Global Disaster Preparedness Center

RESEARCH PAPER

Assessment of Early Action for Flood Protection in Makhuwira: Understanding Last-Mile Community Response to Flood Warning in Chikwawa District, Malawi

Photo: Benoit Matsha-Carpentier / IFRC

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Acronyms and Abbreviations

AA	Anticipatory Action
ADRMC	Area Disaster Risk Management Committee
CDA	Community Development Assistant
DoDMA	Department of Disaster Management Affairs
ECHO	European Civil Protection and Humanitarian Aid Operations
EWS	Early Warning Systems
FbF	Forecast-based Financing
FDGs	Focus Group Discussions
GoM	Government of Malawi
IDREAM	Increased Disaster Resilience and Early Action in Malawi
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
KII	Key Informant Interviews
MRCS	Malawi Red Cross Society
NGOs	Non-Governmental Organizations
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNDRR	United Nations Office for Disaster Risk Reduction
UNICEF	United Nations Children's Fund
VCPC	Village Civil Protection Committees
WFP	World Food Programme

Abstract

Flooding, exacerbated by climate change, poses significant risks to vulnerable last-mile communities in Malawi, particularly in Makhuwira, Chikwawa District, where high poverty levels constrain disaster preparedness and resilience. This study evaluates the effectiveness of early warning systems and household-level early actions during Cyclone Freddy, employing a mixed-methods approach that integrates household surveys, key informant interviews, and focus group discussions to examine disaster outcomes and challenges in implementing early actions.

Findings reveal that while 78.6% of households received early warnings, proactive responses were hindered by financial constraints, inadequate evacuation infrastructure, and delayed dissemination of warnings. Only 30.7% of households evacuated preemptively, with an additional 33.9% evacuating after the onset of the disaster. Resource protection measures, such as safeguarding homes (10.6%) and livestock (9.8%), were minimal. Statistical analysis found no significant correlation between early actions and reduced flood impacts, attributed to systemic barriers and the overwhelming severity of the cyclone.

Qualitative insights emphasize the urgent need for improved evacuation infrastructure, timely financial support, and greater community engagement in disaster preparedness. The study highlights the importance of inclusive, community-centered strategies to build resilience and mitigate flood risks in marginalized areas like Makhuwira.

Key words: Early action, Early Warning Systems, last-mile community, flood impact

1. Introduction

1.1. Background

Floods pose a significant threat to communities, particularly in developing countries, due to their potential to cause extensive damage to infrastructure and human life (Nur, 2017). Climate change is considered the primary driver of the increased frequency, scope, and magnitude of floods over the past two decades (Centre for Research on the Epidemiology of Disasters, 2019). Flooding results in injuries, illnesses, and fatalities, along with other adverse effects, posing a significant challenge to sustainable development (Dewa et al., 2022).

Early Warning Systems (EWS) have emerged as a crucial tool in disaster risk reduction, providing communities with timely information to prepare for and respond to impending floods (Kafle, 2017). These systems integrate scientific forecasting with community-based monitoring to enable early action - the timely steps taken by communities to protect lives and assets before a disaster strikes (Gonzalez-Cao et al., 2019; Fernández-Nóvoa et al., 2024). However, among the most vulnerable to the devastation of floods are the "last mile" communities - the marginalized, most vulnerable and most remote populations (Knight, 2009). These communities have limited resources and socioeconomic vulnerabilities that compound the challenges of disaster preparedness and response (Cornell 2018; Kohn, 2012) and make them hard to reach (Knight, 2009).

Malawi is facing a rising frequency of climate-related issues, including erratic rainfall, high temperatures, strong winds, droughts, and flooding (Chisale, 2021). In recent years floods have intensified, adversely affecting livelihoods of rural communities (Hussein et al., 2023; Zuzani et al., 2019). It is reported that extreme weather events contribute significantly to GDP reduction of about 1.7% in Malawi (Pauw et al., 2011). These floods primarily drive persistent poverty and food insecurity in many parts of the country (Joshua et al., 2021; Mijoni & Izadkhah, 2009).

In response, various stakeholders in Malawi have implemented early action interventions, including community-based early warning systems, evacuation planning, and pre-positioning of emergency supplies (OCHA, 2022). The Malawi Red Cross Society has been particularly active in implementing these interventions, working to bridge the gap between early warning and early action in vulnerable communities (IFRC, 2020). These interventions are carried out in anticipation of a hazard impact and based on a prediction of how the event will unfold (Anticipation Hub – World Disasters Report, 2020).

1.2. Problem Statement

The frequency and intensity of natural disasters are increasing globally, largely due to the effects of climate change (Lopez et al., 2018). In Malawi's southern region, Chikwawa district is particularly vulnerable to recurring floods that disproportionately affect marginalized communities (Hussein et al., 2023; Coulibaly et al., 2015). To enhance disaster resilience and encourage early action at community and household level, the Malawi government, along with various organizations, have implemented early action activities such as early warning, disaster preparedness training and resource distribution (Gettliffe, 2022). However, the effectiveness of these interventions in encouraging early action among Chikwawa's last-mile communities remains unclear as there are still multiple reports of continued devastation in the district (Braka et al., 2024; Aderinto, 2023).

The Malawi Red Cross Society (MRCS) has been at the forefront of implementing Early Action since 2017, with special focus on predicting sudden-onset flooding and activating life-saving actions (MRCS, 2024). In March 2023, before Cyclone Freddy's impact, MRCS, in coordination with disaster stakeholders, implemented specific early actions in Chikwawa, including:

- Strengthening early warning systems
- Disseminating early warning messages
- Securing safe evacuation places
- Pre-positioning emergency supplies (MRCS, 2023).

Despite the growing application of early action in the region (Gettliffe, 2022), there has been no comprehensive assessment of last mile community response measures to flood warnings, and the impact of those measures on reducing flood effects. Without such an assessment, disaster preparedness strategies risk being non-inclusive and may fail to address the specific needs of these vulnerable populations.

1.3. Objectives

Main Objective

To assess the types, extent, and effectiveness of household-level early actions taken in response to flood warnings in Makhuwira, a last-mile community in Chikwawa District, during the pre-Cyclone Freddy period.

Specific Objectives:

1. To evaluate the effectiveness of early warning systems and communication channels used in Makhuwira.

2. To examine the types and extent of early actions taken by households in Makhuwira before a disaster.
3. To analyze the impact of early action taken by households in reducing flood impact.

Research Questions:

1. How effective were the early warning systems and communication channels in Makhuwira?
2. What types of early actions did households in Makhuwira take before the disaster?
3. To what extent did early actions taken by households reduce flood impact?

1.4. Hypothesis

1. *Hypothesis 1 (*H1H1*)*: Early warning systems and communication channels effectively reached a significant proportion of households in Makhuwira before Cyclone Freddy.

   *Null Hypothesis 1 (*H0H0*)*: Early warning systems and communication channels did not effectively reach a significant proportion of households in Makhuwira before Cyclone Freddy.

2. *Hypothesis 2 (*H1H1*)*: Households in Makhuwira took significant early actions before disaster.

   *Null Hypothesis 2 (*H0H0*):* Households in Makhuwira did not take significant early actions before disaster.

3. *Hypothesis 3 (*H1H1*):* Early actions taken by households in Makhuwira significantly reduced flood impact.

   *Null Hypothesis 3 (*H0H0*):* Early actions taken by households in Makhuwira did not significantly reduce flood impact.

1.5. Justification

The research presented in this study holds great promise for advancing the development of inclusive and people-centered strategies in the realm of disaster preparedness. The emerging significance of Anticipatory Action as a critical intervention mechanism in disaster preparedness highlights the need to thoroughly explore its full potential. A growing body of evidence suggests that early warning and

early action approaches are more effective in saving lives and preserving livelihoods compared to post-facto responses (MacLeod et al, 2021; Knight, 2009). Therefore, advancing knowledge to design and develop effective and efficient inclusive and people-cantered Anticipatory Action programs is important for all stakeholders involved.

Reaching the last mile is a key strategy to fulfilling Sustainable Development Goal 1 which aims at ending poverty in all its forms everywhere, and emphasizes on the principle “leave no one behind”. This also aligns with Malawi Vision 2063 Enabler Number 5 which focuses on Human Capital Development. The enabler seeks to “improve the shock sensitivity of the social protection system for the poor, marginalized and vulnerable groups by stimulating their ability to prepare for, cope with and adapt to shocks.” By identifying gaps and successes in early warning and early action strategies, the findings will contribute to shaping more effective, community-centered disaster preparedness policies and interventions in Malawi and similar contexts.

1.6. Conclusion

Floods driven by climate change continue to disproportionately affect last-mile communities, particularly in Malawi. Early Warning Systems and anticipatory actions are essential tools for mitigating these impacts, yet their effectiveness in reaching and empowering vulnerable populations remains underexplored. This study focuses on assessing household-level early actions in Makhuwira, Chikwawa district, during the pre-Cyclone Freddy period. The findings aim to inform more inclusive disaster preparedness strategies, ensuring these interventions effectively serve the needs of the most vulnerable communities.

2. Literature Review

In recent decades, the escalation of environmental hazards, driven by climate change and environmental degradation, has led to a surge in disasters (Bolan, 2024). Malawi, particularly in the southern region, faces significant risks from floods and droughts, impacting millions of people annually (World Bank, 2019). The frequency of weather-related disasters has increased, imposing substantial costs on the country for repairs and rebuilding which accounts for an annual GDP reduction of about 1.7% (Karl Pauw et al, 2011). Furthermore, indications point toward a rising trend in the size and occurrence of these disasters (Phillips et al., in 2015).

On March 4, 2023, the Department of Climate Change and Meteorological Services warned Malawi about Freddy evolving into a Moderate Tropical Storm, intensifying in the Mozambique Channel, with models indicating a high chance of it recurving towards the Mozambique coast (GoM, 2023). In response, MRCS implemented an early action plan for prepositioning stock, and community awareness on Early Warning, especially in targeted areas (IFRC, 2023). The deployed MRCS National Response Team focused on districts projected to receive high rainfall, such as Chikwawa, Blantyre, Phalombe, Mulanje, Thyolo, Nsanje, and Zomba (IFRC, 2023).

Cyclone Freddy hit Malawi's Southern Region on March 12, 2023, bringing torrential rainfall and causing devastating floods and mudslides (GoM, 2023). On 13 March 2023, President of Malawi declared a state of disaster in 14 districts that were severely affected. As of March 22, the Government of Malawi's Department of Disaster Management Affairs reported the impacts, including 676 casualties, 563,602 displaced individuals, 533 missing, and 1,066 injured (GoM, 2023). Public infrastructure, including schools, health facilities, and main roads, suffered damage in all affected districts (GoM, 2023).

2.1. Theoretical Framework

This study employs Resilience Theory as its theoretical foundation, specifically focusing on the community resilience framework developed by the International Federation of Red Cross and Red Crescent Societies (IFRC, 2014). The IFRC defines resilience as "the ability of individuals, communities, organizations or countries exposed to disasters, crises, and underlying vulnerabilities to anticipate, prepare for, reduce the impact of, cope with and recover from the effects of shocks and stresses without compromising their long-term prospects." The framework encompasses three key dimensions: anticipatory capacity, which involves predicting and preparing for potential hazards; adaptive capacity, focusing on implementing early actions and mobilizing resources; and transformative capacity, addressing long-term system changes that reduce vulnerability.

This theoretical framework is particularly relevant for studying last-mile communities as it acknowledges individuals, households, and communities as active agents in their own preparedness and recovery. The framework guides this study's investigation of how households receive, process, and act upon early warnings, considering both formal and informal communication channels while providing a structured way to analyze how early warning systems and early actions contribute to building long-term community resilience against recurring flood threats.

Figure 1: *Flooding in Lower Shire following Cyclone Freddy (Photo by Malawi Red Cross)*

2.2. Understanding Last-Mile Communities and Early Action

Despite the increased usage of the term last-mile communities, there is a lack of consensus on its precise definition, making it challenging to effectively address issues within these communities (Davison et al., 2021). Nonetheless, the UNDP's 'Getting to the Last Mile in Least Developed Countries' defines the 'last mile' not only as the poorest of the poor but also encompassing underserved and excluded individuals, places, and small enterprises (UNDP, 2016). IFRC, 2009 asserted that 'last mile' is a term that has been adopted by disaster managers because it expresses the sentiment that warnings and the means to respond to them often do not reach those who need it most – those within the last mile. These 'last mile' may be communities or people who, for reasons of age, gender, culture, or wealth, are not reached by disaster preparedness programs (Knight, 2009).

The evolution of disaster management strategies has witnessed a significant shift from traditional post-event response approaches to more proactive intervention

methods. Historical disaster management primarily focused on providing aid after disasters occurred, resulting in delayed and often inadequate responses (Cutter, 2008). This reactive approach proved insufficient in addressing the dynamic nature of environmental hazards and left communities vulnerable to recurring disasters (IFRC and RCCC, 2020). The heavy reliance on post-disaster recovery efforts diverted significant resources away from anticipatory measures that could have reduced overall damage and losses (Perez et al., 2022).

Early actions in flood management encompass a comprehensive range of proactive measures implemented across different temporal phases: before, during, and immediately after flood events. These interventions include community preparedness initiatives, enhancement of early warning systems, and infrastructure improvements. The IPCC identifies these proactive strategies as vital to effective risk management, particularly in scenarios influenced by climate change (Lavell et al., 2012). Evidence suggests that early action is not only crucial for protecting lives and livelihoods but also proves cost-effective, with studies indicating that one dollar invested in early action can save four dollars in emergency response and recovery expenses (Knight, 2009). The importance of early interventions is further demonstrated by comparative case studies, such as those from Cockermouth in the United Kingdom and Patuakhali in Bangladesh, which illustrate the effectiveness of timely interventions in minimizing economic and social disruptions during flood disasters (Ingirige & Amaratunga, 2013).

However, implementing these measures in last-mile communities presents unique challenges, primarily due to resource limitations, knowledge gaps, insufficient technical capacity, and institutional challenges (Wilson et al., 2021; Sukhwani et al., 2019). Research indicates that household income significantly influences early action and preparedness during flood disasters. Higher-income households tend to be better prepared and can more effectively mitigate flood damages (Yin et al., 2021; Silva & Kawasaki, 2020).

2.3. Effectiveness of Early Warning Systems and Communication Channels

Early Warning Systems (EWS) represent a complex network of capacities designed to generate and disseminate timely warning information, enabling threatened communities to prepare and act appropriately (UNDRR, 2009). Research indicates that the effectiveness of these systems varies significantly, particularly in last-mile communities where infrastructure limitations and social barriers persist (Bhardwaj et al., 2021). Multi-channel dissemination strategies, combining various communication methods such as radio broadcasts, public announcements, and local meetings, have shown superior results in improving community response rates (Coleman et al., 2020).

Studies across multiple countries have identified several common challenges in EWS implementation. These include one-way communication processes that fail to incorporate community perspectives (Gwimbi, 2007), limited reach to vulnerable populations (Gwimbi, 2007; Hippola et al., 2018), and gaps between warning dissemination and residents' ability to respond (Glago et al., 2019). Message effectiveness has been found to depend heavily on cultural and linguistic adaptation (Maskrey, 2011), with locally tailored communications generating significantly higher response rates compared to external channels (Ayeb-Karlsson et al., 2019). Moreover, Kreibich et al., (2021) inserted that the effectiveness of these warnings depends significantly on people's knowledge of appropriate actions to take.

Persistent challenges in marginalized communities include insufficient community participation, inadequate preparedness levels, and institutional communication gaps (Perera et al., 2020). Technical and financial constraints, combined with insufficient attention to gender and social inclusion, further compromise EWS effectiveness (Perera et al., 2020). Research suggests that successful EWS implementation requires participatory approaches involving at-risk populations throughout the entire process (Baudoin et al., 2014).

2.4. Early Actions taken by Households

At the household level early action encompasses a range of protective measures, with evacuation and asset protection being primary concerns. Research has shown that households typically prioritize the safety of family members and valuable possessions when responding to flood warnings (Dam & Adamgbe, 2018). Common preparedness measures include relocating to safer areas, constructing embankments, and raising house foundations (Dam & Adamgbe, 2018). Studies by Ahmed et al. (2019) found that families who act promptly on early warnings can reduce potential economic losses by protecting property.

However, socioeconomic factors significantly influence the household's capacity to implement early actions. Poor households often face substantial challenges in evacuation and asset protection due to limited resources and transportation options (Younes et al., 2021; Yusuf et al., 2023). This vulnerability is compounded by settlement patterns, as low-income groups frequently reside in flood-prone areas due to limited housing alternatives (Nchito, 2007; Kawasaki et al., 2020; Patankar, 2015). Research has demonstrated that household income levels correlate strongly with preparedness capacity and ability to mitigate flood damages (Yin et al., 2021; Silva & Kawasaki, 2020).

Early actions taken are closely tied to the clarity and specificity of warning messages, as well as households' knowledge of appropriate response measures (Kreibich et al., 2021). Studies have shown that long-term preparedness measures and prior training

significantly enhance communities' ability to respond effectively to warnings (Kreibich et al., 2021). Additionally, risk perception influences early action taken by households and individuals. A study by Dhar et al., (2023) in the Global South revealed a dynamic relationship between risk perception and adaptive behavior. The study by Dhar et al., (2023) identified four aspects that influence community risk perception, namely, place and community attachment, local stakeholders' varied interests, socio-economic opportunities, and risk-tolerance capacity.

2.5. Impact of Early Actions on Disaster Outcomes

The implementation of early actions has demonstrated significant positive impacts on disaster outcomes, particularly in reducing casualties and property damage (Rogers & Tsirkunov, 2010; Ringo et al., 2025). Research has consistently shown that early evacuation serves as one of the most critical measures for ensuring population safety (Radosavljevic, 2017). The economic benefits of early action are substantial, with studies by Gros et al. (2019) and Pople (2020) indicating that securing assets such as livestock and household items during the lead-up to a flood can greatly reduce economic and livelihood losses.

In Africa, households take proactive action in response to warnings such as evacuation and drainage system maintenance (Ringo et al., 2023). These measures have been shown to reduce casualties and property damage (Ringo et al., 2023). However, the effectiveness of these measures can vary depending on contextual factors. While some households implement structural measures such as raising structures or employing relocation strategies (John, 2020; Rusdi et al., 2023), many lack sufficient preparedness. This is often due to low household incomes, which significantly hinder their adaptation efforts (Ajijola & Adedire, 2023). Resource constraints and settlement characteristics, such as structural vulnerabilities and poor drainage, can further reduce the effectiveness of household preparedness measures (Patankar, 2015; Yusuf et al., 2023; Perera et al., 2020).

2.6. Conclusion

The literature review reveals several critical insights regarding early action and disaster preparedness in last-mile communities. First, while early warning systems and early actions have proven effective in reducing disaster impacts, their implementation faces significant challenges in reaching and serving marginalized populations. Second, the success of early action initiatives depends heavily on factors such as socioeconomic conditions, settlement characteristics, and communication effectiveness. Third, household-level responses to early warnings are influenced by a complex interplay of factors, including income levels, risk perception, and access to resources. These findings highlight the need for more inclusive and context-specific approaches to disaster preparedness, particularly in last-mile communities.

3. Methodology

3.1. Description of the Study Area

Makhuwira is a Traditional Authority (TA) located in Chikwawa District in the Southern Region of Malawi. In Malawi, districts are divided into traditional authorities (TA), and each TA comprises several villages. These villages are organized into group villages, each led by a group village headman (GVH). Individual villages are headed by village headmen (VH), who, along with their subjects, report to the GVHs (Muriaas et al. 2020).

Malawi, a landlocked country in sub-Saharan Africa, shares borders with Zambia (northwest), Tanzania (northeast), and Mozambique (east, south, and west). The country faces significant vulnerability to natural hazards, including tropical storms, earthquakes, droughts, and floods. According to the World Bank (2015), floods represent 48% of major disasters recorded between 1946 and 2013, severely impacting agriculture, sanitation, education, and the environment – critical sectors for Malawi's predominantly rural population.

Chikwawa District, covering 4,892 km² with a population density of 116 people per km², is among Malawi's most impoverished and flood-susceptible regions. According to the *Chikwawa District Physical Development Plan* (GoM, 2020), the district's topography is primarily flat, situated at 112 meters above sea level in the lower basin of the Shire River – Malawi's largest river. The landscape features marshlands along the Shire River, moderate highlands to the west, and the Thyolo Escarpment to the east. The district experiences a tropical climate with distinct wet and dry seasons, receiving annual rainfall between 170 mm and 967.6 mm. Temperatures range from an average minimum of 27.6°C in July to a maximum of 37.6°C in November.

According to the *Chikwawa District Council Socioeconomic Profile 2017–2022* (GoM, 2020), the people of Chikwawa District are predominantly from the Mang'anja and Sena ethnic groups, with minority tribes such as the Yao, Lomwe, Ngoni, and Nyungwe. The main languages spoken are Chichewa, Chisena, and Mang'anja. Christianity is the dominant religion, practiced by 92.2% of the population, followed by Islam (1.2%), other religions (1.3%), and 5.3% identifying as non-religious. Culturally, the district practices mostly patrilineal marriage systems, where women live at their husband's home, dowries are paid, and men dominate household decision-making. A minority follows a matrilineal system in the northern parts, where no dowry is paid. Chieftainship is traditionally passed through male lineage in the patriarchal system and through female lineage in the matriarchal system.

Within Chikwawa, TA Makhuwira encompasses 63 km² and hosts a population of 79,933 (NSO, 2019). Its flat, wetland topography and proximity to the Shire River

make it particularly susceptible to flooding. Climate change has intensified both the frequency and magnitude of floods in the area over the past decade (Hussein et al., 2023), resulting in widespread destruction of crops, livestock, and infrastructure. These disasters perpetuate food insecurity, restrict access to essential services, and trap vulnerable households in poverty cycles. Due to its high-risk profile, Makhuwira is designated as a highly vulnerable zone in Malawi's National Adaptation Programme of Action (NAPA). Figure 2 shows the Map of Makhuwira, Chikwawa district.

3.1.1. Makhuwira as a Last-Mile Community

Makhuwira's classification as a last-mile community is primarily due to its severe poverty levels. The area's socioeconomic marginalization is evident through limited economic diversification, scarce employment opportunities, and poor access to social services (Mwale et al. 2015). With 84% of households living in poverty and 55% in ultra-poverty, these rates significantly exceed the national averages of 50.7% and 24.5% respectively (GoM, 2017). Within Chikwawa District, out of eleven Traditional Authorities, Makhuwira reports the second-highest poverty rates, surpassed only by TA Chapananga where 91% of households are poor and 63% are ultra-poor. The combination of extreme poverty and high disaster vulnerability emphasizes Makhuwira's status as a last-mile community and underscores the critical need for targeted interventions to enhance disaster resilience and ensure equitable resource access.

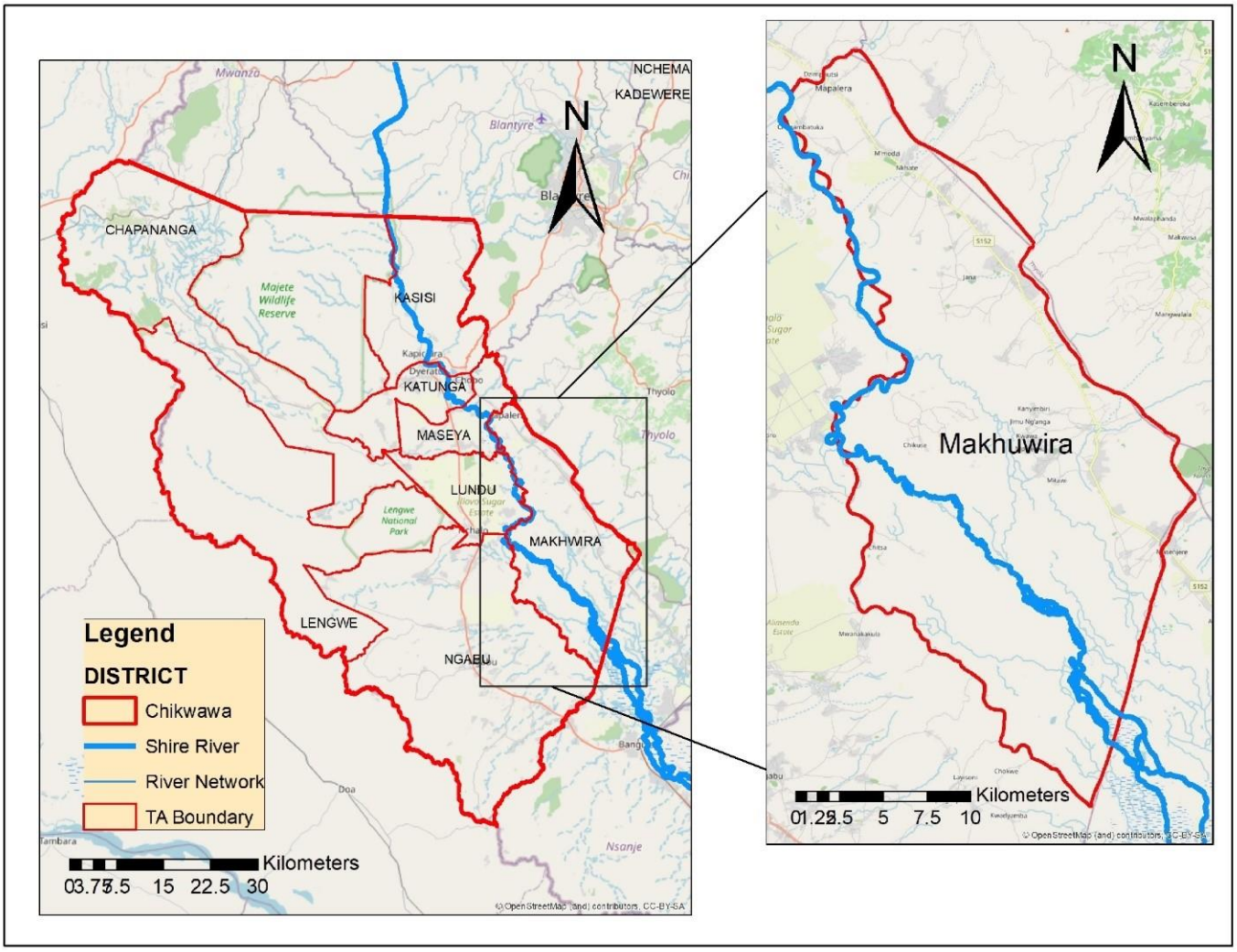

Figure 2: *Map of Chikwawa showing Makhuwira in Chikwawa district*

3.2. Research Design

The study employed a mixed-methods research design. The research methodology integrated quantitative and qualitative approaches to capture both statistical data and contextual insights. Quantitative data collection consisted of structured surveys measuring access to early warnings, early actions taken, and disaster outcomes. The qualitative component involved semi structured surveys, focus group discussions (FGDs) and key informant interviews (KIIs) to understand community perspectives, challenges, and dynamics.

The rationale for selecting this mixed-methods approach was its ability to facilitate data triangulation, thereby enhancing the reliability of findings. While quantitative methods revealed broad trends in early warning and household actions, qualitative insights highlighted the underlying factors influencing community behavior and decision-making. This comprehensive methodological framework enabled the

development of evidence-based recommendations grounded in both statistical data and the experiences of the community members.

3.3. Sampling Design

3.3.1. Population

The population of interest includes households in Makhuwira, Chikwawa, a highly vulnerable flood-prone area. Makhuwira faces significant hardships, with the majority of households living in poverty and many in extreme poverty.

3.3.2. Participant selection

The study employed stratified sampling to ensure representation across different geographic and flood-exposure characteristics within Makhuwira. The area comprises 16 Group Villages, of which four—Savala, Mpama, Nantusi, and Kamoto—were purposively selected based on local expert opinions with the help of Community Development Assistant for TA Makhuwira. These Group Villages were identified as the most flood-affected areas, with significant disaster exposure and experience. Within these Group Villages, households were randomly selected using systematic sampling, where well trained ground data collectors were instructed to choose every fifth house for participation in the survey. Table 3.1 gives a summary of the Group Villages and individual villages from which survey participants were recruited.

Table 3.1: *Summary of Villages*

Group Village	Villages
Mpama	Sakisoni, Mpama, Buleki, Gome, Daniel, Pakamwa, N'gabu, Chafulumira
Namtusi	Namtusi, Matabwa, Kadyamwano, Machokola, Singano, Taombe, Gowela, Kamoto
Savala	Savala, Thomu, Kankapa, Champhanda
Kamoto	Kamoto, James, Makwiza, Khingi, Estere

Focus group discussions (FGDs) were conducted separately from the household survey participants, involving community members selected from different villages within the four Group Villages. A total of three FGDs were held, with participants representing a cross-section of perspectives. For key informant interviews (KIIs), participants were chosen based on their roles within disaster risk management structures at various levels. At the village level, interviews were conducted with

Group Village Headman and Village Civil Protection Committee chairs. At the Traditional Authority (TA) level, the Area Disaster Risk Management Committee chair, Community Development Assistant and the ward councilor were interviewed. At the district level, the DRM officer from Chikwawa District Council participated, although attempts to interview a representative from the Chikwawa Red Cross were unsuccessful. An officer, Anticipatory Action specialist, from MRCS was interviewed. Additional key informants included religious leaders, the director of Savala evacuation center, and the Mpama CBO director, providing diverse perspectives on disaster preparedness and response in the study area.

3.3.3. Sample size

The sample size was calculated using a formula that was devised by Kothari (2004). This formula is used particularly when the population under study is known. The total number of people in the study area is 79,933 and has a household population of 14,954.

The Kothari formula is as follows:

$$n = \frac{z^2}{e^2} \frac{p.q,N}{(N-1) + z^2 .p.q}$$

Where:

n= the required sample size

Z^2 = Number of standard deviations at a given confidence interval

N= the population size

p= the population proportion (assumed to be 0.5 since this would provide the maximum sample size)

q= 1-p

e = is the margin of error (5% error or 0.05)

$$n = \frac{1.96^2}{0.05^2} \frac{0.5 * (1-0.5) * 14{,}954}{(14{,}954-1) + 1.96^2 * 0.5 * (1-0.5)}$$

$n = 375$

The calculated sample size for the study is 375.

3.4. Data Collection

3.4.1. Quantitative Data

The quantitative data for this study was collected over a period of one week, from 5 July 2024 to 11 July 2024. A team of trained data collectors was engaged to administer the surveys and systematically gather responses from participants. The selection process involved systematic sampling, where every fifth household in the designated Group Village Headmen (GVHs) of Savala, Mpama, Nantusi, and Kamoto was approached for participation. This approach ensured a representative sample across the study area.

The data collection process was conducted electronically using mobile phones equipped with KoboCollect, a digital tool designed for efficient and accurate survey data entry. Data collectors followed standardized procedures to approach selected households, explain the purpose of the study, and obtain informed consent before administering the survey. The use of electronic data collection minimized errors associated with manual data entry and facilitated the immediate capture of responses in a secure and organized manner. This method also allowed for monitoring of data collection progress, ensuring adherence to the sampling protocol and data quality standards throughout the process.

A total of 378 households participated in the study. The demographic and socioeconomic characteristics of the participants are presented below.

Gender and Age Distribution

Table 3.2: *Distribution of Household Heads by Gender*

Gender	Frequency	Percent
Male	214	56.6
Female	164	43.4
Total	378	100.0

Table 3.3: *Age Distribution of Household Heads*

Age Group (Years)	Frequency	Percent
18-24	34	9.0
25-34	78	20.6

35-44	76	20.1
45-54	53	14.0
55-64	39	10.3
65+	98	25.9
Total	378	100.0

Household Characteristics

Table 3.4: *Marital Status and Family Size Distribution*

Characteristic	Category	Frequency	Percent
Marital Status	Married	305	80.7
	Single	10	2.6
	Divorced/Separated	23	6.1
	Widow/Widower	40	10.6
Family Size	1-4 members	120	31.7
	5-6 members	126	33.3
	7-14 members	132	34.9

Socioeconomic Characteristics

Table 3.5: *Education and Occupation Distribution*

Characteristic	Category	Frequency	Percent
Education Level	No formal education	114	30.2
	Primary school	206	54.5
	Secondary school	55	14.6

	Vocational/Technical	1	0.3
	Other	2	0.5
Occupation	Farmer	165	43.7
	Business owner	60	15.9
	Employed	6	1.6
	Unemployed	20	5.3
	Casual work	124	32.8
	Other	3	0.8

Table 3.6: *Monthly Income Distribution*

Income Range (Malawi Kwacha)	Frequency	Percent	Cumulative Percent
0 - 15,000	85	22.5	22.5
15,001 - 30,000	141	37.3	59.8
30,001 - 50,000	97	25.7	85.5
50,001 - 100,000	24	6.3	91.8
Above 100,000	31	8.2	100.0

Housing Characteristics

Table 3.7: *Housing Construction Materials*

Component	Material	Frequency	Percent
Wall	Burnt Bricks	260	68.8
	Unburnt Bricks	108	28.6
	Concrete Blocks	1	0.3

	Grass/Sticks	7	1.9
	Iron Sheet	1	0.3
	Other	1	0.3
Roof	Iron Sheets	224	59.3
	Grass	152	40.2
	Tarpaulin	1	0.3
	Other	1	0.3
Floor	Concrete	59	15.6
	Mud/Clay	317	83.9
	Other	2	0.5

Flood Experience and Awareness

Table 3.8: *Flood Experience and Risk Awareness*

Characteristic	Category	Frequency	Percent
Flood Experience (Past 5 Years)	Yes	366	96.8
	No	12	3.2
Awareness Level	Very Aware	252	66.7
	Aware	110	29.1
	Neither Aware nor Unaware	2	0.5
	Unaware	8	2.1
	Very Unaware	6	1.6

Figure 3: *A data collector conducting an interview with a respondent in a household survey (Photo by the author)*

3.4.2. Qualitative data

In-depth Interviews

In total, 17 Key Informant Interviews (KIIs) were conducted to gather in-depth qualitative data for this study, held between 20 June 2024 and 10 July 2024. The selection of key informants was purposive, based on their roles and expertise within the disaster risk management framework at the village, Traditional Authority (TA), and district levels. These informants were chosen to provide diverse perspectives on disaster preparedness, response mechanisms, and community resilience, reflecting their direct involvement in disaster risk management activities. Table 3.6 gives a summary of informants that were interviewed and their roles.

Table 3.9: *Key Informants and their roles*

Key Informants	Number of Participants	Affiliation/Role
Village Civil Protection Committee (VCPC) Chair	4	Representing the four selected GVHs (Savala, Mpama, Nantusi, Kamoto)
Group Village Headman	4	Leaders of the selected Group Villages
Area Disaster Risk Management (ADRM) Chair	1	Chair of the ADRM Committee at TA level
Community Development Assistant	1	Community Development Assistant for the TA
Ward Councillor	1	Political representative
Disaster Risk Management (DRM) Officer	1	Representative of Chikwawa District Council
Religious Leader	1	Representing head of church used as an evacuation center during emergencies
Savala Evacuation Center Director	1	Manager of Savala evacuation center
Mpama CBO Director	1	Head of the Mpama Community-Based Organization
Mpama CBO Evacuation Center Director	1	Director of undesignated evacuation center in the study area

Focus Group Discussions

Three Focus Group Discussions (FGDs) were conducted as part of the qualitative data collection for this study, held on 5 July 2024. The FGDs, which were moderated by trained facilitators, using a semi-structured guide, were designed to capture perspectives from different societal groups—men, women, and youth—to ensure diverse insights into disaster preparedness and response. This segmentation was also intended to create a comfortable discussion environment, minimizing feelings of inferiority or intimidation that might affect data quality.

Each FGD consisted of participants drawn from various villages within the four selected Group Village Headmen (GVHs): Savala, Mpama, Nantusi, and Kamoto. The FGD for women included 9 participants, as did the FGD for men. The FGD for youth involved 10 participants. Recruitment was facilitated by Village Civil Protection Committees (VCPCs), who were tasked with identifying suitable participants from their respective villages. These participants were selected to represent their communities and provide a broad range of perspectives on disaster-related issues.

3.5. Data Analysis

3.5.1. Quantitative Data Analysis

Descriptive Statistics: Survey responses were analyzed descriptively to identify patterns and trends. Descriptive statistics established a baseline understanding of the community's current state. This enabled the identification of patterns, trends, and variations in key variables. The information was essential for contextualizing subsequent analyses.

Inferential Statistics: The study aimed to assess household preparedness and safeguarding actions during Cyclone Ana and Cyclone Freddy. The analysis used the Chi-square test and independent samples t-test to evaluate the effectiveness of early action in reducing flood impacts, such as property damage, injuries, and loss of livelihoods.

1. *Chi-Square Test*

The chi-square test was used to assess the relationship between categorical variables, such as early action taken by households (e.g., evacuation, safeguarding of property) and disaster outcomes (e.g., house damage, livestock loss). This test was applied to evaluate whether early action was associated with a significant reduction in these disaster outcomes. The chi-square test is appropriate for categorical data, allowing the comparison of observed frequencies with expected frequencies to determine whether there is a statistically significant association between the variables.

The formula is:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where O is the observed frequency and E is the expected frequency.

This test was selected to examine whether early action significantly influenced disaster outcomes by assessing whether households that took preventive measures experienced significantly different outcomes from those that did not.

2. *Independent Samples T-Test*

The independent samples t-test was used to compare the means between two groups: households that took early action and those that did not. The t-test was applied to evaluate whether there were statistically significant differences in the outcomes between these groups. This test was useful for continuous data, such as the number of injuries or acres of crops damaged, to assess the impact of early action.

The formula is:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where $\bar{x}_1$ and $\bar{x}_2$ are the sample means of the two groups, and S_P is the pooled standard deviation.

This test was chosen to determine whether early action significantly influenced disaster outcomes, comparing the two independent groups of households that either adopted or did not adopt early preparedness measures.

3.5.2. Qualitative Data Analysis

Content analysis: The qualitative data from Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) was analysed using content analysis. This method was chosen because it provides a straightforward way to systematically identify and interpret key themes and patterns within textual data. Content analysis allowed the study to focus on the main issues raised by participants, such as challenges with disaster preparedness, effectiveness of early warnings, and barriers to early action. The approach helped to explain the reasons behind quantitative trends, such as the proportion of households receiving early warnings or the percentage of participants taking early actions.

3.6. Ethical Considerations

Prior to collecting data, the study got ethical clearance from Mzuzu University Research Ethics Committee. In addition to that, the study sought permission from traditional leaders from the study area and the targeted participants of the study who were asked to give a consent before interviews. Lastly, the study ensured that anonymity and confidentiality was observed throughout the data collection, interpretation and reporting process.

3.7. Conclusion

The methodology chapter presents a mixed-methods approach combining quantitative surveys with qualitative KIIs and FGDs to assess disaster preparedness in Makhuwira. Stratified sampling and systematic selection ensured representative participation across geographic area. Digital tools facilitated data collection, while content analysis of qualitative data complemented descriptive statistics. This approach captured both statistical patterns and contextual insights into disaster preparedness and response in Makhuwira.

4. Results and Findings

This chapter presents findings from research conducted in Makhuwira, Chikwawa District, examining the implementation and effectiveness of early warning systems and early action activities during Cyclone Freddy. The analysis integrates quantitative data from 378 household surveys with qualitative insights from stakeholder interviews and focus group discussions, structured around three main themes: early warning systems and communication, early action implementation, and impact assessment. Through descriptive statistics, statistical tests, and content analysis, the chapter evaluates how communities received and responded to early warnings, the actions taken to protect lives and property, and the effectiveness of these interventions in reducing flood impact.

4.1. Early Warning Systems and Communication

4.1.1. Coverage and Reach of Early Warning Systems

The study revealed significant but incomplete coverage of early warning systems in the study area. A majority of respondents 78.6%, (n=297) reported receiving early warnings about Cyclone Freddy, while 21.4% (n=81) did not receive any warnings. This finding indicates substantial reach of the warning systems while highlighting a notable gap in coverage that left one-fifth of the population uninformed.

4.1.2. Communication Channels and Their Effectiveness

Primary Communication Methods

Multiple communication channels were employed to disseminate disaster warnings in Chikwawa. Table 4.1 presents the distribution of warning message reception across various communication channels.

Table 4.1: *Modes of Communication for Early Warning*

Mode of Communication	Frequency	Percent
Radio/Television	165	43.7%
Audio Publicity	185	48.9%
Community Meeting	29	9.8%
Friend / Neighbour	45	15.2%
Door-to-Door	20	6.7%
Religious Meeting	2	0.7%
Mobile Alerts	1	0.3%
Other	1	0.3%

The data reveals that audio publicity was the most effective channel, reaching 48.9% of respondents. Audio publicity was primarily operated through mobile methods, with Chikwawa DC and MRCS using vehicles equipped with loudspeakers (Figure 4), while Village Civil Protection Committees (VCPCs) utilized megaphones as they traveled through villages by bicycle or on foot. During flood emergencies, VCPCs also employed whistles for immediate evacuation alerts. With no permanent speaker installations in the villages, the effectiveness of this system relied heavily on mobility. However, the area's marshy terrain often restricted vehicle access, especially during rainy seasons, making the VCPCs' efforts on foot and bicycle particularly essential to the success of this communication channel.

Radio/television broadcasts closely followed at 43.7%. These formal communication channels were supplemented by informal networks, with 15.2% receiving warnings through friends or neighbors. Community-based channels showed lower utilization, with community meetings reaching 9.8% of respondents and door-to-door communication accounting for 6.7%. Religious meetings and other sources played minimal roles, each reaching only 0.7% of respondents. A surprising finding was the low recipient rate through mobile alerts (0.3%). Focus group discussions revealed that this limited reach was due to low phone ownership in the area, compounded by challenges in accessing electricity for charging devices.

Figure 4: *Mobile Audio Van Publicity*

Frequency of Warning Messages

The frequency of warning message reception varied among respondents, as shown in Table 4.2.

Table 4.2: *Frequency of Receiving Early Warning Messages*

Frequency of Messages	Frequency	Percent
1-3 times	235	79.1%
4-6 times	29	9.8%
7-9 times	13	4.4%
10 times or more	20	6.7%

The majority of respondents (79.1%) received warnings between one and three times, suggesting limited repeated exposure to warning messages. A smaller proportion received more frequent warnings: 9.8% reported receiving messages 4-6 times, while only 11.1% received warnings more than seven times. This pattern indicates potential

room for improvement in message repetition to ensure better retention and response.

4.1.3. Institutional Sources of Early Warnings

The study identified various institutional sources responsible for disseminating early warnings, as presented in Table 4.3.

Table 4.3: *Sources of Early Warning Messages*

Source of Early Warning	Frequency	Percent
Government Agencies (DoDMA e.t.c.)	152	51.2%
Chikwawa DC	75	25.3%
Malawi Red Cross Society	57	19.2%
Other	13	4.4%

National-level government agencies emerged as the primary source of early warnings, accounting for 51.2% of messages received. These agencies, particularly the Department of Disaster Management Affairs (DoDMA) and the Department of Climate Change and Meteorological Services (DCCMS), primarily disseminated warnings through mobile communications (SMS and internet) and national radio stations such as Malawi Broadcasting Corporation (MBC) and Zodiak Broadcasting Station (ZBS). At the district level, the Chikwawa District Council played a significant role, being the source for 25.3% of warnings, reflecting the decentralized disaster management structure in Malawi. The Malawi Red Cross Society contributed 19.2% of warnings, while other sources accounted for 4.4%. Notably, many respondents exhibited uncertainty about the specific origins of warnings, often attributing them generally to "government/boma."

4.1.4. Qualitative Insights on Early Warning Implementation

Stakeholder Coordination and Communication Flow

Interviews with key stakeholders revealed a structured approach to warning dissemination, with clear communication channels between different administrative levels. A local Councillor described the process:

"As councilors, we receive warning messages via phone from the District Council. We then share these messages with the villagers. MRCS donated megaphones, which we used to relay information through individuals riding bicycles."

The ADRMC chairman further elaborated on the warning process:

"[Before Cyclone Freddy] warning messages reached us through our committees at DoDMA and Non-governmental organizations, such as Malawi Red Cross Society and others, who warned us that there will be a lot of rain... The warning message was first received by us [ARDMC members]. We then passed the messages on to VCPCs, who in turn shared them with the community members."

This hierarchical dissemination structure was reinforced by the Mpama VCPC chair's account:

"We were able to relay the early warning message to community members before the disaster, thanks to the support of the Malawi Red Cross Society through the ECHO IDREAM project. Through this project, we received resources such as megaphones, which we used to spread the warning message. As the VCPC, we visited every village under GVH Mpama to ensure the message reached everyone."

Community Perspectives and Challenges

Focus group discussions revealed both strengths and limitations in the warning system's implementation. Community members acknowledged the multiple channels through which warnings were received:

"The warning message reached us. I received it on my mobile phone, and it was also broadcast on the radio. Radio stations like Zodiak were spreading the warning message."

"We have leaders in our community – VCPC members – who warned us about the cyclone"

However, several challenges emerged from the discussions:

1. Technology access barriers: Lack of access to communication devices emerged as a significant barrier, as illustrated by one respondent: *"The warning messages did not reach me because I do not have a radio."*

2. Timing of warnings: Multiple FGDs respondents indicated receiving warnings relatively late: *"The [early warning] message came late, a day before the disaster." "The MRCS warned us just two days before the cyclone"*

3. Clarity of messages: Several respondents mentioned that the warning they received only indicated strong winds and prolonged rainfall. The arrival of floods came as a surprise. One respondent noted, *"The warning I received was about prolonged rainfall; the floods were unexpected."*

The community made several recommendations. FGDs participants emphasized the need for earlier warning dissemination and the use of multiple communication channels: *"Warning messages should be issued in good time so that we can have enough*

time to take early action." Another person added: *"Since few people have access to radios, using audio publicity, such as megaphones, in areas where people can hear the warning would be helpful."*

4.2. Early Action Implementation

The implementation of early action measures varied significantly among households, reflecting diverse priorities and capacities. These actions, undertaken in response to early warnings, were broadly categorized into two primary areas of focus: evacuation and resource safeguarding. Evacuation involved the relocation of individuals and households to safer locations, while resource safeguarding included measures aimed at protecting valuable assets and resources, such as homes, livestock, or essential tools.

This categorization was critical for understanding the specific types of early actions taken and their intended outcomes. For instance, installing flood barriers could serve multiple purposes, such as protecting a home from water damage or safeguarding livestock enclosures. Similarly, stockpiling essential supplies and securing productive assets represented proactive efforts to minimize flood-induced disruptions. The following sections detail the types and extent of these early actions, and their intended outcome.

4.2.1. Types and Extent of Early Action

Despite the widespread dissemination of early warnings, the study revealed limited adoption of early action measures among households. Analysis of the data shows that evacuation was the most common early action, with 30.7% (116 households) relocating before the disaster. Structure reinforcement was undertaken by 8.5% (32 households), while flood barrier installation was implemented by 3.7% (14 households). Even fewer households engaged in stockpiling essential supplies (3.4%, 13 households) or securing productive items (2.4%, 9 households), which include tools, equipment, or assets critical for livelihood activities, such as farming tools, fishing gear, or small business inventory. Notably, 36.5% (138 households) of respondents who received warnings took no early action, while 21.4% (81 households) did not take action due to not receiving warnings.

4.2.2. Evacuation Patterns and Behavior

Evacuation Statistics

The study revealed complex patterns in evacuation behavior during Cyclone Freddy, as illustrated in Table 4.4.

Table 4.4: *Evacuation Status During Cyclone Freddy*

Evacuation Status	Households	Percentage (%)
Evacuated before disaster	116	30.7
Evacuated after disaster	128	33.9
Did not evacuate	115	30.4
No need to evacuate	19	5.0
Total	378	100.0

While the total evacuation rate reached 64.6%, the timing of evacuation varied significantly. Only 30.7% of households evacuated preemptively, while 33.9% delayed their evacuation until after the flooding had begun, potentially exposing themselves to increased risk. A substantial portion (30.4%) did not evacuate at all, while 5% reported no need for evacuation due to their exposure.

Evacuation Center Challenges

The study identified infrastructural gaps in evacuation facilities. The Savala evacuation center (Figure 5) served as the only designated facility for the entire area, leading to overcrowding and resource strain. Temporary centers, including schools, Community-Based Organizations (CBOs), and churches, attempted to fill this gap but proved inadequate for accommodating large numbers of displaced residents. These facilities faced numerous challenges, including insufficient food supplies, inadequate hygiene facilities, and limited private spaces for families. Additionally, these centers, such as churches, were not opened to host evacuees until the onset of the disaster, preventing people from seeking refuge in advance.

A local Councilor emphasized this infrastructure deficit: *"Villagers welcomed the warning messages, but the issue lies in finding places to evacuate to. In Savala village, there is an evacuation center where residents can go. However, around here [Nantusi village], there is no designated center for people to evacuate to."*

The situation was further complicated by resistance from temporary shelter providers. A church elder expressed their frustration: *"As board members of this church, we agreed that if there will be another disaster we will not allow people to take refuge in our church. People come, stay, and leave without showing any gratitude."* Similarly, the Mpama CBO director noted issues with facility vandalism and called for the construction of a designated evacuation center near their village.

Delayed support at evacuation camps presented another significant challenge. With no economic activities available at the camps, evacuees depend entirely on external assistance for their basic needs. This delay in support discourages early evacuation, as many residents prefer to remain in their villages where they can at least access food or find casual labor. During Focus Group Discussions (FGDs), community members proposed implementing immediate financial and resource support upon arrival at camps to encourage early evacuation. As one respondent explained: *"When there is an emergency and we are at the camp, NGOs should help us early. People suffer at the camp since they arrive there with nothing. And during such emergency times there are very limited casual labour opportunities."*

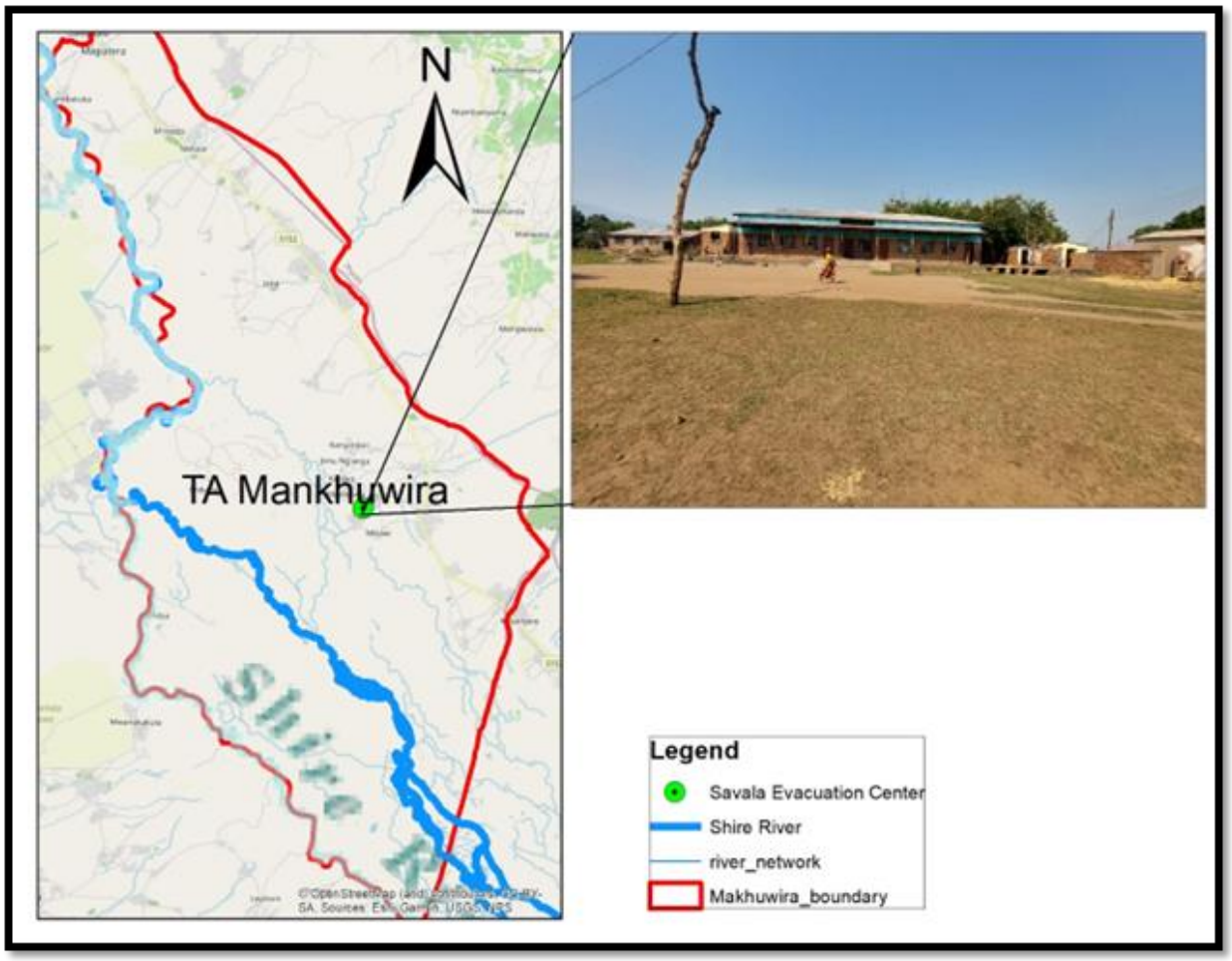

Figure 5: *Savala Evacuation Center*

4.2.3. Resource Safeguarding Measures

During Cyclone Freddy, households implemented various safeguarding measures to protect their assets and resources, though the adoption rates remained relatively low across all categories. Table 4.5 presents the distribution of resource-safeguarding actions across different types of assets.

Table 4.5: *Distribution of Resource Safeguarding Actions*

Resource	Households	Percentage (%)
Medical Supplies	54	14.3
House (home)	40	10.6
Livestock	37	9.8
Drinking Water	22	5.8
Productive Items	20	5.3
Toilets	12	3.2
Crops	8	2.1

Securing of medical supplies emerged as the most common safeguarding action, undertaken by 14.3% of households, followed by home protection measures at 10.6%. Livestock protection ranked third at 9.8%, while other resources saw protection rates below 6%. The notably low percentage for crop protection (2.1%) may be attributed to the timing of the cyclone relative to the agricultural calendar and limited options for crop protection.

Households employed various structural protection methods for their homes. These included placing heavy stones on roofs to prevent wind damage and installing plastic sheets and tarpaulins for waterproofing. At the community level, residents constructed water barriers and check dams to control flood water flow. However, as one participant noted, timing constraints often limited these efforts: *"The messages came late, a day before the disaster. We did not have enough time to respond."*

4.2.4. Enhancing Early Action

To enhance warning response, communities suggested several methods ranging from improved community engagement and education on disaster preparedness to increased financial support. Focus Group Discussion (FGD) participants noted that disaster preparedness training at the village level is primarily provided to Village Civil Protection Committee (VCPC) members, who are then expected to transfer their knowledge to community members. However, this cascading approach proves ineffective due to the time-intensive nature of knowledge transfer and the limited technical capacity of committee members. As one FGD respondent explained: *"The government and NGOs should conduct disaster preparedness training directly with community members in groups, similar to how they train VCPC members. When only one*

VCPC member is trained in a whole village, it takes too long for the knowledge to reach everyone, and sometimes, depending on that member's commitment, the information may reach us too late."

The survey data, through semi structured question, revealed several key initiatives that could improve household response to flood warnings. A significant number of respondents emphasized the importance of financial support as a critical enabler for effective early action. As one respondent noted, *"The government should support us with funds to prepare our homes for such a disaster as a flood."* This financial assistance would enable households to strengthen their homes, purchase necessary supplies, and have resources ready for evacuation when warnings are issued.

The data also highlighted the need for designated evacuation centers and clear evacuation protocols. Several respondents indicated that having pre-identified safe locations would improve their response to warnings. As explained by one community member: *"The government should establish a place that should be a designated evacuation center and ensure that food supplies reach the center as soon as possible and very sufficient."* This suggests that uncertainty about evacuation destinations and resource availability at these locations may be hampering prompt response to warnings.

4.2.5. Resources and Financial Aspects

Resource Requirements

The implementation of early actions required various resources. Financial resources, needed by 69.8% (n=111), were most crucial for purchasing protective supplies, evacuation materials, and others. Knowledge and information needs, cited by 32.7% (n=52), included understanding proper evacuation procedures or protective actions to take. Building materials, essential for 30.8% (n=49), encompassed items like sandbags and reinforcement supplies for flood protection. Community support, involving collective assistance and shared resources, was important for 19.5% (n=31) of households, while technical ability was required by 11.3% (n=18), which included the skills needed for the construction and implementation of protective measures.

Financial Sources and Utilization

The study revealed diverse financial strategies employed by households for early action implementation, with many activities requiring minimal or no financial input. Table 4.6 presents the detailed distribution of financial sources across different early action categories.

Table 4.6: *Sources of Finance for Early Action Activities*

Category	Households Taking Action	Savings (%)	Helped by Relatives/Friends (%)	Other Sources (%)	No Financial Input (%)
Evacuation	244	1.6	12.7	2.0	83.2
House	40	27.5	0	20.0	52.5
Livestock	37	18.9	8.1	8.1	64.9
Crops	8	25.0	0	12.5	62.5
Productive Items	20	20.0	15.0	0	65.0
Drinking Water	22	22.7	0	18.2	59.1
Toilets	12	25.0	0	0	66.7
Medical Supplies	54	11.1	3.7	20.4	64.8

Notably, evacuation activities primarily proceeded without financial input (83.2% of cases), while house protective measures required the highest proportion of personal savings (27.5%). Support from relatives and friends was most significant for evacuation activities (12.7%) but played a minimal role in other categories. The relatively low financial utilization highlights the limited financial options that the community had to take proactive action.

4.2.6. Barriers to Early Action

In response to Cyclone Freddy, two distinct groups of respondents faced barriers to early action: households that took early action but encountered challenges during its implementation, and households that did not take any early action at all, including those who received early warnings and those who did not. Below is a detailed discussion of the barriers faced by each group to provide clarity.

Barriers Faced by Households That Took Early Action but Faced Challenges (n=151)

Among the 151 households that successfully took early action, several challenges arose during implementation, which could have affected the effectiveness of their efforts. Inadequate financial resources were the most significant challenge, affecting

71.7% (108 households). These households struggled to afford materials, transportation, or supplies necessary to fully implement protective measures, such as reinforcing homes or stockpiling essential items.

In addition to financial barriers, 27.7% (42 households) reported a lack of technical ability. This challenge included difficulties in using resources effectively or executing safety measures, such as constructing flood barriers or securing property. Resistance to change was another notable issue, with 26.4% (40 households) hesitant to fully commit to new practices or adjustments, such as relocating to safer areas or adopting alternative preparation methods.

Cultural barriers, such as religious or traditional beliefs that discouraged certain actions, were reported by 7.5% (11 households). Another challenge was the unavailability of essential materials in local markets, which was reported by 4.4% (7 households). Lastly, 3.1% (5 households) cited other unspecified challenges that hindered the successful implementation of their early action measures. These challenges, though varied, collectively limited the overall effectiveness of early action efforts.

Barriers Faced by Households That Did Not Take Any Early Action (n=227)

In the group of 227 households that did not take any early action, whether they received early warnings or not, a lack of knowledge and information regarding weather forecasts emerged as the most significant barrier, cited by 41.0% (93 households). Many of these households either did not understand the warnings they received or did not receive warnings at all.

Both a lack of financial resources and a perceived low risk of disaster were common barriers, each affecting 17.6% (40 households). Households in this group either lacked the means to prepare or underestimated the severity of the floods and chose not to act. A smaller proportion of respondents, 4.4% (10 households), reported that the unavailability of essential materials prevented them from taking early action, while 2.2% (5 households) cited a lack of technical capacity to carry out protective measures, such as securing property or reinforcing homes.

Cultural barriers, including religious or traditional beliefs, were reported by 3.1% (7 households) as reasons for inaction. Misinformation or disbelief in early warnings was another issue, with 3.5% (8 households) of respondents expressing mistrust in the warning system. Lastly, 6.2% (14 households) mentioned other unspecified reasons for not taking early action.

By separating these two groups and clearly outlining the challenges they faced, it becomes easier to understand the distinct and overlapping barriers to early action. The first group (n=151) took early action but encountered significant challenges that likely reduced the effectiveness of their efforts, while the second group (n=227)

represents households that did not act at all, highlighting a range of barriers, from lack of information to financial constraints. Figures 6 and 7 provide visual summaries of these findings. Figure 8 shows an open well used for drinking water, where a household lacked resources to build a proper barrier and cover during Cyclone Freddy.

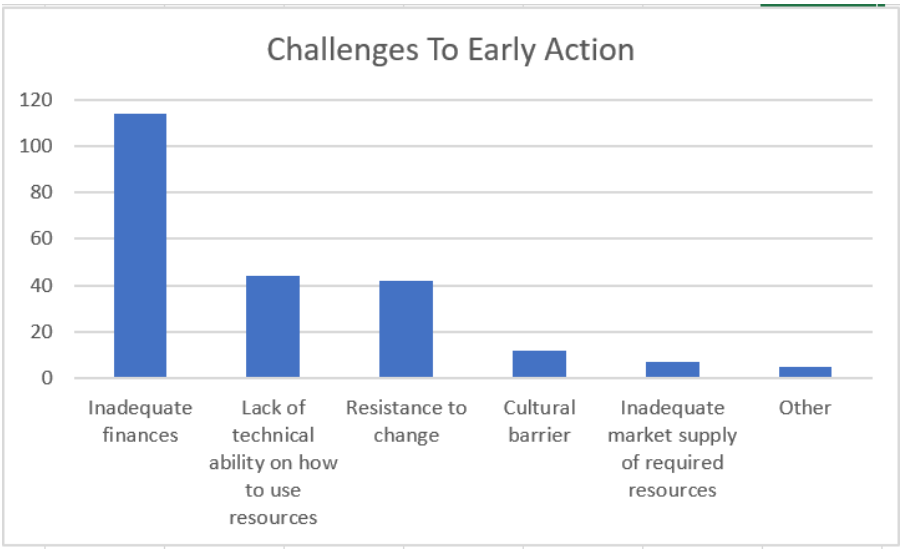

Figure 6: *Bar Chart showing challenges to early action*

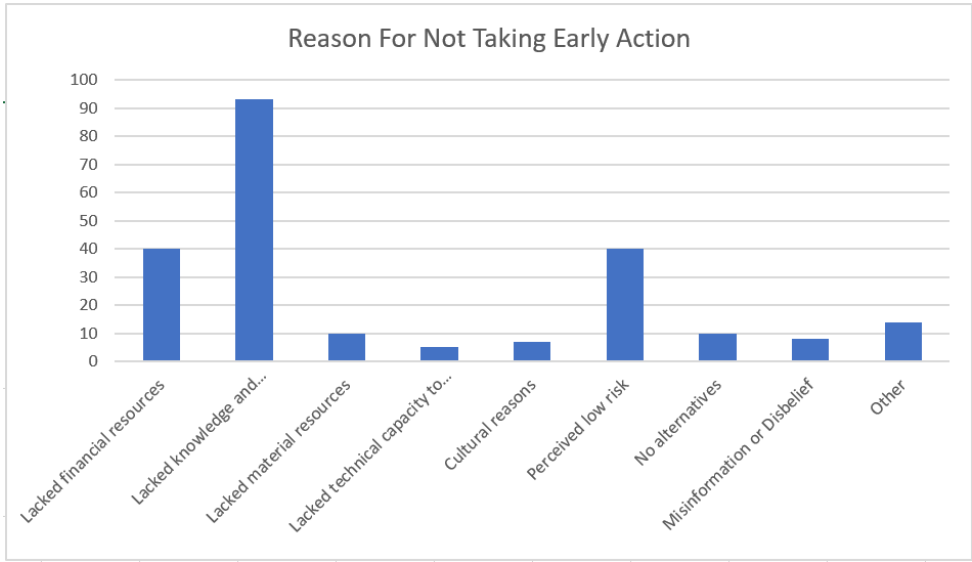

Figure 7*: Bar Chart showing reasons for not taking early action*

Figure 8: *An open well used for drinking water, where a household lacked resources to build a proper barrier and cover, using only a tire, which was insufficient to prevent water from entering during Cyclone Freddy (Photo by the author)*

4.2.7. Role of Supporting Organizations

At the community/village level the Malawi Red Cross Society (MRCS) emerged as a key facilitator of early action through the ECHO IDREAM project. Their support included providing essential equipment such as ropes, torches, medicine, megaphones, and whistles, alongside training for VCPC members. This support proved crucial during evacuation and rescue operations, as evidenced by one participant's account: *"When the water started rising, we used ropes provided by MRCS to guide our family across the flooded area. Without it, we would have struggled to escape."*

However, VCPC committee members reported that the support, while valuable, fell short of meeting comprehensive early action needs. The Nantusu VCPC Chair articulated these challenges: *"Most flood disasters occur at night, as was the case with Cyclone Freddy. As a village committee, we try to help those affected, but because we lack the capacity to respond quickly, especially when disasters strike suddenly and at night, we face significant challenges."*

The ARDM chairperson further highlighted resource limitations: *"The equipment we have to conduct our operations is insufficient. For example, in GVH Savala, there are more than thirty villages, but we only have two megaphones. Additionally, we lack protective clothing for search and rescue activities."*

4.3. Impact of Early Action

4.3.1. Cyclone Freddy Impact Assessment

The study conducted a comprehensive assessment of Cyclone Freddy's impact across multiple dimensions, including human casualties, structural damage, and asset losses. This analysis provides crucial insights into the effectiveness of early action measures and the overall vulnerability of the affected communities.

Impact on Human Life and Health

Among the 378 households surveyed, the majority (90.5%) reported no injuries. A small proportion of households had members who were injured, with 8.5% reporting one injured person, and 1% reporting two or three injured individuals.

In terms of fatalities, 97.1% of households reported no loss of life. However, 2.4% reported the death of one household member, while a small percentage reported more than one death. Table 4.7 indicates flood impact on household members

Table 4.7: *Flood impact on household members*

Impact on Household Members	Frequency	Percentage
No Injuries	342	90.5%
1 Person Injured	32	8.5%
2-3 People Injured	4	1.0%
No Loss of Life	367	97.1%
1 Person Lost	9	2.4%
2-4 People Lost	2	0.5%

Structural Damage Assessment

Households experienced varying degrees of structural damage to their homes, with some components more severely affected than others. Table 4.8 details the extent of damage across different structural elements.

***Table 4.8**: Distribution of Structural Damage*

Type of Damage	**No Damage**		**Damage**	
	Frequency	*Percentage*	*Frequency*	*Percentage*
Roof Damage	206	54.5%	172	45.5%
Wall Damage	125	33.1%	253	66.9%
Foundational Damage	257	68.0%	121	32.0%

Wall damage was the most prevalent form of structural impact, affecting 66.9% of households, followed by roof damage at 45.5%. Foundation damage affected 32.0% of households. Figure 9 illustrates a house completely damaged by floodwaters following Cyclone Freddy.

***Figure 9:** A house completely damaged by floodwaters following Cyclone Freddy. (Photo by the author)*

4.4.1.3 Asset and Resource Losses

The cyclone had substantial impacts on household assets and agricultural resources. Table 4.9 summarizes the distribution of losses across different categories.

***Table 4.9**: Distribution of Asset and Resource Losses*

Type of Loss	**No Loss**		**Loss Reported**	

	Frequency	*Percentage*	*Frequency*	*Percentage*
Livestock Loss	72	19.0%	254	67.2%
Loss of Productive Items	83	22.0%	124	32.8%
Food Crop Damage	9	2.4%	339	89.7%

Food crop damage was particularly severe, affecting 89.7% of households, while livestock losses impacted 67.2% of households. Productive item losses were reported by 32.8% of households. Figure 10 illustrates agricultural land inundated with floodwater following Cyclone Freddy.

Figure 10: *Agricultural land inundated with floodwater following Cyclone Freddy (Photo by the author).*

4.3.2. Statistical Analysis of Early Action Impact

This section examines the impact of early action measures in reducing the impact of flooding, using chi-square and independent samples t-tests. The Chi-Square test was employed to analyze the association between categorical variables, specifically

focusing on the relationship between taking early actions (such as evacuation or safeguarding property) and disaster outcomes (such as property damage and resource loss). The Chi-Square test is suitable for evaluating associations between two categorical variables, allowing an exploration of whether taking early action was associated with improved disaster outcomes. For instance, this test helps determine if households that took specific preventive measures experienced fewer damages compared to those that did not.

Additionally, the independent samples t-test was used to compare the means between two independent groups—households that took early action and those that did not—on continuous outcomes like the number of injuries, livestock lost, and the extent of crop damage. This test is ideal for comparing means between two groups when dealing with continuous data (e.g., number of injuries or acres of crops damaged). It helps assess whether households that implemented early actions experienced significantly different outcomes than those who did not, providing insight into the practical impact of early action measures on disaster resilience.

Effect of Early Action on House Damage

A chi-square test was conducted to determine if there was a significant relationship between early action and house damage:

- Pearson Chi-Square Value: 20.788
- Degrees of Freedom (df): 13
- p-value: 0.077

The p-value (0.077) suggests no statistically significant association between early action and the extent of house damage.

Effect of Early Action on Household Injuries

An independent samples t-test was performed to assess whether early action reduced the number of household injuries.

Early Action Status	Mean Injuries	Standard Deviation
Took Early Action	0.08	0.294
No Early Action	0.13	0.426

The t-test resulted in a p-value of 0.167, indicating no statistically significant difference in injuries between the two groups.

Effect of Early Action on Lives Lost

Another independent samples t-test was conducted to evaluate the impact of early action on lives lost.

Early Action Status	Mean Lives Lost	Standard Deviation
Took Early Action	0.02	0.156
No Early Action	0.05	0.337

The t-test yielded a p-value of 0.358, suggesting no statistically significant difference in lives lost between the two groups.

Effect of Early Action on Productive Items Lost

An independent samples t-test was performed to assess the loss of productive items between households that took early action and those that did not.

Early Action Status	Mean Items Lost	Standard Deviation
Took Early Action	3.55	13.736
No Early Action	1.62	3.730

The t-test resulted in a p-value of 0.334, indicating no statistically significant difference in productive items lost between the two groups.

Effect of Early Action on Livestock Lost

We conducted an independent samples t-test to assess whether early action affected the number of livestock lost during Cyclone Freddy.

Early Action Status	Mean	Standard Deviation
Took Early Action	8.62	28.248
No Early Action	7.43	9.118

The t-test yielded a p-value of 0.643, indicating no statistically significant difference in livestock lost between the two groups.

Effect of Early Action on Crops Damaged

An independent samples t-test was performed to evaluate the impact of early action on the extent of crop damage.

Early Action Status	Mean (acres)	Standard Deviation
Took Early Action	1.8113	1.09809
No Early Action	1.6285	1.45690

The t-test resulted in a p-value of 0.202, suggesting no statistically significant difference in crops damaged between the two groups.

Despite the statistical findings, qualitative evidence suggested some positive impacts of early action. One respondent noted: *"There is a river near my two houses. When I realized that the flowing water could destroy both houses, my wife and I used stones and sandbags to create water barriers. As a result, only one house was damaged by the water."* Such testimonials indicate that while early action may not have shown statistical significance across the entire sample, individual cases demonstrated positive outcomes from preparedness measures.

4.4. Conclusion

The findings presented in this chapter reveal a complex picture of early warning and early action implementation in Makhuwira during Cyclone Freddy. While early warning systems achieved significant reach, with 78.6% of households receiving warnings through multiple communication channels including audio publicity and radio broadcasts, the translation of these warnings into effective early action was limited by various factors. The study identified critical gaps in both the warning dissemination process and the community's capacity to respond effectively, with timing and frequency of warnings, technological constraints, and resource limitations affecting the overall effectiveness of the early warning system.

The implementation of early action measures was notably hindered by financial limitations, inadequate evacuation infrastructure, and technical capacity to take protective measures. While statistical analysis revealed no significant relationships between early action measures and disaster outcomes, qualitative evidence indicated instances where early action measures helped reduce disaster impacts at the individual household level.

5. Discussion

This chapter critically examines the findings presented in Chapter 4. The discussion focuses on three key areas: the effectiveness of early warning systems in reaching last-mile communities, the early action taken by last mile communities, and the impact of early action taken by last mile communities on reducing flood impact in Makhuwira, Chikwawa district.

5.1. Effectiveness of Early Warning Systems

5.1.1. Coverage and Accessibility

The finding that 78.6% of respondents received early warnings demonstrates both the success and limitations of current warning systems, a key part of resilience (Baudoin et al., 2014). This coverage rate, while substantial, reflects broader global challenges in early warning system implementation. The United Nations (2024) reports that one in three people globally lack access to adequate multi-hazard early warning systems, with this gap particularly pronounced in least developed countries and small island developing states. The 21.4% who did not receive warnings in our study area align with these global patterns, representing a critical gap in the system that particularly affects last-mile communities.

This coverage gap takes on renewed urgency in light of the UN's Early Warnings for All initiative, launched in 2022, which aims to ensure universal protection from hazardous weather, water, and climate events through life-saving early warning systems by 2027 (UN, 2024). The initiative recognizes that as climate change drives more frequent and intense extreme weather events, early warning systems are a proven, efficient, and cost-effective way to save lives, protect infrastructure, and support long-term sustainability.

The dominance of radio/television (43.7%) and audio publicity (48.9%) as primary communication channels suggests an over-reliance on traditional broadcasting methods. Many households lack access to electricity or cannot afford radio/television sets, while audio publicity may not effectively reach remote or isolated areas. The limited use of community meetings (9.8%) and door-to-door communication (6.7%) indicates a missed opportunity for more personalized and interactive warning dissemination, which Aldrich and Meyer (2015) identify as crucial for building community resilience. Personalized and interactive warning methods often prove more effective in reaching marginalized populations (Graves and Kuleshov, 2024; Alias et al., 2019). Perera et al., (2020) emphasize that these face-to-face communication methods, such as door-to-door are essential for ensuring message

comprehension and action in vulnerable communities, where traditional broadcasting methods may prove insufficient or inaccessible.

5.1.2. Clarity and Frequency of Warning Messages

The frequency of warning messages presents another area of concern. With 79.1% of recipients receiving only 1-3 warnings, the current system may not provide sufficient message repetition to ensure comprehensive understanding and response. This limited frequency could explain why some community members reported being unprepared for the extent of flooding, despite receiving warnings about prolonged rainfall. This finding aligns with Maskrey's (2011) emphasis on the importance of message clarity and repetition in early warning systems. Studies reveal that message repetition can convey a sense of urgency and increase comprehension (Bean et al., 2015; Aimers & Thurgood, 2015).

The hierarchical warning dissemination structure, flowing from government departments and district authorities through local committees to communities, demonstrates clear organizational channels. However, the reported delays in warning delivery suggest potential inefficiencies in this chain of communication. The late arrival of warnings, sometimes just a day before the disaster, significantly constrained communities' ability to implement effective early actions, highlighting a critical gap between warning systems and practical response capabilities. This gap is particularly concerning given that the Department of Climate Change and Meteorological Services issued a warning on March 4, 2023, about Cyclone Freddy evolving into a Moderate Tropical Storm, with models indicating its likely path toward the Mozambique coast and potential impact on Malawi (GoM, 2023). Despite this eight-day lead time before the cyclone hit southern Malawi on March 12, 2023, the warning information failed to reach vulnerable communities in a timely manner.

5.2. Early Action Implementation and Barriers

The low rate of pre-flood evacuation (30.7%) and the fact that 36.5% of warned households took no early action reveal significant barriers to protective behavior. This finding is particularly concerning given that evacuation was one of the primary recommended actions (MRCS, 2023). Financial constraints emerged as the predominant barrier, with 71.7% of households citing inadequate finances as their primary challenge. This economic limitation affected multiple aspects of preparedness, from securing temporary accommodation to securing food and basic needs at the new accommodation.

Resource limitations further complicated preparedness efforts. Only 8.5% of households could reinforce structures, while a mere 3.4% managed to stockpile supplies. The limited technical capacity for implementing protective measures

compounded these material constraints, highlighting the need for both resource provision and technical support in preparedness programs.

5.2.1. Evacuation

Access to safe evacuation sites was a significant issue. Makhuwira had limited evacuation infrastructure, Savala Evacuation Center, is the only designated evacuation center in an area of 63 km² that is predominantly flat and low lying, with the large proportion of the residents living in flood prone areas. This limitation forced many residents to rely on temporary shelters, such as schools, churches, and community-based organizations (CBOs), which were ill-equipped to host people prior to the disaster. These temporary shelters lacked essential resources, including adequate space, toilets, and clean water, preventing them from serving as viable pre-disaster evacuation sites.

As a result, delayed evacuations were common, with 33.9% of households waiting until the floods had already struck to move to safer areas. One woman shared, *"We did not do anything to prepare for the incoming floods because we did not have any place to go to."* The lack of basic necessities, such as food and proper shelter at evacuation sites, further discouraged early evacuations as many people prefer to live near rivers where they can fetch food.

Survey respondents and focus group discussions (FGDs) strongly emphasized the potential of financial support to enable early evacuations and improve disaster preparedness. Participants highlighted that many households are reluctant to evacuate early because they prefer to remain near villages and rivers, where they can fetch food and other resources for their families. This decision is often driven by economic necessity, as families struggle to sustain themselves at evacuation centers due to the limited economic opportunities which makes it difficult to find food and other basic necessities.

During FGDs and comments from survey respondents, community members suggested that if financial support were provided before the disaster, it could address these challenges and encourage early evacuations. They noted that such support would allow households to purchase essential items like food, cooking supplies, and hygiene products, ensuring they could sustain themselves at evacuation centers. This would alleviate the fear of leaving their homes without the means to meet their basic needs.

Social and personal challenges also presented barriers to early action. Family separation, concerns about intimacy, and hygiene issues were frequently cited as complications. Men expressed unease about being separated from their wives, while women highlighted challenges related to menstrual hygiene in evacuation settings.

These personal and social factors made it difficult for individuals to evacuate early, even when warnings were received and understood.

These findings highlight the urgent need for improved evacuation services. Enhancements such as better hygiene facilities, privacy provisions for couples, and accessible resources at evacuation sites could encourage early action and improve the overall evacuation experience.

5.3. Impact Analysis of Early Action

5.3.1. Statistical Significance

The discussion on the effectiveness of early action during Cyclone Freddy reveals that, despite some households attempting to take proactive measures, these efforts were largely ineffective in mitigating the damage caused by the flood. The analysis focused on six key areas—house damage, household injuries, lives lost, loss of productive items, livestock, and crops—demonstrating that early action taken were insufficient in preventing substantial losses.

5.3.2. House Damage

Although households that took early action experienced slightly less house damage, the difference was not statistically significant, as indicated by a Chi-square test with a p-value of 0.077. This suggests that the steps taken by these households, such as safeguarding efforts, did not involve sufficient structural reinforcement to protect homes from the extreme force of Cyclone Freddy. The lack of significant results highlights the need for stronger protective measures, especially ones that promote structural reinforcements to protect their properties in future extreme weather events.

5.3.3. Household Injuries and Lives Lost

The findings also show that early action did not significantly reduce household injuries or fatalities. Independent samples t-tests resulted in p-values of 0.167 for injuries and 0.358 for lives lost, indicating no meaningful difference between households that took early action and those that did not. However, although the statistical analysis indicates that early action did not have a significant impact on reducing injuries or fatalities this doesn't fully reflect the reality on the ground. One key factor that contributed to the low levels of injury and fatalities of those who did not evacuate before the disaster, was the success of search and rescue efforts, involving both local community members and external support. VCPCs and local residents, familiar with the terrain, played a vital role in guiding others to safety, while outside rescue teams contributed valuable resources and manpower to ensure as many people as possible were protected from harm.

Therefore, while early action alone did not statistically reduce injuries or loss of life, well-coordinated rescue efforts were crucial in keeping injury and death rates low, especially among those who hadn't evacuated prior to the flood. The ARDM chairperson reported that *"VCPC members rescued people who had not evacuated in time."* Hence, the finding still emphasizes the importance of early evacuation during Cyclone Freddy in preventing deaths and injuries.

5.3.4. Loss of Productive Items, Livestock, and Crops

The results related to productive items, livestock, and crop losses further emphasize the limited effectiveness of early action. Households that took early action did not significantly reduce their losses in these categories. For instance, the t-test for productive items yielded a p-value of 0.334, while livestock losses showed a p-value of 0.643, and crop damage produced a p-value of 0.202. These findings indicate that, even though some households attempted to safeguard their livelihoods, the lack of sufficient resources—whether in the form of time, finances, or technical capacity—meant they were unable to adequately protect their livestock, tools, or crops.

Given that these assets are critical to the economic stability of rural households, the inability to effectively safeguard them points to a critical gap in disaster preparedness. Households need better financial and technical support to protect their livelihoods. This might include creating designated safe areas for livestock or providing more comprehensive training on how to protect crops and productive assets before a disaster strikes.

5.3.5. Contextual Analysis on Impact assessment

The lack of statistical significance in early action outcomes can be attributed to several interconnected factors. First, the unprecedented intensity of Cyclone Freddy overwhelmed existing preparations and traditional coping mechanisms. The severity of the event exceeded the protective capacity of typical household-level interventions.

In terms of housing, the predominant use of mud as a building material (83.9% of houses) significantly compromised structural integrity. Although 68.8% of houses used burnt brick and 59.3% used iron sheets, the use of mud mortar instead of cement created significant vulnerabilities. When exposed to prolonged rainfall and flooding, mud mortar loses its cohesive properties and structural strength as it absorbs water, leading to weakening of walls and potential collapse (Rashmi & JagadishK, 2014). This inherent weakness of mud construction in wet conditions meant that protective measures like roof reinforcement and water barriers were inadequate against Cyclone Freddy's combination of prolonged rainfall and flooding, regardless of early action taken by households.

Resource inadequacy emerged as a fundamental constraint. Gros et al. (2019; 2024) have similarly demonstrated that financial constraints limit the ability of households to implement effective disaster preparedness measures. The limited financial means available to households restricted their ability to implement comprehensive preparations. This economic barrier was compounded by limited access to materials and technical expertise. The resulting constraints in implementing strong protective measures likely contributed to the uniform impact across different levels of preparation.

The timing and quality of warnings also played a crucial role. Many respondents reported confusion about the severity and nature of the threat, with some interpreting warnings of prolonged rainfall as less urgent than warnings of severe flooding. This communication gap, combined with the limited window for preparation, may likely have reduced the effectiveness of early action efforts even among households that attempted to prepare. Households took proactive actions in the expectance of a different hazard to the one they ultimately experienced. This reflects a broader issue in disaster communication, where incomplete or unclear messaging can reduce the effectiveness of early action (Cutter et al., 2010).

5.4. Implications for Future Disaster Preparedness

The findings of this study offer critical insights for enhancing disaster preparedness in last-mile communities like Makhuwira, focusing on policy, practice, and community resilience.

First, gaps in early warning systems—particularly in reach, timeliness, and clarity—underscore the need for policy-level interventions to strengthen disaster communication mechanisms. Although the study found a significant reach of warning messages (78.6%), further improvements in early warning are vital. Empowering Village Civil Protection Committees (VCPCs) with resources such as megaphones and mobile phones is essential to ensure that all households, especially the most marginalized, receive timely, clear, and actionable warnings.

Second, the financial, technical, and infrastructural barriers to early actions highlight practical challenges in disaster management. Providing anticipatory financial support, improving evacuation infrastructure, and offering technical training on effective protective measures are crucial steps to empower households to take proactive actions. These measures not only reduce disaster impacts but also lower recovery costs.

Third, the study emphasized the pivotal role of VCPCs in minimizing human deaths and injuries during Cyclone Freddy through effective search and rescue operations. The VCPC chairs highlighted the contributions of the MRCS through the ECHO IDREAM project, which provided training and essential search and rescue equipment

critical for the success of their operations. Continued efforts should focus on maintaining and enhancing these outcomes, as they are integral to protecting the lives of vulnerable populations in Makhuwira.

5.5. Study Limitations

This study encountered several important limitations that warrant consideration when interpreting the findings. Firstly, the geographic scope represents a primary limitation, as the study was conducted exclusively in Makhuwira, Chikwawa District. This approach provided valuable, in-depth insights into a specific context; however, the findings may not be applicable to other last-mile communities with different social, economic, and environmental conditions. The localized nature of the research, while allowing for detailed analysis of one area, limits the broader applicability of the results to communities with distinct geographical characteristics, socio-economic profiles, and infrastructure development levels.

Secondly, the research was conducted in Makhuwira, identified as a last-mile community due to its high levels of poverty and limited economic diversification. The classification of Makhuwira as a last-mile community is supported by the data of the study, which revealed that more than 85% of households have a monthly approximate income of less than or equal to 50,000 Malawi Kwacha (equivalent to approximately 28.81 US dollars per month or 0.96 US dollars per day). This income rate is well below the World Bank's extreme poverty line of 2.15 US dollars per day (World Bank 2024). The lack of access to household-level data from government agencies, which could have helped identify ultra-poor households, necessitated categorizing the entire community as ultra-poor. While this approach effectively highlighted the severe poverty in the area, it may overlook potential variations within the community. However, given that the study revealed such a high proportion of households below the poverty line, the risk of significant bias from participants outside this classification is considered minimal.

5.6. Conclusion

The findings reveal a complex interplay between early warning systems, community capacity, and disaster outcomes in Makhuwira. While early warning systems reached a majority of households, the limited translation of warnings into effective early action highlights significant systemic gaps. The lack of statistical significance in early action outcomes suggests that current approaches require substantial enhancement, particularly in addressing financial constraints and resource limitations.

6. Conclusion and Recommendation

This chapter provides a summary of the key findings, actionable recommendations addressing the study's objectives, and a conclusion that responds to the hypotheses and problem statement. The findings revealed significant gaps in early warning systems, early actions, and their effectiveness on reducing flood impacts in Makhuwira. The recommendations aim to address these gaps by proposing targeted interventions to improve disaster preparedness and resilience in last-mile communities.

6.1. Summary of Key Findings

The study assessed the impact of early action on disaster preparedness in Makhuwira, focusing on three objectives: evaluating the effectiveness of early warning systems, examining the types and extent of early actions taken, and analyzing their impact on reducing disaster outcomes.

First, the effectiveness of early warning systems was found to be limited by gaps in reach, timeliness and clarity. While 78.6% of households reported receiving warnings, 21.4% remained uninformed. Warnings were often delivered late, giving households insufficient time to act, and lacked clarity about the nature and severity of the disaster. For example, households expected strong winds and prolonged rainfall but were unprepared for the flooding that ensued.

Second, the types and extent of early actions were constrained by financial, technical, and infrastructural barriers. While 30.7% of households evacuated before the floods, others were unable to act due to resource limitations. Key barriers included the inadequacy of evacuation centers, financial constraints preventing households from stockpiling supplies or reinforcing structures, and limited technical knowledge about effective protective measures.

Finally, the impact of early actions on reducing disaster outcomes was mixed. Statistical analysis showed no significant reductions in house damage, injuries, or resource losses for households that took early actions. However, qualitative evidence highlighted localized benefits, such as the use of sandbags to protect homes, suggesting that early actions can be effective when adequately applied.

6.2. Recommendations

6.2.1. Improving Early Warning Systems Effectiveness

The enhancement of early warning systems requires a multi-faceted approach focusing on reach, timeliness, and clarity of communications. To expand warning

coverage beyond the current 78.6% of households, authorities, in coordination with VCPCs, should implement comprehensive door-to-door campaigns and conduct regular village meetings. VCPCs require additional resources, including mobile phones, bicycles, megaphones and protective clothing, to conduct these outreach efforts effectively.

Warning timeliness must be improved through earlier dissemination and more frequent message repetition. The late warnings left households with insufficient preparation time. By providing VCPCs with proper equipment and logistical support, warnings can be distributed more promptly and effectively throughout communities. This can supplement traditional broadcasting methods.

Warning clarity should be enhanced by crafting messages in local languages that reflect cultural contexts. Messages must explicitly detail hazard types, expected severity, and provide specific actionable recommendations. For example, future warnings should clearly outline potential flooding risks and their impacts, along with detailed guidance on protective measures such as evacuation procedures and asset protection strategies.

6.2.2. Strengthening Household Early Actions

To address the concerning finding that 36.5% of households took no preparatory action despite warnings, interventions must focus on removing financial, technical, and infrastructural barriers. The implementation of anticipatory cash transfers or vouchers before disasters would enable households to undertake crucial preparatory measures. These funds could support transportation costs, supply stockpiling, and structural reinforcement of homes. The establishment of Forecast-based Financing (FbF) and Early Action Protocols would ensure timely distribution of resources when specific disaster triggers are met.

Community-based disaster preparedness training programs should focus on practical skills like flood barrier construction, house elevation, and asset protection. To ensure inclusive participation, villagers can be organized into working groups for direct training. This approach, supported by Focus Group Discussions (FGDs), would improve knowledge transfer from disaster management officials to the broader community, addressing current delays in information dissemination.

The evacuation infrastructure requires significant improvement through the construction and proper equipping of evacuation centers. New facilities should include clean water access, adequate sanitation facilities, appropriate sleeping areas, and family privacy provisions. These improvements would make evacuation centers more viable during disasters.

6.2.3. Enhancing the Impact of Early Actions

The study found that early actions, while implemented by some households, did not significantly reduce disaster outcomes such as house damage, injuries, or resource losses. This was largely due to the unprecedented intensity of Cyclone Freddy, structural vulnerabilities in housing, and partial or inadequate interventions resulting from financial and technical limitations.

To enhance the effectiveness of early actions, investments should be made in promoting resilient infrastructure. Households should be encouraged and supported to use durable building materials, such as cement mortar and reinforced iron sheets, which are better suited to withstand flooding.

The role of financial support in strengthening early actions cannot be overstated. Cash transfers, when provided in advance, can enable households to take comprehensive protective measures. Evidence from other countries, such as Mongolia and Uganda (Gros et al., 2020; Pople, 2020; Katongole, 2020)., highlights how financial assistance ahead of disasters can improve food consumption, protect assets, and reduce economic losses. Similar initiatives should be implemented in Makhuwira to strengthen the robustness of early actions.

6.3. Conclusion

The study assessed the effectiveness of early warning systems, the types and extent of early actions taken, and their impact on disaster outcomes in Makhuwira. The findings revealed significant gaps in the reach, timeliness, and clarity of early warning systems, as well as financial, technical, and infrastructural barriers to early actions. While early actions did not show statistically significant reductions in disaster impacts during Cyclone Freddy, qualitative evidence highlighted localized successes, such as the use of sandbags and other protective measures, demonstrating their potential when properly supported.

In addressing the problem statement, the findings underscore the need for inclusive and targeted strategies to enhance disaster preparedness in last-mile communities. The proposed measures—such as expanding early warning systems to reach all households, delivering timely and clear warnings, providing financial and technical support to encourage early actions, and investing in resilient evacuation infrastructure—offer the potential to significantly reduce the level of devastation currently experienced in areas like Makhuwira.

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