

# Vulnerability of Informal Settlements to Flood Disasters: A Review of Public Health Implication

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**Abstract** Floods are the most frequent disasters in the world with devastating effects on millions of people and the natural environment. The health status of any community is directly affected by the quality of their housing and the environmental risks they are exposed to. Rapid urbanization and the inability of the government to meet with the high demand for housing has led to the formation of informal settlements resulting in the unsustainability of cities due to overcrowded housing, poor sanitation, poor collection of solid waste, blocked drainage system as well as poor healthcare and compromised healthcare delivery system. The impact of floods on informal settlement dwellers is becoming increasingly severe and frequent. Using multiple data sources, this study critically evaluates eThekweni metropolitan area. The review shows that eThekweni has the largest number of informal settlements in south Africa characterized by poor housing conditions, inadequate infrastructure, unhealthy natural environments and poor health services predisposing them to increased risk of diseases and poor wellbeing, which is exacerbated during flood disasters. The findings of this study advocate for improved governmental involvement in service delivery, risk informed decision-making concerning floods, public health and affordable housing for residents of informal settlements in eThekweni metropolitan area.

**Keywords:** Floods; Healthcare; eThekweni Metropolitan area; Informal settlements; Environment.

## 1. Introduction

Floods are the most frequent disasters in the world with devastating effects on millions of people and the natural environment (EM-DAT, 2015). Floods have contributed to over 500,000 mortalities worldwide and 500 billion US dollars in financial losses in the past thirty years (Kocornik-mina et al., 2015). Floods have serious consequences on the health and wellbeing of community members. The health impact of floods is far reaching and goes beyond the immediate consequences of direct health effects to include long-term effects on community health, livelihoods of households and environment (Okaka and Odhiambo,

2019). The health status of any community is directly affected by the quality of their housing and exposure to environmental risk (Sakijege et al., 2012).

It is estimated that 50% of the world's population live in the cities and this will rise to 70% by 2050 (Bai et al., 2018). Rapid urbanization is resulting in the inability of cities to be sustained due to overcrowded housing, poor sanitation, poor collection of solid waste, blocked drainage system as well as poor healthcare and healthcare delivery system (Williams et al., 2018). The inability of the government to meet with the high demand for housing has led to the formation and congestion of informal settlements. Informal settlements also referred to as squatter settlements and slums are unplanned land location devoid of survey as residential and mainly consisting of informal structures that have no governmental or local approval which are not intended for permanent structures. Study conducted by Williams et al. (2018), show that residents of informal settlements are mostly the urban poor. The impact of flooding on informal dwellers is becoming increasingly severe and frequent making them highly vulnerable to water-borne and other diseases (Sakijege et al., 2012). Studies have shown that there is a relationship between poverty, vulnerability and disasters on urban informal settlements (Mfingwana, 2020).

Informal settlements in South Africa is coming up in an alarming rate. eThekweni municipality accounts for the largest number of informal settlements among the municipalities in South Africa (United Nations, 2022). eThekweni is home to over 580 informal settlements and encompassing 314,000 households. These comprises over a quarter of its population. Informal settlements in eThekweni is characterized by poor housing conditions, inadequate infrastructure, unhealthy natural environments, poor health services and insufficient healthcare predisposing them to increased risk of disease and poor wellbeing (WHO, 2018). The continued influx of people into eThekweni municipality and a limited supply of well-located land is a precursor of the vulnerabilities experience by its population (United Nations, 2022). Another cause of flood in eThekweni is its location around the coast and steep and low-lying topography. Storm surge and

overflowing of rivers frequently cause floods leading to more deaths and leaving people vulnerable. This is the case of the recent flood disaster that hit KwaZulu-Natal in April 2022 with eThekweni being badly hit especially the informal settlements (Wicks, 2022). The aim of this study is to critically evaluate the public health consequences in eThekweni informal settlements as a result of the impact of flood disasters. This review will further provide insight into the need to decongest informal settlements and make it a safer environment.

## 2. Method

The study anchors on the review of the vulnerability of flood disasters and its public health implications with focus on eThekweni Informal settlements. Multiple sources of information are utilized in this review study. Peer-reviewed and published research articles and conference proceedings from academic research databases rich in information is used. Published thesis and online reports, flood reporting sites and newspaper articles are also used to obtain a rich literature review of the vulnerability of informal settlements in eThekweni to flood disasters and its public health implications.

### 2.1. Flood Risk Assessment in South Africa

An assessment of flood risk is very crucial in understanding the vulnerability that it may present. South Africa is a semi-arid to arid climate having a total land area of 1.2 million square meters. Flood is the major natural hazard occurring in South Africa (Midgley et al., 2005). Increasing urban population coupled with unregulated informal development and chaotic planning has led to the population being vulnerable to floods and other disasters (Busayo and Kalumba, 2021). According to Zuma et al. (2012), the risk of flooding occurring in any given year in South Africa is 83.3%. In the past decade, several major floods have occurred that led to significant damage to infrastructure, loss of lives and livelihood.

eThekweni is located on the coast of the Indian ocean and the presence of water bodies makes it prone to heavy rainfalls and flooding events. Rapid urbanization is responsible for the growth of informal settlements in number and size (IFRC, 2022). According to IFRC (2022), a quarter of the city's population lives in informal settlements, unplanned constructions which are built with poor quality materials on vacant land most of which are flood prone areas thus exposing the community to flood risk and exacerbating the devastating effects of flood risk on the people and the environment. Flooding in eThekweni occurs on a yearly basis causing extensive damage to infrastructure, displacement of people and fatalities (Olanrewaju and Reddy, 2022). Study by Olanrewaju and Reddy (2022) on the assessment and prediction of flood hazard by examining the trend of flood events in eThekweni metropolitan area in the period of 1985 - 2016 showed that flooding has continued to be more severe with every year. Report by Davis (2016) highlighted the devastation of the July 2016 floods in eThekweni which resulted in damages running into millions of Rands and thousands displaced from their homes. Informal settlements in eThekweni were the worst hit areas. April

2022 heralded another severe flooding caused by heavy rainfall which led to the death of 435 people, 80 missing, over 12,000 houses completely destroyed, 19,113 households with 128,743 people affected. Critical infrastructures such as major roads, health centres, schools, electricity and communication systems were severely damaged (IFRC, 2022). The hardest hit areas were found to be informal settlements built close to the rivers and below flood lines with little or no infrastructure for protection. The presence of numerous informal settlements which are inhabited by the poor and vulnerable makes the flood disasters devastating as the impact on the health and psychological wellbeing of the people lingers very long after the waters of the floods have dried up.

### 2.2. Vulnerability of Informal Settlements to Flood Risk

Majority of the informal settlements are located in risk areas such as river banks and low-lying lands faced with climate threats associated with flooding. This makes them disproportionately more vulnerable as a result of greater exposure associated with under invested or lack of infrastructure, geophysical location and poor housing quality (John, 2020). These settlements rely on incompetent or non-existent risk reduction services. De risi et al. (2013) affirms that informal settlements of big cities are the most vulnerable to the impacts of flood disasters as a result of high population densities and high levels of poverty. In their study, they showed that poverty was responsible for the low-quality building material that is easily destroyed during floods causing displacement, injury and death and putting more hardships and poor recovery on the affected community. Mfingwana (2020) assessed the relationship between poverty, vulnerability and flood disasters in informal settlements and found that there is a direct relationship between the variables and that flood disasters in informal settlements resulted in deaths, collapsed housing structure, loss of possession and loss of land. The study showed that the location of informal settlement close to a river and the poor and vulnerable living conditions was a root cause of the constant flooding as was the case with Quarry road informal settlement located in eThekweni. This is confirmation of study by Tas et al. (2013) that poor quality of housing structures increases flood morbidity by killing the people inside their houses. In Dakota informal settlement, the presence of water bodies, high number of poor and vulnerable people and poor building materials made the impact of the April 2022 flood disaster very grievous with many people displaced, homes destroyed, people injured and some dead. This was duplicated in many informal settlements in eThekweni municipality because it is situated in coastal area.

### 2.3. Public Health Consequences of Flood Disasters in Informal Settlements

Immediately after flood disasters, there is an increased risk of disease outbreak especially among displaced people. Potable water is often contaminated by pollutants from overflowing sanitation facilities. This results in increased risk of water and vector-borne diseases. Vulnerable people are mostly affected. Mortality is increased by up to 50% rate within the first year after a major flood disaster while

psychological distress has a prevalence of 8.6-53% and lingers up to 2 years after the flood disaster (Alderman et al., 2012). Study conducted by Cunnan and Maharaj (2000) on healthcare in informal settlements in Durban show that the most prevalent disease in these settlements are tuberculosis, sexually transmitted diseases (STDs), asthma and diarrhoea. Flood coupled with poor sanitation are indicators of water-borne diseases. Water-borne diseases are endemic and infectious and present primary health concerns after flooding (Olanrewaju et al., 2019). Study by Carias et al. (2022) suggest that the urban poor population living in informal settlements experiences increase in acute morbidities and depressive symptoms following floods. The study also found that the negative mental health effects last long, which could be as a result of the worsening economic outcome caused by the flood disaster.

In the study of Quarry road west informal settlement in eThekweni municipality, Williams et al. (2019) showed that the severity of flooding determines to what extent polluted water spreads throughout the informal settlement. The study found that Polluted water in the settlement influences the persistence of mosquitos and the increase in vector-borne diseases impacting negatively on the already low standard of health. The study also found that the frequency and persistence of heavy rainfall events impair the standard of health by causing respiratory illnesses as a result of dampness in the homes constructed with poor building materials that are unable to buffer the dampness. Because informal houses are built close to one another and lack proper sanitary facilities, there is accelerated spread of communicable diseases. Flood disasters compound the already dire situation of informal settlements and poverty faced by them makes them unable to quickly recover from flood disasters.

Flood disasters greatly affect humanitarian conditions. This is especially so in informal settlements where the affected people live in fear and are greatly traumatized. This is the case with the April 2022 floods disaster in eThekweni, overcrowding of evacuation centres results in lack of minimum protection standards which inevitable will lead to protection risks such as Sexual Gender Based Violence (SGBV). The flood disaster led to an increase in the number of Covid-19 cases as eThekweni municipality accounted for 80% of the new cases.

#### 2.4. Flood Risk Management in eThekweni Informal Settlements.

eThekweni is a metro government encompassing the port city of Durban and several surrounding towns into one jurisdiction of both urban and rural land. Across eThekweni, there are hundreds of shack-like slums scattered in the urban area suffering from high rates of natural disasters. Flooding is more problematic in informal settlements due to lack of planning (Naidu et al., 2022). In eThekweni and across South Africa, floods are not usually predicted well in advance hence resources meant for important services such as sanitation and healthcare are diverted to provide relief to flood victims. Naidu et al. (2022) suggest that it is paramount to look at flood management in South Africa in a more holistic and context-specific angle. This they say will involve

integrating local people's indigenous knowledge (IK) to flood risk management. Naidu et al 2022 suggested in their study that if local communities were consulted and their IK integrated there will be a clearer and more detailed picture on vulnerability of informal settlements to flood disasters. They argue that although GIS is able to show areas vulnerable to flooding, it is unable to explain human factors that cause flood vulnerability. In their summation, they postulate that IK can be a source of resilience to flooding.

According to report from World Bank (2009), the government of eThekweni municipality was unable to make a demonstratable improvement on the informal settlement dwellers needing houses but lacking basic amenities such as good healthcare, portable water, electricity etc. Meanwhile, the informal settlements continue to be an incubator for diseases. Govender *et al.*, (2011) in their study argue that ineffective service and lack of sanitation in informal settlements is opposing the efforts and improvement strategies of other efforts. Mainstreaming infrastructure in informal settlements is paramount as deteriorating infrastructure will have terrible consequences. An initiative by the eThekweni municipality is the implementation of Flood Early Warning Systems (FEWS) approach to flood management which is based on open source software tailored specifically for eThekweni municipality. This real-time monitoring network allows ground truthing of predictive models that are running the Global Forecast System (Chrystal *et al.*, 2015). The system after receiving weather report from the South African Weather Service every 12 hours in a three days forecast, highlights critical points where there is a risk of flooding in the municipality (Evans, 2022). This approach however failed when about 500 deaths recorded and thousands displaced from their homes in the April 2022 flood disaster in eThekweni. This highlights the relationship or lack of between the government of eThekweni and the residents. One will wonder what went wrong. Report from Evans (2022) following analysis of the flood disaster suggest that early warning systems was sometimes not enough. It was illustrated that having strong partnership between the government and the local community can help prevent loss of life and prepare for disasters such as floods. If the information received cannot get into the hands of the community at risk, then it is useless. It was also understood that building knowledge and understanding and not just transferring knowledge to community members was very important. Knowledge from researchers, monitoring from the municipality and community based-knowledge was found to be very powerful in the management of flood disasters (Evans, 2022).

### 3. Conclusions

eThekweni has a record of yearly floods as shown in various studies reviewed and every year the devastating effect is more than the previous. Links are made between housing, governance and health and arguments made on the fact that these parameters do not necessarily have to be linked to improve the health and wellbeing of residents of informal settlements. It was argued that if facilities such as health centres, sanitation and electricity were provided, the wellbeing of the residents will be better and resources will

be better managed. So many initiatives have been developed over the years to mitigate against flood disaster and subsequent health challenges. However, in a city such as eThekweni where a third of the residents live in informal settlements. Quarry road initiative alone is too little to make any difference to the impact of flooding in the entire municipality. It becomes very important to understand and acknowledge that community-based or indigenous knowledge is an important key to holistic flood risk management and should be explored in ongoing research.

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