasonal changes in malaria were significantly associated with climate variables. Drug resistance and HIV infection were also found to be important drivers of malaria over the long term. Modelling projected an expansion in the suitable areas for *Plasmodium falciparum* in some regions and contraction in other regions. Some regions will also experience a longer season of transmission

The primary adaptation measure in dealing with vector borne diseases is the need for a well-prepared health system and public health system. Health systems that are better prepared now in dealing with current levels of disease and climate variability, are better prepared in the face of climate change (Nerlander 2009). With most countries in the region having very low per capita health expenditure, the health systems are not well prepared for the potential impact of climate change.

An early warning system has been implemented in the SADC region as part of the Abuja Targets for Roll Back of Malaria in Africa, which set a target that 60 percent of epidemics must be detected within two weeks of onset and 60 percent of epidemics will be responded to within two weeks of detection (DaSilva et al. 2004). Surveillance systems should be improved through the provision of better primary health care, improved laboratory facilities and standardized diagnosis (Nerlander 2009).

3.3 HIV/AIDS and Climate Change

Countries that have been most affected by the HIV/AIDS pandemic in Southern Africa include Botswana, Zambia, Malawi, Lesotho and Swaziland. HIV/AIDS poses multifaceted challenges with direct implications on productivity, disease burden and food security as well as major implications for national

economies and quality of life. According to Dube and Chimbari (2009) life expectancy in Botswana and Malawi dropped significantly from 62 years in 1990–1995 to 39-48 years in 2000–2005 (CHGA 2008). Brown et al. (2012), reported that the Zimbabwe National Network of People Living with HIV and AIDS is concerned about the impact of climate crisis on the vulnerability of people living with HIV/AIDS.

Studies in the region established a direct link between HIV/AIDS, climate change and institutional capacity in the management of disasters. For example, Suarez et al. (2008) reviewed 6 disaster management institutions in Malawi to assess the combined impact of HIV/AIDS and climate change on their institutional capacity to manage disasters. The study found that HIV/AIDS had a major impact on staff performance, with high level of absenteeism and increased workload (Suarez et al. 2008).

The disease burden and the combined social response capacity of countries in the region need to be better understood in order to comprehensively plan for the best use of resources whose application would simultaneously constitute improved adaptation and reduced vulnerability, based on an integrated approach. However, in countries like South Africa, where HIV is responsible for a quarter of the disease burden, other more amenable contributors to the burden need to be prioritized in order to free up capacity. Productivity and efficiency in services also need attention – and not just productivity reduction directly due to AIDS.

Many communities in the region rely on local knowledge to develop climate change adaptation measures; however, many of these communities have been devastated by the impact of HIV/AIDS. This has resulted in dysfunctional social structures in many communities, with many child headed households. Rebuilding social structures in vulnerable communities through services such as the provision of better access to health care and the implementation of psychosocial programmes will help to build community resilience against the impacts of HIV/AIDS and climate change.

4. National and Regional Health Policies related to Climate Change in the Southern Africa

In Southern Africa, there is wide variation regarding progress in the development of policies and strategies for addressing climate change in the health sector. South Africa is one of the countries in the SADC region that has made serious progress in incorporating climate change adaptation measures into its policies and strategies. Most of the progress has however been made in the last 3 years, which culminated with the COP17 summit in Durban, where a climate and health declaration was issued. Although the National Climate Change Response Strategy for South Africa clearly states that climate change adaptation measures will be mainstreamed into the health sector, specifically through the Department of Health Strategic Plan, there is no mention of climate change in the National Department of Health Strategic Plan 2010-2013. The strategy has, however, clearly outlined how South Africa plans to combat diseases such as malaria, whose transmission patterns are projected to change as a result of climate change.

According to Myers and Rother 2012, following the COP17 meeting in Durban in 2011, there was an increase in climate change policy development in South Africa at all tiers of government. This included the development of the National Climate Change and Health Adaptation Policy, as well as at the provincial level in the Western Cape Province and KwaZulu-Natal. At the local government level, the city

of Cape Town and eThekweni municipality have specific climate and health adaptation policies. In South Africa the National Health Act 2003, provides a framework for a structured uniform health system taking into account the obligations imposed by the constitution and other laws on levels of government concerned with health services. The Act makes provision for the control of vector borne diseases such as malaria, whose management is a national mandate. South Africa's National Infection Prevention and Control Policy Strategy (2007) recognizes that climate change will increase the transmission of infectious diseases.

Malawi's National Health Policy was still in a draft format, and there are no clear indications that the policy has been finalized. The top five health care priorities for Malawi in the draft policy include (i) vaccines for preventable diseases; (ii) malaria; (iii) acute respiratory infections; (iv) diarrhoeal diseases including cholera; and (v) sexual and reproductive health (Government of Malawi 2011). The national health policy does not mention climate change, but the health priorities correspond to the diseases that are going to be impacted by climate change.

Climate change considerations in regional health sector policies and strategies

SADC has a Protocol on Health, which is a legal instrument for coordinating and harmonizing health sector activities in the region (SADC 1999). The protocol was ratified by Member States in 1999, and addresses a range of issues related to climate change. Although it does not address the threat of climate change explicitly, it highlights the need for a coordinated approach to disaster risk management, health and communicable and non-communicable diseases. The protocol also led to the establishment of a Health Sector Co-coordinating Unit (HSCU) and a Health Sector Committee of Ministers (HSCM).

SADC has also developed a Health Policy Framework to raise the regional standard of health care through promoting, coordinating and supporting Member States to improve access to high impact health interventions. The policy framework recommends the development of policies, strategies and priorities on several health issues such as HIV/AIDS, communicable and non-communicable disease control and health promotion.

5. Gaps in Climate Change Adaptation Research and Policy in the Southern Africa Health Sector

5.1 Research Gaps

Studies in the region have identified gaps in the understanding of adaptation to climate change in the health sector. One of the major knowledge gaps is lack of understanding of adaptation strategies that have been effective elsewhere and could be applied in the region (Myers et al. 2011). Adopting such approaches would help the region to quickly implement adaptation measures cost effectively, without having to develop completely new measures whose efficacy has not been tested. The region still lacks very basic understanding of local knowledge on climate change adaptation. This problem has been recognised and initiatives such as the promotion of regional downscaling are initiated to close this gap (Ziervogel and Zermoglio 2009).

Knowledge gap in the health sector due to the effect of climate change on disease burden has only been assessed for a very few key infectious diseases (Confalieneri et al. 2007), Furthermore, most of the models that have been used to predict the impact of climate change on specific disease prevalence were not developed and tested in the region, therefore, some of the projections might be entirely inaccurate in assessing the impact of climate change on disease burden in the region.

5.2 Key Policy Gaps

Because most of the discourse on climate change impact on the Southern Africa health sector is academic, only a few countries in the region have national climate change health response strategies, which, in some cases, are too broad to address issues specific to the health sector. There is often lack of coherence in policy development and implementation. For example, despite the existence of a plethora of policy frameworks, strategies and other policy documents in South Africa, it took a long time for the country to establish a coherent climate change policy (Richards 2008).

There is need to strengthen evidence based policy implementation. Current policies are not based on strong evidence, as a very small pool of research related to climate change has been carried out for the region. This is because climate change policies do not clearly identify the strategies that need to be implemented to address the situation. For example, the National Water Resource Management Policy of Malawi does not state clearly the kind of strategies that need to be put in place to manage sanitation, placing a huge burden on the implementation of such a policy.

Many climate change adaptation policies are not comprehensive in their approach; for example, the climate change adaptation strategy for Zimbabwe has been criticised for a very strong focus on rural areas without saying much about urban settings (Brown et al. 2012). This has major implications for the management of diseases as urban populations grow due to rural-to-urban migration.

In a comprehensive review of the researcher-policymaker interface in several countries including Malawi and Tanzania, Stephenson and Hennink (2002) identified the key barriers to research uptake by policymakers; these include limited access to research outputs, poor dissemination skills by researchers and a lack of central points to access information. In many cases the quality of research outputs is very poor; hence, policymakers do not find the information useful for decision-making. Researchers and policymakers are isolated, without a common platform for collaboration or formal communication channels through which research outputs could be disseminated to policymakers in the region.

The key research and policy gaps identified are relatively generic, and apply to various sectors and geographic locations. However in this case it could also be argued that the main drivers of the research policy gaps is influenced by the fact that the integrated health and climate research agenda is still very new, and most of the research work in both sectors has been conducted in parallel.

6. Stakeholders and Opportunities for Collaboration in Research on Climate Change in the Southern Africa Health Sector

Southern Africa has the largest number of stakeholder institutions working on climate change issues,(see Figure 1) and in many cases, their work encompasses the entire Southern African region; as a result, other countries in the region that do not have enough research capacity have benefitted from the work carried out by South African research institutions.

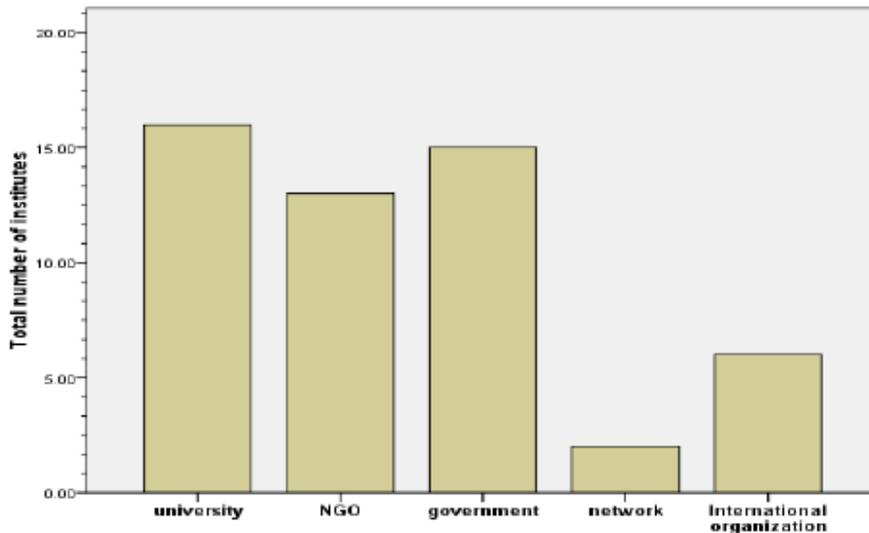


Figure 1: Number of institutions where climate change work related to health is being conducted (Dube and Chimbari 2009).

The key stakeholder institutions can be classified as follows: There are very few actors and players in the Southern African region that are focused exclusively on adaptation to climate change in the health sector. The key stakeholder institutions in Malawi for climate change include the Ministry of Environmental Affairs, and the Faculty of Science at the University of Malawi. International organizations in Malawi include CURE International and Action Aid. In Zimbabwe the key institutions include ZERO Regional Environment Organization. The University of Zimbabwe and Midlands State University have conducted research on climate change mitigation and adaptation.

In South Africa, leading institutions and stakeholders include the Ministry of Environment and Water Affairs, the Council for Scientific and Industrial Research (CSIR) and Climate Systems Analysis Group. The Centre for Occupational Health and Environmental Health Research at the University of Cape Town is engaged in conducting research on the impact of climate change on the health sector.

Government Stakeholders: Government stakeholders include Ministries of Health, Environment, Water, Disaster Management, Irrigation, Food Security, Livestock and Fisheries. Most governments also have inter-ministerial committees to coordinate climate change; for example, South Africa has a National Climate Change Committee that draws members from different arms of the government.

Non-governmental Organizations (NGOs): NGOs in Southern Africa play a major role in advancing our understanding of issues that require research. Active NGOs include international ActionAid, CARE International and Médecins Sans Frontières (MSF). Countries also have local NGOs that have played a key role working with the poorest communities or advocating for health services that reach those at the bottom of the social hierarchy.

7. Conclusions and Recommendations

7.1 Conclusions

Evidence from this review indicates a direct link between climate change and disease and that the health sector in Southern Africa is already facing multiple challenges in relation to its burden of disease, and that climate change will exacerbate this current situation. Southern Africa is confronted with a major challenge because of the burden of disease associated with HIV/AIDS, infectious diseases, chronic diseases and intentional and unintentional injuries.

The vulnerability of the population to the impact of climate change on human health depends on multiple factors including the current state of health care, access to primary health care by the community; and the characteristics of the individual affected, such as age, gender and education level. Institutional drivers such as policy responses and governance systems also play a critical role in determining the vulnerability of populations impacted by climate change.

For all of the diseases reviewed in this study, namely water and food borne diseases, vector borne diseases and HIV/AIDS, there is significant evidence linking them to the impact of climate change. The impact of climate change on the prevalence of these diseases was linked to other factors such as access to adequate water supply and sanitation, reliable food supplies and, in the case of HIV/AIDS, a breakdown in social structures that has led to inadequate use of local knowledge in climate change adaptation.

Several options to build adaptive capacity are available to cope with the impact of climate change on the health sector. Key options include effective planning that takes into account multiple dimensions and pathways through which the impact of climate change will be felt in the sector. There are still knowledge gaps in our understanding of how specific diseases will be impacted by climate change. In addition, most of the research work linking health to climate change has been conducted outside the region, so there is need for locally driven initiatives which integrate local context in understanding the impact of climate change on the health sector.

Several SADC countries have developed climate change adaptation policies and strategies, but health policy responses are still relatively inadequate compared to other sectors such as agriculture and water. Although many countries in the region have health policies, they have not adequately incorporated climate change considerations in their implementation.

The overall conclusion is that although the impact of climate change on the health sector has become increasingly apparent in the region, more work still needs to be done to develop the knowledge base, and to mainstream health considerations into climate change policies.

7.2 Recommendations

The following recommendations were endorsed by regional stakeholder at a workshop convened to validate the outcomes of the study.

1. Gather more primary data and locally relevant information to improve the evidence base for linking climate change to the occurrence of diseases in the region.

Although the impact of climate change on human health is well understood, the evidence base to make informed decisions is still lacking. One of the main constraints in building this evidence base is the lack of long-term health data for specific areas, and climate data at a relatively fine scale to link human health to changes in the climate system (CSIR 2010). There is a need to gather evidence at fine spatial and temporal scales, to provide reliable information to policy-makers for informed decision making.

2. Promote stronger alignment between the different sectors in trying to understand the impact of climate change.

The impact of climate change on the health sector should not be considered in isolation without participation by other sectors such as agriculture and urbanization, since these are closely linked. Climate change adaptation planning therefore needs a holistic approach to develop measures that have multiple outcomes and optimal use of limited adaptation resources.

3. Provide strong political support and champions to mainstream health considerations into climate change issues.

There is an urgent need for strong political support and champions to promote the uptake of health considerations into climate change discourse, policy formulation and planning. Health dimensions of climate change have not featured as prominently as other sectors such as agriculture and water in various forums including UNFCCC negotiations. This could be partly associated with a lack of political support and champions required to influence such agendas and programmes of work in national and global platforms.

4. Need for more coordinated and dynamic adaptation planning that takes cognisance of future uncertainties

Most efforts in understanding the impact of climate change focused on 'major' diseases such as malaria and HIV/AIDS, which form the basis for adaptation planning. There is a risk that diseases that are neglected might become of major concern in the future as a result of climate change. It is therefore important to develop climate change adaptation strategies and toolboxes that recognize these future uncertainties and will be responsive to such changing circumstances.

5. There is need to develop good understanding of the cost of climate change adaptation in the health sector.

There is a need to develop better understanding of the cost of climate change adaptation in the health sector. Very few studies have been carried out to understand the direct and opportunity costs of climate change in the health sector, which presents a major gap with serious implications on climate change adaptation planning.

6. Streamline communication of research outcomes to unlock barriers to uptake of research outcomes by policymakers and practitioners.

Publications that specifically target policymakers, such as policy briefs, on climate change and the health sector are not available and packed in a format that is suitable for policymakers to access. It is therefore important for research outcomes to be communicated in a manner that targets various audiences, such as the science community, government and the general public. These pathways could potentially be unlocked through the use of knowledge brokers such as the traditional media outlets and more recently social media, which has become a very powerful medium of communication.

8. References

- AfDB (2006) *Southern Africa Development Community Support to the Control of Communicable Diseases (HIV/AIDS, Tuberculosis and Malaria)*, Tunis, Tunisia: African Development Bank
- Brown, D.B., Chanakira, R.R., Chatiz, K., Dhliwayo, M., Dodman, D., Massiwa, M. ... and Zvigadza, S. (2012) *Climate Impacts, Vulnerability and Adaptation in Zimbabwe*, London, UK: International Institute of Environment and Development
- Chagutah, T. (2010) *Climate Change Vulnerability and Adaption Preparedness in Southern Africa*, Cape Town, South Africa: Heinrich Boll Stiftung
- CHGA (2008) *Securing Our Future*. Report of the Commission on HIV/AIDS and Governance in Africa, Addis Ababa, Ethiopia: UN Economic Commission for Africa
- Christensen, J.H., Hewitson, B., Busuioc, A., Chen, A., Gao, X., Held, I. ... and Whetton, P. (2007) 'Regional

Climate Projections', in *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, UK: Cambridge University Press

Confalonieri, U., Menne, B., Akhtar, R., Ebi, K.L., Hauengue, M., Kovats, R.S. ... and Woodward, A. (2007) 'Human Health', in *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, UK: Cambridge University Press, pp.391-431

Dube, O.P. and Chimbari, M.J. (2009) *Documentation of Climate Change and Human Health in Southern Africa*, Copenhagen, Denmark: University of Copenhagen

Government of Malawi (2006) *Malawi Growth and Development Strategy: From Poverty to Prosperity 2006-2011*, Lilongwe, Malawi: Government of Malawi

Government of Malawi (2011) *Malawi National Health Policy*, Lilongwe, Malawi: Ministry of Health

Government of South Africa (2004) *National Climate Change Response Strategy*, Pretoria, South Africa: Department of Environmental Affairs and Tourism

Government of South Africa (2013) *Government Gazette No. 36354, Notice No. 376 of 2013*, Pretoria, South Africa: Government of South Africa

Government of Zimbabwe (2009) *The National Health Strategy for Zimbabwe 2009-2013*, Harare, Zimbabwe: Ministry of Health and Child Welfare

Hartmann, J., Ebi, K., McConnell, J., Chan, N. and Weyant, J.P. (2002) 'Stable Malaria Transmission in Zimbabwe under Different Climate Change Scenarios', *Global Change and Human Health*, 3(1):42-54

IPCC (2007) *Climate Change 2007: Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, UK: Cambridge University Press

Menne, B., Apfel, F., Kovats, S. and Racioppi, F. (eds) (2008) *Protecting Health in Europe from Climate Change*, Washington, DC: World Health Organization

Myers, J.E. and Rother, H.A. (2012) 'Chapter 10: Public Health Impact and Response to Climate Change in South Africa', in Padarath, A. and English, R. (eds), *South African Health Review*, Cape Town, South Africa: Health Systems Trust

Nchito, M., Kelly, P., Sianongo, S., Luo, N.P., Feldman, R., Farthing, M. and Baboo, K.S. (1998) 'Cryptosporidiosis in Urban Zambian Children: An Analysis of Risk Factors', *American Journal of Tropical Medicine and Hygiene*, 59(3):435-437

Patz, J.A., Campbell-Lendrum, D., Holloway, T. and Foley, J.A. (2005) 'Impact of Regional Climate Change on Human Health', *Nature*, 438(7066):310-317

Richards, R. (2008) 'Assessing Progress on Climate Change Policy and Practice: Observations from South Africa and SADC', *Policy: Issues and Actors*, 21(1)

SADC (1999). Southern Africa Development Community: Protocol on health. Gaborone, Botswana.

SADC (2005) *Regional Indicative Strategic Development Plan (RISDP)*, Gaborone, Botswana: Southern African Development Community

SADC (2013) *Facts and Figures*, Gaborone, Botswana: Southern African Development Community / <http://www.sadc.int/about-sadc/overview/sadc-facts-figures/#LifeExpectancy> [accessed 19 June 2013]

Stephenson R, and M Hennink. (2002). Moving beyond research to inform policy: Barriers and strategies in developing countries. Opportunities and Choices Working Paper No 2002/05. University of Southampton, UK.

Suarez, P., Givah, P., Storey, K. and Lotsch, A. (2008) *HIV/AIDS, Climate Change and Disaster Management: Challenges for Institutions in Malawi*, Washington, DC: The World Bank

Thomas, C.D., A. Cameron, R.E. Green, M. Bakkenes, L.J. Beaumont, Y.C. Erasmus, B.F.N., Ferreira De Siqueira, M, Grainger, A., Hannah, L., Huntley, B., Van Jaarveld, A.S., Midgley, G.F., Miles, L., Ortega-Huerta, M.A., Peterson, A.T. & Philips, O.L (2004). Extinction risk from climate change. *Nature*. 427, 6970, P. 145- 148.

Thompson, A.A., Matamale, L. and Kharidza, S.D. (2012) 'Impact of Climate Change on Children's Health in Limpopo', *International Journal of Environmental Research and Public Health*, 9:831-854

UNAIDS (2013) *How Africa Turned AIDS Around*, New York, NY: Joint United Nations Programme on HIV/AIDS

World Bank (2004) *World Development Report 2004: Making Services Work for Poor People*, Washington, DC: The World Bank.

Ziervogel, G. and Zermoglio, F. (2009) 'Climate Change Scenarios and the Development of Adaptation Strategies in Africa: Challenges and Opportunities', *Climate Research*, 40:133-146