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## **Climate change impacts and effects on health system: A challenge towards achievement of sustainable development goal 3 in South Africa**

**Tirivangasi Happy Mathew<sup>1</sup>, Rankoana Sejabaledi Agnes<sup>2</sup>, Nyahunda Louis<sup>3</sup>**

<sup>1</sup>Department of Research Administration and Development, University of Limpopo,

<sup>2</sup>Department of Sociology and Anthropology, University of Limpopo, <sup>3</sup>Unit of Institutional Change and Social Justice University of the Free State, Bloemfontein, South Africa

[mathewtirivangasi@gmail.com](mailto:mathewtirivangasi@gmail.com)

**Abstract.** The aim of this paper is to present climate change health related effects that may pose a challenge for South Africa to attain South Africa's plans to achieve Sustainable Development Goal (SDG) 3. It examined South Africa's preparedness to address the impacts of climate change in order to best achieve SDGs 3. Climate change is a challenging phenomenon, which has seen many people around the world being affected by its effects unaware and unprepared. Climate change affects weather patterns, for instance rainfall patterns and temperatures. Consequently, this resulted in draughts, floods, diseases, veld fires, high temperatures, changing times of floods occurrences and depleted water resources in Africa and the rest of the world. This has placed human life in danger. Considering the increasing burden of diseases, the United Nations (UN) adopted Sustainable Development Goals (SDGs) to address of poverty, hunger disease and want by 2030. However, climate change threatens the ability of countries to achieve this by the anticipated time. The researchers conducted an extensive content analysis by interrogating various sources of literatures sources that include journal articles, thesis, academic books, and documents written by the government of South Africa. The study reveals that that climate related deaths will increase between 2030 and 2050 due to these health impacts of climate change. The study reveals that South Africa, like many other countries in Sub-Saharan Africa faces threat of vector borne diseases, mental health, malnutrition, and diarrheal, and other disease resulting from water scarcity and heat waves. This comes because of high prevalence of drought, floods, and increased temperatures. The study recommends early awareness and new communication strategies for the promotion of mental health, heat education campaign and prevention of vector borne diseases.

**Keywords.** Climate Change; Diseases; Sustainable Development Goals (SDGs); Health; South Africa

### **1. Background and Introduction**

This chapter interrogates the climate change health related effects or impacts that may pose an immediate challenge for South Africa's plans to achieve SDGs 3 and 6. This was achieved through an extensive systematic content analysis looking at literature that dwells on climate change hazards facing at present and their impacts or effects on South Africa. The South African government identifies population health as a primary goal of sustainable development

(South African Department of Health, 2014:1), and human beings are at the risk of negative impacts of climate change through extreme which causes terrible weather events such as droughts, rising sea levels, floods, cyclones and hurricanes (Mahapatra *et al.*, 2018; Nyahunda & Tirivangasi, 2019; Salvador *et al.*, 2020). Moreover, climate change has impacts on food, water, air, infrastructure, agriculture, ecosystems, and livelihoods (Firdaus *et al.*, 2019; Firdaus *et al.*, 2020). As consequence of the aforementioned impacts of climate change, many people die from heat waves, floods, storms, fires and droughts; diarrhoea and respiratory diseases; water and food-borne diseases (Ncube & Tawodzera, 2019; Salvador *et al.*, 2020), and mental, nutritional, infectious and other health effects (Bell *et al.*, 2018). In response to the impacts of climate change South Africa committed herself to international agreements that seeks to address the health impact of the environment ie. The Rio Declaration of 1992. The Rio declaration placed human beings at the centre of concerns for sustainable development and are entitled to a healthy and productive life in harmony with nature (United Nations Conference on Environment and Development [UNCED], 1992; Bauer & Scholz, 2010:91; European Commission [EU], 2020).

The South African government recognised that goals of sustainable development set by United Nations can only be attained through the absence of diseases while health gains require poverty eradication for the entire population (Bradshaw & Steyn, 2001; Ataguba, *et al.*, 2011). In light of this, there is need to address the causes of health concerns and the most of them emanate from the environmental causes and their impacts on development and vulnerable groups, including women, children, people with disabilities, elderly persons and indigenous people. The first step towards addressing the health challenges posed by climate change is through abiding to the mandates or goals set by UN for individual countries to work towards, in order to achieve sustainable development goals. The UN adopted Sustainable Development Goals (SDGs) to set out an important ambitious and life changing vision to ensure a world free of poverty, hunger disease and want by 2030 (United Nations, 2015; Kumar *et al.*, 2016; Behzadifar *et al.*, 2018). The main goal is to ensure equitable and universal access to health care which ensures physical, mental, and social well-being of different communities around the globe (World Health Organization, 2019). The UN reaffirms commitments regarding human right to safe drinking water and sanitation, improved hygiene, and food sufficiency, safety, affordability and nutritious (Pol *et al.*, 2016; Gostin *et al.*, 2019).

It remains the responsibility of each country to ensure successful economic and social development through implementation of targets under all 17 SDGs as stated in the 2030 Agenda (Weitz *et al.*, 2018). The UN recognises that each country is likely to face challenges to achieve sustainable development, especially African countries, which are mostly susceptible to the impacts of climate change (UN, 2013; Omisore, 2018). The SDGs were developed and adopted at the time when there are remarkable increases in warm days, erratic rainfall patterns and ecological variability as well as decrease in water levels (Intergovernmental Panel on Climate Change [IPCC], 2018). The changes in climate posed a challenge to the health care system of development countries, hence, the need for South Africa and other countries in Southern Africa to take the impacts of climate change seriously. Further, the assertions by World Bank (2010) were collaborated by the World Health Organisation (WHO) (2010), who warned that achievement of 'Health For All' may not be possible as a result of the effects of climate change. The observation was that diseases such as cholera, diarrhoeal, malnutrition, malaria, and dengue fever which are often triggered in the aftermath of climate change related disasters (WHO, 2010).

Consequentially, as the effects of climate change increases and continue to be felt, most communities become more vulnerable. Previous studies reveal that climate induced such as

floods and draughts have an impact on water resources resulting in the lack of clean water for both humans and their livestock. Further, the disrupted rainfall season results in draughts and famines which affect the availability of food, this has direct and indirect adverse health impacts (Myers et al., 2012). These observations are collaborated by Mugambiwa and Tirivangasi (2017) and collaborated by Meurs *et al.* (2019) reveal that climate change has negatively hampered achievement of SDG 3 in South Africa. Although South Africa achieved its MDG targets more than five years before 2015 due to its sophisticated infrastructure and a well-developed private sector and a stable macro-economy (Statistics South Africa, 2015). Despite this spectacular accomplishment, other MDGs targets were not achieved, which include inequality in education, access to quality health care. While the country recommends strengthening of efforts to mitigate disease, the impact of escalating temperature patterns and other environmental disasters should be considered.

Despite the advancement in climate change adaptation and mitigation efforts, the IPCC (2013) observes that climate change will continue to change the natural environment in ways that threaten rights to health, food, water, and life. As a result, actions to implement the SDGs targets, should first address adaption to the negative impacts of climate change on specific programme actions and projects. The UN acknowledges that the United Nations Framework Convention on Climate Change (UNFCCC) was developed to mitigate greenhouse concentrations. Effective measures and actions were then developed to remove obstacles, which may adversely affect economic and social development (Alshehhi, 2019). However, the member states are expected to be cautious about the impacts of climate change as possible obstacles towards achievement of SDGs 3 (Bowen *et al.*, 2019; Alshehhi, 2019). Climate change as a development challenge may hinder progress towards ending epidemics and combatting diseases, reducing premature mortality, achievement of access to quality essential health care services; reduction of death and illness resulting from pollution and hazardous chemicals and reduction of health risks (SDG 3) (Stockholm Environment Institute, 2009; WHO, 2017c).

Furthermore, the impacts of climate change may obstruct access to safe and quality drinking water, sanitation and hygiene; reduction of water scarcity; protection of water-related natural resources; and strengthening of local community participation in water and sanitation management (SDG 6) (Abedin *et al.*, 2019). The need for concerted efforts were earlier noted by IPCC (2013) who observed that the impact of climate change on human development will be felt by 2030 across the globe with the severity and frequency of climate change related disasters increasing. This is true despite the existence of the highly ambitious vision set under the SDGs with the target 2030. The goals provide a clear policy framework regarding climate change incentivises international cooperation and mobilises additional resources for mitigation and adaptation activities is essential to provide best chance of achieving the SDGs by 2030 (Ansuategi *et al.*, 2015).

## **2. Climate change in South Africa**

South Africa is experiencing a gradual, steady changing climate with significant increased temperatures over the last 60 years (Midgley et al., 2002). The study reveal that possible changes are expected over the next 50 years show global warming of between 1°C and 3°C, this would result in 5 to 10% reduction in current rainfall patters; and temperatures are expected to rise in both summer and autumn in the western parts of South Africa (Madzwamuse, 2010). These changes will consequentially result in draughts and floods whereas temperature inversions will exacerbate air pollution problems (Madzwamuse, 2010). These observations were collaborated by Kruger and Sekele (2012) provide that change in climatic conditions in

South Africa show average temperature patterns increase by 1-3°C, with erratic rainfall, frequent and devastating droughts and floods. Major changes are excessive heat, depletion of water sources and biodiversity, soil erosion and decreased subsistence production, which are negatively impacting on human health conditions and livelihood (Kruger & Sekele, 2012). Potential health impacts of climate change may result from hunger, starvation, water stress, pests, and disease (Rankoana & Mothiba, 2015). Potential changes in the intensity and seasonality of rainfall will cause major climate health impacts on the livelihoods of South Africans.

Kruger and Sekele (2012) and collaborated Shongwe (2013) note that there was an increase in autumn temperature averaged over the country as a result human influence on climate making the occurrence of warm autumn temperatures more frequent and cold autumn temperatures less frequent. Shongwe (2013) argued that cumulative emissions of CO<sub>2</sub> will determine global mean surface warming by the late 21<sup>st</sup> century and beyond. These trends have resulted in changes in precipitation with dry spells becoming more frequent in Southern Africa. Southern Africa is projected to become drier (Christidis et al. (2011). The data from meteorological organisation and early warning systems in estimated that mean temperatures over South Africa will increase by 2°C over the next century. Climate change poses a serious threat to South Africa's water resources, food security, health, infrastructure, as well as its ecosystem services and biodiversity. Considering South Africa's high levels of poverty and inequality, these impacts continue to be of concern to policy makers and the government (South African National Climate Change Response White Paper, 2011; IPCC, 2013). Drought is a normal, recurrent feature of the South African climate and has resulted in significant economic, environmental, and social impacts and highlight the country's continuing vulnerability to this natural phenomenon.

### **2.1 How climate change impacts South Africa's population**

According to the South African Climate Change and Adaptation Plan (2014-2019), it is the South Africa's demographics and socio-economic state that makes it vulnerable to the consequences of climate change (South African Department of Health, 2014). The Stats SA (2019) reveal that South Africa has a population of 58,7 million people, of which one third of the population is under the age of 15 years. The present inequalities statistics around the world show that South Africa stands as one of the highest in the world with a Gini coefficient of 0,65 (Stats SA, 2019). The research by Stats SA reveal that the bottom 60 % of the households in South Africa depends on grants and less on income from the labour market. This makes many South Africans to be vulnerable to the consequences of climate change. Worku and Woldeesenbet (2015) conclude that that health cannot thrive in environments of poverty and inequality. The South African Department of Health (2014: 11) notes that

*“South Africans are potentially vulnerable to the consequences of climate change on health, certain groups may be more vulnerable. For the purpose of the plan, these include, among others: Young children; The elderly; Women and child-headed households; Those with pre-existing health conditions; The poorest in urban and remote rural areas; Those performing work in sun-exposed condition including those living and working in the hottest parts of the country, such as the Northern Cape; Migrant or displaced people; Coastal populations.”*

These vulnerable group of people live in both rural and urban areas. Their vulnerability is triggered by several factors for instance over 19 million population of South African live in the rural areas. The rural population is supposed to be relying on agricultural land for survival, however, the land distribution remain unequal in South Africa (Tirivangasi & Tayengwa, 2017) with 80 percent of the land being owned by commercial farms and 20 percent, former

homelands, where agriculture is underdeveloped belong to the majority of the population. In these areas, people remain densely populated, poor and depend on urban remittances for survival. These are some of the conditions in the rural South Africa which makes most of the population to be vulnerable. More similarly, climate change health related hazards pose significant negative impact on the urban population in South Africa. The urban population constitute of at least 60% of the total population. The population demographics reflects that there is high unemployment, poverty, and growing number of informal settlements. As noted earlier by Worku and Woldesenbet (2015), good health does not thrive in places that exhibit such characteristics.

## **2.2 The South African government response to climate change in the health sector in South Africa**

The National Climate Change Response Policy (NCCRP) was the first important policy document which was drawn to address climate change with a detailed mitigation and adaptation approach. The main objective of this policy was to manage the inevitable impacts of climate change through the interventions that build on socio-economic and environmental resilience (South African Department of Health, 2014). The efforts to tackle climate change were to be taken by different stakeholders including the health sector. These departments were to update policies, strategies, measures, mobilise resources, research and development and increase awareness of climate change. The NCCRP planned to respond to climate change through climate change adaptation, mitigation, and climate resilient mechanism development.

In this regard the South African National Climate Change and Health Plan had a set of the following actions to be implement between 2014 -2019, (i) National Climate Change and Health Steering Committee: This committee was meant to serve for a five year period and guide the Department of Health in outlining how to conduct national climate change and health vulnerability assessments and the implementation of key activities and intersectoral interventions. (ii) Capacity building interventions- this would include public participation and making sure that the public is informed of the impacts of climate change and participate in the implementation of key adaptation actions, (iii) Monitoring and Surveillance – this action was intended on detecting climate change and health trends at an early stage, hence avoiding dire consequences, (iv) National Vulnerability Assessments, (v) research and development, (vi) Health Impact Assessments, (vii) health systems readiness- health facilities assessment and strengthening where necessary, (viii) Intersectoral Action for Climate Change and Health i.e. this involves the department of health working with other departments to reach health goals., (ix) Model and Pilot Climate Change and Health Adaptation Projects, (x) international cooperation (South African Department of Health, 2014). This are some of key actions which were put in place by the government of South Africa in response to the health impacts of climate change. As this chapter is not set to evaluate them, we will use these key actions to recommend what the government need to do to respond to the climate change effects or impact.

## **3. The impact of climate change on SDG 3 targets in South Africa**

Through the interrogation of the literature the researchers stated the target and then identified how each target is affected or impacted by the changing climate in South Africa.

### **Table.1. The impact of climate change on SDG 3 targets in South Africa**

1. “By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births” (WHO, 2016:1). The research carried out by Lindsey, Paola and Standley (2011) reveal that children are more vulnerable to the impacts of climate change in South Africa. This is due to physical, social, and emotional changes that takes place during a child’s developmental

stages. The findings by Lindsey et al. (2011) were collaborated by Sheffield & Landrigan (2011) who argue that children are highly sensitive to negative climate change induced events like changes in temperatures result heat waves and cold days. The effects take toll on children due to the lack of voice and agency in responding to the changing climate.

2. “By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births” (WHO, 2016:1). This goal is affected by climate change which lowers agricultural activities in South Africa resulting in the vulnerability of the population to hunger and malnutrition. According to Who (2015) despite the efforts made on climate resilience hunger and malnutrition will increase by 20% by 2050. The prevalence of stunting in children under 5 was 23.9 in 2008 and more children were underweighting as well. Geruso and Spears (2018) notes that very hot and humid days results in large mortality with neonatal mortality of 0.7 deaths per thousand births occurring during the first month of life.

3. “By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases” (WHO, 2016:1). The research by WHO (2015) argues that under high emissions situation in South Africa about 30 000 people in 2050 are projected to be at the risk of Malaria. This is a huge increase from a baseline of 190,000 per year during the apartheid era. However, the study projected a decrease in the risk of communicable diseases by 2070.

4. “By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being” (WHO, 2016:1). There is limited data on the impact of climate change on Noncommunicable Diseases in spite recognising these diseases as a global challenge of the 21<sup>st</sup> century (Chowdhury et al., 2018; Frumkin & Haines, 2019). Around 70% of all deaths globally are linked cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes. Most of these deaths, 80% occur in sub-Saharan Africa (WHO, 2013a, WHO, 2013b; WHO, 2014)

5. “Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol” (WHO, 2016:1). The effects of climate change continue to be felt as the researchers continue to find a link between climate change and mental health issues like substance abuse. Cianconi et al. (2020) note that in the aftermath of floods, storms and other climate induced disasters, levels of poverty, desperation increases resulting in stress and drug abuse.

6. “By 2020, halve the number of global deaths and injuries from road traffic accidents” (WHO, 2016:1). This target is also affected by climate changes as changing climate causes hazardous weather for instance wind speed, precipitation, rain, snow, temperature, and fog. These results increased number of road accidents (Islam et al. 2019). This could too damaging when countries where infrastructure is poorly developed this include well maintained drainage systems in urban areas.

7. “By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes” (WHO, 2016:1). Scholars including UNFPA note the value of sexual and reproductive health and rights as an important means of preparing and adapting to climate change and poor sexual and reproductive health and lack of access to basic rights increases a population’s vulnerability to climate change effects (Kumar, 2020). Inversely it is reckoned that most countries where there is poor sexual and reproductive health, also have higher vulnerability to climate change. Through educating young women and girls

results in small family size and healthier children who have the capacity to handle climate induced disasters such as cyclones, floods, and droughts (Bongaarts & Sitruk-Ware, 2019).

8. “Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality, and affordable essential medicines and vaccines for all” (WHO, 2016:1). This target is very imperative in dealing with the aftermath of the climate induced disasters such as floods. In the aftermath of floods, the affected communities need access health care facilities as well as need for immediate medical supplies (Kruger & Sekele, 2013; Salas & Jha, 2019).

9. “By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and “(WHO, 2016:1). Research by Kibria (2014) reveal that climate change exposes humans to extreme temperatures, wildfires, pesticides, metals and metalloids, allergens, polluted air and water, dioxins and other chemicals which can be detrimental to health. Climate change can enhance the toxicity of contaminants such as metals and pesticides. These findings are collaborated by WHO (2017c), who observes that hazardous chemicals in the air, water, food, and consumer products causes diseases such as cancer, respiratory diseases, cardiovascular and urinary system, and immune disorders.

9a. Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate (WHO, 2016:1).

9b. “Support the research and development of vaccines and medicines for the communicable and no communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all” (WHO, 2016:1).

9c. “Substantially increase health financing and the recruitment, development, training, and retention of the health workforce in developing countries, especially in least developed countries and small island developing states” (WHO, 2016:1). Research reveals the need for increased health financing in developing countries as a respond to climate change. Climate change effects on health are expected to increase with the diseases burden worsening in developing countries which face lack of resources. Climate change variability has an impact on social and environmental determinants of health for instance clean air, clean water, proper housing, and sufficient food. WHO (2020) argues that there is a need of comprehensive approach to financing health protection from climate change and this will be towards health sector ensuring adequate trained health personnel, improving health infrastructure and services which are of paramount importance in addressing the shocks of climate induced disasters.

9d. “Strengthen the capacity of all countries, developing countries, for early warning, risk reduction and management of national and global health risks.” (WHO, 2016:1). Tirivangasi (2018) notes that developing early warning systems in Southern Africa and compliance will enhance, preparedness and disaster management. This include being prepared for climate induced emergencies such as ensuring food security, maintaining strong health care system, increasing awareness among health practitioners and policy makers of climate change and its impacts among the disadvantaged population.

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Source: Authors

The global health targets set by United Nations Sustainable Development Goals of the 2030 integrate three dimensions of sustainable developments namely economic, social, and

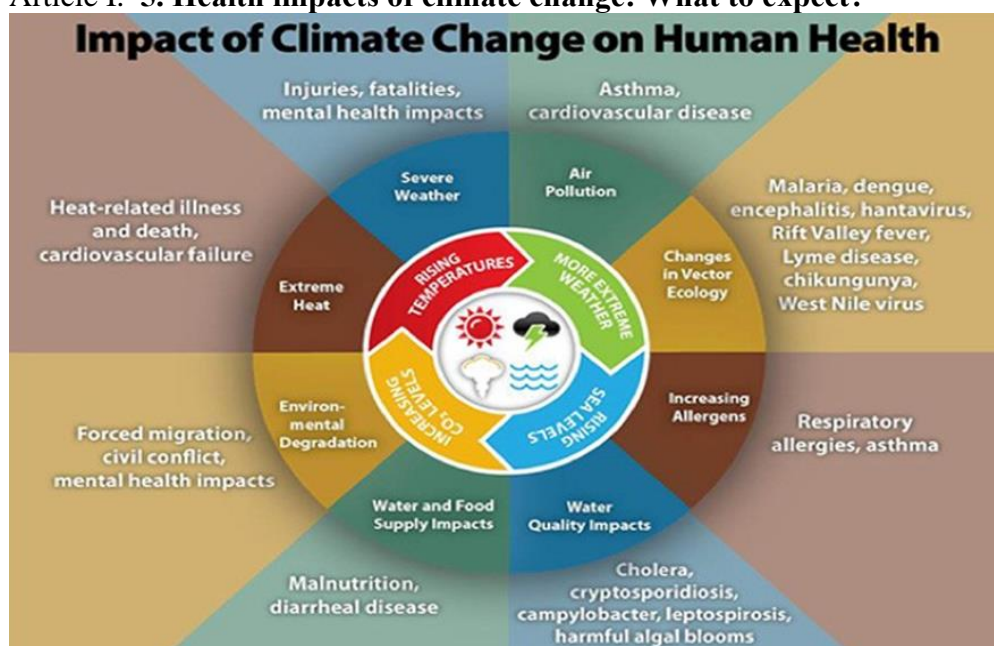
environmental knowing that eliminating poverty and inequality, ensuring inclusive economic growth, and preserving the planet are closely linked. Through the SDG 3 and its 13 targets, the global leaders managed to cover all health priorities and links the targets to many other goals ie. SDG 13 ‘Take urgent action to combat climate change and its impacts’. As noted by the above discussion of the link between the 13 targets of SDG 3 and climate change, almost all aspects of health are affected by climate change. In as much as climate change adaptation and management is concerned, addressing SDG 3 is of paramount importance as meeting these targets will help reduce the aftershocks of climate change induced disasters.

#### 4. South Africa's readiness to achieve SDG3

According to the South Africa Voluntary National Review (VNR) report (2019) notes that whereas advances have been made on SDG 3 on health and well-being is noted, South Africa's health care system is still plagued with historical inequalities which were reinforced by apartheid government. The system created inequalities, and this resulted in some areas receiving fair and better health access than some areas. Some other provinces like Gauteng and North West have better access to health care system than provinces such as KwaZulu-Natal, Limpopo, and the Eastern Cape (Ngobeni *et al.*, 2020). Furthermore, vulnerable groups like people living with disabilities still have challenges in getting access to health care (Vergunst *et al.*, 2017). They are still some disabled without equipment and therapy required for their survival, especially in the rural areas (Vergunst *et al.*, 2017). Furthermore, South Africa has lost many skillful workers with many senior health professionals leaving the country. The South African National White climate change response White paper (2014) recognised health sector as one of the key priorities of the government. First, the government recognised that climate change threatens to worsen and undermine resistance to diseases such HIV/AIDS and tuberculosis (Myers *et al.*, 2012). Further. The government of South Africa understood the link between droughts, flooding and water borne diseases being established. Further, women as care givers in the society were established as the most vulnerable to climate change in South Africa (South Africa National Climate Change Response White Paper, 2014).

In response and preparedness to the health impact of climate change, the South African government planned to reduce respiratory diseases by 2020 by ensuring that the country meet the National Ambient Air Quality Standards; improving the status of individuals access to nutritious food as a strategy to build resilience to the health threats of climate change (Myers *et al.*, 2012). Further, South African government planned to initiate public awareness campaigns on the health risks of high temperatures and encourage behaviours that avoid exposure to high temperatures; respond and create "Heat-Health" action plans which include quick response and access to health facilities, ensuring that there is safe water and improved sanitation. Further, improve awareness programmes on malaria and cholera outbreaks (South Africa National Climate Change Response White Paper, 2014).

#### Article I. 5. Health impacts of climate change: What to expect?



**Fig. 1: Impact of climate change on human health**

**Source:** (Centres for Disease Control and Prevention [CDCP], 2020)

In Figure 1, research carried out by CDCP (2020) reveals the impact of climate change on human health. Evidence of changing climatic conditions provided by Ziervogel et al. (2014), Kruger and Sekele (2013), Chersich et al. (2018) notes that the impacts of climate change on human health are justified by reported increase in changing weather and precipitation patterns responsible for poor water quality, air pollution, changes in land use and ecological variations. Malnutrition, spread of infectious disease, mental illness, respiratory and cardiovascular diseases are most common health impacts of climate change encountered across human society (IPCC, 2018). suggest that South Africa may have challenges towards achievement of a better life for all because of the impact of climate change on the health conditions of society. The health impacts of climate change if not addressed, may impact negatively on the SDG 3 targets by 2030. Care should be given to the impact of climate change on human health. Several observations from South Africa and other parts of the world show that human health and well-being are among areas of human life negatively affected by the impacts of climate change (Jones, 2019; Chersich & Wright, 2019). The World Health Organisation) estimates that climate related deaths will increase between 2030 and 2050 due to these health impacts of climate change (Hayes et al. 2018). The health impacts of climate change are obvious as society in developing countries is susceptible to diarrhoea, cholera and malaria have become more prevalent as a result of drought, floods and increased temperatures (Hachileka & Vaatainen, 2011; Mugambiwa & Tirivangasi, 2017). For Huynen, Martens and Akin (2013) and Nyahunda and Tirivangasi (2019) notes that climate change exacerbated existing vulnerability to disease risk and malnutrition because of increased temperature, food insecurity and poor water quality. Observations of temperature variations may put community members at risk of diseases associated with heat such as stroke, high blood pressure, fatigue, swollen feet, and headache. The IPCC (2018) reinforces the findings that rising temperatures have increased the risk of heat-related deaths and illnesses.

### **5.1 Scarcity of water in South Africa**

The SDG 3 target 1 seeks to reduce the global maternal mortality ratio to less than 70 per 100,000 live births by 2030, However, according UN Women (2020:1) the lack of water and sanitation have serious health consequences on the lives of women and children for instance during child birth “clean water and sanitation can mean the difference between life and death for both mothers and babies”. In a nutshell, lack of water and good sanitation is a threat to the attainment of SDG 3 target 1. Although water issues are addressed mainly by SDG 6. Previous research show that Africa will face water scarcity with the risk of water conflicts increasing with each passing season as all most all 50 river basins in Africa are trans-boundary (De Wit & Jacek 2006). These findings were collaborated by Ziervogel (2018) who argues that Southern Africa will significantly be affected with South Africa, Zimbabwe and Botswana sharing the Limpopo basin. It is projected that by 2025 South Africa together with several other African countries would have reached levels of both water stress and scarcity (Madzwamuse, 2010). The rainfall and temperature patters vary dramatically with farmers worrying about the dry spells whereas the urban dwellers worry about floods. South Africa is no exception to the effects of climate change on water resources. Water availability has an impact on agricultural activities, and with population increase, lack of reliable rainfall will eventually affect food security in the country. Further, health is linked with health of families at household level, the decreasing water levels will affect water quality, exacerbate waterborne diseases, and reduce

available hydropower (Madzwamuse, 2010). In 2017, Cape Town experienced third straight below normal rainfall. This resulted in the scarcity of water which can be abated in the meanwhile however, preparedness for future consequences is a must give the effects of unclean water (Ziervogel, 2018). Department of Water and Sanitation's (DWS) is mandated by the South African constitution to ensure that the country's water resources are protected, managed, used, developed, conserved and controlled in a way that helps everyone in all provinces. Sinanovic et al. (2005) conclude that there is need for financing for water projects and activities.

### **5.2 Mental health and climate change in South Africa**

As noted in Table 1. Target 4 of the SDG 3 seeks to "... promote mental health and well-being", however, climate change poses serious threat to the achieving of this target. Mental health refers to a human condition where an individual suffers from mental illness and mental disorders. Further, this definition is also expanded to include state of mental wellness and psychosocial well-being (WHO, 2017b). Hayes et al. (2018) argues that although no mental health outcome can be attributed to a particular climate change risk as more research is required on the subject, however, the impacts of climate change are more visible than before. Scholars of mental health argue that climate induced disasters like floods, fires, earthquakes, draughts, and heat waves causes Major Depressive Disorders (MDD), Depression, Post Traumatic Stress Disorder (PTSD), Suicidal ideation, trauma, and survival guilty (Clayton et al., 2017; Bourque & Cunsolo, 2014). Mental health due to climate induced disasters poses challenges to countries that are not used to climate change stressors.

Consequently, mental health becomes an area that warrants attention in South Africa in the aftermath of climate change related disasters. Changes in weather affects agricultural activities hence, affecting the socio-economic activities of families who relies on farming. This will cause the livelihood of this families be disrupted as they are not able to fulfil their daily needs, depression and stress occurs as a result. Chersich et al. (2018) observes in their research in South Africa that the impact of climate change may trigger multiple stressors that are already existing for instance the situation of vulnerable groups like people living with disability, women and children, rural farmers, and those living in informal settlements. Given the clear effects of climate change on the mental health of individuals and various communities, it is important to address this stressor in order to achieve SDG 3 target 4, however, research by Voluntary National Review (VNR) Report (2019) reveals that South Africa was lagging behind on providing mental health services. The report suggested that for South Africa to achieve SDG 3, the country needs to scale up key interventions within the health system. This can be achieved by introducing and adopting innovative models in health-care delivery to accelerate progress (Voluntary National Review (VNR) Report, 2019).

### **5.3 Impact of heat waves on health in South Africa**

In a more recent study conducted in 2020 on heat waves by Mbokodo et al. (2020) entitled "Heatwaves in the Future Warmer Climate of South Africa", the scholars noted that heat waves affect both agricultural yields and human health. Although the study on heat waves in South Africa remains under explored, the scholars were able reveal that heat waves causes illness in both children and the elderly which may increase mortality rates hence, hindering the attainment of the SDG3 by 2030 (Larsen, 2003; Fischer, 2007; Lindsey *et al.*, 2011). Research conducted in other regions of the world show that heat waves can be fatal. In 1995 alone 700 people died in Chicago due to heat waves in 3 days (Mbokodo et al., 2020). The short-lived heat waves are fatal as they result in high evaporation and veld fires which has a negative impact on agricultural activities. Consequentially prolonged heat waves cause droughts and famines

which will affect people's livelihood. Droughts results in many children suffering from famine and underweight. As noted in Table 1., under target 1 of SDG 3, the target is to reduce the maternal mortality ratio to less than 70 per 100,000 live births, heat waves pose a threat to the achievement of this goal. Moreover, as noted in the section of mental health, droughts and heat waves have both direct and indirect effect on people's mental health. Target number 4 of the SDG 3 promotes mental health and in this case heat waves poses a threat to the mental wellbeing of individuals or communities, hence the importance of addressing this climate change stressor.

According to a research conducted in 2020 entitled "Heatwaves in SA are occurring more frequently and are expected to last longer- report" by Bega (2020), reveals that South Africa is bound to experience more frequent heat waves in the coming years. Bega (2020:1) reports from her scientific read that over a "30-year period average maximum temperatures may rise by up to 6°C across much of the interior of South Africa by 2070-2099 with respect to 1983-2012 under a high GHG concentration". This rises awareness on the impact of climate change on human health and the need for future preparedness. In regard with heat wave response in South Africa, the study by Chersich and Wright (2019) note that the South African government developed Disaster Management Frameworks and a National Disaster Management Centre (Department of Environmental Affairs, Republic of South Africa, 2017), which deals with the disasters and strengthening of the cooperation between various sectors in response to impending catastrophes. The heat waves can be regarded as one of such disasters, however the worry expressed by Chersich and Wright (2019) is that the National Disaster Management Centre concerted efforts are noted in collaboration with stakeholders dealing with climate change efforts. This implies the need for realignment of focus in order to compact heat waves.

#### **5. 4 Changes in vector ecology and climate change**

In Fig. 1 changes in vector ecology<sup>1</sup> is shown as being triggered by the changes in climate. These findings are collaborated by a research conducted by Githeko et al. (2000) which shows that climate variability have direct influence on the epidemiology of vector borne diseases like malaria, Schistosomiasis, yellow fever, and Rift valley fever. Research reveals that the effect of climate variability on vector borne diseases will be felt more in Africa as the continent has high density variety of vector species. These species respond to changes in temperature as well as rainfall patters. According Campbell- Bendrum (2015) an approximately one sixth of illness and disability suffered across the world can be attributed to vector borne diseases. The vector borne diseases kill at least one million people globally and one billion people are affected annually. The developing countries are affected more than the developed countries due to different health care system and the immunisation programmes offered.

Research reveal that per capita mortality rate from vector is almost 300 times more in developing countries than in developed countries. Malaria transmission depends on certain climatic conditions which are suitable for Anopheles mosquitoes and Plasmodium parasite development. The changes in climate change results in the changes of the occurrences of malaria in different regions of the world. Research by Ryan et al. (2020) reveal that at least 75.9 million people will at the risk of exposure to malaria in Eastern and Southern Africa by the year 2080. WHO (2020) notes that South Africa recorded at least 9500 cases of malaria in 2018, which is decrease from 22000 cases recorded in 2017. WHO reveals that South Africa's response to malaria epidemic has been to increase the funding towards malaria eradication. The country also responded to malaria by carrying out the indoor insecticide spraying (WHO, 2020). In eradicating the cases of people affected by malaria, South Africa will be achieving SDG 3

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<sup>1</sup> Vector ecology refer to the study of disease carrying organisms, their behaviour, environments where they are found; how to prevent and control them. In the study of climate change we referring to parasites that cause malaria.

target 3 “...end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases” by 2030.

## **6. Conclusion**

The researchers through this chapter recognised the precarious impacts of climate change on the health livelihood of the South African citizens. Climate change poses serious challenges to South Africa as well as the developing countries in attaining the SDG 3 targets. Hence, this chapter engages the scholarly literature in assessing how SDG 3 targets are affected by climate change. The study shows that the SDG3 targets are significantly affected by the climate change related disasters. This is worsened by the lack of preparedness by the South African government as the health inequalities still exist in the health care system. The South African health care system still show some disparities as some areas and vulnerable groups ie. Disabled people still struggle to access health care. However, the government through the white paper recognised some of the health challenges posed by climate change on health. The researchers went on to discuss critical (few selected) impacts of climate change on health which remain under researched and in need of attention from policy makers such as scarcity of water, mental health, heat waves and changes in vector ecology. These selected impacts of climate change on health require the attention of the government of South Africa as well as those in the Sub Saharan Africa as they pose serious threat in the future. The study is of paramount importance as it sheds light on the relationship between climate change and health through the lenses of UN SDG 3 targets. This will assist different stakeholders interested in developing climate change mitigation and adaptation strategies.

## **Recommendations**

The achievement of the targets requires integration of community-based adaptation practices into the national climate strategy. Climate change has the potential to undermine the attainment of SDG 3 by making the country to be more susceptible to diseases; hence, the researchers argue that unless immediate and concerted efforts are made to reduce greenhouse gas emissions, future threats of increased temperature and unpredictable rainfall will have devastating effects on human health. This argues that effectiveness of adaptation interventions rests on the strength of data systems and surveillance of extreme weather events by developing early warning systems. This would require the government to listen to the climate change activist as well as departments set in place to guide their decision making. Further, the researchers recommend that more research should be conducted on heat waves as most research available is conducted in the developed world. Furthermore, Heat education campaign, prevention of vector borne diseases and promotion of mental health communication strategies should be developed to increase awareness. Lastly the researchers recommend further research on the effects of climate change on mental health among the vulnerable population groups ie. Women, children, rural farmers, and people with disability.

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