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Local community perceptions of climate change and its health impacts: A review

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Abstract

Local communities have a longstanding knowledge of their locality, its natural environment, and climatic conditions. Any change in the local environment and climate is discernible, and its impacts on the community's livelihood and subsequent coping mechanisms are developed. The review objectives are to describe how rural communities in South Africa's Limpopo Province perceive climate change and its potential health impacts. The review presents community members' perceptions about climate change and its health impacts based on existing literature on climate change experienced by the members of rural communities. The results show rising temperatures and erratic rainfall as widely held perceptions of climate change. Climate-related health conditions such as hunger, poverty, malnutrition, and diseases like malaria, diarrhea, and dysentery attributable to exposure to excessive heat and a lack of clean water supply, as well as food insecurity as a result of rising temperatures and erratic rainfall are reported. The community's perceptions of temperature and precipitation trends as indicators of climate change are aligned with meteorologically observed trends. Understanding the changes in climate based on the perceptions of local communities could provide important insights into local climate change adaptation strategies to strengthen community capacity and resilience.

Keywords: Climate Change; Environmental Change; Environmental Health; Health Impacts; Local Community; Limpopo Province

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1. Introduction

The Intergovernmental Panel on Climate Change (IPCC) reports that not only do scientists perceive changing climatic conditions, but members of local communities are also aware of variations in temperature and rainfall patterns. Unfortunately, little is known about how climate change is currently perceived and understood by the members of local or rural communities, particularly on the African continent, where most people still depend on natural resources to meet their daily needs. However, *South Africa Talks Climate* provides patchy community understanding of climate change. The key finding is that South African rural communities use climate change as an umbrella term to refer to the destruction occurring in their natural environment, with changes in the weather and seasons observed over time. Nonetheless, the present review describes rural communities' perceptions of climate change and its health impacts accumulated over years of interacting with their natural environment in two district municipalities of South Africa's Limpopo Province. The review begins with an overview of the environmental changes that communities have experienced and then focuses on key issues that people say directly impact their health. The findings indicate that perceptions of increased temperature and decreased rainfall are widely held beliefs about climate change. Climate-related ill-health conditions such as hunger, poverty, malnutrition, and diseases such as malaria, diarrhea, and dysentery caused by excessive heat and exposure to dust, as well as a lack of clean water, have been reported as potential health impacts of climate change. The community's perceptions of temperature and rainfall trends as indicators of climate change are aligned with meteorological reports for Limpopo Province.

2. Literature review

Climate change is a global developmental challenge that impacts negatively on the local communities that depend on natural resources for their livelihoods.). The ongoing discourse on climate change often misses a basic component of indigenous knowledge (Nakashima et al., 2018; Whitmarsh and Capstick, 2018). The International Panel on Climate Change reports have shown that climate change is real, and that Africa is the most vulnerable continent (Ndlovu et al., 2020). The African continent is likely to warm during this century, and the warming would be larger than the global annual mean warming, with drier subtropical regions warming more than the moist tropics (Nakashima et al., 2018). The climate of most parts of the African continent may be classified as arid or semi-arid, with high drought risks as parts of Africa are also endowed with a humid tropical climate that receives a substantial amount of rain throughout the year (IPCC, 2007; 2014).

Indigenous peoples or local communities with a long history of interaction with the environment have developed complex knowledge systems that allow them to detect changes in local weather and climatic variability, as well as the impacts of such changes on the determinants of health. Hoang (2020) supports that these perceptions of climate change are linked to environmental knowledge, environmental awareness, attitudes, beliefs, and perceptions of risk. Important findings in the studies of Ruz et al. (2020) and Sraku-Lartey et al. (2020) are that local community members typically understand climate change as being embedded within their ecological knowledge. For example, they observe a change from a hotter summer to a milder winter, prolonged periods without rainfall, and unusually frequent extreme weather events (IPCC, 2022).

The direct effects of climate change are usually in the form of drought, depletion of water resources and biodiversity, soil erosion, decreased subsistence economies, and cessation of cultural activities, which impact

negatively on human health (IPCC, 2022). An increase in the frequency or severity of some extreme weather events, such as extreme precipitation, flooding, droughts, and storms, may threaten the health of people during and after the event (Rocque, 2021). Erratic rainfall and rising temperatures threaten human health by affecting the food people eat, the water they drink, the air they breathe, and the weather they experience (IPCC, 2022). Exposure to extreme heat can lead to heat stroke and dehydration, as well as cardiovascular, respiratory, and cerebrovascular disease. Continuous heat without rainfall may deplete the water resources, leading to a lack of safe water for livestock, crops, and household consumption (Rankoana, 2022a). The most commonly reported health impact of climate change is reduced agricultural yields and production because of changes in temperature and precipitation, as well as droughts and floods (IPCC, 2022).

Climate change impacts are vast and disruptive to human beings (Musakwa et al., 2020). In Africa, climate change is far from abstract; it is already determining the course of people's lives. Extreme weather events and greater unpredictability in weather patterns are having serious consequences for people who rely on land, lakes, and seas to feed themselves and earn a living (Ndlovu et al., 2020). Climate change threatens Africans' health and homes and the natural resources upon which many depend to survive, Africa's population faces an urgent crisis (Le Roux-Rutledge and Neville, 2019). It is predicted that Africa will be one of the regions worst affected by climate change. For people struggling with the challenges posed by climate variability, environmental degradation, and poverty, climate change represents a tipping point.

The health effects of climate change are not experienced in isolation. They possess a level of a holistic nature comparable to that of human existence. Global reports on climate change and health are increasingly acknowledging the indirect health consequences. These include illnesses caused by unsafe food and water, malnutrition due to food insecurity, malignant melanoma resulting from exposure to ultraviolet radiation, and chronic kidney disease caused by dehydration (Gamble et al., 2013). Furthermore, the Lancet provides information on the frequently overlooked indirect effects of climate change on human health, particularly the psycho-social repercussions (Watts et al., 2021). For Hayes et al. (2018) these embrace interpersonal strain, risk of violence, stress and aggression resulting from increasing temperatures, rising sea levels, and intermittent droughts and altered natural environments and poor infrastructure. The health impacts arising from climate change are also unevenly and disproportionately distributed. The vulnerability of local health conditions is determined by a multitude of intricate aspects, such as exposure, location, demography, innate sensitivities, and local adaptive capability. Specific populations, such as children, elderly persons, low-income groups, and certain communities of colour, face a higher susceptibility to experiencing adverse health effects resulting from climate change (Schramm et al., 2020).

Climate change exacerbates pre-existing disparities, placing the most marginalised individuals at a higher risk of experiencing adverse health effects caused by variations in temperature and rainfall (Sraku-Lartey et al., 2020). The impact of climate change-related events such as droughts, floods, and rising temperatures may especially affect the poor and most socially vulnerable people, thus negatively influencing their health conditions (Whitmarsh and Capstick, 2018; IPCC, 2021). Studies by Tayengwa et al. (2020) and Watts et al. (2020) report that the most affected people are the rural poor because they are highly dependent on climatic and environmental factors in addition to their greater reliance on climate-sensitive sectors such as agriculture and health, posing critical challenges for natural development. Perera (2017) states that children, young individuals, and the elderly are more susceptible to climate-related injury and illness. For example, children are particularly vulnerable to the harmful consequences of malaria, diarrhea, and undernutrition due to their

physiological sensitivity (World Health Organisation, 2018). Other observations are that climate change has the potential to amplify the occurrence and intensity of various physiological and socio-economic factors that render older adults particularly vulnerable to heat waves and other extreme weather events (such as hurricanes, floods, and droughts), as well as poor air quality and infectious diseases (Gamble et al., 2013).

In South Africa, systematic studies on indigenous peoples' perceptions of climate change are still scarce, especially those that seek to understand the perceptions of climate change and its health risks as perceived by the local communities other than descriptions by scientists. According to Sraku-Lartey's et al. (2020) submissions on this subject, South Africa is lagging in the use of indigenous knowledge in climate change adaptation because local knowledge-based perceptions on climate change are essential to developing enabling policies, effective communication strategies, and socially accepted technologies to minimize risks and reduce climate vulnerability and effective climate adaptation. Understanding these community perceptions could provide important insights into local climate change adaptation strategies to strengthen community capacity and resilience (Kaganzi et al., 2021). Comprehending and assessing local communities' awareness of climate change and perspectives is crucial for devising and implementing more efficient adaptation strategies that are specifically customised to the local context (Mucahid et al., 2020). The the way indigenous populations perceive climate change has a significant impact on their actions in reaction to climate-related health care challenges (Kaganzi et al., 2021). Barnes et al. (2020) argue that local communities effectively deal with the health consequences of climate change, individuals modify their current practices or behaviours within established social-ecological systems (adaptation) or implement more profound changes that can reshape prevailing social-ecological dynamics and establish new systems or possibilities (transformation) in terms of how they perceive changing climatic conditions.

3. Context

3.1. Study area

The review examines rural communities' perceptions of climate change in Limpopo Province, South Africa. South Africa is located in an area with highly variable and erratic rainfall (Polokwane Municipality Integrated Development Plan [IDP], 2022-2026). The country is situated within a drought belt and a subtropical region of high pressure, that makes rainfall highly erratic and variable. With an annual rainfall that is slightly more than half of the global average, the country is largely arid and vulnerable to droughts and floods in any given year (Le Roux-Rutledge and Neville, 2019). The average annual temperature in the Limpopo Province ranges between 25 and 40 °C, making the province hot and semi-arid. Daytime temperatures often range from 28 to 34 °C from October to March, making for hot summer days. Low temperatures in the summer range from a comfortable 16 °C to a pleasant 21° C. Winter daytime low temperatures range from 19.6 to 25.2 °C, giving the season the feel of spring or summer. Throughout the winter, temperatures range from 4.3 °C to 12.1 °C. The area falls within the summer rainfall belt, and it receives rain from November to March. The rainy season lasts from November to February, with an annual average of 600 to 650 mm (Polokwane Municipality Integrated Development Plan [IDP], 2022-2026).

3.2. Data sources

This review examined previous studies on climate change to describe the communities' understanding of climate change and its health impacts. Examples of previous studies on climate change in Limpopo Province provide selected for this review include Tshibalo and Olwoch (2010), Mpandeli (2014), Mpandeli et al. (2015), Rankoana (2016; 2020; 2022a; 2022b), Modise et al. (2022), and Polokwane Municipality Integrated Development Plan [IDP], 2022-2026.

The search for these was carried out in electronic databases such as Elsevier, Wiley Journals, Emerald Management Journals, and Science Direct, with a limitation to papers written in English. The primary search criteria encompassed original research pertaining to the local community's perspectives on climate change and the local community's perspectives on the health-related effects of climate change. A uniform search methodology was employed to investigate international studies on the impacts of climate change on local communities and its effects on public health. To be eligible, the papers needed to depict the local communities' perspectives on climate change and its effects on health. The research was not subject to any time constraints. This study only considered empirical research and reviews when examining the relationship between climate change and health. Any other sources of information were excluded.

4. Results and discussion

4.1. Community perceptions of climate change

Increased temperature and decreased rainfall are widely held perceptions of climate change, which are responsible for excessively hot summers and warmer winters, earlier or delayed rainfall, drought, and seasonal changes. Climate change perceptions in the form of rising temperatures and rainfall are detailed below.

4.1.1. Rising temperature

There is evidence of climate change viewed in the context of wider environmental changes. Rural communities are aware of changes in their natural environment and note that alterations in weather and temperature are probably one of the causes of these changes. Reports on the perception of temperature variation show that there is certainty that weather conditions are changing. Communities are aware that the weather is changing, and many of them attribute these changes to global warming and climate change, according to observations from earlier studies. It is held that the weather is getting hotter, less steady, and unpredictable, with significantly less rain. For instance, participants in the study of Rankoana (2020) noted changes in weather conditions that are related to global warming and climate change as described by the IPCC (2014; 2022) and Africa Climate Talk (Le Roux-Rutledge and Neville, 2019) to name a few. Changing patterns in temperature variations were found to be a major indicator of changing weather patterns (Kruger and Sekele, 2012; Mpandeli et al., 2015; Rankoana, 2022a). Community members perceive long-term changes in temperatures that are responsible for excessively hot and dry summers (Tshibalo and Olwoch, 2010; Mpandeli, 2014; Mpandeli et al., 2015; Rankoana, 2016; 2020; 2022a; 2022b; Modise et al., 2022). The most noticeable indications of climate change are warming temperatures and changes in precipitation. It is believed that long-term changes in temperature are to blame for summers that are too hot and dry (Mpandeli et al., 2015).

Temperature increases and modifications to precipitation patterns are the most obvious direct effects of climate change (Kruger and Sekele, 2013).

According to Popoola et al. (2020), South Africa's temperatures could rise by 1.2 °C, 2.4 °C, and 4.2 °C in 2020, 2050, and 2080, respectively. These accounts are supported by the remarkable change in temperature observed in the meteorological record over the period 1960–2009, during which the mean annual temperature increased by at least 1.5 °C (Ziervogel et al., 2014). Increased temperatures are mostly felt in rural areas with extreme heat felt in urban areas (Zhou et al., 2022). The provinces of Limpopo, KwaZulu-Natal, and Eastern Cape, which comprise sizable rural areas with agriculture as their primary industry, are particularly susceptible to rising temperature patterns (Zhou et al., 2022). In China, Phan et al. (2019) looked for evidence of differences in temperature-mortality relationships between rural and urban areas and discovered that people in rural areas were more susceptible to high temperatures.

Southern African rural communities encounter challenges of rising temperature as their livelihood patterns render them very vulnerable (Hosen and Nakamura, 2020). These are in line with Davis and Vincent's (2017) report and predictions that there has been a 0.85 °C increase in global mean annual temperatures since 1880 with an anticipated increase from 0.3 to 2.5 °C by 2050. These findings align with the research and projections by Davis and Vincent (2017), which indicate a 0.85 °C rise in world average yearly temperatures since 1880. Projections for Ghana indicate a clear indication of temperature increases of 0.6 ºC, 2.0 ºC, and 3.9 ºC by the years 2020, 2050, and 2080 respectively (Sraku-Lartey et al., 2020). According to Adaawen (2021), there is a global trend of more frequent and intense extreme weather occurrences, which are causing broad negative effects. According to van Baal et al. (2023), climate change leads to rising temperatures and prolonged periods of heat, as well as extreme weather events. It also causes air pollution, water and food scarcity, and alters the patterns of diseases transmitted by vectors. These consequences directly or indirectly affect human health leading to heat injuries, infectious diseases, allergies, malnutrition, and mental problems, among other things (van Baal et al., 2023). The impact of this situation will be particularly pronounced on vulnerable demographics, such as rural communities, the elderly and small children, leading to an exacerbation of existing disparities (Maibach et al., 2015; Zhou et al., 2022).

4.1.2. Erratic rainfall

The studies of Tshibalo and Olwoch (2010), Mpandeli (2014), Mpandeli et al. (2015), Rankoana (2016; 2020; 2022a; 2022b) and Modise et al. (2022) describe the rural communities 'perceptions of erratic rainfall. These are reported in the form of reduced, coming earlier, later, and scarce rainfall. One common observation is that the rainy season sees less precipitation. Additionally, there are reports of early rain. There have been reports of instances of winter precipitation that warmer winters are to blame for. The first rain is typically anticipated to arrive in September or November, but in recent years it is instead arriving later, in October, December, or January. Other areas of the province are experiencing drought due to the current lack of rainfall, which has a devastating effect on subsistence farming, biodiversity, and water supplies. The observations that summers are getting longer, and winters are getting shorter are widely accepted. It is also claimed that winter is no longer cold but rather warm with unusual precipitation. The sun, moon, and stars have all changed in terms of their motion and positioning. Normally, the sun rises in the south in the summer and sets in the north in the winter. However, according to the current observations, the sun rises in the south until midwinter, when it should be in the north.

These perceptions of rainfall are supported by Adaawen (2021), which reports that rural Ghanaian communities describe the pattern of rainfall as unpredictable because it never comes when it is needed. Another supporting research by Zhou et al. (2022) states that variations in rainfall are more striking in rural areas where farming households struggle with the effects of drought and less rainfall on their production.

Similarly, in Ghana, Sraku-Lartey et al. (2020) report an inconsistent pattern of rainfall in the rural areas, characterised by both rises and decreases in precipitation across different regions. These estimates suggest that the region will likely encounter elevated mean annual temperatures and greater variability in rainfall patterns (Kaganzi et al., 2021). This alteration greatly impacts human morbidity and death and has direct implications for individuals as well as global and public health (van Baal et al., 2023).

4.2. Validation of community perceptions of climate change

The perceptions of climate change in this review are centred on variations in temperature and rainfall patterns. These are supported by climate data from 26 weather stations across South Africa which show that the country's average annual temperatures increased by about 0.133 ºC per decade between 1960 and 2003, with varying increases across the seasons (South African National Biodiversity Institute, 2011). Additional supporting data by Dube and Phiri (2013) is that higher temperatures and sporadic rainfall patterns with frequent droughts have resulted from climate change. For Turpie and Visser (2016), Limpopo Province is already experiencing warmer and wetter winters and hotter and drier summers, with predictions of seldom and intense heat waves and heavy rainfall (Polokwane Municipality Integrated Development Plan [IDP], 2022-2026). According to the South Africa's Ministry of the Environment, climate change is predicted to result in increased average temperatures across South Africa of between 1 and 3 degrees Celsius by 2050 and it is expected that the country's most arid areas will experience the highest increases over the next few decades (Zhou et al., 2022). The effects of these variations could lead to extreme heat, dwindling water supplies and biodiversity, soil erosion, and reduced subsistence production, all of which would have an impact on people's health and way of life (Dube and Phiri, 2013; Turpie and Visser, 2016; The South African National Climate Change Response Policy, 2011). The IPCC (2021) supports that loss of ecosystems on which people rely for their livelihoods is one of the main threats brought on by climate change. Annotations of a sharp temperature rise with detrimental effects on the livelihood patterns of rural communities' support observed changes in rainfall and temperature patterns (IPCC, 2021) in Limpopo Province. A study by Gemeda et al. (2021) concedes that climate-borne disease and pests, food insecurity, frequent droughts, and flooding correlate with climate change, with p values of 0.000, 0.029, 0.010, and 0.047, respectively. Correspondingly, the IPCC (2022) reports supporting evidence of remarkable changes in temperature patterns over the years, where the mean annual temperature increased by at least 1.5 times the observed global average of 0.5°C over the past five decades. Additionally, it should be noted that the perceptions of climate variability within local communities may offer more specific insights into climate patterns that are not adequately represented by meteorological data in communities where the collection of such data is not well-established (Bomuhangi et al., 2016).

4.3. Perceptions on the health impacts of climate change

Climate change has numerous direct and indirect health effects on South Africa's rural communities (Tshibalo and Olwoch, 2010; Dube and Phiri, 2013; Ziervogel et al., 2014; Mpandeli et al., 2015; Rankoana and Mothiba,

2016). The indirect effects take more complicated paths, such as threatening food and water security due to salinity intrusion and spreading infectious diseases as vector and pathogen ecology changes (Rahman et al., 2019). Indirect exposures happen when climate change affects various environmental parameters such as air, water, food quality, food production, and disease vectors, or social parameters such as changes to population distribution and economic variables (Dibakoane et al., 2022). These observations are supported by Tripathi et al. (2021) that individuals' views of climate change are strongly influenced by their personal experiences with local weather conditions. This correlation accounts for people's understanding and awareness of the health consequences associated with climate change (Whitmarsh and Capstick, 2018; Farrokhi et al., 2020; Rakhmanova et al., 2021). The perception of the health impacts of climate change is predominantly localised and linked to the observable fluctuations and extreme occurrences in weather patterns (Tripathi et al., 2021). This observation aligns with the findings of Adger et al. (2013), who argue that rural communities view climate change as closely connected to global inequalities, as its negative effects on health disproportionately affect the most impoverished and vulnerable individuals who depend on climate-sensitive livelihoods (Amare et al., 2017).

In this review, the most reported health impacts of climate change are water and food insecurity exacerbated by rising temperature and erratic rainfall.

4.3.1. Water insecurity

The studies of Tshibalo and Olwoch (2010), Dube and Phiri (2013) Ziervogel et al., (2014), Mpandeli et al. (2015), Rankoana and Mothiba (2016), provide arguments about rural communities' understanding of the impacts of climate change. A common observation in these studies is that the communities' health conditions may deteriorated due to an increased lack of reliable rainfall, resulting in a partial drought responsible for decreased water levels and resource contamination. Cholera and dysentery, bilharzia, diarrhea, cholera, and red eyes are the most common diseases associated with a lack of safe drinking water. Furthermore, a lack of safe water for drinking, cooking, cleaning, and repairing houses jeopardizes personal hygiene. Rather, access to safe water for cooking, washing, and bathing, as well as household maintenance and proper sanitation, all contribute to the promotion of good health and well-being. These observations support the South African Department of Water Affairs (Department of Environmental Affairs, 2011) report that South Africa is a water-scarce country with a highly variable climate and one of the lowest run-offs in the world, a situation that is likely to be exacerbated significantly by the effects of climate change. In South Africa, water is the primary medium through which the effects of climate change are felt (Limpopo Economic Development and Tourism, 2013). According to findings from the South African Climate Change Adaptation Strategy (Limpopo Provincial Climate Change Response Strategy 2016 – 2020), a lack of access to reticulated water and sanitation means lack of accessibility to reticulated water and sanitation means that people rely on ground water, springs and rivers, which are vulnerable to pollution and drought as a result of changing rainfall patterns. A large portion of South Africa experiences low and erratic rainfall, and some communities struggle to get access to clean drinking water as most surface water resources have already been fully used (Ziervogel et al., 2014; South African Weather Services, 2015).

These observations support the IPCC (2014) that climate change will continue to alter the natural environment in ways that endanger human health due to water scarcity. Caretta et al. (2022) concede that over 50% of the global population, which amounts to around 8 billion individuals, is projected to face significant

water scarcity during some periods of the year because of catastrophic climate fluctuations. These climate extremes are expected to result in significant water scarcity and/or inundation, which are likely to have adverse effects on human health conditions (IPCC, 2022). Bhatta et al. (2020) corroborate that water-stressed communities often experience outbreaks of seasonal and water-borne diseases such as diarrhea, malaria, and dengue. Additionally, the usage of contaminated water may increase cases of flu and typhoid (United Nations, 2019) as climate change is expected to lead to water shortages and increased health and life hazards for billions of people in poor countries. Underdeveloped countries lack the ability to ensure consistent access to enough clean water that is suitable for supporting livelihoods, human welfare, and socio-economic progress as people struggle to protect against water pollution and water-related disasters, as well as to preserve ecosystems in a peaceful and politically stable environment (IPCC, 2022). Water insecurity undermines the ability to provide safe and high-quality water, hindering the achievement of Sustainable Development Goal 6 ("Ensure availability and sustainable management of water and sanitation for all") (IPCC, 2022). This has negative implications for society's health and well-being, as well as for improving nutrition, eradicating hunger, maintaining peace and stability, preserving ecosystems and biodiversity, and attaining energy and food security (IPCC, 2022). These findings support the IPCC's (2014) observations that climate change will persistently modify the natural environment, posing a threat to health rights due to water scarcity. Water-related hazards have a greater impact on vulnerable populations, including the poor, women, children, indigenous peoples, and the elderly. This is particularly true in the Global South, where historical, socio-economic, and political marginalisation has created systemic inequities (IPCC, 2022) where infants, children, and elderly individuals are particularly affected, potentially as a result of their diminished immunity, physical frailty, and less adaptability (Sraku-Lartey et al., 2020).

4.3.2. Food insecurity

The studies of Tshibalo and Olwoch (2010), Dube and Phiri (2013) Ziervogel et al., (2014), Mpandeli et al. (2015), and Rankoana (2022), report that food security is maintained through subsistence crop production. There is common view that the production of indigenous crops is poor as the crops die and wither before they reach maturity and are ready for consumption. The poor production of subsistence crops is brought on by rising temperatures and decreased precipitation. Less precipitation and higher temperatures have been linked to food insecurity, which supports the idea that climate change will make it more challenging to continue producing food for subsistence (Moerlein and Carothers, 2012). Madzwamuse (2010), and Maponya and Mpandeli (2012) agree that about 70% of people living in rural areas of developing countries depend on subsistence crop production, which is currently characterized by low productivity and instability due to marginal and erratic rainfall, low soil, and ambient temperatures below the minimum temperature of 10 °C. Increased temperatures and drought are two recent widespread stressors that rural communities must deal with, and subsistence farmers are particularly vulnerable to their effects (Musetha, 2017). The current health problems brought on by the loss of traditional foods will probably worsen because of climate change's effects on traditional food availability, access, and gathering practices (IPCC, 2021). Ambient temperatures below the minimum temperature of 10 °C and marginal and erratic rainfall have a negative impact on subsistence food production as a basic need for health (Rankoana, 2022a). Climate change negatively impacts the four pillars of food security namely, availability, access, utilization, and stability and their interactions. The Intergovernmental Panel on Climate Change's most recent report highlighted increasing temperatures,

changing precipitation patterns, increased frequency of extreme events such as heatwaves and tropical cyclones, and the incidence of agricultural and ecological droughts as the main drivers that jeopardize food security under escalating climate change. Consequently, yields of staple crops such as maize have decreased across Africa, widening food insecurity gaps (IPCC, 2021). In South Africa, declining production output of maize is a major cause for concern given the significant role it plays in the daily diets of South Africans (Dunjana et al., 2022). These observations support the view by Food and Agriculture Organization of the United Nations (2019), that approximately 70% of rural residents in developing countries rely on traditional foods, which have recently been characterized by poor production because of unfavorable environmental conditions.

A common observation in the previous literature is that climate change in Limpopo Province causes devastating changes in their living conditions such as malnutrition, poverty, poor water supply, and increased disease risks. As for rural communities, they bear the brunt of changing climatic conditions as they are unable to secure food to sustain indigenous health and well-being practices. These health risks are becoming increasingly recognized as major concerns in South Africa's Limpopo Province (Rankoana, 2022b) as traditional foods are consumed for their nutritional value. The South Africa Climate Talk reports that a decline in yields is predicted to lead to a greater risk of malnutrition for people who rely on the land to eat and increased food insecurity for those who rely on buying food in the marketplace (Le Roux-Rutledge and Neville, 2019). Poor rural communities in some parts of Limpopo Province are immensely susceptible to climate change owing to a lack of livelihood assets, leading to increased hunger and malnutrition. Poor communities in South Africa are highly susceptible to climate change, posing a major risk to food security and nutrition (Mugambiwa and Tirivangasi, 2017). Traditional food systems are an important aspect of subsistence and medicinal practices, as well as community health and cultural traditions (Donatuto et al., 2014). This has resulted in increased hunger and malnutrition. There is evidence that poor and rural communities whose economies rely on favorable climatic conditions bear the harsh effects of climate change (Tirivangasi et al., 2022). Climate variability frequently causes devastating changes in human living conditions such as food supply, water shortages, energy availability and security, natural resource shortages, and poverty (IPCC, 2022). The primary health consequence frequently associated with climate change is the decline in agricultural yields and output due to alterations in temperature and precipitation patterns, with occurrences of droughts and floods (IPCC, 2022). Zhu et al. (2021) acknowledge that climate change is causing a rise in the decline of productivity in subsistence crops, which poses a significant risk to global food security and the health and well-being of impoverished populations (Razaaq et al. 2021). Donatuto et al. (2014) suggest that climate change would worsen the health problems related to the decline of traditional foods, as it impacts their availability and accessibility.

5. Conclusion

From the review findings, community members are aware that climate change is occurring in the study area and is manifested increasing temperatures and erratic rainfall responsible for poor provision of food and water. Rural communities have a clear perception about variability in temperature and rainfall. While these communities are aware climate variability changes in environment, they are most concerned about how their changing climate is impacting indigenous food and water resources that are essential for health. The health impacts of climate reported include ill-health conditions such hunger, poverty, malnutrition, and related

illnesses like marasmus and kwashiorkor. The review suggests acknowledgement of community-based perspectives on climate change to inform climate change adaptation policies. This will be beneficial in formulating effective policies, implementing successful communication strategies, and adopting socially accepted technologies to mitigate risks and decrease vulnerability to climate change. Callaghan et al. (2020) corroborate that having knowledge about public opinion and specific perspectives on climate change is crucial for effectively influencing policy related to adaptation. The study conducted by Sraku-Lartey et al. (2020) bear evidence that the experiences and indigenous knowledge of people in rural communities in Ghana play a significant role in shaping climate change policies where local decision-making relies on indigenous knowledge of climate change. Samaddar et al. (2021) found that climate change adaptation projects in Africa frequently have the intended effect because they incorporated the socio-cultural context, attitudes, and perspectives of local beneficiaries. Schramm et al. (2023) reported a similar case involving the Minnesota Climate and Health Programme, which achieves its goal of providing the education and research on the health impacts of climate change by offering education and research on the health consequences of climate change, as well as by enhancing the ability of local governments and other entities to implement climate resilience solutions through community-based knowledge of the health impacts of climate change.

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