Climate Change and Reproductive, Maternal, and Child Health Outcomes in Tanzania: Evidence from a Qualitative Study in Kilwa District, Lindi Region

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Abstract

Background

Climate change continues to unfold at an unprecedented rate, affecting various forms of human life, including health and well-being. Evidence indicates that climate change affects maternal, reproductive, and child health outcomes in multiple ways. The increased risk of stillbirth, preterm birth, and miscarriage is indirectly associated with climate change, as extreme weather events can damage infrastructure, limiting access to essential healthcare services. Evidence of the nexus between climate change and maternal, reproductive, and child health in the Tanzania context is limited. This study was designed to explore the influence of climate change on maternal, reproductive, and child health outcomes in Kilwa District Council, Tanzania.

Methods

In October 2024, a cross-sectional qualitative study design was employed where 10 focus group discussions and 15 key informant interviews with women and healthcare workers in 10 flood-prone villages in Kilwa District were conducted. All discussions and interviews were audio-recorded, transcribed verbatim, and analyzed using NVivo-12, both inductively and deductively.

Results

Study findings show that respondents were aware of climate variability such as changes in rainfall patterns, increase in temperature, and extreme weather events such as floods and tropical cyclones. Women and young girls were perceived to be more vulnerable due to their traditional responsibilities such as fetching water, firewood, and caregiving roles. Rising incidence of climate-sensitive diseases such as mmalaria, and diarrhoea is taking a toll on pregnant women and children under five years of age especially following heavy rainfall season. Recurring floods are claimed to limit access and delivery of healthcare services. Participants reported a few cases where pregnant women gave birth on the way to the facility or at their homes because of the destruction of roads and bridges. Floods and drought have led to reduced yield of food crops and therefore have contributed to food insecurity. Respondents expressed concerns about reduced food availability, which they linked to poor maternal nutrition, negatively impacting the health of pregnant women, children, and unborn babies, leading to adverse outcomes such as low birth weight. Some participants explained changes in fertility intentions caused by floods and prolonged drought; women expressed fear as these events reduced their capacity to support their families. Respondents reported several adaptation measures that included reducing the quantity and number of meals taken per day in response to food shortages, water, and food storage for use during the dry season, relocating from flood-prone areas, sleeping outside during hot nights, and staying at the so called maternity waiting homes to overcome delays to reach health care facilities during the rainy season.

Conclusion

The climate crisis is taking a heavy toll on maternal, reproductive, and children's health in Kilwa district. The findings from this study underscore the critical urgency for strengthening the climate resilience of the healthcare system and the need to mainstream maternal, reproductive, and child health into national climate policy frameworks in Tanzania.

BACKGROUND

It is undeniable that climate change is the greatest public health threat of the 21st century (Dhimal et al., 2021; Moyo et al., 2023; Nick et al., 2019). Extreme temperatures, floods, recurring droughts, wildfires, tropical cyclones, and other extreme weather events have been increasing both in frequency and intensity over the years, affecting the health of millions of people worldwide and causing economic losses. For the last two decades (2000–2019), a total of 7348 major climate-related disasters occurred worldwide, with Asia recording more disaster events, than any other continent in the world (UNDRR, 2021). In 2019 alone, 396 disasters were reported to claim the lives of 11,755 people, affecting more than 95 million, and causing economic loss of nearly $130 Billion (Ebi et al., 2020). Several human activities such as the use of fossil fuels, deforestation, and agriculture, to mention a few contribute to increased levels of greenhouse gases such as carbon dioxide which is responsible for global warming.

The intensity of climate change impact is greatest in developing countries in the global south despite having less contributions to the emission of heat-trapping gases (greenhouse gases. This is partly contributed to less climate change adaptive capacities in these countries. For example, six of the top ten countries affected by extreme weather events by a total affected/100,000 people, were in Africa (Moyo et al., 2023). These countries were Somalia, Zimbabwe, Lesotho, Eswatini, Niger, and Mauritania. Moreover, since the beginning of 2022, African countries have witnessed extreme weather events such as recurring droughts, flooding events, cyclones, heatwaves, and famine which have collectively affected more than 19 million people and have claimed the lives of at least 4000 people (Moyo et al., 2023).

The continued threat that climate crisis represents has motivated the studies of their impact on human health. Growing evidence has revealed that climate change directly and indirectly impacts the health and well-being of the population through the increasing prevalence of malnutrition, respiratory diseases, and water-borne, and vector-borne diseases (Akhtar, 2024). Other studies indicate that the impacts of changing weather conditions disproportionately affect directly and indirectly, maternal, reproductive, and child health in multiple ways; extreme heat has been linked with increased negative birth outcomes such as stillbirth, and pre-term birth. Likewise, extreme weather events such as excessive rainfall may be associated with floods consequently limiting access to healthcare facilities, therefore, compromising the provision of lifesaving Sexual and Reproductive Health (SRH) services such as safe deliveries. Moreover, climate change indirectly affects reproductive health through an increase in mosquito-borne diseases such as Malaria and dengue, which may lead to adverse health effects for pregnant women and newborn children (Ahuja & Muntode Gharde, 2023; Chong et al., 2023; Lufele et al., 2017). The climate crisis has

the potential to exercabates these factors in multiple ways and therefore has the potential to reverse the hard-won gains in maternal, reproductive, and child health globally.

In Tanzania, there is limited research on the effects of climate change on maternal, reproductive, and children's health. In addressing the research gap, our study in Kilwa District, Lindi Region, explored the community's and healthcare perspectives on the influence of climate change on maternal, reproductive, and child health outcomes. The generated findings contribute valuable insights into understanding the nexus between the climate crisis and maternal, reproductive, and child health outcomes in Tanzania's context, offering concrete information that can inform sound climate change policies and Reproductive, Maternal, Neonatal, Adolescent, and Child Health (RMNACH)programs.

METHODS

Study area

The study was conducted in Kilwa District Council which is in the Southeast of Tanzania's mainland. It is one among the six councils forming the Lindi Region and covers a total area of 15,000 km^2. It is bordered to the east by the Indian Ocean and to the west by Nyerere National Park. Kilwa has a coastal climate with an average annual temperature ranging from 22°C to 30°C, with 98–100% humidity and a mean annual rainfall of 1034 mm (Kalonga et al., 2015). According to the most recent national population and housing census of 2022, the district has a total population of 297,676 (URT, 2022). This district was purposively selected for this study because it is one of the most climate-affected areas in the southern zone of Tanzania. Recurring floods, tropical cyclones, and prolonged dry spells have been observed for several years. Recently, between March and May 2024, the district was heavily hit by devastating floods and tropical cyclone Hidaya, which left a trail of destruction in farmlands and other critical infrastructures such as roads, bridges, houses, electric poles, schools, and healthcare facilities.

Study design

This study was a cross-sectional qualitative study design that was purposively employed to gather information from members of the Council Health Management Team, healthcare providers from primary healthcare facilities (gatekeepers in Tanzania's healthcare system), and women (mothers) aged 18 years and above. These study respondents were carefully selected to ensure in-depth gathering of lived and observed experiences of the effects of climate change on maternal, reproductive, and child health in Kilwa District Council. The FGDs approach was employed to explore understanding of climate variability and its related impacts on maternal, reproductive, and child health outcomes among women who are pregnant, or have given birth in the previous 10 years. Additionally, the study took advantage of KIIs approach with key healthcare providers from dispensaries, health centers, and district hospitals to gain an in-depth understanding of working experience during climate-related disasters, extreme weather conditions, and perceived impacts on maternal, reproductive, and child health outcomes.

Sampling

Seven wards were purposively selected for this study because they recently experienced devastating floods and tropical cyclone Hidaya between March and May 2024. At least one focus group discussion (FGD) and one Key Informant interview (KII) were conducted in each selected ward. With help from local leaders and the district health management team, 102 participants (87 group discussants and 15 key informants) participated in this study. A purposive sampling technique was used to select individuals who could provide in-depth information on the topic under study (Cresswell, 2014).

Data collection

A total of fifteen KIIs and ten FGDs, each consisting of 8 to 10 participants, were conducted. The KII and FGD semi-structured guide focused on exploring participants' perceptions of climate change, the impacts of climate change on maternal, reproductive, and child health, and existing coping strategies to adapt to the changing climate. The KII and FGD semi-structured data collection tool guides were developed specifically for this study. The tool guides were prepared in English and translated into Kiswahili by the Principal Investigator (PI). All KIIs and FGDs were conducted in Swahili, as it is a *lingua franca* throughout Tanzania. All FGDs were moderated by the first author with the help of research assistants who were taking notes. On average, FGDs lasted about 1 hour, while KIIs lasted about 35 minutes. Point of saturation was reached in the 7th FGD session and 10th KII; however, additional FGDs and KIIs were conducted to confirm the saturation.

Data management, processing, and analysis

FGD discussions and Key informant Interviews were recorded using a tape recorder (*Sony Voice Recorder, IPX470*) followed by transcription that was done verbatim. All audio recordings were transcribed and translated from Swahili to English. Data collected were cleaned to ensure they were correctly coded and labelled. Data analysis was done thematically where open, axial, and selective coding were used. Open coding involved line-by-line transcript analysis to continuously compare the emerging concepts and categories. Conceptual and theoretical concepts that arose during data analysis were documented in memos. Data analysis was carried out continuously until theoretical saturation was attained. Finally, selective coding, which involves identifying and describing the major phenomenon or core categories within the data that best expresses the perspectives of research participants was presented in a narrative report (Beech, 2000).

RESULTS

Social Demographic Profile of Participants

A total of 102 participants took part in the study of whom 87 female respondents participated in the FGDs while the remaining 15 respondents (4 females and 11 males) participated in Key Informant Interviews. Ten (10) FGDs were held in total, with 8–10 participants per group. Women who participated in FGDs aged between 18 to 65 years with a median age of 35.5 years old. Most of them (74.7%) had primary-level education. The majority (90.8%) of the FGD respondents engaged in small-scale farming as their main economic activities (Table 1).

Table 1
Socio-demographic profiles of FGD study respondents

Variable	Frequency (N)	Percentage (%)
Age		
18–27	22	25.3
28–37	31	35.6
38–47	27	31.0
48–57	7	8.0
Sex		
Male	0	0.0
Female	87	100
Marital Status		
Divorced	12	13.8
Married	63	72.4
Single	11	12.6
Widowed	1	1.1
Education level		
Diploma	3	3.4
Certificate	2	2.3
None	7	8.0
Secondary	10	11.5
Primary	65	74.7
Occupation		
Entrepreneur	3	3.4
Small-scale farmer	79	90.8
Health Assistant	1	1.1
Laboratory technician	1	1.1
Nurse	3	3.4

General Perception About Climate Change

When asked what they understand about climate change, most of the respondents described climate change as the changing of the seasons or shifting weather patterns. They also perceived it as a close and serious threat unfolding in their community having experienced devastating floods in May 2024. When further probed about the major changes in seasons, or weather events experienced in their community, the most mentioned were; extreme precipitation, unpredicted rainfall, and increase in frequency and intensity of extreme weather events (EWEs) such as floods, drought, and increasing temperature. One of the participants explained;

"There have been changes in the timing of the rainfalls. In the past, we used to experience normal rainfall seasons that was normal but from as early as the 2020s we experienced heavy rains that led to flooding and people had to relocate from their homes. Likewise, from 2023 to 2024, there was extreme rainfall which caused devastating floods we have never experienced before….." (FGD 03, Participant No.4, Kipindimbi Village)

Another participant added;

"According to my understanding, in the past years, the rain was normal and we knew when it would rain and thus, we had time to prepare. Yet it was uncommon for rainfall to cause floods or any destruction. They were even predictable, if it was raining in March, for sure you knew it would rain in March, but now if you expect rainy season in March, you will be surprised it is not raining……" (FGD 01, Participant No. 8, Nakingombe Village).

Follow-up questions on rainfall patterns during the interview triggered more participants to share their experiences on how changing climate impacts their livelihoods particularly food and cash crop cultivation. One participant narrated that;

"In the past, we used to prepare our farms in September expecting rain to start in December so that we can plant our seeds. But now in December, there is no rain as it used to be" (FGD 02, Participant No.10, Miguluwe Village).

Another participant added on the occurrence of prolonged dry spells and floods;

"Drought is also now more common compared to the past years. In 2023, it was too sunny and dry, pastoralists moved with their cattle into our area as grazing lands became scarce. In 2024, floods happened, and our crops were destroyed. The situation is bad" (FGD 04, Participant No.3, Mavuji Village)

Respondents were also asked to explain about the causes of climate change. This question was felt to be more scientific and many people could not respond to it. However, one of the respondents mentioned about the factors that drive climate change;

"In my understanding, two factors contribute to climate change: deforestation to grow sesame on a vast scale. Secondly, gas emissions from industries, also contribute to climate change" (FGD 01, Participant 8, Nakingombe Village).

Impacts of Climate Change on Health

Respondents reported that climate change negatively affects women's and children's health in many ways. Although some of the responses did not indicate a direct relationship between maternal, reproductive, and child health outcomes, our analysis has identified five sub-themes that emerged from the intensive discussions and interviews with the respondents. These include the increasing burden of climate-sensitive diseases, maternal and child malnutrition, mental health, limited access to health care services, and intensifying sexual and Gender-based Violence (GBV). These are explained as follows;

Impacts of climate change on maternal and child nutrition

Respondents in this study reported that the climate crisis impacts maternal, and child nutrition status in Kilwa District Council. Unpredictable rainfall patterns, prolonged droughts, and extreme weather events such as floods, and tropical cyclone Hidaya were mentioned to contribute to food insecurity in the district as they affect agricultural productivity. Participants confirmed reduced food availability in the aftermath of devastating floods that recently occurred in their respective areas. One of the participants said;

"Regarding food availability, it is now a challenge because all farming fields have been flooded, we cannot cultivate. In this situation, food availability has significantly reduced as our farms in low-lying areas have been flooded with water" (FGD 02, Participant No.1, Kipindimbi Village).

To cope with this, many households resort to reducing the quantity and number of meals taken per day. When asked about the most common type of food consumed by pregnant, and lactating mothers, and children, stiff porridge (ugali) was highly mentioned by the respondents. One of the respondents said;

"*You may find a woman making cassava porridge in the morning, in the afternoon she has nothing to eat, and in the evening, she cooks ugali (stiff porridge) to eat with her children. She still has to leave some for her children to eat before going to school the next day. Only God understands the challenges they face." (FGD 02, Participant No. 4, Miguluwe Village).*

Moreover, participants mentioned climate change has impacted the consumption of leafy vegetables in the district. Various factors such as unpredicted rainfall, floods, and an increase in pests and diseases have made it difficult for vegetable cultivation. Some of the key informants pointed out that this would be among the reasons anemia (iron deficiency) among pregnant women and children remains high in the district. One of the respondents said;

"As a result of that challenge, many pregnant women and many children suffer from anemia. If you look at the top ten diseases, anemia ranks first because there are no green vegetables……." (FGD 09, Participant No.5, Tingi Village).

Some of the participants indirectly associated climate change with various birth outcomes such as low birth weights. Climate-induced food insecurity was reported to result in reduced food consumption

among pregnant women which can also impact the health of unborn babies. One participant commented;

"… giving birth to underweight children is increasing in our communities and many cases occur during flooding or summer, therefore, you understand reduced access to sufficient nutritious food contributes to malnutrition." (FGD 04, Participant No.5, Mavuji Village).

Increased prevalence of climate-sensitive diseases

Discussants and key informants expressed their concerns about increased cases of some diseases following heavy rainfall season, and rising temperatures. The most common climate-sensitive diseases mentioned were malaria, diarrhea, heat rashes, urinary tract, and cholera. It was reported many pregnant women and children suffers more from Malaria in the district. This was linked to climatic conditions such as (rainfall and temperature) that create conducive environment for rising malaria-carrying vectors. One of the participants expressed her concerns about the increasing mosquito vector population;

"In the past, the cold season started in May and ended in August. But now it is very hot and the mosquito population is relatively high in both seasons" (FGD 03, Participant No. 6, Kipindimbi Village).

The rising cases of malaria in the district following heavy rainfall season and flooding were associated with living in shelters where utilization of mosquito bed nets was relatively low. One respondent narrated that

"……. some of the children were sleeping in schools. They were suffering most from Malaria because they did not have mosquito nets and the mosquito population was high" (FGD 09, Participant No.5, Tingi Village).

One of the key informants revealed how malaria and other climate-sensitive disease can impact pregnant women. Respondent narrated that;

"...during that season malaria prevalence was high, some of the pregnant women who contracted malaria, they gave birth prematurely. Also, if a pregnant gets cholera, she is likely to lose much body fluids therefore she could get complications which could also cause pre-term birth" (FGD 09, Participant No.5, Tungi Village).

Respondents also mentioned the increasing prevalence of water-borne diseases following flood season. It was reported main drinking water sources were contaminated with flood and this was associated with the outbreak of diarrhoea disease in the district. One of the key informants narrated that;

"… People fetch water that is already contaminated by the floods. For example, this year there has been an outbreak of diarrhoea due to heavy floods, something we had almost forgotten about here in Kilwa. But it has happened this year and it continues to persist because people are consuming drinking water from the ponds. (KII 02, In Charge of Health Facility, Kinyonga District Hospital).

Another participant added that;

"…. I would like to talk about my experience during flooding. Most of the children were suffering from diarrhea. This diarrhea may be due to children collecting water from rivers and drinking" (FGD 04, Participant No.1, Mavuji Village).

Limited access to healthcare services

Respondents reported that floods and tropical cyclone Hiday in 2024 introduced challenges in accessing healthcare services. Most of them confirmed crucial infrastructures such as roads, and bridges were damaged making it hard to reach the healthcare facilities. As a result of this seasonal barrier, participants revealed pregnant women and mothers faced challenges in attending antenatal and post-natal clinics. Some respondents shared the lived experience of a few pregnant women in their communities delivering without assistance from skilled attendants as a result of flooding. One respondent had this to say:

"Pregnant women face health risks. For example, sometimes roads become impassable therefore some of the pregnant women deliver at home, and some of them may even lose their babies…" (FGD 09, Participant No.4, Tingi Village).

Another healthcare worker shared his experience of assisting a pregnant woman to deliver safely at home as she was unable to reach the facility in time due to flooding. The participant said;

"…. many places in the village were flooded, I remember I attended three cases, where I had to assist with home deliveries because they couldn't make it to the healthcare facility. In other cases, you may find she has already given birth, so I would just give her support. There were several cases like these during flooding. There was a period when even healthcare workers could not reach the facility, it was very challenging because of floods (KII 15, Health worker, Somanga Health Center).

Other participants also stated;

"For a pregnant woman, when there are heavy rains and the river overflows, it becomes difficult for her to attend clinic. It also happens children fall sick but they cannot access timely healthcare services." (FGD 01, Participant No. 6, Nakingombe Village).

Failure to attend clinics was reported to have serious impacts on maternal and child health. Respondents mentioned this can result in poor health outcomes and other childbirth complications. One of the key informants mentioned;

"……..when a mother comes to the clinic, it is not only for check-ups but also for health education. We provide them with health education. For example, for pregnant mothers, we test their blood levels every week, but also through those clinics, they are given drugs and supplements, such as deworming drugs, antimalarial drugs, and iron supplements to increase the amount of blood. So, if the mother does not

attend the clinics, it becomes a challenge, many pregnant women may lose their pregnancies because they do not attend the clinic….". (KII 15, Health worker, Somanga Health Center).

Climate Change and Fertility Intentions

As a result of the increased vulnerability of pregnant women to the changing climate, women fear carrying pregnancy because of the worsening climate crisis, especially recurring floods. Many of the participants described not wanting to have more children in the wake of climate-related disasters as they found it challenging to access essential reproductive health services such as safe childbirth and meet basic needs for children such as feeding and taking them to school. One of the participants mentioned family planning is the best option they rely on to avoid the associated challenges of having a pregnancy in the wake of climate disasters. She said;

"Yes, we are afraid of getting pregnant because of the road conditions during the rainy season. Therefore, you go to the health facility and get an implant that will last for five years, others may prefer pills or injections. If the roads are impassable there is no way you may choose to take the risks to get pregnant" ((FGD 02, Participant No.4, Miguluwe Village)

Existing financial hardship associated with the economic losses from low yields of food and cash crops was also linked to changes in fertility intentions. The same participant added that;

"You are living with your husband and you don't have five thousand shillings, what will happen when you get pregnant? Nowadays being pregnant is expensive, in just the first week you must incur some costs until you reach nine months…." (FGD 02, Participant No.4, Miguluwe Village)

Intensifying Sexual and Gender-Based Violence

Study participants reported that all household chores such as cleaning the house, cooking, fetching water and firewood, washing clothes, and taking care of children and subsistence agricultural work are considered traditional roles of women. Among the mentioned household chores assigned to women, fetching water was pinpointed to be the most tiresome task than others since water have become a scarce resource therefore forcing women and girls to walk long distances searching for water sources. Surprisingly, women are expected to continue working even in the final stages of pregnancy. One of the participants mentioned long-distance traveling, coupled with other household chores often leaves women exhausted and fatigued to the extent they may be unable or unwilling to engage in sexual relationships. This fuels frustration among their partners which often results in domestic violence. One of the participants said;

"When women return from the farm, they go to search for firewood and vegetables therefore they do not get adequate rest. Even when the husband wants intimacy, he will be frustrated as he thinks she is denying him sex leading to verbal abuse and domestic violence." (FGD 02, Participant No.10, Miguluwe Village)

Additionally, another respondent added that women might be questioned by their partners about being tired from such tasks and being beaten by their husbands, she said;

“Ooh! You are tired?... but you have fetched water, why are you tired to do this, you are beaten and experience all sufferings” (FGD 02, Participant No.4, Miguluwe Village)

Moreover, the participants reported sometimes the role of fetching water rests on the shoulders of young girls when their mothers are overwhelmed with other household tasks or become fatigued. Young girls without accompaniment by adults may be abducted and raped while walking to water collection points. One of the participants articulated this concern by pointing out that;

“Sometimes the mother may be overwhelmed with other household tasks and thus may request help from her young girl. When she goes there, she may find a lot of containers lined up, and other people may not consider she will be late going back home. These water sources are located in distant areas, and often children are sent to fetch water there. Recently, pastoralists have moved into our areas, their minds are different from ours. When they see young girls, they take advantage and rape them” (FGD 02, Participant No 1, Miguluwe village)

Also, respondents reported that Extreme weather causes an increase in the occurrence of early pregnancy and sexual violence by intensifying elements of structural oppression, such as gender inequality and poverty. Participants reported as a result of compromised livelihoods and economic instability, young girls are compelled to engage in risky jobs such as transactional sex to get money to meet their basic needs. One of the respondents mentioned;

“…Also, many women were experiencing abuse from their husbands due to a lack of resources in the family. When parents separate, and the mother has no means of gaining income to feed her family, the children are forced to find means of living on their own, sometimes they are being sexually exploited to get money. For the young girls they may be raped, so it becomes a bit of a challenge.” (FGD 09, Participant No.7, Tingi Village)

One of the key informants said that;

“Aaaah… those issues are also common here. When you look at statistics, many young girls below 18 years of age are pregnant and when you investigate you find poverty contributes much to this therefore if they are offered something they are easily influenced. Such cases are many in our community, and if you look at our register, you will find the age of first-time mothers is around 15, 16, 17, or 18. They are still young girls” (KII 15, Health worker, Somanga Health Center)

Existing adaptation measures to address the impacts of climate change

The extreme weather events impose seasonal barriers to access health facilities, especially for pregnant women who live far away or across difficult terrain from healthcare facilities. This is coupled with limited

transportation options. One of the key informants mentioned in the District Hospital, a Maternity Waiting Home (MWH) has been constructed where pregnant women stay before giving birth. This helps many pregnant women access essential healthcare services including timely safe deliveries at all times. One of the key informants said;

"……in our district hospital, we have a designated building called Mama Ngojea. This is a building that accommodates pregnant women who come from remote areas, therefore they come here early so that they may not face any barriers when it is time to give birth" (KII01, DMO, Kilwa District Council)

Additionally, Psychosocial support is given to climate-related disasters such as flood victims. The key informant mentioned;

"There are organizations that provided psychosocial support conducted during village meetings for flood victims who lost their properties to build their resilience ……" (KII 01, DMO, Kilwa District Council)

There is also relocation of the community members from flood-prone areas to safe grounds. One of the health workers said;

"…Njinjo is one of the villages that was completely wiped out two or three years ago. There is a river called 'Matandu' which severely flooded the village. The rains were pouring in nearby areas like Morogoro but the floods water reached Njinjo and submerged the whole village. Due to this, they decided to relocate the village to another safe area….." (KII 02, In Charge of Health Facility, Kinyonga District Hospital)

DISCUSSION

This study aimed to explore community and healthcare workers' perspectives on the influence of climate change on maternal, reproductive, and child health outcomes in Kilwa District Council. The climate change terminology was familiar to the respondents, as most demonstrated a good understanding of its meaning and the causes of climate change. Respondents described climate change based on several indicators such as shifting rainfall patterns, altered precipitation, temperature fluctuations, and the occurrence of climate-related disasters such as floods and drought. The findings clearly showed that Kilwa District Council is experiencing climate change. Similar findings were reported in a study that was conducted in Eastern Kenya where local communities associated changes in weather conditions in a specified period as clear evidence of climate change (Recha et al., 2017). This good understanding among participants could be attributed to the timing of the study which was conducted a few months after tropical cyclone Hidaya and devastating floods heavily hit the district between April and May 2024. Participants also acknowledged anthropogenic activities such as industrial pollution, and deforestation as among the drivers influencing climate change. Similar findings were identified in the studies conducted in Kenya and the Mediterranean Islands (Recha et al., 2017; Tourlioti et al., 2024).

A significant contribution of our study was the exploration of maternal, reproductive, and child health outcomes and healthcare service delivery in the context of floods. Our findings reveal that essential maternal and reproductive health services become increasingly inaccessible during flooding because of paralyzed transportation networks. A significant increase in transportation costs during flooding events also prevented people from seeking timely care. These disruptions pose significant risks to pregnant women as they may give birth in unsafe conditions which may result in preventable deaths. Additionally, the inability to attend antenatal and postnatal clinics means a loss to access lifesaving health education and crucial interventions such as vaccinations, deworming, and supplements such as folic acid, and Vitamin A which are essential for pregnant women and children's health and well-being. Our findings echo concerns in other low and middle-income countries, as studies have reported limited accessibility to essential lifesaving healthcare services during flooding and other climate-related disasters (Ashraf et al., 2024; Mallett & Etzel, 2018; Mroz et al., 2023; Pappas et al., 2024). Vast evidence shows that limited access to sexual and reproductive health services contributes much to morbidity and mortality among women of reproductive age (Ashraf et al., 2024). As future projections depict a worsening climate crisis, accessibility to healthcare services will be a significant challenge, especially in flood-prone districts because of seasonal geographical barriers. In this regard, there is an urgent need to prioritize maternal and child healthcare services in emergency preparedness and response plans.

The rising prevalence of diseases was seen as a grave public health concern in the post-flood scenario in our study. Respondents reported rising cases of malaria, diarrhea, skin rashes, and suspected cholera in their local areas. Pregnant women and children under 5 years of age were identified as the most vulnerable population group, especially to Malaria. Similar findings were reported in a study conducted in Pakistan, where malaria, diarrhea, and rashes, increased tremendously following devastating floods (Abdullah et al., 2024). Health workers explained the possible consequences of contracting some diseases such as malaria during pregnancy as it may result in miscarriage, anaemia, and preterm delivery. Studies across the world have also reported malaria infection during pregnancy can have grave consequences on both mother and unborn baby, including maternal and fatal anemia, miscarriage, preterm birth, low birth weight infants, and maternal and/or neonatal mortality (Bakken & Iversen, 2021; Berhe et al., 2023; Chua et al., 2021; Iqbal & Ali, 2021; Satapathy et al., 2024).

Moreover, malnutrition in the aftermath of devastating floods and tropical cyclone Hidaya was a recurring theme across all focus group discussions and key informant interviews. Respondents spoke about food insecurity they experienced immediately after the floods washed away food crops in their farmlands. This was reported to contribute to inadequate access to nutritious foods and reduced food intake, further compounded by financial constraints. Healthcare workers expressed their concerns regarding food insecurity among pregnant women and children and associated it with poor health outcomes including low birth weights. Our findings share similarities with a study conducted in Bangladesh in which pregnant women reported reduced food intake during the flooding season (Goudet et al., 2011). Moreover, a systematic review on the impact of flooding on pregnancy and child health has also reported that climate-induced food insecurity is associated with malnutrition among pregnant women and children (Mallett & Etzel, 2018).

The study findings depicted that the climate crisis has taken a gender dimension as women and young girls are disproportionately affected than their counterparts' men. Respondents reported climate crisis exacerbates existing gender disparities by increasing the risks of sexual and gender-based violence and increasing the burden of household chores such as searching for water, and firewood. Rising rates of teenage pregnancies were a concern among respondents. This was linked to economic hardship among struggling families which may compel young girls to engage in risky activities including transactional sex to earn a living. Our findings resonate with global concerns, as several studies have documented rising cases of sexual and gender-based violence such as domestic violence, and child marriage because of the climate crisis worldwide (Ahmed et al., 2019; Allen et al., 2021; Arunda et al., 2024; Asadullah et al., 2020). In the wake of climate-related disasters, response efforts often focus on addressing the immediate needs of affected communities and rebuilding damaged critical infrastructures and economies. The gendered impacts of climate crisis are often overlooked putting women and girls in more vulnerable positions. As the future climate scenario depicts a worsening climate crisis, so will the prevalence of sexual and gender-based violence (SGBV). In this regard, concerted efforts are needed to address the gendered impacts of the climate crisis as one of the instrumental pillars to increase women's resilience.

Mental Health challenges following climate-induced disasters were highly mentioned by the study participants. Respondents mentioned that the recent floods and tropical cyclone Hidaya destroyed livelihoods and properties on a massive scale. This was also accompanied by the loss of loved ones. All these issues combined to deteriorate mental health among flood victims. Some psychological symptoms such as depression, psychological distress, and post-traumatic stress disorder (PTSD) were reported by the respondents. Our findings are similar to a study conducted in Bangladesh, in which adolescents in flood-affected communities experienced the same mental health problems following devastating floods (Siddik et al., 2024). Similarly, other studies have documented mental health disorders among flood and other natural catastrophe victims across the world (Fernandez et al., 2015; Hande et al., 2018). From this study, it is crystal clear that mental health issues and psychosocial support should be given adequate attention when addressing the needs of flood-affected communities.

Several measures were reported to have been taken to cope with the climate crisis in the Kilwa district. These were the establishment of Maternity Waiting Homes (Mama Ngojea), family planning, and relocation of flood-prone communities to high-lying areas. The MWHs play a crucial role in counteracting geographical barriers such as seasonal flooding that may impede pregnant women's timely accessibility to healthcare facilities. Family planning was considered important in strengthening women's resilience to the impacts of climate change due to the perceived benefits of improved health and welfare for themselves and their children. However, beliefs and cultural norms limit women's autonomy in family planning. Building a robust and climate-resilient community requires sound climate adaptation policies that reflect local realities, stakeholders' engagement, and adequate financing. To ensure the protection of women and young girls who are most vulnerable to the climate crisis, gender-responsive climate action is urgently needed. This includes increasing opportunities for women's participation in decision-making spaces, and prioritization of women's and girls' unique needs in adaptation plans.

CONCLUSION

Climate crisis impacts maternal, reproductive, and child health, and threatens to reverse the progress that has been made in the last decade in reducing preventable maternal, neonatal, and child mortalities in Tanzania. Our findings reveal that the manifestation of the climate crisis in Kilwa District Council contributes to poor maternal and child health outcomes, such as increasing morbidity rates of climate-sensitive diseases such as Malaria and diarrhoea, and malnutrition caused by climate-induced food insecurity. Additionally, extreme weather conditions (floods, tropical cyclones, to mention a few) limit timely access and delivery of essential healthcare services, including routine child immunizations, and reproductive health, as pregnant women fail to attend antenatal and postnatal clinics during climate-related disasters such as floods. Also, the findings show that the ongoing climate crisis has intensified sexual and gender-based violence. Being the first study of its kind in Tanzania, particularly in a district that experiences extreme weather (recurring flooding, heatwaves, and tropical cyclones), these findings contribute to a much-overlooked area. The findings point to the critical urgency of prioritizing maternal, reproductive, and child health in climate policies, including the Health National Adaptation Plan (HNAP), the Nationally Determined Contributions (NDCs), to ensure delivery of the maternal, reproductive, and child health services is resilient to the changing climate. This also calls for full integration of climate change considerations in existing health sector policies, strategies, plans, and interventions as deliberate efforts to strengthen healthcare system resilience. This study was conducted in only one flood-prone district; therefore, the generated findings may not be generalizable, taking into account that impacts of climate change are context-specific. Further research is needed, especially from other districts experiencing different climate variability, such as drought. Lastly, more epidemiological evidence is needed in Tanzania to establish a causal association between health outcomes mentioned by the respondents, such as malaria, diarrhoea, heat rashes, and climate data such as increased temperature, precipitation, to mention a few.

Abbreviations

EWEs	Extreme Weather Events
FGD	Focus Group Discussion
KII	Key Informant Interview
MUHAS	Muhimbili University of Health and Allied Health Sciences
MWH	Maternity Waiting Home
PTSD	Post-traumatic stress disorder
SGBV	Sexual and Gender-based Violence
SRH	Sexual and Reproductive Health

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with ethical principles provided in the Declaration of Helsinki. Ethical clearance to conduct this study was obtained from the Muhimbili University of Health and Allied Sciences (MUHAS), Institutional Review Board with reference MUHAS-REC-09-2024-2450. Additionally, a permission letter to conduct this study was sought from the President's Office of Regional Administration and Local Government (PORALG), regional, district, ward, and village authorities. Informed consent was sought from all respondents before they participated in the study. This was provided verbally by all respondents. Confidentiality was adhered to during data collection, as the names of participants were excluded from the audio recordings.

Consent for publication

Not applicable

Availability of Data and Materials

The data analysed during the current study will be available from the co-corresponding author on reasonable request. Interested parties should contact Dr. Hussein Mohamed at hmohameds1@gmail.com

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

RM and HM conceptualized the study and designed the research protocol, which included developing semi-structured data collection tools. SM secured funding for this study, mentored the implementation and writing processes, and reviewed the manuscript. WR, SK, ES, and MJ collected the data. RM, HM, SM, and BM prepared the first draft of the manuscript. All authors contributed to and approved the final version of the manuscript.

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Author Details

Not applicable

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Figures

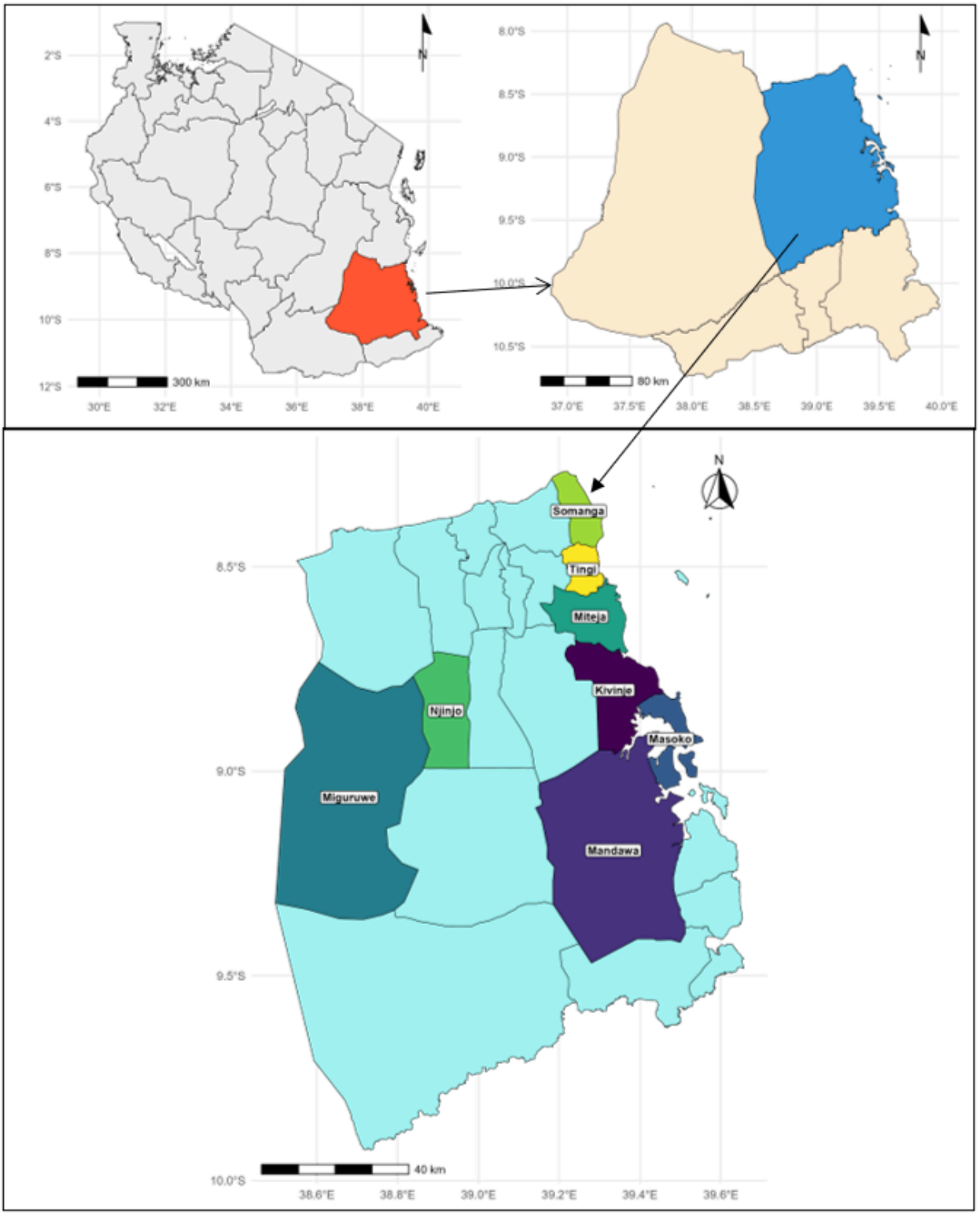

Figure 1

Map of United Republic of Tanzania showing study area (Kilwa District Council)

Supplementary Files

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