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DISASTER RISK MANAGEMENT IMPLEMENTATION IN MALAWI: POLICY OPTIONS FOR RESILIENCE TO ADVERSE IMPACTS OF FLOODING IN NSANJE DISTRICT

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Thesis submitted in fulfillment of the requirements for the degree Doctor of Philosophy in Public Health at the School of Health Systems and Public Health in the Faculty of Health Sciences at the University of Pretoria

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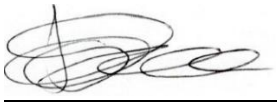
DECLARATION

I declare that this thesis, which I hereby submit for the degree Doctor of Philosophy in Public Health at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.



Ozius Dewa

DEDICATION

Dedicated to all people historically and yet to be affected by disasters.

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First and foremost, I am extremely grateful to my supervisors, Prof. O.A. Ayo-Yusuf and Dr. D. Makoka for their invaluable advice, continuous support, and patience during my PhD study. Their immense knowledge and plentiful experience have encouraged me throughout my academic research. They consistently allowed this thesis to be my own work but steered me in the right direction whenever they thought I needed it.

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ABBREVIATIONS

ACPC	Area Civil Protection Committee
APC	Academic Programme Committee
CB-FRM	Community Based-Flood Risk Management
CCA	Country Capacity Assessment
CPC	Civil Protection Committee
CSOs	Civil Society Organisations
DCPC	Civil Protection Committee
DEC	District Executive Committee
DODMA	Department of Disaster Management Affairs
DP	Deliberative Polling
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
FGD	Focus Group Discussion
GAR	Global Assessment Report
GDP	Gross Domestic Product
GVH	Group Village Head
HFA	Hyogo Framework of Action
IDNDR	International Decade for Natural Disaster Reduction
LUANAR	Lilongwe University of Agriculture and Natural Resources
MOH	Ministry of Health
NCST	National Commission for Science and Technology
NGO	Non-Governmental Organisation
ODK	Open Data Kit
ODM	Office of Disaster Management
RAN	Resilient Africa Network
SA RILab	Southern Africa Resilience Innovation Lab
SADC	Southern African Development Community
SDGs	Sustainable Development Goals
SEC	Student Ethics Committee

SFDRR	Sendai Framework on Disaster Risk Reduction
SHSPH	School of Health Systems and Public Health
SWOT	Strengths Weaknesses Opportunities Threats
TA	Traditional Authority
UN	United Nations
UNISDR	United Nations Office for Disaster Risk Reduction
VCPC	Village Civil Protection Committee
WHO	World Health Organization

ABSTRACT

Background

Weather-related disasters are becoming increasingly frequent, due largely to a sustained rise in the numbers of floods and storms. Globally, flooding alone accounted for 47% of all weather-related disasters between 1995 and 2015, affecting 2.3 billion people. The African Region experiences natural and man-made disasters annually. Malawi, one of the world's poorest countries, is prone to flooding and droughts that cause significant damage, with public health effects. Serious flooding occurred in Malawi in 1989, 1997, 2001, 2012, 2015, 2019, and in 2022 due to tropical storm Ana. Nsanje district in southern Malawi is one of the most affected. The adverse effects of floods, if not mitigated or reduced, will not only result in many health-compromising conditions of public health importance, but also pose a resilience challenge with adverse outcomes on the socio-economic development of affected communities.

At global level, efforts to reduce the impact of disasters are embodied in frameworks such as the International Health Regulations 2005 (IHR), the Paris Agreement on Climate Change, the Hyogo Framework of Action 2005-2015 (HFA), the 2030 Agenda for Sustainable Development and the Sendai Framework for Disaster Risk Reduction 2015–2030 (Sendai Framework). Along with these global efforts, other disaster-related frameworks and strategies have emerged at the regional level emphasising the need to strengthen health systems preparedness for adequate health sector responses to emergencies. The World Health Organisation (WHO) disaster risk management (DRM) strategy for the health sector in the African region is a case in point. Despite the development of these international frameworks and related national policies and strategies, evidence suggests that these efforts to establish frameworks and related strategies are not matched by community level action where adaptation to disaster occurs. Equally so, the role of public health had not been emphasised until the Sendai Framework, which puts forward a strong focus on the need to enhance the resilience of communities, and health and social systems, and the need for improving the scientific evidence base to advance health emergency responses and DRM concurrently.

In line with the call for enhanced scientific evidence, this thesis adds to the development of innovative public health DRM solutions by assessing the capacity for- and implementation status of the WHO African region DRM strategy for the health sector in Malawi. Using a deliberative polling® (DP) method, the study also assessed the feasibility of DP for effective

community engagement and specifically for the assessment of flood-affected community's support for various flood mitigation policy options. This thesis also analysed the factors that are associated with community flood resilience. Findings from the studies in this thesis informed the discussion on flood-affected communities' perception of fair adaptation and the future role of the public health profession therein.

Methods

This thesis employed a combination of quantitative and qualitative methods and in one study a mixed methodology was used. Objective one, which focused on assessing capacity and implementation status of the WHO DRM strategy for the health sector, applied a mixed method approach using a workshop method for primary data collection. Data was obtained from representatives of disaster risk management stakeholders including government ministries, departments, donor organisations, community-based organizations, members of community level DRM structures and the academia at national and district levels. Objectives two and three which focused on measuring community flood resilience and its associated factors and the community supported flood risk management policy options, respectively, utilised secondary quantitative and qualitative data analysis. Both the survey and qualitative data were obtained from community members as part of the deliberative polling process.

Findings

Results of the assessment of the capacity for- and implementation status of the WHO African region DRM strategy for the health sector in Malawi confirmed the findings of the World Bank relating to the development of national policies and strategies that emphasise the resilience of communities in disaster risk management. The results of this study showed that Malawi has significantly strengthened its institutional framework, characterised by a shift from a reactive to a more proactive approach to DRM, at least at the policy and strategic level. The DRM organisational structure included eleven subcommittees with the health and nutrition technical subcommittee led by the Ministry of Health. This meant that the health sector and its structures contributed to the design and implementation of DRM interventions at national and district levels. The study also found that non-state actors, such as international and local non-governmental organisations (NGOs), played a key role in coordinating DRM activities. Like some previous studies, this study found that limited funding from government undermined the progress made in the development of the DRM institutional framework. In addition, lack of vulnerability and risk assessment data, limited human resource capacity and inadequate

planning processes at district level, emerged as the key factors hindering full implementation of DRM interventions.

This thesis also showed that the two study communities had developed coping and adaptation mechanisms based on an established reciprocal relationship to sustain their livelihoods. This relationship was characterised by the lowland community having an alternative place to shelter in the upland in the case of flooding and the upland community accessing land in the lowland for agricultural production. The top five policy options identified by the two communities as key for supporting this existing coping and adaptation mechanism were increased access to family planning services, women economic empowerment interventions, support for children's education, strengthening security of the most vulnerable during flood response activities, and implementation of laws to end child marriages. This finding suggests that there is need for development and implementation of flood risk management (FRM) policies that put issues of gender, the welfare of the most vulnerable, human capital development through education and training and, other social determinants of health, at the core of strengthening community capacities for coping and adapting to flooding. This thesis also showed that against the backdrop of contestation between government and the communities on relocation policy, community members had high levels of trust in government and that community governance systems would adopt and implement their views as expressed through the DP process.

In terms of community flood resilience measurement, this thesis showed that the measurement derived latent construct of resilience captured the elements of engineering resilience, systems resilience and complex adaptive systems, as encompassed in a previously proposed conceptual model of resilience. In this thesis, the engineering and systems (ecological) resilience related to the construction of a dyke to ward off flooding and the provision of Early Warning Systems (EWS) to alert communities of an impending flood. This would enable the communities to continue with their livelihood activities while maintaining system function with minimum impairment, thereby strengthening community flood resilience. The complex adaptive systems element, which captures the community's ability to adapt, learn and transform, was captured by the importance placed on the need for families to stay together during a flood evacuation (psycho-social health and possible proxy for community's sense of connection and maintaining system function), the need to prioritise the elderly and the sick (possible proxy for community's sense of caring), and increased access to family planning services (health care and long-term adaptation). This thesis showed that increasing health and well-being are key factors for

increased community flood resilience in the context of DRM as resilient health systems are better able to protect themselves and human life from the public health impacts of disasters.

The thesis also suggests that public health has a central role in disaster risk management and in strengthening the resilience of communities in disasters, yet it appears to be the missing link in the two case communities. By looking at public health in a comprehensive manner, including considering the social determinants of health, this study departs from the traditional approach of looking at public health only from a clinical perspective. Thus, the study contributes to knowledge on the social aspects of DRM public health that have long been studied predominantly from a clinical perspective.

Methodologically, this thesis adapted and applied a workshop methodology to assessing the capacity for- and implementation status of a DRM Strategy for Health; an approach that can serve as a model framework for other districts in Malawi, as well as in other low- and middle-income countries in the context of Sendai Framework implementation. In addition, the ability of the communities to participate in the policy-making process, which is often considered difficult, is confirmation of the DP as an effective means for community consultation in flood risk management policy development and implementation. Furthermore, this thesis' application of a multidimensional approach to community resilience measurement that captures and accounts for various community capitals (socioeconomic, physical, health, human, natural) is relevant in the African context in which most people live in flood prone areas and rely on floodplains and rivers for food production and other livelihood activities.

Key words: disaster risk management, flooding, resilience, health, policy, Malawi

— CHAPTER 1 —

INTRODUCTION

CHAPTER 1: GENERAL INTRODUCTION

1.1. Introduction

Weather-related disasters are becoming increasingly frequent, due largely to a sustained rise in the numbers of floods and storms. Globally, flooding alone accounted for 47% of all weather-related disasters (1995-2015), affecting 2.3 billion people.[1] The number of floods per year rose to an average of 171 in the period 2005 to 2014, up from an annual average of 127 in the previous decade. In 2011, disasters were estimated to have cost $378 billion, breaking the previous record of $262 billion in 2005.[2] Often, when a disaster strikes, it is accompanied by extensive fatalities, injuries, disabilities, displacement, disease outbreaks, physiological distress, property and environmental damage, and devastating economic losses some of effects of which exceed the ability of the affected community or society to cope using its own resources.[2]

Hydro-meteorological events are key factors in triggering intensive disasters and crisis across all scales, as illustrated by powerful weather systems like Cyclone Eline that traversed 2,000 km across Southern Africa, adversely affecting five million people in seven countries.[3,4] The 2010 West/Central Africa flood emergency extended across 17 countries, including Liberia, Sierra Leone, Senegal, Cameroon and Chad.[5] Such wide area events are juxtaposed against highly localized and often unreported instances of realized extensive risks, such as drought[6], severe storms[7], wildfires[8], earthquakes[9] or locust infestations[10]. Figure 1.1 shows the share of disasters that affected the African region between 2000 and 2019 and demonstrates that flooding contributed 64% of all recorded events, 32% of all reported deaths and 16% of all the affected people reported.[11]

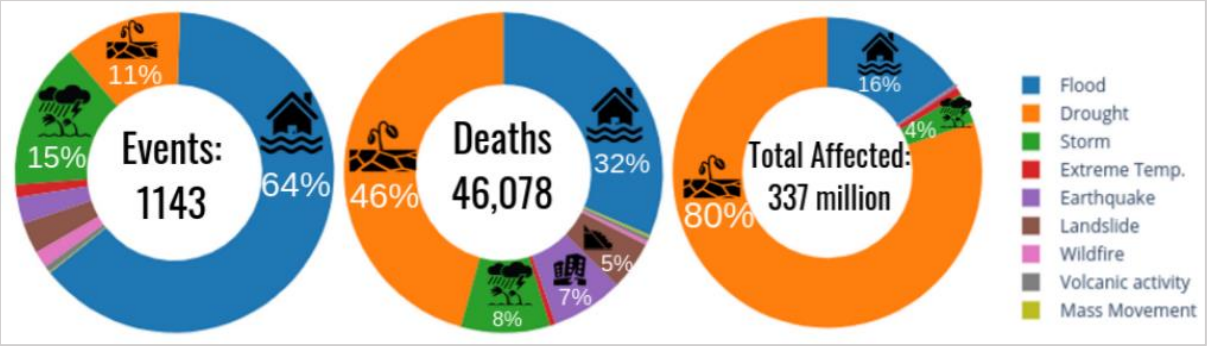

Figure 1 Share by Disaster Type (2000-2019)

Source: Centre for Research on the Epidemiology of Disasters (CRED)
https://www.emdat.be/cred-crunch-56-disasters-africa-20-year-review-2000-2019

Africa also faces significant and recurrent risks of escalating communicable disease outbreaks, particularly cholera and measles, as well as viral hemorrhagic fevers, such as Marburg and Ebola.[12] The trans-boundary character of the region's epidemic risk profile is illustrated by the scale of the 2008-2009 Southern Africa cholera outbreak – which resulted in 156,000 cases and 4,686 deaths[13], and the Africa Ebola outbreak, which resulted in 14,408 cases and 5,176 deaths according to the World Health Organisation (WHO).[14] Similarly, as at the time of this report, the Coronavirus 2019 disease (COVID-19) has resulted in about 8.7 million infections and more than 223,100 deaths – a Case Fatality Rate of 2.5%.[15]

Malawi is one of the world's poorest countries and it is particularly prone to flooding and droughts which cause significant damage with public health effects. In economic terms, annual losses due to drought and flooding amount to 1.7% of the country's Gross Domestic Product (GDP).[16] Serious flooding took place in 1989, 1997, 2001, 2012 and 2015, with the most recent floods of 2019, caused by Cyclone Idai, being the worst.[17] It is estimated that approximately 975,600 people were affected by the cyclone Idai-induced flooding, with 60 deaths and 672 injuries reported.[17] The lowland district of Nsanje in the southern part of the country was most affected. Flooding in the south is becoming a more frequent hazard because of the high siltation in the Shire River, and the cultivation in the Ndindi Marsh, which ecologically could have trapped the waters, reducing the incidence of flooding.[18]

The impacts of flooding, if not mitigated or reduced, will not only result in many health-compromising conditions of public health importance, but also pose a flood-associated disaster resilience challenge with impact on the socio-economic development of affected communities. These impacts may be reduced or mitigated if there was capacity among the people and support for systems to anticipate, prevent, mitigate, adapt, and recover from flood occurrences. Such capacity, conceptualised as resilience[18], is a function of many factors including the community's perceived fairness of adaptation, and the implementation of policies and strategies that have community support. Such policies, which can also be conceptualised as

part of basic infrastructure for flood management, should therefore not only be directed at reducing flood-associated health risks but must also aimed at sustaining livelihoods.

Recognising the impact of increased frequency and magnitude of disasters, the WHO Regional Office for Africa developed the Disaster Risk Management (DRM) for Health Strategy (2012) to contribute to human security and development.[5] The strategy aims to improve the health sector's management of disaster risks and facilitate a comprehensive health response to emergencies and disasters. The strategy provides targets that must be met by African member states by 2014, 2017 and 2022 towards its implementation. Besides a multi-country assessment conducted in 2016[19] and annual self-assessments by countries, there has been no study conducted to determine the extent of the implementation of the WHO strategy in Malawi with a focus on adaptation at national and district levels. As adaptation to disaster happens at community level, it is important that an assessment of policy adaptation and implementation be conducted at that level.

1.2. Resilient health systems and community resilience

Masten (2001) defined health system resilience as the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learned during the crisis, reorganize if conditions require it.[20] Following this definition, a health system should be seen to, not only produce good health outcomes, but also protecting and enhancing quality human life before, during and after a disaster. The increased deaths, societal disruption, and collapse of basic healthcare service provision during disasters such as the recent COVID-19 epidemic aptly illustrate the linkages and interconnectedness of health systems and disasters. This complex interaction has been described as a vicious cycle in which weak health systems provide fertile grounds for deterioration of public health and natural hazards into disasters while on the other hand, disasters further decimate already weak health systems (Kieny MP, Evans DB, Schmets G, Kadandale S, 2014).[21] As a result, there have been growing calls for the use of resilient health systems as a conceptual framework for public health DRM in Africa (Olu 2017, Aitsi-Selmi A, Murray, 2015, Dar O, Buckley EJ, Rokadiya S, Huda Q, Abrahams J, 2014, Bayntun C, Rockenschaub G, Murray V., 2012).[23-25]

Despite these growing calls for a health systems resilience framework in the African region, the concept of and approach to health system resilience has been critiqued for maintaining the

status quo or stable functioning of health systems and not addressing the underlying drivers of vulnerability and beneficial population health outcomes such as equitable distribution of and access to health services (van de Pas R, Ashour M, Kapilashrami A, et al., 2017; Topp SM, Flores W, Sriram V, et al., 2019).[26-27] Because of its focus on maintaining system function only, the approach has been perceived as perpetuating pre-existing vulnerabilities and societal imbalances that may underlie some currently stable but poorly performing health systems (Barasa EW, Cloete K, Gilson L., 2017; Institute of Development Studies, 2019.[28-29]

The critics of the health systems resilience concept note that the current conceptualisation and measurement of health system resilience has been blind to the complex aggregation of individual, community and organisation resilience that lead to improved health outcomes. Resilience studies among Ebola affected communities in Liberia revealed that while infrastructural inputs were important the game-changer in stopping the Ebola outbreak were community-led activities and collective actions delivered via existing community structures (Kirsch TD, Moseson H, Massaquoi M, et al., 2017, Alonge O, Sonkarlay S, Gwaikolo W, et al. 2019).[30-31] However, community resilience is often neglected in the assessment of resilience in health systems (Alonge O, Sonkarlay S, Gwaikolo W, et al. 2019).[31] Following this argument, community resilience measurement capacity is considered a key factor in strengthening community structures that are needed to prevent and prepare for future health shocks and the achievement of positive health outcomes (Kruk ME, Myers M, Varpilah ST, Dahn BT, 2015).[32] It is therefore important that public health studies investigate and document the nexus of health systems and DRM and provide recommendations of how the scope of resilient health systems framework can be expanded to strengthen public health DRM in Africa.

The studies presented in this thesis assessed the capacity for and the implementation status of the WHO DRM Strategy for Health at national and district levels in Malawi. The thesis then explored the community level factors associated with community resilience to flooding in two Traditional Authorities (TAs) called Nyachikadza and Ndamera in the Nsanje district of Malawi, as case study. Furthermore, through a Deliberative Polling®[33] (DP) approach, the thesis also explored whether poor communities exposed to flooding in rural Malawi can effectively participate in disaster risk management (DRM) policymaking and priority-setting in a manner they consider fair. Community trust in government, which recent studies[34-37] have demonstrated to be essential in DRM interventions, is also explored using data from the DP event.

1.3. Study rationale and significance

A mid-term review of the Hyogo Framework of Action 2005-2015 (HFA) implementation conducted by the United Nations in 2010-2011 found that while significant progress has been made in its implementation, there is a significant gap between national and local level action.[38] The report reveals that progress diminishes as activities are implemented closer to the communities. The report also noted that among European countries, those who have implemented disaster risk reduction for longer were at advanced stages in terms of decentralising risk reduction activities to community level. This seems to suggest a phased approach, whereby institutional structural factors are addressed at central level first, and localisation at a later stage. If this trajectory is applicable to African countries like Malawi, this study is timeous as it comes at a time when Malawi has recently developed its DRM strategy[39] and developed DRM structures from national to local level. In addition, Malawi's newly approved DRM Bill to replace the Disaster Preparedness and Relief Act of 1991 would require a stronger focus on strengthening community-based systems to better anticipate, prepare, respond and recover from disasters. The studies in this thesis provide, amongst others, insight into factors relating to local level adaptation that should be considered in higher-level policies and structures for successful implementation. It is hypothesised that such an approach will inform the development, adoption and implementation of disaster risk policies that have community support.

Another cited rate limiting factor in the implementation of the Hyogo framework is its limited focus on the role of public health[40] in DRM which has subsequently found expression in the Sendai Framework for Risk Reduction 2015-2030.[41] In an attempt to address this limitation, the WHO, through its World Health Assembly resolution WHA64.10, developed and adopted the African Region DRM Strategy for Health in 2012.[3] This was after a WHO assessment revealed that most countries in the region lacked policies, capacities and legislation to institutionalize DRM in the health sector.[3] The strategy to improve human security and development by enhancing the health sector's management of disaster risks and enabling a comprehensive health response to emergencies and disasters. Among its key interventions is the need to implement resilience building in health facilities and at community level.

To date, one assessment of progress towards the implementation of the WHO strategy has been conducted with twenty-five (25) African Member States (MS) participating.[19] Results have

shown that despite overall implementation of the strategy lagging far behind schedule, there has been improved awareness and better understanding of DRM concepts among health stakeholders across the region, and recognition of the need for DRR in the health sector.[19] Besides this assessment, countries, based on self-assessments, have produced progress reports against the nine targets of the strategy. Due to the self-referential nature of the assessments, these could be critiqued for being subjective – in line with what Baudrillard (1986) called a subjective self-reinforcing hyper-reality, in which perceptions of progress and achievement in DRM contrast with the lack of progress in addressing the underlying risk drivers at community level (GAR, 2015).[42,43] This critique reinforces what was found in the review of HFA implementation, where development of policies at national level did not match community level action. In addition, the fact that the review with 25 member states was conducted at regional level and not at country level means that it was limited in its focus on community level factors that could promote or hinder successful implementation of the strategy. This study addresses this lacuna by focusing on one country and community level factors of disaster resilience.

Scientific evidence has shown that public health is an important component of community disaster resilience. Lessons from the West African Ebola outbreak and Hurricanes Katrina and Haiyan show how an emergency situation can deteriorate into a disaster in the face of a weak health system.[44-46] Conversely, resilient health systems could reduce vulnerability to the public health consequences of disasters.[44] In order to build community disaster resilience, public health is considered a key component in which resilient health systems are able to protect themselves and human lives from the public health impact of disasters and are critical to achieving good health outcomes before, during, and after disasters.[47] Olu et al.[19] conclude that there is need for the African continent to develop innovative public health DRM solutions that place resilient health systems at the core.

The studies in this thesis contribute to addressing the need for the development of innovative public health DRM solutions by assessing the capacity for- and implementation status of the DRM strategy for the health sector in Malawi (Chapter 4). The thesis then explored the community level factors associated with community resilience to flood risk in two Traditional Authorities (TAs) called Nyachikadza and Ndamera in the Nsanje district of Malawi, as case study (Chapter 5). Using a DP® method, the third study of this thesis (Chapter 6) assessed flood affected community support for various flood mitigation policy options, presumably

mitigating the factors identified as associated with being less resilient to flooding (Chapter 5). To have a complete picture of the adaptation process, the study investigated what affected communities consider fair adaptation when developing and implementing flood risk adaptation policies that affect their livelihoods. The study explains and clarifies to policymakers the competing views on relocation as flood risk mitigation and community perceptions on the impact relocation has on their livelihoods and the lived values that inform their resistance to it. In the broader context of social determinants of health, such an appreciation of local values can help shape the future of the public health profession.

1.4. PhD study conceptual and theoretical frameworks

Conceptual framework

A conceptual framework explains, either graphically or in narrative form, the main things to be studied- they key factors, constructs, or variables- and presumed relationships among them (Miles and Huberman 1994).[48] The studies in this thesis combined aspects of DRM, health and resilience. The cross-disciplinary concepts of DRM, public health and community resilience have been reviewed and discussed from different theoretical and conceptual frameworks. The building of the conceptual and theoretical frameworks for this thesis provided the researcher focus and content for decision making about the study design and helps readers with clarity about the lens through which the concepts of DRM, community resilience and public health were and should be viewed. Figure 2 presents a conceptual framework for this study highlighting how the study objectives were interlinked to produce this thesis.

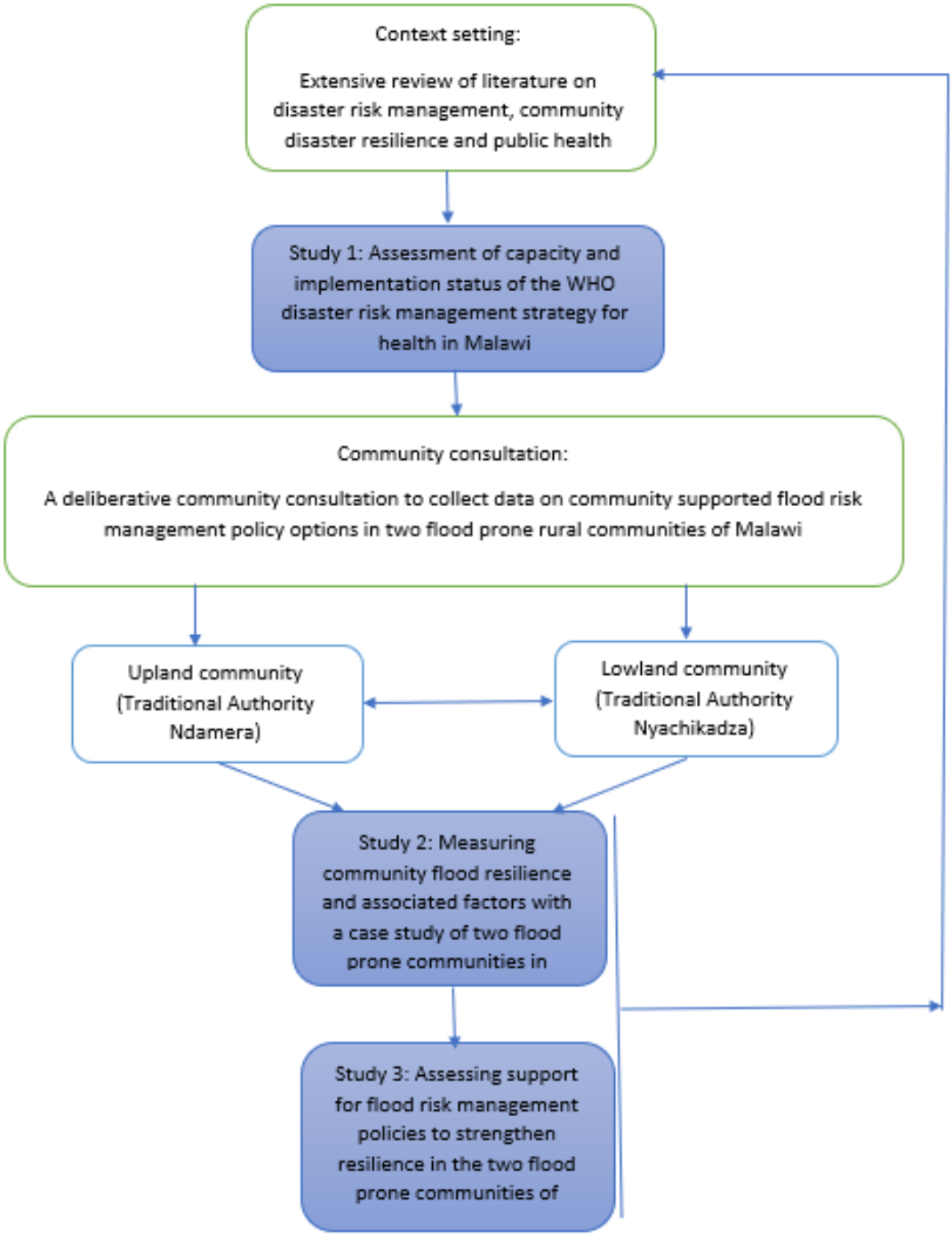

Figure 2: Study conceptual framework

The initial step of this PhD study was to conduct an extensive review of literature on DRM, community disaster resilience and public health demonstrating the various conceptualisations that have been used for these interdisciplinary concepts. This was followed by an assessment of the capacity for and implementation status of the World Health Organization (WHO) strategy for health in Malawi. As part of this assessment, a focus on the evolution of DRM

policies in Malawi provided contextual background needed to understand why DRM capacity and implementation was at the stage at which it was. Following this assessment, the researcher conducted analysis of secondary data collected using a deliberative polling method to assess community support for various flood risk management policy options in two adjacent flood prone rural communities (TA Ndamera and Nyachikadza) of Malawi. Results of this analysis culminated in two studies. One study focused on measuring community flood resilience and its associated factors. The other study focused on assessing community support for various flood risk management policy options in these two communities. Results of this study helped to identify what the target communities valued in their lives and its interaction with the flooding environment that they chose to stay in despite government efforts at relocating them. These values were conceptually considered measures of fair adaptation. In overall analysis and discussion, results from the third study are compared with those from the second study and reflections made on the community flood resilience measurement approach used. Results of the last two studies identified further research questions requiring further investigation to provide evidence for strengthening capacity for and implementation of DRM strategies for strengthened community disaster resilience not only in Malawi but also other low-to-middle income countries.

Theoretical framework

The section on resilient health systems and community resilience has demonstrated the nexus of these two concepts in the context of DRM and how these are affected by individual or group capacity to adapt to climate change. Climate change induced natural disasters such as flooding interact with human activities, actions and practices like farming, fishing, transportation, cultural patterns, indigenous knowledge, etc., which are all at the centre of community resilience. Adaptation and disaster resilience are a function of the strength and availability of institutions and policies targeted at engendering climate change adaptation beyond the individual (Anugwom 2021).[49] As public health is placed at community level; it becomes critically important in strengthening the capacity of communities to adapt to climate change. Given this importance of public health in climate change adaptation, it is essential that health is placed at the centre of all other activities that community members conduct for their livelihoods. Therefore, health systems that not only promote improved population health outcomes but are also resilient to climate change are important in improving the functioning of communities in other areas such as politics, social, culture and livelihoods, inter alia.

Given this study's focus on three interdisciplinary concepts of DRM, community disaster resilience and public health, and the established nexus among them, a systems approach was adopted for this thesis as a theoretical and philosophical base to explore and discuss the role of public health in the discourse and practice of climate change adaptation. A systems approach is defined as "a paradigm or perspective that considers connections among different components, plans for the implications of their interaction, and requires transdisciplinary thinking as well as active engagement of those who have a stake in the outcome to govern the course of change" (Leischow SJ and Milstein B 2006, p. 403).[50] Public health, as defined (Shi, Leiyu & Tsai, Jenna & Kao, Senyeong. 2009),[51] recognizes that health goes beyond the biomedical conditions of the individual or society making public health capable of embodying perspectives and viewpoints beyond the bio-medical field. Thus, public health is presented here as not only suited but also strategically placed at community level to tackle the multi-pronged challenges of climate change in a multidisciplinary way. Therefore, the systems approach was recommended for this thesis as it holds the promise to transcend the conventional or orthodox unidimensional conceptualisations the role of public health in DRM and climate change adaptation. This makes both policy makers and practitioners realise that public health challenges of climate change required a multidisciplinary approach and concerted efforts of different actors.

1.5. Research objectives

The overall objective of the study was to assess the capacity for- and implementation status of the DRM Strategy for Health in the context of fair adaptation, and explore factors associated with community resilience to flooding in the Nsanje district of Malawi.

Specifically, the research sought to:

- assess capacity and implementation status of the DRM Strategy for Health in Malawi at national and district levels;
- determine the factors associated with community resilience to flood risk in TA Nyachikadza and Ndamera in Nsanje district; and
- explore the local community's perceived measures of fair flood risk mitigation policy adaptation and implementation.

1.6. Research questions

The study was guided in its investigation by the following research questions:

- What is the capacity for and status of the implementation of the DRM for health strategy in Malawi?
- What are the factors associated with community resilience to flood risk in Nsanje district of Malawi?
- What flood risk policy options do local communities support and what do they consider fair adaptation?

1.7. Methods and research design

The study employed a mixed-method approach utilising both primary data collection and secondary cross-sectional data analysis. The specific methods utilised included literature review, workshop methods with a case study, secondary survey data analysis and secondary analysis of qualitative data. Table 1 presents an overview of the research methods based on the study objectives, which are elaborated below.

Table 1 Overview of the study methods and outputs

Objective	Method(s)	Output Paper Titles
To assess capacity for- and the implementation status of the DRM Strategy for Health in Malawi at national and district levels	Mixed methods ○ Facilitated consultative workshops (cross-sectional survey and group discussions)	Assessing Capacity and Implementation Status of the Disaster Risk Management Strategy for Health and Community Disaster Resilience in Malawi. *Int J Disaster Risk Sci* **12,** 673–688 (2021). https://doi.org/10.1007/s13753-021-00369-z
To explore factors associated with community resilience to flood risk in TA Nyachikadza and Ndamera in Nsanje district	Quantitative methods ○ Post survey secondary data analysis	Dewa O, Makoka D, Ayo-Yusuf OA. Measuring community flood resilience and associated factors in rural Malawi. Journal of Flood Risk Management. 2022. https://doi.org/10.1111/jfr3.12874

To explore the local community's perceived measures of fair flood risk mitigation policy adaptation and implementation	Mixed methods ○ Pre-Post survey secondary data analysis ○ Deliberative poll group discussions secondary data analysis	A deliberative rural community consultation to assess support for flood risk management policies to strengthen resilience in Malawi. *Water*. 2022; 14(6):874. https://doi.org/10.3390/w14060874

Objective 1: To assess the implementation status of the DRM Strategy for Health in Malawi at national and district levels

A mixed method facilitated consultative workshop approach[52,53] was adopted to collect both quantitative and qualitative data. The workshop methodology was deemed suitable for this study as, unlike other qualitative methods, it seeks to establish a shared position among participants after inter-subjective interactions.[53] It enables collective problem-solving[54] through a participatory appraisal approach[55] comprising group brainstorming and consensus building.[56] A collectively agreed answer to each question is supported by evidence, such as administrative and policy documents, and examples of established institutions, such as health subcommittees. The researchers were independent external reviewers/facilitators guiding the discussions towards mutual interactions and agreement on a common position, while ensuring there were no dominant voices. Collective positions were those considered to be accurate representations of the country's capacity for mainstreaming health in DRM interventions and status of implementation of the various domains in the DRM Strategy for Health. This consensus building approach[57] establishes a strong foundation for collective identification of gaps, and thus, agreement on required intervention pathways for effective integration of public health in DRM.

Cross-sectional quantitative data was also collected at the national and district levels (Nsanje District) during September and October 2019, respectively. Each of the WHO regional strategy targets (See Table 5) was mapped to the relevant domains of an adapted Country Capacity Assessment (CCA) questionnaire (Appendix 2) developed and implemented by WHO. The CCA adapted tool was administered to participants at both the national and district levels. In both instances, a workshop method was used for data collection, where participants gathered in one place to collectively review the questions and agree on the most appropriate response

(an agreed group answer for each question) representing the country's DRM capacity and implementation status, at national and district levels, as at the time.[53] At district level, the data collection tool was adapted to ensure applicability by focusing on operational aspects of the strategy as opposed to high level policy issues. Consequently, domains one (Institutional framework) and two (Ministry of Health coordination) were not assessed at district level as they focused more on higher level policy and legislative aspects that were adequately responded to at national level. Consensus scores at national and district levels were averaged, resulting in scores reported in this study as described in the analysis section below. The questions in the CCA adapted tool required participants to collectively assess the availability, functionality and operational status of institutional frameworks for DRM, health sector coordination, health disaster risk analysis and mapping, emergency and disaster early warning, disaster response and recovery, preparedness planning and management, and health facility and community resilience building.

Objective 2: To explore factors associated with community resilience to flood risk in TAs Nyachikadza and Ndamera in Nsanje district

This was a secondary analysis of population-based cross-sectional survey data collected in June 2017 to assess the level of support for flood mitigation policy options in the TAs Nyachikadza and Ndamera. Data collection was conducted using a seven-step community consultative approach called Deliberative Polling® (DP).[33] Applied for the first time in southern Africa, and for the fourth time in Africa (Malawi) (OECD, 2020), the approach involved the following seven steps, as previously published elsewhere:[58-60]

- Conducting a desk review to identify different policy options for flood risk mitigation, their advantages, and disadvantages
- Identification of a community advisory group, comprising, among others, community members, traditional leaders, representatives of community-based organisations working in the flood-prone communities, members of the local district council, representatives of government ministries, and political representatives, to discuss the identified flood risk mitigation policy options and expand on their pros and cons based on knowledge of local context
- Development of a structured household questionnaire and briefing materials for participants based on the outcomes of consultations with the community advisory group
- Identification and training of data collectors and moderators

- Conducting a baseline opinion poll on different flood mitigation policy options with a randomly selected representative sample of the flood prone communities
- Sampled individuals were convened for small group (about 18 participants in each group) discussions on the flood mitigation policy options followed by larger plenary sessions where participants had an opportunity to ask questions to experts and policymakers
- The event concluded with the same questionnaire as at baseline being administered with the same participants, with no option for replacement, to capture participants' considered opinions and how they had changed following the small group discussions and explanations of experts and policymakers

Data analysis was conducted using the post-event survey data as it was considered representative of informed participant opinions after the small group discussions with like-minded individuals and explanations from experts and policymakers.

Objective 3: To explore the local community's perceived measures of fair flood risk mitigation policy adaptation and implementation

This was a mixed methods study with both quantitative and qualitative data collected and used to assess community members' level of support for flood risk management policy options. The study comprised a DP based repeat cross-sectional survey, with pre-deliberative and post-deliberative event assessments being conducted. A structured household questionnaire was used to collect information from randomly sampled respondents before and after the deliberative event. In between the surveys, a facilitated deliberative event was conducted at a local primary school to collect qualitative information on opinions held by participants around flood risk management policies. A facilitated deliberative event is when representative community members gather at a single place to discuss, with the help of a trained moderator, the issues being studied for which their opinion is sought.[33] The conduct of the deliberative event in between the surveys allowed for assessment of the impact of participant deliberations on their support for various flood DRM policies. Data collection followed a seven-step process previously published elsewhere.[58-60]

The pre- and post-deliberation surveys were matched for each participant. The analyses, using IBM SPSS Statistics for Windows, version 25, examined the pre- and post-deliberation data

using paired samples *t* tests. The paired comparison tests excluded "don't know" and missing data. To measure change between the pre- and post-DP scores, mean differences in the rating indices were computed. The DP event produced slightly over 100 hours of transcribed audio recordings of deliberations on various flood risk management policy options. Transcriptions were done by group in *Chichewa* before being translated to English. Thematic analysis[61] was used to analyse qualitative data obtained from the deliberative event. A deductive analysis approach was used with the three broader policy priorities treated as major themes and their specific 32 policy options as guiding preconceived sub-themes. Data was categorised under each of these themes and reflected upon to have a better subjective and explanatory understanding of the quantitative results and any changes in opinion after deliberation.

1.8. Study setting and population

1.8.1 Setting

This study was conducted in Malawi. As the study combined both policy analysis and flood mitigation policy options supported at community level, the study was conducted at both the national government level in Lilongwe and the district level in Nsanje. At the national level, the study was focused on assessment of the implementation of the DRM Strategy for Health by the Department of Disaster Management Affairs (DoDMA), the Ministry of Health (MOH), Non-Governmental Organisations (NGOs) and the World Health Organisation (WHO) Outbreak and Disaster Management (ODM). While DRM and public health are multi-disciplinary, requiring combined efforts of many actors, the DRM Strategy for Health requires that African Member States capacitate the MOHs to lead a health response to disasters. This was the rationale for singling out the MOH for this study. The DoDMA is the Government of Malawi's agency responsible for coordinating and directing the implementation of DRM programmes in the country. It was established through the Disaster Preparedness and Relief Act of 1991 for the purpose of improving and safeguarding the quality of life of Malawians, especially those vulnerable to and affected by disasters.[62]

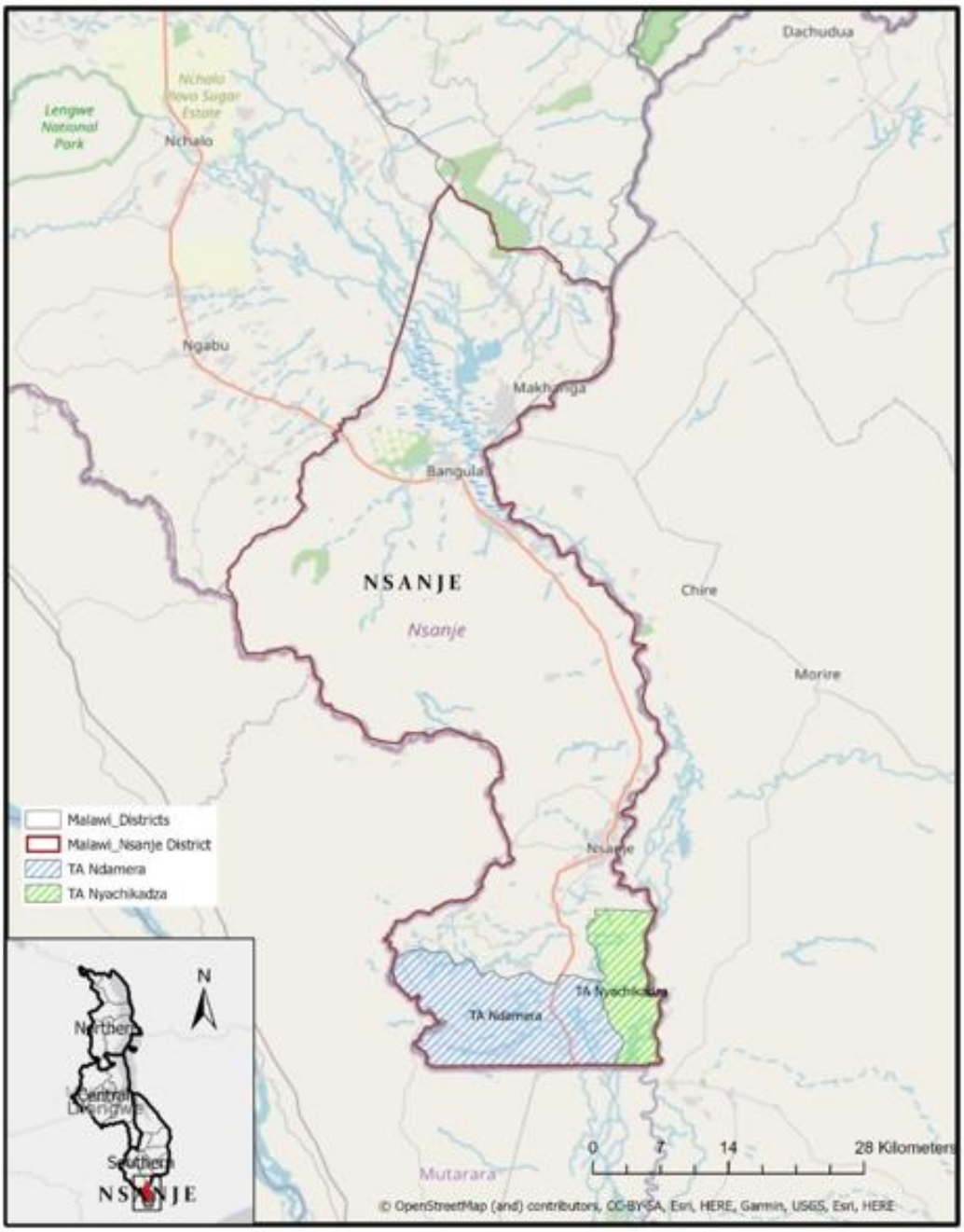

Figure 3 Map showing the location of Malawi and Nsanje District

Nsanje is the southernmost district in Malawi and lies in the Lower Shire River valley. It straddles the Shire River in the north (the river forms most of Nsanje's eastern boundary) and it is surrounded by Mozambique. Nsanje is the poorest among the 28 districts in the country and is virtually dependent on government and Non-Governmental Organisations (NGOs).[63] In addition, the district and the two Tas selected are among the most affected areas in the country,[18] hence their selection for this study. The majority of incomes in the district come from small holder farming. Maize, millet, sorghum, rice, sweet potatoes, beans and cotton are

all produced using almost entirely rain-fed agriculture. Maize is grown in the post rain season in the marsh areas. This renders the district vulnerable to climate variability (drought/flooding) with devastating effects on crop production. Livestock production and fishing are the other economic activities that sustain lives of many. Most people in the district live below the poverty line. The poverty rate for Nsanje was estimated as 81.2% with the ultra-poverty rate, those living below half the poverty line, estimated at 56% of the population.[63] Nsanje also has the highest poverty gap, an estimate of how far the poor are from the poverty line, in the country at 40.4%, implying that the poor people in Nsanje survive on MK14,948.80/year below the poverty line of MK 37,002.00/year.[64] Table 2 presents basic demographic information about Malawi and Nsanje district.

Table 2 Basic demographic indicators for Malawi and Nsanje district

Indicator	**Measure (#/%)**
Malawi Total Population	**17,563,749**
Sex ratio	94.2
Urban	16.0
Rural	84.0
Nsanje District Total Population	**1.7% of national population (299,168)**
Male	143,578 (48%)
Female	155,590 (52%)
Age (0-14)	138,219 (46%)
Age (14-64)	146,988 (49%)
Age (65+)	13,961 (5%)
Religion (Christian)	88%
Literacy	55%
Rural	91%
Urban	9%

Source: 2018 Malawi Population and Housing Census Report[65]

The district is subdivided into 9 Traditional Authorities (TA), two of which are TA Nyachikadza and TA Ndamera. TA Nyachikadza is home to over 1,000 households, which are located across 9 group village heads (GVHs). The community is affected by frequent flooding. When flood waters come, residents of TA Nyachikadza seek refuge in the neighbouring TA

Ndamera.[18] TA Ndamera has 28 Group Villages (GVH). Of these, 14 GVHs are neighbours with TA Nyachikadza in the wetlands. In these 14 GVHs, around 80% of the households grow crops in the wetlands of Nyachikadza. Half of these households own land in the wetlands of Nyachikadza, and the remaining half grow their crops on rented land. The other 14 GVHs that are further away from Nyachikadza are less dependent on the marsh. It was reported that in these GVHs, only around 30% grow their crops from the wetlands in TA Nyachikadza. In general, the community members from TA Ndamera are increasingly less dependent on rain-fed agriculture.[18]

1.8.2 Population

This study engaged multiple stakeholders at different levels as participants. At the national level, participants (n = 14) included staff from the technical subcommittees of the Department of Disaster Management Affairs (DODMA) (n = 5), the Ministry of Health (MOH) (n = 1), the World Bank (WB) (n = 1), the World Food Programme (WFP) (n = 1), the Ministry of Water Affairs (n = 1), the Department of Climate Change and Meteorological Services (DCCMS) (n = 1), the Housing Department (n = 1), the Environmental Affairs Department (EAD) (n = 1) and the Centre of the Lilongwe University of Agriculture and Natural Resources (LUANAR) (n = 2). At the district level, participants (n = 20) included staff from the District Executive Council (DEC) representing the various committees responsible for DRM implementation (n = 6) and nongovernmental organisation (NGO) representatives (n = 14).

The DP participants were selected through a four-stage sampling technique. During the first stage, two (2) TAs from Nsanje District, one from the upland (TA Ndamera) and another from the lowland (TA Nyachikadza), were purposively selected due to their vulnerability and experience of flooding, being the worst affected among all TAs in the district. In the second selection stage, five (5) Group Villages (GVs) and seven (7) Group Villages were selected from TAs Nyachikadza and Ndamera, respectively, using the simple random sampling technique. The distribution of the GVs was proportional to the number of GVs in each TA. At the third stage, a random selection of 40 households from each GV was conducted using stratified random sampling.

The sample size was determined by taking into consideration three factors; desired level of precision, confidence level and the degree of variability in the population.[66-68] The

determination of the sample size was considered an important step towards achieving a scientifically rigorous DP that would confer confidence on the results and allow inferences to be made. To this end, the researcher employed the procedure set out by Yamane (1967)[68], assuming a 95% confidence level, 7% level of precision and 0.5 degree of variability.[67] The DP applied the finite sample size calculation formula below:

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

Where:

n = sample size;

p = proportion of population containing the major interest

z = Z-statistic corresponding with confidence level;

e = confidence interval; and

N = population size.

Using the above formula and the Malawi National Statistical Office's 2017 projected population in the sampled 7 GVHs in TA Ndamera which was 8,370[1] for TA Ndamera, the **minimum** sample size for Ndamera was 192. Similarly, for TA Nyachikadza the projected population in the sampled 5 GVHs was 4,157. Using this population, the minimum sample size that was obtained for TA Nyachikadza was 187. The two calculated sample sizes were rounded up to 200 per TA. Furthermore, an attrition of about 20% between pre- and post-DP surveys was estimated, hence a target sample of 240 per TA (a total of 480 for the study) was determined. At the fourth stage, a listing of all households in TAs Nyachikadza and Ndamera formed the sampling frame for the sampling process. From the 480 households identified, household members older than 18 years were listed and one member was randomly selected from each household to participate in the survey without any option for replacement later in the deliberative event and post event survey.

1.9. Study novelty

This study is innovative due to the following characteristics:

- The study departs from a traditional approach of looking at public health from a clinical perspective to include the social determinants of health and how they interact with

[1] The 2018 Malawi Population and Housing Census Report indicates a population of 33,679 for TA Ndamera and 7,643 for TA Nyachikadza.

DRM to inform community flood resilience. Thus, the study contributes to knowledge on the social aspects of DRM public health that have long been looked at predominantly from a clinical perspective.

- The study documents, for the first time, results of an external empirical country specific and in-depth evaluation of the status of WHO DRM Strategy for Health implementation in Southern Africa, therefore, it provides insights on issues the next WHO strategy should address as the current one expires in 2022.
- This study is the first to apply a DP method in Southern Africa as a proven and impactful innovative community consultation approach for community flood risk resilience.
- By looking at public health from a social sciences perspective and overlaying it with statistical data, this study answers recent calls for the use of multidisciplinary approaches to understanding resilience measurement.
- Through the DP approach, this study demonstrates the ability of poor rural communities to participate in policy making, decision making and priority setting on issues affecting their livelihoods.
- This study has potential to influence flood risk policy in Malawi, shifting from a reactive relocation to a collaborative flood risk management approach that treats affected poor rural communities as knowledge generating labs.

1.10. Thesis structure

This thesis is presented in six (6) chapters that include three peer-reviewed manuscripts originating from this research work.

- Chapter 1: Introduces the study and discusses the study rationale and motivation, study objectives, and an overview of research methods adopted in addressing each objective.
- Chapter 2: Highlights the extensive literature that was reviewed, and which guided the study. This includes literature on disaster risk management, community disaster resilience, understanding the nexus of public health, disaster risk management and community disaster resilience, flood risk practices and literature in Malawi, community consultation approaches for flood risk management (FRM), and the factors associated with community flood resilience.
- Chapter 3: Presents an original paper published in the International Journal of Disaster Risk Science, titled, "*Assessing Capacity and Implementation Status of the Disaster*

Risk Management Strategy for Health and Community Disaster Resilience in Malawi." https://doi.org/10.1007/s13753-021-00369-z.

- Chapter 4: Presents an original paper currently undergoing review for publication in the Journal of flood risk management with the title, *"Measuring community flood resilience and associated factors in rural Malawi".*
- Chapter 5: Presents an original paper published in Water, titled, *"A deliberative rural community consultation to assess support for flood risk management policies to strengthen resilience in Malawi".* https://doi.org/10.3390/w14060874
- Chapter 6: Presents the overall general discussion and conclusion of the research, recommendations, and proposed areas of further research.

The references for each chapter are provided at the end of the relevant chapter. The reference style used in Chapters 1, 2 and 6 is the Vancouver system accepted by the School of Health Sciences and Public Health in the Faculty of Health Sciences at the University of Pretoria. The referencing styles for Chapters 3, 4 and 5 are according to the specifications prescribed by the journals in which the papers are published or are submitted for publication.

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— CHAPTER 2 —

LITERATURE REVIEW

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter presents a review of literature relevant to the study objectives. The first section situates DRM for health in the context of contemporary research and highlights gaps that this study fills. It further provides definitions of key terms and explores the nexus of disaster risk management for health and community disaster resilience. It explores and discusses the concept of community consultation for public health policymaking and priority setting. Furthermore, the chapter discusses the approaches that have previously been used in community flood resilience measurement, note the gaps and what needs to be done to address such gaps. The chapter ends with a presentation of the DRM structure in the African and SADC regions before zeroing in on Malawi. Within the Malawi context, the evolution of DRM is outlined before presenting its current structure and how it is influenced by the international frameworks and disaster occurrences. Challenges and gaps as it relates to DRM in the health sector are noted and how they informed the need for the studies of this thesis.

2.2. Disaster risk management for health and research

In the last few decades, disasters driven mainly by, among other factors, climate change and weak health and community resilience systems, have resulted in public health needs that often exceed local communities' capacity to respond leading to significant morbidity and mortality.[1,2] It is estimated that disasters caused by natural hazards such as flooding affected about 200 million people resulting in 70,000 deaths per year between 2008 and 2017.[2] While some disasters were of national, regional, and even global scale, like the Corona Virus Disease 2019 (COVID-19), others remained local with devastating impacts on community health and livelihoods that undergird community disaster resilience. Weak health systems and community disaster resilience are both determinants and outcomes of the human dimension of disaster risk reduction (DRR).[1] As disasters are uncertain, greater efforts are needed to advance research on the role of public health in disaster risk so as to enhance disaster resilience policymaking and participation of disaster affected communities for improved adaptation.

At a global level, efforts to reduce the impact of disasters are embodied in frameworks such as the International Health Regulations 2005 (IHR),[3] the Paris Agreement on Climate Change,[4] the Hyogo Framework of Action 2005-2015 (HFA),[5] the 2030 Agenda for Sustainable

Development and the Sendai Framework for Disaster Risk Reduction 2015–2030 (Sendai Framework).[6] Literature suggests that, in the past 25 years, there has been an increase in global cooperation on DRR with successive global frameworks being developed to inform a government-led and coordinated DRM approach.[7] However, the role of health systems and public health in DRM had not been emphasised in previous frameworks until the Sendai Framework which brought a strong focus on the need to enhance the resilience of communities, and of health and social systems. Compared to its predecessor, the HFA, that only mentions health three times, the Sendai Framework references health more than 30 times.[6,8] At least four of its targets are directly linked to health, focusing on people's wellbeing, reducing mortality and injuries, early warning and promoting the safety of health facilities. The Sendai Framework also emphasises the need for improving the scientific evidence base for the concurrent advancement of health emergencies and DRM.

Along with these global efforts, other frameworks have emerged at the regional level further emphasising the need to strengthen health systems preparedness for adequate health sector responses to emergencies, such as the World Health Organisation DRM strategy for the health sector in the African region.[9] Furthermore, in 2019, the WHO published the Health Emergency and DRM framework (EDRM), again emphasising the need to save lives and protect health, the need for a multi-sectoral approach in health EDRM, and the need for community leadership in disaster responses. In particular, the health EDRM framework emphasises focus on the needs of vulnerable populations, including women, children, people with disabilities, older persons, migrants, refugees and displaced persons, and people with chronic diseases in DRM. Despite these efforts, the importance of health as a core dimension in disaster risk reduction, as emphasised within the Bangkok Principles,[10] has not yet been fully addressed.[1] Instead, there remain significant hindrances to communities' ability to achieve optimal development outcomes, including those related to public health. Among these obstacles is the discernible shift from valuing local community input to more technology-based DRM interventions,[11] and limited coordination with the health sector and between health and other sectors.[12] Thus, many communities have remained highly vulnerable to disasters.

Criticism has also been raised on the self-referential nature of the assessments of countries' progress towards achieving the objectives of key regional and global DRM frameworks. Dissenting views argue that countries' self-assessments have presented very little beyond what Baudrillard[13] (1983) called a subjective self-reinforcing hyper-reality in which perceptions of

country progress and achievement in DRM contrast with the lack of progress in addressing the underlying risk drivers at community level.[14] This contrast between perceived progress on the development of generic DRM policies and the lack of policies that speak to local realities, cultures, and communities[15] creates a scale discordance gap that is not unique to DRM but is also found in climate change and sustainable development discourse.[16] This observation supports calls for strengthening research and the evidence base for community supported DRR and resilience strengthening interventions. This study could help fill this lacuna.

DRM practitioners face a lot of uncertainties about the nature and occurrence of disasters, and interventions that are required to mitigate the adverse effects of disasters. These uncertainties may be due to limitations in existing methods of knowledge generation, dissemination, and uptake[17-19] which, in turn, limit the influence of health research on healthcare policy and practice improvement.[20] This study contributes to this important area of research by employing a multidisciplinary and multidimensional approach in investigating the implementation status and capacity for DRM in Malawi, using flooding in the Nsanje district as a case. The study places public health at the centre of community disaster resilience in line with the recommendations of the Sendai Framework.

2.3. Defining disaster risk management, community disaster resilience, and public health

2.3.1 Disaster risk management

Different disciplines have offered divergent views in their conceptualisations of risk. Social scientists, on one hand, have considered risk as a social construction, meaning that the understanding of risk requires knowledge of individual perceptions and social representations, and of the interactions between different social actors. On the other hand, natural scientists have adopted an objective view of risk based on the postulation that it can be quantified and objectively measured.[21] In addition, the applied sciences focus more on the effects of a disaster event than the event itself in their definition of risk, with this perspective often critiqued for its limited consideration of political, social, economic, and cultural factors that may inform risk. From the above conceptual frameworks, it is evident that there is need for an integrated understanding of risk to fully define the concept of disaster risk management.

In its technical review of terminology on disaster risk reduction, the UN defines DRM as the application of disaster risk reduction policies and strategies to prevent new disaster risk and reduce existing disaster risk, contributing to the strengthening of resilience and reduction of disaster loses.[22] This definition resonates with the current approaches to DRM as espoused in the Sendai Framework due to its focus on community-based approaches that promote the involvement of potentially affected communities in DRM. To include aspects of health in DRM, the WHO (2012)[9] has provided a definition of DRM for health as a multisectoral systematic analysis and management of health risks posed by emergencies and disasters, through a combination of (i) hazard and vulnerability reduction to prevent and mitigate risks, (ii) preparedness, (ii) response and (iv) recovery measures.

The UN and WHO definitions above capture both the quantitative and qualitative elements of DRM by accounting for all three actions of DRM, namely, prospective DRM (avoidance of new or increased risk), corrective DRM (reduction of disaster risk) and compensatory DRM (strengthening socio-economic resilience of individuals and communities).[6] This approach enhances understanding of DRM by rising above the antagonism that has long characterised the different conceptualisations of the concept. Thus, this study adopts the UN and WHO definitions by using a mixed and multidisciplinary approach covering all three actions of DRM for community disaster resilience.

2.3.2 Resilience

Defining DRM-related concepts requires that specific aspects of the phrases be clarified first. Thus, before defining the concept of community disaster resilience, it is important that this study present a working definition of the construct of resilience. Like other DRM-related concepts, there has been little consensus of the definition of resilience as different conceptualisations have emphasised aspects of the term that are important to their disciplinary approach[23] resulting in a blurred polysemous understanding of resilience. A review of the literature on resilience shows that although the term was first used in the natural sciences,[24] its application in the field of disasters emerged about half a century ago.[25] Holling (1973, p. 17) defined resilience as "a measure of the persistence of systems and of their ability to absorb change and disturbances and still maintain the same relationships between populations or state variables."[26] The concept of resilience is also seen emerging from an environmental perspective[27,28] in the ecological literature of the 1960s and the 1970s.[26,29] Later, many academic fields began drawing from this conceptualisation of resilience, including

geography[30-31], psychology,[32] sociology,[33] socio-ecological systems research,[29,34] and sociological disaster research.[35,36]

The challenge of pursuing a singular definition of resilience across all disciplines is that researchers must then accurately characterise and quantify resilience, which in turn, undermines the policy formulation, development, and implementation process. Many attempts have been made to provide a monosemous meaning to the resilience construct. For example, Martin-Breen and Anderies (2011) combined elements from the three interdisciplinary frameworks of engineering resilience, systems/ecological resilience and complex adaptive systems.[37] From an engineering perspective, resilience is defined as maintaining the status quo and as the ability to withstand a large disturbance without, in the end, changing, disintegrating, or becoming permanently damaged; to return to normal quickly; and to distort less in the face of such stresses.[38] The systems/ecological framework defines resilience as maintaining system function in the event of a disturbance,[26] while the complex adaptive systems perspective defines the term as the ability to withstand, recover from, and reorganise in response to crisis.[37] In the end, Martin-Breen and Anderies (2011) state that resilience should be defined and measured in terms of the capacity of the system to function despite external drivers (both shocks and directed change).[37]

African based researchers have recently added their voice to the growing list of offerings on the definition of resilience based on research conducted in different parts of the continent. The Resilient Africa Network (RAN)[2], a partnership of 20 African universities in 13 countries, developed a resilience framework for low-to-middle income countries and defined resilience as the capacity of people and systems to mitigate, adapt to, and recover and learn from shocks and stresses in a manner that reduces vulnerability and increases wellbeing.[39] There are two reasons why the RAN definition is adopted as a working definition for this study: (i) it captures the prospective, corrective, and compensatory actions of DRM as defined by the UN and WHO, and can therefore be considered to transcend disciplinary differences, and (ii) it is based on research conducted in the African region, including in Malawi, and therefore deemed contextually relevant to this study and in its potential application to other low-to-middle income countries. Having established a working definition of resilience, it is important to further define

[2] https://www.ranlab.org/

the concept of community disaster resilience with a focus on flooding, for measurement specificity purposes.

2.3.3 Community disaster and community flood resilience

Increasingly, DRM literature is putting a lot of emphasis on enhancing community resilience to reduce impacts of disasters.[40,41] Community disaster resilience (CDR) has become the cornerstone of hazard readiness and DRR in developed countries.[42] Community resilience is recognised by the United States of America's (USA) National Strategy for Public Health and Medical Preparedness, National Health Security Strategy and by the Department of Homeland Security as the critical component of public health, medical preparedness and national health security.[42] The developing world is also gradually coming to recognise the critical role of community resilience in disaster risk management. For example, the Malawi National Resilience Strategy (2018-2030) notes that as the impacts of climate change are felt locally, action to address them must engage those most affected by supporting and scaling up autonomous and planned adaptation.[43] Similarly, the Malawi National Community Health Strategy (2017-2022) underscores the importance of improving health service delivery in rural and urban communities as a way of improving health, resilience, and livelihoods.[44]

A community can be defined as a group identifiable by its socioeconomic, cultural, political, or ethnic makeup and bound by geography.[30] All communities are composed of "built, natural, social, and economic environments that influence one another in complex ways".[45] The concept of community disaster resilience speaks more precisely of a community's capacity to adapt to change, handle disruption, and respond in a positive and timely manner to emergencies, while continuing to sustain critical systems and maintaining the community's unique character.[30] In other words, a disaster-resilient community is better able to overcome adversity with temporary impairment to its social, economic, health, and security functions. Importantly, an understanding of community disaster resilience must be inclusive of the extent to which natural ecosystems are able to continue to support a community's economic and social welfare while successfully absorbing the influence of human activity.[46]

Given this definition of a disaster resilient community, this study establishes a clear functional definition of community flood resilience, links it to the DRM policy context in Malawi, and clearly articulates the scale (community level) and context (flooding) in which measurement is conducted. Prior and Haggmann (2013) posit that this approach assists with the development

of a measure of resilience that is fit for purpose.[47] To that end, the current study looks at disaster resilience from a community perspective and ensures specificity by focusing on community flood resilience, so as to conceptualise disaster resilience at community level.

This study adopted Bulti, Girma, and Megento's (2019) definition of community flood resilience, which is, the ability of a community and all its socio-ecological and socio-technical networks, across temporal and spatial scales, to maintain or rapidly return to desired functions in the face of flood events, to adapt to change, and to transform systems that affect the current and future adaptive capacity.[48] The rationale for the adoption of this definition lies in (i) its focus on a specific hazard (i.e., flood) which is a critical element of specificity in measurement, (ii) its conceptualisation of the concept of community as encompassing socio-ecological and socio-technical networks, which goes beyond the economic and physical indicators and, (iii) its focus on adaptation, a long-term concept including ex-ante (pre-flooding) preparedness and mitigation efforts[49] which are important for a comprehensive DRM approach in the context of funding scarcity[50] which is characteristic of Malawi's DRM funding landscape.

2.3.4 Public health

Public health is defined as all organised measures, whether public or private, for the prevention of disease, promotion of health and prolonging of life among the population. Its activities aim to provide conditions in which people can be healthy and they focus on entire populations, not on individual patients or diseases.[51] Activities aimed at strengthening public health capacities and services seek to provide conditions under which people can maintain and improve their health and wellbeing or prevent the deterioration of their health. Public health focuses on the entire spectrum of health and wellbeing, not only the eradication of diseases. Public health emergency preparedness has been described as "the capability of the public health and health-care systems, communities, and individuals to prevent, protect against, quickly respond to, and recover from health emergencies, particularly those whose scale, timing, or unpredictability threatens to overwhelm routine capabilities".[52] The inclusion of disaster 'prevention' reflects the public health perspective which is proposed here, whereas preparedness in 'emergency management' is limited to actions for anticipating and building response capacity.

A health system can be defined as "comprising all the resources, organisations and institutions that are devoted to producing interdependent actions aimed principally at improving, maintaining or restoring health".[51] Historically, the different aspects of disaster management

have been considered and discussed in isolation. However, the multi-disciplinary health systems approach to disaster management suggests that each component of a health system must have resilience to threats built into its structure. In this way, the whole health system can be strengthened to meet the demands of any type of disaster, enabling a coordinated, rapid and effective response and recovery.

2.4. The disaster risk management, community resilience and public health nexus

The nexus of DRM, public health and community disaster resilience can be conceptually considered as tied together by three observations; namely, (i) disasters are considered, first and foremost, in terms of their health consequences[14], (ii) adaptation to effects of disasters happens at community level where public health is strategically positioned[41], and (iii) reducing the effects of disasters and strengthening resilience require an increased focus on addressing underlying factors of risk and vulnerability.[53]

The public health impacts of flooding are well documented.[54] When disasters occur, they result is adverse effects on people's health, including injuries, mortality, psychosocial problems, population displacements, and loss of access to essential services which further exposes people to food insecurity (Makwana 2019).[55] Climate change induced disasters are argued to be causing a shift in the distribution of a vector-borne diseases. For example, it is argued that, as a result of flooding, malaria is already encroaching in areas hitherto alien to it including the highlands of Ethiopia, Kenya, Burundi, Rwanda (Caminade et al., 2014; Caminade et al., 2011; Chaves and Koenraadt 2010).[56-58] Worrisomely, it is expected that such the Sahel, East Africa as well as Eastern, Central and Southern Africa (Anugwom 2021).[59] These adverse effects of floods are worsened by poverty and incapacity of institutions, particularly those at community level to timely prepare for, mitigate, prevent and respond to disasters when they occur. As health status is a key contributing factor to the level of vulnerability and disaster resilience, it is therefore a major predictor variable for community development outcomes associated with DRM (Bergstrand et al., 2014).[60] These include livelihoods and economic development, which rely on a healthy, safe and secure workforce in the public, private and community sectors, community safety and security, and early childhood development and school attendance.[6] Table 3 is an illustration of the nexus between health and adverse climatic conditions.

Table 3 An illustration of the nexus between health and adverse climatic conditions

	Health Issue	Adverse Climatic/Weather Event
1.	Hypothermia	Cold
2.	Hyperthermia	Heat (including heat waves and heat stress)
3.	Famine	Droughts; Floods
4.	Internal Displacement	Floods; Drought
5.	Personal injuries	Floods; Hurricanes; Wildfires; Tornadoes
6.	Death (including drowning)	Floods; Droughts; Wildfires; Landslides
7.	Vector Borne Diseases (malaria; dengue fever; rift valley fever)	General adverse climatic conditions especially precipitation; floods;
8.	Food contamination and shortages (impact on nutrition and disease resistance)	General adverse climatic conditions especially precipitation; floods;
9.	Emerging Infectious Diseases (West Nile virus; Ebola; hantavirus)	General adverse weather and climate
10.	Cardiovascular and respiratory diseases	General adverse weather and climate

Specific health issue by adverse climatic/weather event (reprinted from Anugwom, E. E. Reflections on Climate Change and Public Health in Africa in an Era of Global Pandemic. 2021)

Incidentally, the direct impact of these disaster situations go beyond human health as there is now incontestable evidence linking weakened health systems and increased vulnerability which in turn undermines community disaster resilience (Frumkin, Hess and Luber 2008; Anugwom 2021).[59.61] It is predicted that due to heightened vulnerability in African compared to other continents, informed by poverty, weak institutions, weak governance and leadership, and conflicts (ClimaDev-Africa 2013),[62] African communities will suffer more pronounced health consequences related to climate change. As the effects of disasters are felt at community level where adaptation occurs, it is logical that planning for DRM should include improving and enhancing social and governance systems and processes that enable households, as groups, to better anticipate, prepare for, mitigate, respond and recover from disasters. To that end, available evidence suggests that beyond the physical infrastructure (built structures), human capital assets such as health conditions[63] (Weldegebriel and Amphune, 2017), gender[64]

(Llorente-Marrón et al., 2020), population pressure[65] (Donner and Havidán, 2008), and household interest in learning and practicing adaptive flood-based farming practices[66] (Nguyen and James, 2013), are key determinants of flood resilience.

In line with the realization for DRM to go beyond biomedical aspects of health is the need for a comprehensive framework for community disaster resilience. Such a framework would cover, as posited by Norris et al., (2008)[45], aspects of community economic development, social capital, social participation, community agency, availability of and easy access to information and communication and community bonds (ClimaDev-Africa 2013).[62] Such conceptualisation is important to this study as it captures community adaptive capacities as interrelated in their interaction at community level disaster resilience strengthening. With the forgoing arguments, public health practitioners and policy makers need to consider health as an important dimension of climate change and disaster resilience strengthening. Such consideration would entail the need to frame into public health planning, implementation, research and academic teaching, DRM and climate change adaptation in a multidimensional and interdisciplinary manner.

2.5. Community consultation in public health policy formulation and implementation

It has long been established that communities are knowledge generating and containing systems.[67] Using this knowledge, which can be common sense, experiential, transcendental, folk wisdom, and/or scientific, communities are able to conduct meaningful social life[68] and participate in priority-setting on issues affecting their health.[69] Community consultation is extoled and widely implemented as a means of improving the formulation and implementation of public policy and priority-setting[70-72] in various fields including public health. It is common to find terms such as ‘community engagement’, ‘community partnerships’, ‘bottom-up’ initiatives, ‘triple bottom line’ planning, ‘stakeholder input’ and ‘community reference groups’ referring to community consultation in the parlance of public policy and FRM.[73]

Social justice, equality, and participatory democracy form the theoretical basis for community involvement in policy formulation and implementation.[74,75] The conceptual and theoretical contributions of this body of literature suggest that in the domain of policymaking, there are “valuations that individuals make, in isolation or as part of a group, about what is important in their lives and the places they live…”[76] These values include health, e.g., access to welfare and a healthy lifestyle; safety, e.g., financial security and access to services; belongingness, e.g.,

social interactions and sense of belonging; esteem, e.g., being respected and having efficacy; and self-actualisation, such as freedom and work-life balance.[77]

In climate adaptation and environmental justice literature, fairness in adaptation relates to ensuring that policy responses to climate change do not place undue and unfair burdens on already vulnerable populations.[78] Following the fair adaptation argument, policymakers must ensure meaningful community participation in the development and implementation of DRM policies. If priorities set are reflective of balanced community input, communities are likely to understand national considerations,[69] improve alignment of DRM policies with national priorities and build trust between affected communities and government.[79,80] Evidence shows that such trust is critical for successful policy development and implementation.

Given this theoretical basis, community consultation is presented as a process through which community individuals and policymakers are perceived, and see themselves, as resourceful and active citizens who can engage with each other and collaborate on all matters concerning the wellbeing of their community.[81] Thus, engaging communities in FRM is considered important for ensuring that FRM initiatives are seen as fair, equitable and effective towards meeting the flood risk adaptation needs of the community in the long-term.[82] Following this argument, community consultation helps explain and clarify to policymakers the competing views, meanings, lived-values[76] and life-events as expressed by community members through their participation. However, even the proponents of genuine community participation are said to harbour fear of an uninformed citizenry or decisions based on inadequate opinion polling.[83,84]

In the context of public health, the 1978 Alma-Ata Declaration on Primary Care emphasised that people and communities have a right and responsibility to be involved in their health.[85] Recently, the Astana Declaration from the Global Conference on Primary Healthcare[86] further emphasised the need for communities' participation and involvement in the development and implementation of policies that impact their health and livelihoods. According to the WHO (2002), such participation is defined as "a process by which people are enabled to become actively and genuinely involved in defining the issues of concern to them, in making decisions about factors that affect their lives, in formulating and implementing policies, in planning, developing and delivering services and in taking action to achieve change."[87] The bottom-up approach implied in this definition is arguably informed by the realisation of how the social determinants of health inform the health outcomes of communities.[88] Thus, community

participation helps ensure that communities express their needs as informed by what they value the most and the perceived procedural[89] and distributive[90] fairness of the policymaking and implementation process.

CB-DRM approaches, including CB-FRM, with a strong element of community consultation have emerged[91] in Africa, where half of the population lives in rural areas, with many paradoxically reliant on floodplains and rivers for their livelihoods.[92] This is mainly because of the realisation that communities living in flood prone areas have a lot to lose when disasters such as flooding occur and also, they stand to benefit from FRM interventions if these are developed and implemented with their involvement. They have the greatest deal to lose when disaster strikes, but also the most to benefit from risk reduction activities;[93] thus, FRM is presented here as a quintessentially local affair, in the context where adaptation occurs. Local communities own a creative set of approaches based on local knowledge and that empowers them to live in flood-prone areas, in line with the paradigm shift from fighting floods to living with them.[94] Despite this promise, actual community consultation processes have been observed to have remained sub-optimal[73] and ineffective.[95]

In their report on ideas for community consultation, advance ten (10) principles for making community consultation work.[81] These are (i) making consultations open, fair, and subject to evaluation, (ii) timely, (iii) inclusive, (iv) community-focused, (v) interactive and deliberative, (vi) effective, (vii) matter, (viii) well-facilitated, (ix) cost-effective and (x) flexible. The principles of inclusivity, interaction, and deliberation relate to the importance of enhanced representation and the need to build deliberative capacity which is essential for ensuring citizens can participate in policymaking processes that are often highlighted as complex.[81] Search conferences,[96] deliberative polls/televoting,[97] citizens' juries,[98] consensus conferences,[99] focus groups,[100] charrettes,[101] residents' feedback panels[102,103] and role-playing[104] are some of the methods considered key for optimizing representativeness and creating deliberative spaces for effective community consultation.[81] However, the advantages and limitations of each of these approaches need to be considered against the local situation and context.[105] Neema et al., (2018) state that effectively consulting communities and seeking their opinions in an adequately representative and unbiased manner remains a challenge owing to the cumbersome nature of community consultation.[95]

A review of the literature on public participation in health care priority-setting found that there is a growing interest in deliberative approaches.[106] The main argument for deliberative approaches is that they are sensitive to the ethics and moral values of communities in priority setting processes, thereby assuring fair and equitable treatment of people.[107] To better understand and assess the level of community support for various flood mitigation policy options in Malawi, this study applied the deliberative polling® (DP) methodology.[108] The rationale for choosing the DP from a multiplicity of methods is that, unlike other methods, it:

- provides access to accurate, evidence-based considerations weighing for and against the proposed policy alternatives or proposed actions,
- engages representative samples to deliberate in-depth in controlled experiments to yield a picture of the public's considered judgments,
- allows for weighing of competing arguments on their merits.[109]

One of the present study's central concerns was the degree to which community knowledge and experiences, gained through consultations, are used in policymaking, particularly for those living in flood prone communities. Thus, the focus of the second objective of this study is on the nature of policymaking and how it impacts on livelihoods, lived values and the successful implementation of flood risk management (FRM) policies. The study further interrogates the top policy priorities supported by communities as part of adaptation to flooding, and what lessons can be learned from these community choices about the role of public health as communities face an uncertain future with disasters predicted to increase in both frequency and magnitude.

2.6. Community flood risk resilience measurement

Modern flood risk management (FRM) has focused on the twin concepts of strengthening community resilience and its measurement in response to inadequacies in the natural sciences' approach of flood control infrastructures.[48] As a result, several resilience measurement tools have been developed by different sectors based on their unique conceptualisations of resilience. The measurement of resilience benefits research by identifying gaps, choosing context specific intervention pathways, monitoring, and evaluating progress towards addressing the identified gaps.[110-114] It is therefore important that community resilience to flooding and its measurement tools and approaches have empirical basis to increase the impact potential of resilience interventions.

Despite this clear need for community and flood resilience measurement, there is still no standardised framework for defining measurements and metrics or a method for determining what needs to be assessed.[115] The findings of several studies indicate that disaster resilience can be measured using diverse approaches.[50,116,117,118] Although the above-acknowledged studies have provided insight into the characteristics of resilience measurement tools, attempts to review resilience measures focusing on specific hazards are limited.

Two major factors have been identified as reasons for the difficulty in measuring community resilience, namely:

- resilience, being a latent concept, is only discovered during times of tragedy,[120] and
- the characteristics of the community, prior to a disaster, that influence this latent construct depend on many interacting variables (individual, household, community, etc.) that are difficult to measure.[113] Therefore, the challenge lies in measuring disaster resilience which involves identifying and measuring these latent community characteristics before an event to better understand how this complex latent construct is shaped.[115]

In addition to these challenges,[115] note that while quantitative analysis of disaster resilience indicators has been conducted at household and country levels,[121] there is little analysis of resilience indicators at community level.[115] This is mainly due to the following factors:

- collecting consistent data for many communities, which is necessary for drawing generalised conclusions, is a resource-intense undertaking,[115]
- work at the community level requires engagement with many stakeholders within and outside the community, which could be cumbersome,[115]
- by focusing on short-term, direct impacts, donors and governments largely ignore engagement tools and participation methods at the local level,[49]
- As resilience is informed by multi-dimensional capitals such as physical, social, financial, institutional, etc., and it is difficult to decide which component exactly leads a particular community to resilience.[122-123]

In their paper on reconceptualising DRM phases, Bosher, Chmutina and van Niekerk (2021) capture two aspects that may have shaped our current understanding of resilience contributing

to the current challenges with its measurement.[124] The authors problematise the limited DRM scope by focusing on the four phases of a disaster cycle (prevention, mitigation, response and recovery) and argue for an expanded scope to include socio-economic and political factors of vulnerability and increased disaster risk. They also challenge the linear cause-effect relationship within the DRM cycle and argue for an improved application of systems thinking and the role of complex systems and their interaction. Broadly, these theorists argue that a holistic concept of resilience is needed for a better understanding of the interrelations between human, financial, natural, social, and physical systems – an argument akin to the one made by Keating et al. (2014)[122] and Cumming et al. (2005)[123] above. The current conceptualisation of DRM is critiqued for ignoring the dynamics of human, social, and environmental functions which leads to suboptimal and unsustainable solutions that may in fact increase disaster risk in the long term.[124] Therefore, the argument being made here is that a systematic assessment or measurement of the multidimensional latent construct of resilience requires an inquiry into the multiple community interactions and functions that help disaster prone communities to manage disaster resilience at community level.

Despite the resilience measurement challenges noted above, Keating et al. (2017)[113] and Campbell et al. (2019)[125] argue that the measurement of community disaster resilience is the first necessary step in understanding the key capacities that are needed for disaster resilience and the challenges in building them. Therefore, public health must make its own contribution to these efforts through comprehensive research that integrates all the elements of health, including the social determinants of health as presented in this study. The community capitals approach supports this proposal by linking disaster resilience to community development and assessing development beyond the limited quantitative economic perspective.[113,126] By furthering this approach, this study acknowledges, at the outset, that community capitals and their interactions cannot be limited to an economic assessment of the effects of disasters, but require a comprehensive assessment of the contribution of all capitals to resilience and the adverse effects of disasters on them. Thus, the community population health or wellbeing impact of disasters needs to be holistically conceptualised as it is based on the multifunctional nature of community capacities and their recursive interactions that construct lived values through which community resilience to disasters such as flooding is strengthened.[45,127]

In addition to adopting this multifunctionality approach to community flood resilience measurement, this study also adopted Bulti, Girma, and Megento's (2019) definition of

community flood resilience, as discussed above.[48] The rationale for the adoption of this definition and its appropriateness for this study inheres in its focus on a specific hazard, which is essential for measurement, its conceptualisation of community as a complex adaptive and knowledge generating system through which meaningful social life is conducted and, as indicated above, its inclusion of the multidimensional aspects of community capitals in resilience measurement. By analysing resilience focused on flooding in two communities, this study brings specificity to community identified needs that are specific to flooding. This study provides evidence for improved understanding of how resilience measurement can be operationalized in the context of flood hazards. This contribution is essential in the context of increasing interest on resilience based FRM.[128]

Given the above synopsis of community resilience and flood resilience measurement, the central aim of the third objective of this study was to measure community flood resilience and investigate the factors associated with it. Specifically, the study sought to (i) identify the factors that dichotomise the more resilient and less resilient groups within two flood prone communities and (ii) identify those factors that are essential in shaping the resilience of these communities to flooding. This is important for policymakers, government and other DRM stakeholders as the study closes key knowledge gaps which will help the identification of intervention pathways that can strengthen the resilience of affected communities for improved health and wellbeing.

2.7. DRM in the African region

The African region is affected mostly by hydro-meteorological disasters[129] with floods occurring more frequently at increased magnitude, particularly along the major river systems.[130] Floods have devastating socio-economic impact on the affected countries and communities. The World Bank estimated that flood-induced damages constitute between 2% and 15% of an exposed country's GDP.[130] Examples of disasters of hydro-meteorological origin in the African region include the 2019 cyclone Idai that affected most of Southern Africa, the large cholera outbreak in Zimbabwe in 2008 which resulted in more than 11,000 cases and high mortality, the 2009 Horn of Africa drought that affected about 23 million people, and the 2010/2011 floods across nine Southern African countries that affected about 150,000 people and destroyed farmlands, housing and social infrastructure including health facilities.[9] According to the World Bank (2010),[130] the cost of natural disasters could be reduced by US$280 Billion if US$40 Billion was invested in disaster prevention.

Despite the devastating socio-economic effects of these disasters and evidence showing that investments in disaster prevention could result in huge savings that could be channelled towards economic development, the development of national DRM governance, institutional frameworks and policies remained a patchwork[9,131] for a long time. However, the World Bank (2019) notes that there was significant improvement in the establishment of DRM frameworks between 2010 and 2020.[132] For example, there was significant increase in the development of policies that incorporated disaster risk reduction in Malawi between 2012 and 2017,[132] including a national health policy (2017) incorporating issues relating to social determinants of health and resilience. The remaining challenges to full operationalisation of these established structures are financial backing, political will, disaster risk skills development, poor coordination and communication.[129]

At the Africa regional level, the African Union developed the Africa Regional Strategy for Disaster Risk Reduction and its associated Programme of Action to guide DRM implementation.[133] The strategy provides high level strategic interventions that regions and countries can implement based on their context. Further, the strategy states that African Regional Economic Communities (RECs) should establish sub-regional risk reduction platforms and focal points and calls on national governments to lead the process of developing risk reduction capacities and integration of DRR into sustainable development.

Malawi, the focus country for this study, is located in the Southern African Development Community (SADC), one of the African RECs. The SADC subregion was the first African regional economic community to draft a disaster risk reduction strategy.[134] Developed in 2001, the strategy was reviewed in 2006 and again in 2011 to align it with the priority areas and objectives of both the Hyogo Framework of Action (2005-2015) and the Sendai Framework (2015-2030). The regional bloc has not yet developed a disaster risk management protocol.[3] The current SADC disaster risk reduction programme has three pillars, namely, strengthening disaster risk reduction coordinating capacity; strengthening disaster risk reduction information management systems; and building response capacity. In terms of mainstreaming health in DRM, the SADC region has a Protocol on Health of 1999.[135] The protocol encourages Member

[3] https://www.sadc.int/themes/disaster-risk-management/ Accessed 26 May 2020

States to cooperate and assist each other in DRM coordination, facilitate DRM implementation and ensure cooperation and assistance with emergency services.[135]

Based on its own assessment, the SADC Secretariat acknowledges that the main challenges for DRM implementation in the region include under-funding and lack of coordination, lack of comprehensive and constantly updated risk assessments and analysis, weak information and knowledge management systems, specifically in high-risk areas, and the need to reduce underlying risk factors.[135] Further, the regional body notes that small, recurrent, disaster events cause more damage to communities, cumulatively, compared to large scale events, as they give little to no time for recovery from the previous event. This is particularly applicable to Malawi, generally, and to Nsanje district, specifically, where floods are slowly becoming annual episodes.[136]

2.8. The evolution, structure and practice of DRM in Malawi

2.8.1 History of disasters in Malawi

Malawi is commonly impacted by natural hazards, such as prolonged and frequent droughts and floods.[137] Droughts and floods have been major causes of the country's fluctuating food production, income, and overall national and household consumption.[138] Since Malawi is a predominantly rural country (85%),[139] agricultural hazards present a major threat to people's lives, public health and the general economy of the country. Malawi has experienced various kinds of disasters since the 1940s.[140] Table 4 provides a chronology of notable natural disasters that occurred in Malawi between 1970 and 2019. It also provides the number of people estimated to have been affected and the response from government and other actors following each disaster.

Table 4 Chronology of notable natural disasters in Malawi between 1970 and 2019

Period	Nature of disaster	Number of people affected	Government and stakeholders' response
1970 to 1981	Flooding	10,300 people	Food distribution
1986 to 1988	Influx of Mozambican refugees	1,2 million refugees	The Malawi government and the United Nations High Commission for Refugees (UNHCR) signed agreements which led to the

			establishment of UNHCR offices in the country
1986	Mealy bug infestation	10,000 farmers	The government responded by providing food to impacted farmers
1986 and 1987	Measles outbreak	7 deaths	Families were encouraged to take children to healthcare clinics for immunisation
1991	Flash floods	128,140 people affected, over 8,000 rendered homeless and 500 deaths	Food distribution These flash floods were the impetus for the development of legislation to address disasters in Malawi
1991 to 1992	Drought	Approximately 6 million people affected	Food distribution New wells were dug while previously existing wells were rehabilitated
1996	Hailstorm	353 households were affected	Provision of food aid and blankets
2001-2002	Erratic rain season	Impacted approximately 3 million people	Food aid donations received from international donor organisations
2003/2004**	Drought	Affected more than 6 million people	Provision of food aid
2005	Armyworm infestation	Impacted approximately 16,000 farmers and their families	The government sprayed insecticide on the affected farms
2009	Cholera outbreak	2,498 people affected	Emergency support received from international NGOs

2009*	Karonga earthquake	215,428 people affected	Emergency shelter, food, health and other services provided through government coordination
2015**	Floods	Affected 1,101,364 people	Government declared a national state of disaster Food distribution and cash vouchers from government and international partners
2019**	Cyclone	975,600 people affected	Government declared a national state of disaster Food distribution and cash vouchers from government and international partners

Source: Adapted from Raymond Misomali; *UN Office of the Resident Coordinator; **GOM

Table 4 above shows that the Malawian government is responsive to the disasters the country faces and the impact thereof on the lives of citizens. Some of the recorded health-related effects of these disasters included damage to public and private infrastructure, increased morbidity, loss of lives, household asset and livelihoods losses and resulting poverty, increased cases of diseases such as cholera and malaria, water scarcity, and limited access to hygiene and sanitation, among others. Despite the recurring disasters, the country and its stakeholders maintained a generally responsive approach. This reflects what Bosher et al., 2021 have called a cyclical process of actions in which DRM actions always follow a disaster and result in another disaster.[124]

2.9. Malawi's DRM legal framework

Prior to 1991, Malawi did not have an official disaster response programme.[140] Until then, the response of government to disaster was *ad hoc*. It appears the recurrence of crises and disasters played a role in disaster management. When a disaster struck, the government acted mostly by declaring a national disaster and requesting assistance from development partners and other players. The attitude towards disasters was arguably fatalistic; perceiving disaster as part of

nature's order, something that had to be accepted as part of life. Consequently, management of such events was not seen as part of government's proper role. In 1991, following the Phalombe floods, the Government of Malawi (GOM) passed the first piece of disaster legislation; the Disaster Preparedness and Relief Act of 1991. The 1991 Act set in motion the first comprehensive, countrywide system of disaster response and relief. The establishment of the Act resulted in five (5) key developments, namely:

- the Act created the Office of the Commissioner for Disaster Preparedness, Relief and Rehabilitation, whose chief executive is responsible for fulfilling emergency relief programmes within the country.
- the legislation established a National Disaster Preparedness and Relief Committee, consisting of high-level administrative heads of departments. Additionally, the Act provided for three to five non-governmental organisation participants to be appointed to serve on the National Disaster Preparedness and Relief Committee. During times of national emergency or disaster, additional non-governmental organisations may be "co-opted"[140] to participate in the committee.
- the third prominent element of this Act was that it outlined the process by which the President could declare a state of disaster.
- fourth, the Act enabled the establishment of a fund for disaster preparedness with parliament being responsible for allocating money for the fund. It also contained a provision for private donations and donations from foreign governments, international agencies, and/or other foreign bodies.
- finally, the Act enabled the establishment of a local disaster response mechanism, the Department of Disaster Management Affairs (DoDMA), creating a regional and community level disaster response system.

By establishing a local response framework, the Act empowered those who would most likely be impacted by a disaster to appropriately prepare for, and respond to, a hazard impacting their community. Developments post the 1991 Act show that the Government of Malawi has not only sought to enhance its disaster policies, but it has also ensured that reducing disaster risk is a major priority within the country. At the time of writing, the Government was in the process of enacting a Disaster Risk Management (DRM) Bill to replace the 1991 Act, focused on enhancing the governance, coordination, and implementation of DRM programmes. From a

legal framework perspective, Malawi has demonstrated commitment to moving along the path of disaster risk management – what the WHO calls "*managing risk, not crisis.*"[9]

2.10. Malawi's DRM policy and institutional coordination arrangements

Malawi's DRM policy landscape has been shaped by international frameworks, including the Kyoto Protocol (1992), the African Strategy for Disaster Risk Reduction (2004), the Hyogo Framework for Action (2005) and the Sendai Framework for Disaster Risk Reduction (2015). These frameworks informed the formulation of Malawi's overarching development planning document, the Malawi Vision 2020, which continues to be implemented through the Malawi Growth and Development Strategies (MGDS) I (2006- 2011); II (2011-2016) and III (2017-2022).

Notwithstanding government efforts to operationalise the Disaster Preparedness and Relief Act (1991) after its adoption, the 2006 Malawi Growth and Development Strategy I and the National Adaptation Programmes of Action (NAPA) represent the first efforts (after 15 years) at developing and implementing a concrete programme for mainstreaming DRM into all sectors and at all levels of planning (i.e., village, area, district and national). Despite development of the NAPA and MGDS, it was not possible to operationalise them without a coherent framework that guides the mainstreaming of DRM in the country which only came nine (9) years later in the form of the National Disaster Risk Management policy (NDRM) (2015).

In 2015, Malawi developed the NDRM policy which has six priority areas and ensures that the country meets its commitments to the HFA, the Africa Regional Strategy for Disaster Risk Reduction, the SDGs and the MGDS III (2017-2022). The six priority areas are:

- Mainstreaming disaster risk management into sustainable development
- Establishment of a comprehensive system for disaster risk identification, assessment and monitoring
- Development and strengthening of a people-centred early warning system
- Promotion of a culture of safety, and adoption of resilience-enhancing interventions
- Reduction of underlying risks, and
- Strengthening preparedness capacity for effective response and recovery.

In the period leading to, and immediately following the adoption of the NDRM policy, Malawi had tried to enhance its DRM policies. The priority accorded mainstreaming DRM into all sectors of the economy is evident in the country's Millennium Growth Development Strategies which has DRM as one of its focus themes and, as noted by the World Bank (2018),[141] through the growth in the number of resilience focused strategies and policies between 2012 and 2017. DRM-related policies and strategies developed during this period include the National Social Support Policy (2012), the National Climate Change Investment Plan (2013-2018) (2013), the National Adaptation Program for Action (Revised, 2015), the National Disaster Recovery Framework (2015), the National Climate Change Management Policy (2016), the Malawi Growth and Development Strategy III (2017–2022) (2017), the Agriculture Risk Management Strategy (2017-2022) (2017), the Disaster Risk Financing Strategy and Implementation Plan (2019-2024) and the Malawi National Resilience Strategy (2018-2030). However, as noted by Dewa et al., (2021),[142] and in line with the findings of the mid-term review report of the HFA,[143] while significant progress has been made at the policy and legal institutional framework levels, there is a significant gap between national and local level action. Most intended outcomes of these policies remain unmet due to inadequate financing.[142,144]

On the institutional coordination front, the GOM has established institutional arrangements that implement the Disaster Preparedness and Relief Act (1991). The Office of the President and Cabinet, through the National Disaster Preparedness and Relief Committee, directs the Department of Disaster Management Affairs (DODMA) and supporting technical committees to coordinate the implementation of disaster risk management at national level. The Vice President of the Republic of Malawi is the Minister Responsible for DODMA and coordinates and directs the implementation of disaster risk management programmes in Malawi. DoDMA is strategically placed within the Office of the President and Cabinet to coordinate DRR and serve as the Secretariat of the National Disaster Preparedness and Relief Committee (NDPRC). It is also well connected with the international DRR system.

The NDPRC comprises Principal Secretaries of all line ministries and departments, the Malawi Red Cross Society, four NGOs and UN agencies which are co-opted when need arises.[145] The committee provides policy direction for the implementation of DRM programmes in the country and reports to Cabinet. It is chaired by the Chief Secretary to the Government. The Humanitarian Country Team (HCT) is also part of the DRM structure and comprises Heads of

UN Agencies, international and local NGOs, Government, and the Malawi Red Cross Society. This team is chaired by the United Nations Resident Coordinator (UNRC).

Figure 2.1 is an illustration of the institutional arrangements for disaster risk management in Malawi.

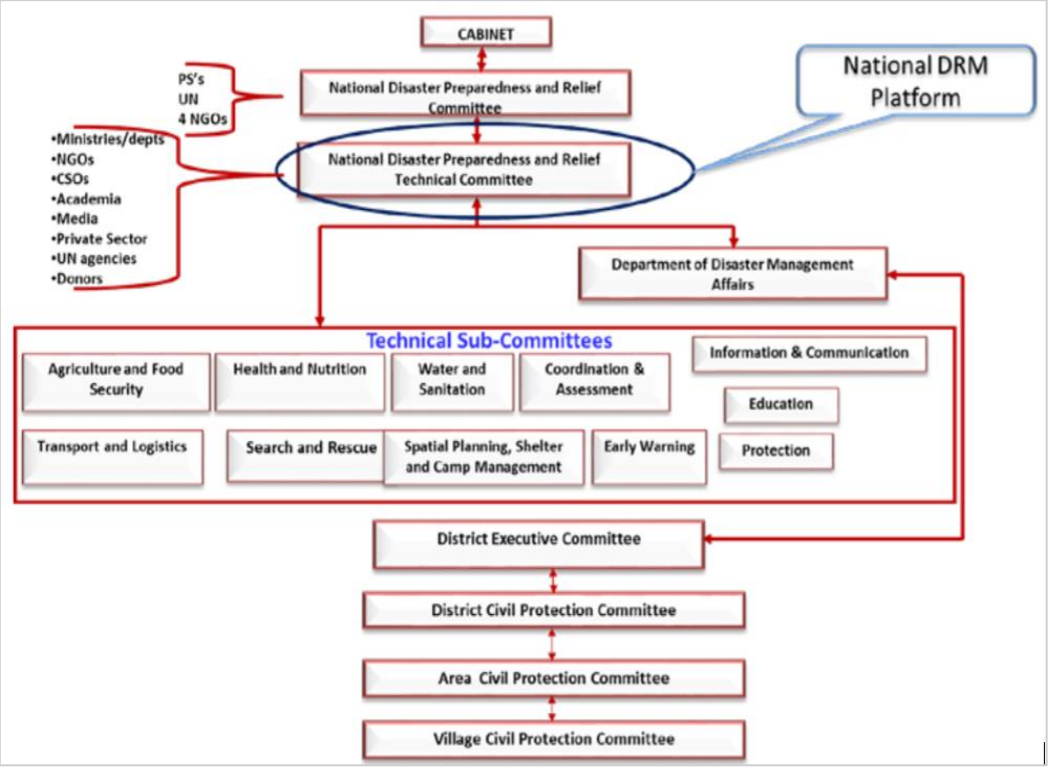

Figure 4 Institutional arrangements for disaster risk management in Malawi

Source: Government of Malawi - National Disaster Risk Management Policy (2015)[145]

Ten clusters were activated to ensure better coordination for disaster assessment and emergency response at operational level. These clusters are coordination, communication, and assessment; Food Security; Agriculture; Water and Sanitation; Health; Nutrition; Education; Shelter and Camp Management; Protection; and Transport and Logistics. The clusters are led by government and co-led by UN agencies and the Malawi Red Cross Society, and most developed response plans to address the 2015 flood response. In the districts, coordination is through the District Executive Committees and Civil Protection Committees at district, area, and village levels.

2.11. DRM Public Financial Management

The Malawi Public Finance Management (PFM) Act (1999), as amended, sets the overarching framework for PFM in Malawi.[146] The Act legally mandates the Ministry responsible for Finance to manage public finances and be the principal financial advisor to the Ministries, Departments and Agencies (MDAs) in the country. In accordance with section 24 of the Act, the Minister of Finance, Economic Planning and Development (MoFEPD) manages and presents the Vote for Unforeseen Expenditure to the National Assembly with a proposed appropriation not exceeding two percent (2%) of the total national budget.[146] The Minister may use funds from the unforeseen expenditure vote in exceptional circumstances (including disasters) upon Cabinet approval. In the event of a disaster, the Minister transfers funds to the nominated Vote of Unforeseen Expenditure such sum or sums as he considers necessary up to but not exceeding the amount of the balance from time to time available in this vote.[146]

The Local Government Act (1998) authorizes local authorities to mobilise resources for discharging any function of the local authorities. The Act mandates the MoFEPD to disburse at least five percent (5%) of the national budget to local authorities in line with the National Local Government Financing Committee approvals.[146] However, most local authorities receive under two percent (2%) of the funds due to fiscal constraints at central government.[146] This, in addition to limited ability to raise their own resources and partial decentralization, means that local governments typically fail to meet costs resulting from disasters.

2.12. Conclusion

The presentation of the literature review above was done to capture salient aspects of the three objectives of this thesis. It provided definitions of key aspects such as DRM, public health and resilience which was important to situate these terms in the context of this study. The nexus of public health, DRM and community disaster resilience was elucidated with evidence calling for public health practitioners and policy makers to consider health as a central element in climate change adaptation which will result in strengthened resilience to disasters. It also highlighted the need to go beyond biomedical aspects of health to consider the social, governance, political, economic, gender, among others, in the development and implementation of DRM policies.

Aspects of community resilience measurement were also problematized with various theoretical and conceptual frameworks for resilience measurement being presented. It has

shown a dearth of community level resilience measurement as a major challenge for adaptation to climate change and identified that as an area for further research and conceptualisation.

Another important aspect to emerge from this literature review if the conceptualisation and conduct of community consultation, particularly when dealing with rural communities living in disaster prone areas. This section pointed to evidence presenting community consultation as a key in ensuring successful development and implementation of DRM policies. However, it also pointed out at the challenges that are still associated with the question of how to conduct such community consultation.

While the study is focused on Malawi, a review of the status of DRM capacity and implementation status would not have been enough without providing context at the African regional and SADC levels. The review of literature therefore included an overview of institutional, policy and legislative frameworks at those levels and revealed that there is so much progress at this high level that is not matched with operationalization at the community level where adaptation to disasters occur.

This review of literature is important as it provides the background needed for the following sections of this thesis and particularly so for the last chapter which ties together the three studies that, put together, constitute this thesis.

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CHAPTER 3

ASSESSING CAPACITY AND IMPLEMENTATION STATUS OF THE DRM STRATEGY FOR HEALTH IN MALAWI AT NATIONAL AND DISTRICT LEVELS

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CHAPTER 3

Introduction

This chapter forms the initial stage in the assessment of DRM capacity and implementation status in Malawi. The aim was to assess capacity and implementation status of the DRM Strategy for Health in Malawi at national and district level. The chapter, therefore, reveals the structural arrangement of DRM in Malawi, the funding arrangements and using the policy triangle analysis, the DRM actors, content, and processes. It also identifies strengths and challenges in the operationalisation of the DRM Strategy for Health in the country with a particular focus at district level.

3. ASSESSING CAPACITY AND IMPLEMENTATION STATUS OF THE DISASTER RISK MANAGEMENT STRATEGY FOR HEALTH AND COMMUNITY DISASTER RESILIENCE IN MALAWI

Abstract

Floods are among the most frequently occurring natural hazards in Malawi, often with public health implications. This mixed methods study assessed the capacity for and implementation status of the disaster risk management (DRM) strategy for the health sector in Malawi, using flooding in the Nsanje District as a case. Data were collected using desk review and a workshop methodology involving key officials from government ministries, national and international development partners, and the academia. The results show that Malawi had recently strengthened its DRM institutional frameworks, with a pronounced policy shift from reactive to proactive management of disasters. Health sector personnel and structures were key contributors in the design and implementation of DRM activities at all levels. Development partners played a significant role in strengthening DRM coordination and implementation capacity. Lack of funding and the limited availability, and often fragmented nature, of vulnerability and risk assessment data were identified as key challenges. Limited human resource capacity and inadequate planning processes at district level impeded full implementation of DRM policies. These findings call for community-level interventions for improved coordination, planning, and human resource capacity to strengthen community disaster resilience and improve public health. The approach used in this study can serve as a model framework for other districts in Malawi, as well as in other low- and middle-income countries in the context of Sendai Framework implementation.

Keywords Community disaster resilience, Disaster risk management, Health, Malawi, Policy

1. Introduction

Global disaster statistics for 2001–2018 revealed staggering economic damages at about USD 2 trillion and over 300,000 fatalities because of water-related disasters (Lee et al. 2020). Evidence suggests that these disasters will continue to increase in both magnitude and frequency (Phillips et al. 2015). Flooding is estimated to account for 40% of all natural hazard-related disasters worldwide causing about half of all deaths (Noji 1991; Ohl and Tapsel 2000). Notable and relatively recent water-related disasters include the tsunami in Southeast Asia in December 2004 (Ahern et al. 2005), cyclone Harold that hit Pacific countries during the COVID-19 emergency in April 2020, and Japan's Typhoon Hagibis in 2019 (Ishiwatari et al. 2020). The African region is struck annually by natural hazard-related and human-made disasters, with direct and indirect impact on mortality, the disease burden, and health care delivery. For example, the 2010/2011 floods in Southern Africa affected about 150,000 people across nine countries and destroyed farmlands, housing, and social infrastructure including health facilities (WHO 2012).

The ability of communities to adapt to change, handle disruption, and respond positively and timely to emergencies in a manner that reduces impairment to its social, economic, health, and security functions, conceptualized as community disaster resilience (Cutter et al. 2008), is undermined by disasters such as floods. Nirupama (2013) argues that the effects of disasters could be significantly reduced if countries and communities identified, processed, and analyzed threats due to hazards, understood people's vulnerability, assessed resilience and coping capacities of communities, and developed proactive strategies for future risk reduction—a process called disaster risk management (DRM). Aitsi-Selmi et al. (2015) further argues for the mainstreaming of health in DRM efforts as a way of addressing health inequalities and vulnerabilities that expose, mostly the poor, to the adverse effects of disasters such as flooding. A growing body of literature has, in many instances, established the nexus of health and disasters (Lechat 1979; Korteweg et al. 2010). These include disasters' clinical and public health impacts (Lechat 1979; Korteweg et al. 2010), disaster epidemiology application (Malilay et al. 2014), emergency management and public health interactions (Clements and Casani 2016), and the role of public health in mitigating disaster risks (Shoaf and Rottman 2000). Despite this evidence, the centrality of health to mainstream disaster risk reduction (DRR) policies and practices has often not been recognized. Efforts to integrate health into DRR programs are reportedly scarce (Murray 2014), with the health sector maintaining a narrower clinical focus (Waring and Brown 2005).

Recognizing this gap, the World Health Organization (WHO) developed a DRM strategy for the health sector (WHO 2012), which in its preamble, recognizes health as the heart and missing link for effective DRM in the African region. The adoption of this strategy by WHO African Member States catalyzed the recognition of the centrality of the health sector in the management of disasters. Three years after the adoption of the WHO strategy, the Sendai Framework for Disaster Risk Reduction 2015–2030 (the Sendai Framework) further strengthened the need for integrating health in disaster risk responses. The strong emphasis on health in the Sendai Framework is demonstrated by its more than 30 explicit references to "health" in the document whereas its predecessor, the Hyogo Framework of Action 2005–2015 (HFA) mentioned "health" only 3 times (Maini et al. 2017). This focus on health was to ensure improved population health by linking individuals, systems, and communities with each other throughout the stages of a disaster, a concept called community health resilience (Wulff et al. 2015; Maini et al. 2017).

Almost a decade after the adoption of the WHO DRM strategy for the health sector, there are currently no publicly available assessments of DRM country capacity and implementation status against the nine targets set by WHO (Table 5). Using a consultative workshop methodology (Ørngreen and Levinsen 2017; Ahmed and Asraf 2018), participants from the government of Malawi (GOM), international and local development partners, and academics in Malawi were brought together at both the national and district levels to assess Malawi's capacity and the status of implementation of the WHO DRM Strategy for Health. This study's findings may inform not only future assessments in other districts of Malawi but could also serve as a model for low- and middle-income countries, particularly those in the African region, seeking to conduct similar exercises in the context of Sendai Framework implementation.

Table 5 World Health Organization (WHO) disaster risk management (DRM) strategy for the health sector targets and how they are linked to the domains of the WHO Country Capacity Assessment tool adapted for data collection for this study

WHO DRM Strategy Targets		**Linkage with the WHO Country Capacity Assessment Domains**
By the end of 2014 all Member States in the African region would have:		
(1)	Identified, assigned responsibility to, and equipped a unit in the MOH to coordinate the implementation of DRM interventions for the health sector;	Ministry of Health (MOH) coordination
(2)	Established functional health sector subcommittees in national multisectoral coordination committees on DRM;	Health sector coordination mechanisms
(3)	Incorporated DRM into their national health legislation, national health policies, and health sector strategic plans;	Institutional framework (policies, strategies, and legal frameworks)
(4)	Conducted health disaster risk analysis and mapping in a multisectoral approach.	Health emergency risk assessment and information management
By the end of 2017, at least 90% of Member States in the African region would have:		
(1)	Instituted a preparedness planning and management process that includes plan development, pre-positioning of essential supplies, resource allocation, simulations, evaluations, and annual updating based on all risks prevalent in the country;	Response and recovery operations readiness
(2)	Incorporated emergency and disaster early warning, preparedness, response, and recovery indicators into the national surveillance and health information systems;	Surveillance and information management
(3)	Instituted health facility and community resilience building, and preventive interventions based on disaster risk analysis and mapping;	Community support interventions
		Information, education, and communication
		Human resources
(4)	Established emergency and disaster response and recovery operations, based on national standard operating procedures, and capable of supporting cross-border interventions.	Response and recovery planning
By the end of 2022 all Member States in the African region will be fully implementing all the interventions of the Regional Strategy.		N/A

Source WHO (2012)

1.2. Context of the Study

Floods and droughts are the most frequently occurring natural hazards in Malawi, accounting for an annual GDP reduction of about 1.7% (GOM 2019a). Malawi's long history of weather-related disasters is also associated with poor health services and outcomes. For example, following the 2015 floods that affected 1,150,000 people, displaced 336,000, and killed 104 (GOM 2015a), the country experienced a surge in cases of malaria (23.1%), eye infection (8%), skin infection (39.9%), acute respiratory infection (19.9%), and diarrhea (18.2%), compared to a baseline year of 2013–2014 (GOM 2016). In addition, the floods damaged health facilities, available medical supplies failed to meet increased demand, and affected areas recorded high health worker absenteeism as staff homes were affected (World Bank 2015). In Nsanje District, which has an HIV prevalence of about 16% among the adult population, people lost their health passports in the 2015 floods, facilities experienced HIV drug stockouts, and many patients were out of treatment for up to two weeks (UNDRR 2015). The WHO DRM Strategy for Health seeks to improve the healthcare sector's management of disaster risks, including the implementation of resilience building in health facilities and at community level (WHO 2012), an approach that has become even more relevant in the face of the recent COVID-19 pandemic with its attendant impact on health systems (Dzinamarira et al. 2020). The WHO DRM Strategy for Health sets nine targets (Table 5) for Member States to achieve by 2022 towards its full implementation.

Malawi is also a signatory to the International Health Regulations (IHR) 2005, which is a legally binding instrument requiring countries to develop, strengthen, and maintain the capacities to detect, assess, notify, and report public health events. Following the adoption of the DRM strategy for the health sector by WHO African Member States, Malawi made great strides in institutionalizing DRM as evidenced by the focus on reducing the socioeconomic impact of disasters in the Malawi Growth and Development Strategy (2012–2016) (MGDS) and the subsequent development of the country's DRM policy in 2015. In general, DRM focus had reportedly shifted from response and recovery to DRR (GFDRR 2014). Similarly, and as evidenced by the Malawi National Resilience Strategy 2018–2030, Malawi's DRM policy shifted from response and recovery towards the current focus on community resilience and early warning (GOM 2019c). However, only limited information is available on the actual shift in practice or the extent to which the policy has been implemented in Malawi, particularly at district and lower levels where adaptation to disasters occurs. Hence, this study

sought to address the limited availability of information on the structural and institutional readiness for DRR in Malawi.

1.3. Study Areas

This study was carried out in Malawi with national level assessments conducted in the country's capital city, Lilongwe, and district level assessments conducted in Nsanje, the southernmost district of Malawi (Fig. 3.1). Nsanje lies in the Lower Shire River Valley, with the Shire River in the north and the rest of the district bordering Mozambique. The district covers an area of 1,942 km^2 and has a population of 299,168 inhabitants. Nsanje has an estimated average terrain elevation of 241 m above sea level, with some hills in the southern-western part of the district rising to 610 m above sea level (GOM 2017a).

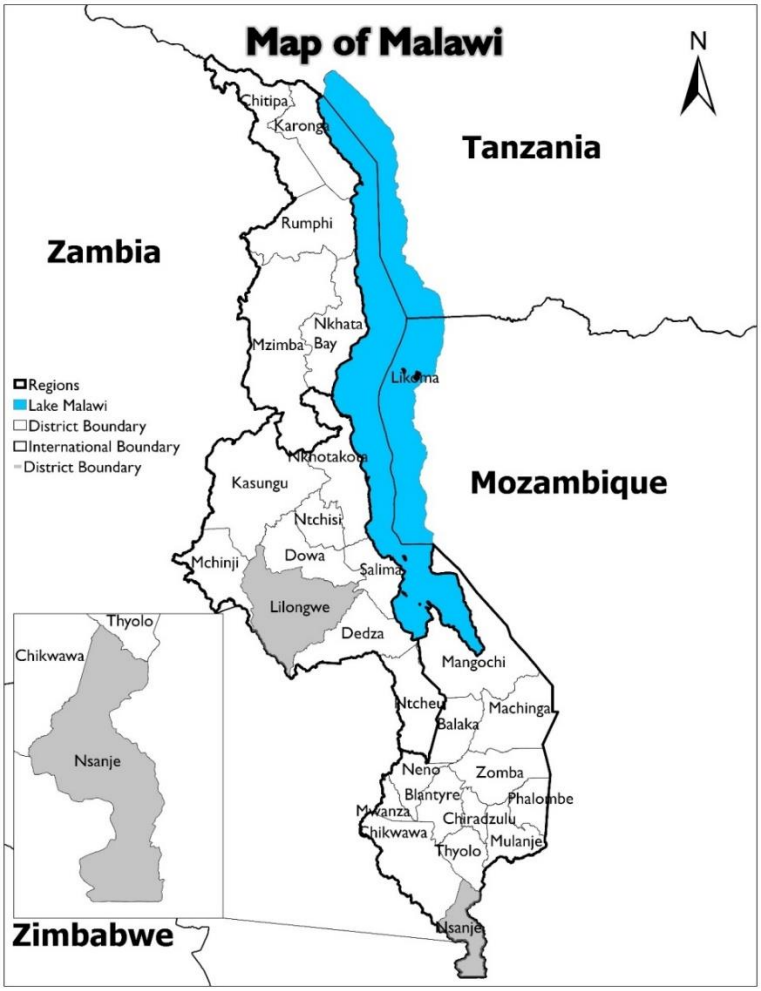

Figure 3.5 Map of Malawi showing the location of Nsanje District

2. Data and Methods

A mixed method facilitated consultative workshop approach (Ørngreen and Levinsen 2017; Ahmed and Asraf 2018) was adopted to collect both quantitative and qualitative data. The workshop methodology was deemed suitable for this study as, unlike other qualitative methods, it sought to establish a shared position among participants after inter-subjective interactions (Ørngreen and Levinsen 2017). It enabled collective problem-solving (Osborn 1948) through a participatory appraisal approach (Temu and Due 2000) comprising of group brainstorming and consensus building (Osborn 1953). A collectively agreed answer to each question was supported by evidence such as administrative and policy documents and examples of established institutions such as health subcommittees. The researchers were independent external reviewers/facilitators guiding the discussions towards mutual interactions and agreement on a common position, while ensuring there were no dominant voices. Collective positions were those considered to be accurate representations of the country's capacity for mainstreaming health in DRM interventions and its implementation status of the various domains in the DRM Strategy for Health. This consensus building approach (Aitsi-Selmi et al. 2015) establishes a strong foundation for collective identification of gaps, and thus, agreement on required intervention pathways for effective integration of public health in DRM.

Cross-sectional quantitative data were also collected at the national and district levels (Nsanje District) during September and October 2019, respectively. Each of the WHO regional strategy target was mapped (Table 5) to the relevant domains of an adapted Country Capacity Assessment (CCA) questionnaire developed and implemented by WHO. The CCA adapted tool was administered to participants at both the national and district levels. In both instances, a workshop method was used for data collection, where participants gathered in one place to collectively review the questions and agree on the most appropriate response (an agreed group answer for each question) representing the country's DRM capacity and implementation status, at the national and district levels, as at the time (Ørngreen and Levinsen 2017). At the district level, the data collection tool was adapted to ensure applicability by focusing on operational aspects of the strategy as opposed to high level policy issues. Consequently, domains one (institutional framework) and two (Ministry of Health coordination) were not assessed at the district level as they focused more on higher level policy and legislative aspects that were adequately responded to at the national level. Consensus scores at the national and district levels were averaged to result in scores reported in this study as described in the analysis section below. The questions in the CCA adapted

tool required participants to collectively assess the availability, functionality, and operational status of institutional frameworks for DRM, health sector coordination, health disaster risk analysis and mapping, emergency and disaster early warning, disaster response and recovery, preparedness planning and management, and health facility and community resilience building.

At the national level, participants (n = 14) included staff from the technical subcommittees of the Department of Disaster Management Affairs (DODMA) (n = 5), the Ministry of Health (MOH) (n = 1), the World Bank (WB) (n = 1), the World Food Programme (WFP) (n = 1), the Ministry of Water Affairs (n = 1), the Department of Climate Change and Meteorological Services (DCCMS) (n = 1), the Housing Department (n = 1), the Environmental Affairs Department (EAD) (n = 1) and the Centre of the Lilongwe University of Agriculture and Natural Resources (LUANAR) (n = 2). At the district level, participants (n = 20) included staff from the District Executive Council (DEC) representing the various committees responsible for DRM implementation (n = 6) and nongovernmental organization (NGO) representatives (n = 14).

2.1. Quantitative Data Analysis

The questions were assessed on a scale of ordered response options. Most of the questionnaire items (181 out of a total of 225) had the response options “Yes completely” (coded 2), “Partially” (coded 1), “No, not at all” (coded 0), and “Don’t know” (to be excluded from analysis). One question inquired whether health sector DRM related training had been conducted, with response options “Yes” (coded 1) and “No” (coded 0). There were 4 questions requiring participants to indicate when tabletop exercises and disaster management simulations were conducted and had response options “In the past year” (coded 3), “In the past 2 years” (coded 2), “In the past 3 years” (coded 1), and “Don’t know” (to be excluded). A question inquiring on the development status of the health sector plans addressing DRM had five questionnaire items, scored as follows: “Completed and coordinated with national disaster office” (coded 3), “Completed” (coded 2), “Being developed” (coded 1), “To be developed” (coded 0), and “Don’t know” (to be excluded). A similar question, with 13 questionnaire items, inquired on the development status of health sector related DRM policies, with the following response options: “Completed and approved” (coded 3), “Completed but not approved” (coded 2), “Being developed” (coded 1), “To be developed” (coded 0), and “Don’t know” (to be excluded). Four questionnaire items required participants to rate different health sector DRM structures/committees and hazard information according

to their perceived level of functionality and accessibility, respectively. These items had response options “Very low” (coded 0), “Low” (coded 1), “Adequate” (coded 2), “High” (coded 3), and “Very high” (coded 4). There was one questionnaire item that required participants to indicate their level of agreement with the statement that the health disaster coordinator had enough resources to lead the health sector DRM program. This question’s response options were coded as follows: “Strongly agree” (coded 2), “Agree” (1), “Disagree” (0), “Strongly disagree” (0), and “Don’t know” (to be excluded). None of the questions returned a “Don’t know” collective response. Hence, no questionnaire item was excluded in all instances that this was a response option.

Quantitative data analysis was conducted using a Microsoft Excel database (Olu et al. 2016). Each questionnaire item was assigned a respective numeric score (as described above) to calculate the mean scores for each domain and its sub-domains that match the respective DRM health strategy target. The following analysis steps were conducted:

- Each WHO regional strategy target was mapped to the adapted CCA questionnaire domain (see Table 5).[4]
- After obtaining national and district level scores separately, composite consensus scores for each questionnaire items were determined by gathering evidence that supported each score. Such evidence included available policy documents, minutes of meetings, training attendance registers, among others.
- It was possible to obtain different scores at the national and district levels regarding the conduct of activities such as simulations and tabletop exercises if these were not conducted by national stakeholders but by NGOs operating at the district level. In such instances, both scores were averaged and recorded as such.
- After obtaining a composite consensus score, categorical Likert scale responses for questionnaire items were converted into respective numeric scores (through coding) for each response to the survey questions as described above.
- Individual scores for each questionnaire item making up a sub-domain were summed to obtain the score for the respective sub-domain. This score was used as the

[4] Number of questionnaire items assessed for each domain: institutional framework = 26; Ministry of Health coordination = 4; health sector coordination mechanism = 36; health emergency risk assessment and information management = 16; surveillance and information management = 15; response and recovery planning = 33; response and recovery operations readiness = 27; community support interventions = 14; information, education, and communication = 25; human resources capacity development = 29.

numerator in percentage calculation of the extent of sub-domain implementation, with the maximum obtainable score for that sub-domain as the denominator.

- Where one sub-domain matched a domain, the sub-domain total score was used as a numerator (N) in the percentage calculation of the extent of domain implementation.
- Where there was more than one sub-domain making up a domain, an average of the sub-domains was calculated to obtain the score for the respective domain that was subsequently used as a numerator (N) in the percentage calculation of the extent of domain implementation.
- The maximum possible score for each questionnaire item, depending on the response options and coding, ranged between 1 (for example, on a "Yes" and "No" Likert scale) and 4 (on a "Very low," "Low," "Adequate," "High," and "Very high" Likert scale). The sub-domain maximum possible score used as a denominator (D) in the percentage calculation of the extent of sub-domain implementation was calculated by multiplying the number of questionnaire items in each sub-domain by the maximum possible score for the respective question response type that make up the sub-domain.
- The percentage score for each domain was obtained by dividing the numerator by the denominator (N/D) multiplied by 100 (Fig. 3.2).

A score of ≥ 90% was considered adequately achieved/implemented as the regional strategy targets were supposed to have been completely achieved by 2017.

2.2. Qualitative Data Analysis

Qualitative data were collected in two ways: First, the consultative workshops conducted with key informants representing various stakeholders discussed above generated qualitative explanatory information on the collective answer to each question. Supporting qualitative quotes are provided to substantiate common positions as agreed by participants in addition to supporting administrative and policy documents and referenced institutional structures such as existing technical subcommittees. Second, available operational policy documents, declarations, resolutions, guidelines, and reports associated with DRM implementation after 2012, when the regional strategy was adopted, were assessed. Information obtained from document review was used to substantiate and validate findings from the consultative workshops. Table 6 presents the approach used for document review.

Table 6 Approach for reviewing Malawi's disaster risk management (DRM) related literature

Documents Accessed and Reviewed	Aspects Searched for in the Documents

• Disaster Risk Management: A Strategy for the Health Sector in the African Region (2012)
• Capacity Development Plan 2017/2018–2019/2020 for the Malawi Department of Disaster Management Affairs
• Malawi National Disaster Risk Management Policy 2015 (GOM 2015b)
• National progress reports on the implementation of the Hyogo Framework for Action (post 2011–2013 and 2013–2015)
• Sectoral policies and strategic plans (by technical subcommittee)
• Post Disaster Needs Assessment reports (2012–2019)
• Malawi National Resilience Strategy (2018–2030)
• Assessment Report on Mainstreaming and Implementing Disaster Risk Reduction Measures in Malawi (2015)
• Disaster Risk Financing Strategy and Implementation Plan (2019–2024)
• Nsanje District Council initial assessment report of March 2019 flood situation (2019)
• Published research papers
• National policies and plans (currently under implementation)
• Official statements and presentations by government officials
• Reports from development stakeholders
• Documents of meetings and DRM conferences in Malawi
• Documents of DRM trainings in Malawi
	• Explicit mention of key DRM issues:
	  • Community resilience in the context of risk management
	  • Managing the risk of flooding and its effects
	  • Role of the Ministry of Health and other disaster coordination structures
	  • Community participation in policy formulation and implementation
	  • Access to health and social services before, during, and after disasters
	  • Disaster risk reduction systems and structures
	  • Role of district and community level structures
	  • Role of development partner (NGO) stakeholders
	  • Operational status of each of the identified policies, systems, and structures post formulation
	• For the above, the year of the policy statement, event occurrence, and document publication was identified to ensure that it aligns with the development and adoption of the African Regional Strategy for Health.

Source Adapted from Bowen (2009).

Thematic analysis (Casteleberry and Nolen 2018) was used to analyze qualitative data obtained from the consultative workshops. A deductive analysis approach was used in which the nine targets of the regional strategy and its components were used as preconceived themes and sub-themes. Data were categorized under each of these themes and sub-themes and

analyzed to provide an explanatory understanding of the quantitative scores assigned by the participants based on their perceptions of capacity for and implementation status of the African Regional Strategy for Health.

Findings from the document review were analyzed using the policy triangle framework developed by Walt et al. (2008) and further enhanced specifically for the health sector (O'Brien et al. 2020). Using this framework, the analytical procedure of this study focused on the context (mostly disaster occurrence) informing the need for the policy; the explicit concern about DRM in the policy, for example, mention of shifts from a reactive to a proactive DRM approach and financial commitments (content); the participants in the formulation and implementation process to investigate inclusion of stakeholders, including those from districts and the international community (actors); and the adopted policy implementation process, focusing on the rollout plan and resource commitment (process).

3. Results

This section presents the results from data analyses conducted to assess capacity and implementation status of the DRM Strategy for Health and community disaster resilience. The section is presented using the DRM Strategy for Health targets as themes. Using this approach, the section presents the high-level institutional framework arrangements such as the role of the Ministry of Health followed by specific subnational level operational issues such as health facility and community resilience building intervention.

3.1. Disaster Risk Management Institutional Arrangements in Malawi

In terms of policy context, the review of documents revealed that there is a DRM structure in place, called the Department of Disaster Management Affairs (DODMA), established by the Disaster Preparedness and Relief Act of 1991 (GOM 2010). Its purpose is to coordinate all DRM activities in the country. The DODMA is made up of two divisions: (1) the disaster risk reduction division, focusing on coordinating the implementation of DRR programs, and (2) the disaster response and recovery division, which is responsible for coordinating the implementation of disaster response and recovery programs.

Existing policies and strategic documents pertaining to DRM and in support of the African Regional Strategy for Health include the National Social Support Policy (2012), the National Climate Change Investment Plan (2013–2018) (2013), the National Adaptation Program for Action (Revised, 2015), the National Disaster Recovery Framework (2015), the National Climate Change Management Policy (2016), the Malawi Growth and Development

Strategy III (2017–2022) (2017), and the Agriculture Risk Management Strategy (2017–2022) (2017). Development of these policies followed the adoption of the Hyogo Framework of Action 2005–2015 (HFA) that emphasized DRR. At the time of data collection, it was reported that a draft Bill revising the 1991 Act had been approved by the Cabinet and was awaiting parliamentary approval. Provisions within all these policies draw clear links between the health outcomes of disasters and the implementation of DRM activities.

The capacity assessment investigated the operational environment of the DODMA that has a direct bearing on DRM capacity and implementation status in Malawi. Table 7 presents quantitative sub-domain scores for the items assessed for each of the WHO African Regional Strategy for Health targets.

Table 7 Summary of averaged achievements against disaster risk management (DRM) for African Regional Strategy for Health targets as at October 2019

DRM for Health Strategy Target	Questionnaire Domain	Questionnaire Sub-domain	Questionnaire Sub-domain Scores and % Achieved
DRM strategy target 1: Incorporated DRM into their national health legislation, national health policies, and health sector strategic plans	Institutional Framework (Policies, Strategies, and Legal Frameworks)	Legal framework	16/16 (100%)
		Policy framework	48/49 (98%)
DRM strategy target 2: Identified, assigned responsibility to, and equipped a unit in the MOH to coordinate the implementation of DRM interventions for the health sector	Ministry of Health (MOH) Coordination	MOH DRM coordination role	8/8 (100%)
DRM strategy target 3: Established functional health sector subcommittees in district multi-sectoral coordination committees on DRM	Health Sector Coordination Mechanism	Health sector subcommittees' functionality	72/77 (94%)
DRM strategy target 4: Conducted health disaster risk analysis and mapping in a multi-sectoral approach	Health Emergency Risk Assessment and Information Management	Hazard assessment	3/4 (75%)
		Vulnerability assessment	12/12 (100%)
		Risk assessment	13/18 (72%)
DRM strategy target 5: Incorporated emergency and disaster early warning, preparedness, response, and recovery indicators into the district surveillance and health information systems	Surveillance and Information Management	Health information system	12/14 (86%)
		Surveillance system	10/10 (100%)
		Rapid health needs assessment	6/6 (100%)
DRM strategy target 6: Established emergency and disaster response and recovery operations, based on	Response and Recovery Planning	Planning framework	8/10 (80%)

national standard operating procedures, and capable of supporting cross-border interventions		Planning process and plan content	45/60 (75%)
DRM strategy target 7: Instituted a preparedness planning and management process that includes plan development, pre-positioning of essential supplies, resource allocation, simulations, evaluations, and annual updating based on all risks prevalent in the country	Response and Recovery Operations Readiness	Health system institution/facility level readiness	3/3 (100%)
		Logistics and surge support readiness	47/52 (90%)
DRM strategy target 8: Instituted health facility and community resilience building, and preventive interventions based on disaster risk analysis and mapping	Community Support Interventions	Community level risk assessment	7/10 (70%)
		Community level preparedness	9/10 (90%)
		Community level DRM structure	10/10 (100%)
	Information, Education, Communication	Communication strategies	18/18 (100%)
		Pre-/Post-event DRM related public health awareness	30/32 (94%)
	Human Resources	Human resource capacity development	19/26 (73%)
DRM strategy target 9: By the end of 2022 all Member States in the African region will be fully implementing all the interventions of the African Regional Strategy for Health.[a]	All	All	N/A

[a]Target not assessed as it was only due in 2022

Note: Sub-domain scores obtained are displayed as numerators and the maximum obtainable from adding up scores from items making up a particular sub-domain are displayed as denominators.

Overall, the participants scored the country and district performances highly across most of the assessed sub-domains, with about 40% of the sub-domains scoring 100%. The data in Table 7 show that hazard assessment (75%), risk assessment (72%), planning process and plan content (75%), health information system (86%), community level risk assessment (70%), and human resource capacity development (73%) were the least performing (< 90%) of all the variables assessed. Figure 3.2 presents the percentage scores achieved for each of the WHO African Regional Strategy for Health targets as at October 2019.

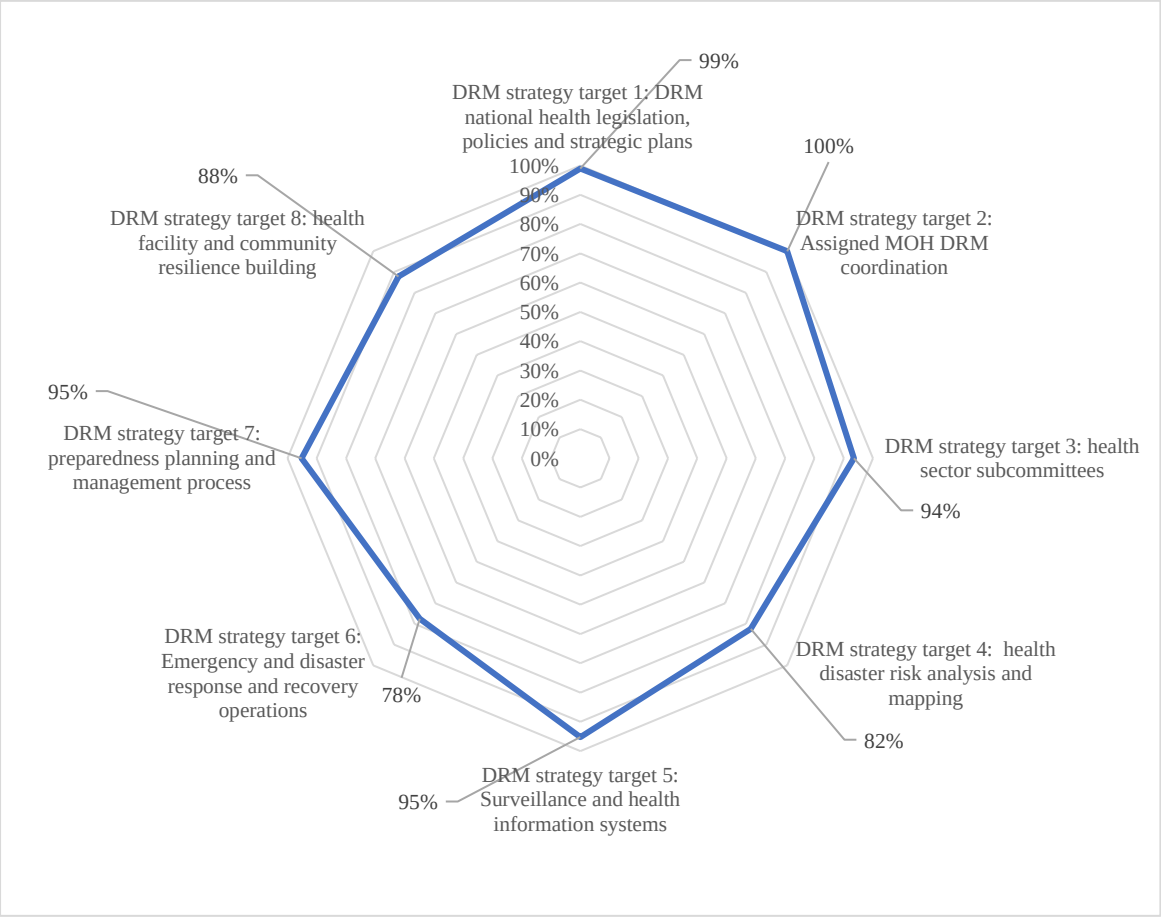

Figure 6 Average percentage scores achieved for each of the African Regional Strategy for Health targets as at October 2019

Figure 3.2 shows that the country did well in terms of meeting targets that relate to establishing policies and coordination mechanisms, with scores of about 90% and above. Scores of below 90% were recorded for targets relating to DRM operationalization, most of which is at the district level (Table 7).

3.2 Ministry of Health Disaster Risk Management Coordination Role

The study found that the Malawi Disaster Preparedness and Relief Act of 1991, which was the guiding Act for all DRM work in Malawi at the time of the investigation, refers to "health" twice. First, it provides for the inclusion of the Secretary of Health in the National Disaster Preparedness and Relief Committee of Malawi as an ex-officio member. Second, it directs the Minister responsible for all DRM work to consult with the Minister of Health regarding burials during disasters.

As part of the DODMA structure and DRM policy coordination actors, the MOH is mandated with leading the health and nutrition technical subcommittee. This structure is replicated at all lower-level government tiers with the District Health Officer (DHO) and the District Environmental Health Officer (DEHO) being part of the District Health Team (DHT) and the District Executive Council (DEC) responsible for all DRM work at the district level. It is through this technical subcommittee that health sector specific DRM work is implemented. The following quote is illustrative: "The policy mandates every cluster, so nutrition is part of it, health is also part of it and agriculture" (Participant, National Consultative Workshop).

The main challenge reported in relation to the capacity of the MOH, and all other clusters, is the unavailability of funding to conduct DRM activities on a continuous basis. The following quote is illustrative: "The budget is there but it is empty, it doesn't have money and it goes year in, year out" (Participant, National Consultative Workshop).

3.3 Establishment of Functional Health Sector Subcommittees

In terms of the national DRM institutional structure, this study found that a National Health Disaster Coordinator is appointed reporting to the cluster lead in the national DRM structure and the Director of the MOH. A health and nutrition technical subcommittee was also established responsible for providing health DRM advisory functions to the national disaster management committee. The chair of the health and nutrition technical subcommittee falls under the MOH, thereby enabling the mainstreaming of DRM functions in the programs of the parent ministry. At the district level, the subcommittees are represented by the DHOs and the DEHOs.

3.4 Disaster Risk Management Incorporation into National Health Legislation, Policies, and Plans

This study found that the health sector in Malawi is guided by the Public Health Act of 1948, as amended, the National Community Health Strategy (2017–2022) and the National Health Policy of 2017. In terms of policy content, only the National Health Policy explicitly mentions DRM. Outlined within the National Health Policy (2017) is a priority area on social determinants of health, which includes, as one of its strategies, the need to strengthen disaster, outbreak, and epidemic preparedness and response. By including disaster preparedness, this strategy is in line with the new DRM policy (2015b).

The document review found that, at the time of data collection, the Disaster Preparedness and Relief Act (1991) was the guiding Act and it provided the legal framework for all DRM work in Malawi. The study also found that the country had a Disaster Risk Management Bill no. 13 of 2019 that had recently been approved by the Cabinet, but had not yet been fully endorsed by the Parliament (World Bank 2018). According to the national workshop participants, this new Bill represented a shift from crisis management to a more proactive and comprehensive risk management approach.

The study found that, in 2015, the GOM developed the National Disaster Risk Management Policy (2015) with support from NGO partners. The policy defines how the country will coordinate the implementation of DRM activities. Operational guidelines were reported to have been developed to operationalize the DRM policy. The guidelines outline the responsibilities of different role players from the district to national levels.

3.5 Health Disaster Risk Analysis and Mapping

This target focuses on health emergency risk assessment and information management, with emphasis on risk identification, vulnerability assessment, and risk assessment. District level participants reported that useful information on flooding was clearly defined, readily available from the national repository, and provided to planners in understandable formats, albeit mostly in hard copy. The following quote is illustrative: “That information is available, but it’s a paper-based information” (Participant, District Consultative Workshop).

The document review, however, revealed that the last country-wide risk assessment and mapping for drought and floods, the Economic Vulnerability and Disaster Risk Assessment Review in Malawi, was conducted by the DODMA in 2009, with support from the World Bank (GFDRR 2009). While a district health risk assessment was conducted in Nsanje, the participants, mainly from the NGOs, reported having conducted supplementary local and fragmented community level vulnerability assessments to inform their program

needs. The following quote illustrates this point: “Some areas are yet to come up with vulnerability assessments pertaining to various hazards. If I want to implement an intervention in TA Nyachikadza as an NGO I can just go there and make a partial vulnerability assessment” (Participant, District Consultative Workshop).

3.6 Preparedness Planning and Management Process

The study found that Nsanje District officials had, together with district level multi-sectoral stakeholders, developed a plan to operationalize the national DRM policy. In terms of process, the district council, working with NGOs, coordinates the purchase of supplies for disaster preparedness and planning. Systems and mechanisms for managing and distributing medical supplies are in place through the decentralized health facilities. All health communication is done through the District Health Promotion office that utilizes various platforms, including the civil protection committees and their representatives at the village and area levels. The participants reported that the district council had no surge capacity for ambulance services in times of disasters but relied on NGO partners to provide more ambulances when needed.

In terms of logistical resources and support needed for flooding, medical supplies and equipment to pre-hospital activities, hospital, temporary health facilities, and public health were reportedly well coordinated, readily available, and periodically tested according to established guidelines. Procedures for procurement of exceptional supplies were reported to be in place and the cold chain for medical supplies was maintained. Pharmaceutical services were also reported to be in place and readily available. The availability of these services was, however, based on available and yet fragmented place-specific risk analysis conducted by individual NGOs at the community level. The study did not find procedures for the pre-positioning and release of essential supplies to high-risk areas. The participants also reported that there was limited capacity for maintaining life support while transporting patients from disaster affected areas as well as for management of medical activities on the disaster scene.

3.7 Emergency and Disaster Early Warning, Preparedness, Response, and Recovery Indicators

As most non-state actors rely on initial rapid assessment (IRA) reports for fund raising and activity implementation, they support the conduct of IRAs during and immediately after a disaster. The participants reported that the District Health Information System (DHIS) was used for health data management with thresholds/triggers for switching from routine to

emergency mode. The district rapid response team was reported to be well trained. However, the participants reported that the surveillance function in the DHIS was managed manually at the facility and community level. In addition to the electronic DHIS surveillance system, the participants reported that unconventional early warning systems (EWS) exist at the village level. Examples given included river gauges, rainfall forecasts, and the use of indigenous knowledge. The following quote is illustrative: "We also have indigenous knowledge e.g. when we see ants coming out in large numbers in November, it's an indication that there will be a lot of rainfall. When we see a lot of mangoes in the trees, we anticipate drought" (Participant, District Consultative Workshop).

3.8 Health Facility and Community Resilience Building, and Preventive Interventions

This target relates to the availability and functionality of community support interventions, information, education and communication, and human resource capacity development. This study found that DRM structures existed and were functional at the community level. Below the district in each Traditional Authority (TA) were Area Civil Protection Committees (ACPCs), and below those, were Village Civil Protection Committees (VCPCs). In addition, it was reported that there are Area Development Committees (ADCs) responsible for coordinating all development work in an area. There were clear terms of reference (TORs) developed by the DODMA for these structures.

In terms of risk and vulnerability assessment, it was reported that communities are fully involved in the process, and they understand the parameters of risk and vulnerability as they participate in the data collection. Community participation was, however, mostly pronounced in local areas of interest to implementing partner NGOs. Community level preparedness is coordinated through the VCPC volunteers who work closely with local clinics and the police. Resources for response are kept at local health facilities and police stations.

Community radio, megaphones, whistles, drums, and cellphones were used as media for communicating early warning messages. Pre-established communication mechanisms were reported to be in place and defined in the district plan. These outline how to care for vulnerable groups like the elderly, sick, and children in the case of flooding. Pre-flooding public awareness raising was conducted using Information Education and Communication (IEC) materials that are available in local languages. The level of public awareness was,

however, not systematically and regularly measured to inform the development of awareness information.

In terms of human resource capacity development, a capacity development plan was reported to be available among NGO partners. Training offered was based on available skilled human resources and not on competencies required for a specific hazard. The participants reported that a database of all trained staff exists in hard copy. The process of accessing training funds from the DODMA was reported to be cumbersome and discouraging.

3.9 Emergency and Disaster Response and Recovery Operations

This study found that the various subcommittees of the DEC, including health, developed individual plans that were then consolidated into one plan, called the district contingency plan. After the district plan is developed, it is submitted to the DODMA for review and approval before implementation. The plan covers aspects such as coordination of international humanitarian assistance based on national standards, health management in shelters and temporary settlements, identification and handling of dead bodies, objectives and actions of recovery, considerations of vulnerable groups and logistical arrangements, among others. To ensure business continuity in cases of flooding, mobile clinics are deployed into communities to provide services. At the community level, it was reported that the availability of disaster plans varied from one place to the other: “We have just conducted a baseline, most of the disaster risk management plans at community level are mostly done by partners when they want to conduct a project, they would at least gather a community and develop the village action plan. So, it varies from one area to another” (Participant, National Consultative Workshop).

There were no reported simulations and tabletop exercises conducted at the district council level, except at the community level where NGOs operated. The following quote is illustrative: “Yes, at community level we have done the drills and simulations. But now at district level, we have never had any simulations” (Participant, District Consultative Workshop).

4. Discussion

This section is divided into three subsections focusing on DRM institutional structure in Malawi, its financing, and how it is operationalized at the district and community levels.

4.1. Disaster Risk Management Institutional Structure

This study has shown that Malawi has made significant strides towards strengthening its DRM capacity and meeting the African Regional Strategy for Health targets. Despite having well developed institutional structures, including a DRR division within the DODMA, the government approach to DRM remained reactive due to limited investment in preparedness activities.

As noted by the World Bank (2019), the lack of pre-financing for preparedness and a reactive approach to DRM undermine the DRR functions of the DODMA. This lack of preparedness has resulted in disasters with increasing and significant impact on people's lives (GOM 2019a), and regular post-disaster emergency appeals, which have received relatively little budgetary contribution from the government (Mijoni and Izadkhah 2009). Government funding for preparedness remained low (Manda 2014) and disasters were seemingly treated and accepted as part of life with dire consequences for populations at risk. As noted by Clary (1985) and Ng'oma and Mwamlima (2008), crises continued to invoke government action and informed policy formulation, with action only coming after the occurrence of a disaster event.

Analysis of the policy development context, process, and environment shows that Malawi benefited from international policy instruments such as the HFA. The HFA reports (2013–2015) and GOM official statements show that the country started shifting from a reactive disaster management approach to an all-inclusive DRM approach in part due to the requirement for reporting on the achievement of HFA targets to the United Nations (UN). The HFA sought to ensure that DRR is a national strategy for reducing disaster underlying risk factors. Therefore, to align with this international framework for DRR and the WHO African Regional Strategy for Health, the GOM developed policies and strategies upholding risk management as a gold standard. Examples of such instruments include the Health Policy (2017), the National Community Health Strategy (2017–2022), the National Resilience Strategy (2018–2030), and the National Disaster Risk Financing Strategy and Implementation Plan (2019–2024). In its acknowledgment of the DRM political commitment by the GOM, the World Bank (2019) highlighted the surge in the development of policies that mainstream community resilience strengthening between 2012 and 2019.

The establishment of health sector subcommittees through the decentralized DODMA structures provides the ministry space to lead all health sector DRM activities in the country. Despite this progress in building a strong foundational legislative, institutional, and policy

framework, there are challenges that may hinder the country from achieving a fully implemented regional strategy by 2022 (target 9). From a legislative perspective, the delayed finalization of the revised Disaster Act, to replace the outdated 1992 Act, limits the full implementation of the 2015 DRM policy. In addition, inadequate financial capacity, and limited availability of comprehensive risk assessment data, both at the national and district levels, affect the country's ability to effectively coordinate policy implementation.

4.2. Financing the Disaster Risk Management Institutional Structure

The typologies of financial instruments for both ex ante and ex post DRM activities in Malawi reflect and confirm what Goldsmith and Eggers (2004) and Milward (1996) have called "hollow states"—states that rely on development partners for joint or singular delivery of public services. This study found that DRM ex ante funding is drawn from a budget vote on unforeseen expenditure, which does not exceed 2% of the total budget, and is disbursed not to exceed the available balance at the time of need (GOM 2017b). For ex post activities and to mitigate the adverse effects of disasters, the government relies on budget reallocations, post-disaster borrowing, external assistance, post-disaster support to the affected, and scalable social protection programs (GOM 2017b).

This financial structure and level of commitment reconfirms the historically reactive and crisis-driven approach of governments to DRM. This observation is not unique to Malawi. The UN Office for Disaster Risk Reduction's (UNDRR) Global Assessment Report on Disaster Risk Reduction 2019 reports on a multi-country assessment conducted in Cameroon, Ghana, Malawi, and Senegal showing that developing countries lack financial resources and financial planning capacities for DRM (UNDRR 2019). The Malawi HFA report (2011–2013) also identified the lack of DRR funding from the central government to the DODMA as the major limiting factor in DRM implementation. For example, Kita (2017a) notes that in 2015/2016, the DODMA had a total budget of USD 125,000 against a total drought impact estimated at USD 365.9 million. The lack of adequate resources for DRM implementation is a major disincentive for the implementation of DRM activities at the community level as exemplified by the relatively lower scores (< 90%) achieved against targets that are more applicable at lower levels. Reliance on short-term donor funding does not allow for full operationalization of resilience focused institutional frameworks developed by the country. A shift from disaster response to DRM needs to be accompanied by a move from short-term donor funding to multi-year DRM financing, which supports the scaling up

of activities that strengthen disaster risk resilience at the community level where adaptation to disasters occurs.

4.3. Operationalizing Disaster Risk Management at the District Level

The study found that Nsanje DEC, as the nucleus of DRM implementation in the district, had gained considerable experience in coordination, control, and monitoring DRM activity implementation by various stakeholders. The strength of their control lay in two main factors, the first being the existence and functional state of the district-controlled DRM civil protection committees. The second is the district's centralized control of all external humanitarian and emergency funding and supplies through its health facilities and the police service. The coordination ability was also demonstrated by the availability of a district DRM plan consolidating individual sector plans developed with the help of NGO partners. The integration of health activities is achieved through the participation and leadership of the DHO and DEHO in the DEC, as well as coordination of all communication through the district health promotion office. It was observed, however, that operationalization of DRM was generally based on inadequate risk assessments. Assessments that were done were carried out by NGO partners, often in a fragmented manner at the community level and in areas of interest to them.

Despite the strengthened institutional capacity for implementation of DRM interventions, this study revealed that lack of resources at the local government level often resulted in the incapacitation of these structures unless they were supported by NGO partners. This observation was supported by the GOM in its Disaster Risk Financing Strategy and Implementation Plan (2019), in which it highlighted that most of the local authorities receive about 2% of the national budget against a legislated 5% due to financial constraints at the central government level. As a result, most of the community-based DRM activities were implemented by NGOs who had time-bound objectives and donor focused reporting requirements. This often resulted in fragmented and suboptimal implementation of critical resilience building DRM activities at the community level. For example, trainings were reportedly not informed by competence needs. Available risk assessment datasets were mostly in hard copy format, which made access and sharing with stakeholders cumbersome. These findings raise questions on how the district manages to implement DRM activities.

It was apparent from the consultative workshops that NGOs had taken a lead in supporting the DEC in DRM design and implementation. This was mainly because NGOs had emergency funds to support the district at the onset of, during, and immediately after a

disaster. While this support made the operationalization of district DRM activities possible, it presented its own challenges. First, most of the donor funding was short-lived and focused on response activities, which undermined the DEC's ability to initiate and implement any resilience strengthening preparedness activities. This finding is consistent with the observation made by the GOM in the HFA report (2011–2013) that donors were not supporting preparedness activities. Second, donor funded projects supported data generation activities only in times and/or geographical areas of their interest, and not district-wide collection of vulnerability and risk assessment data. This meant that resilience strengthening activities were fragmented across the district and dependent on NGO priorities. Third, the reliance on NGO partners for DRM activity implementation created a donor dominance and dependence, establishing a structure that Kita (2017b, p. 246) called "Third-party government," which refers to the delivery of public services by NGO partners. In addition, Trogrlic et al. (2018), concluded from their study in the Lower Shire Valley, that flood risk management strategies often fail because NGOs do not have exit strategies and thereby fail to translate ownership of interventions to communities. This observation was also supported by the findings of this study.

In line with findings by Tiepolo and Braccio (2020) that poor DRM plan preparation capacity limits the implementation of DRR actions, this study found consistent underperformance in the areas of planning process, plan content, and in relation to human resource capacity development at a community level. In addition, given that vulnerability and risk assessment underlie successful implementation of well-developed DRM plans (OECD 2012), the suboptimal performance observed in this study in these areas could potentially explain the consistently high disaster losses experienced by Nsanje District communities following a disaster.

5. Study Limitations

This study was limited to two participatory workshops, one conducted at the national level and another in one district of Malawi. The participation of the DODMA in these workshops may have influenced how the other participating organizations' representatives responded to or agreed with the scores provided. However, requests were made for supporting documents to substantiate suggested scores, thereby validating the scoring. In addition, the workshop conducted at the national level and the reflections shared on national DRM policies and practices helped to ensure generalizability of study findings, with a caution that there could be district performance differences.

6. Conclusion

This study revealed that Malawi has made significant progress towards the establishment of a strong institutional framework for DRM implementation, particularly as it relates to development of policies and coordination mechanisms. This is despite the country not meeting all the 2014 and 2017 targets set out in the WHO African Regional Strategy for Health. Within its coordination arrangements, the country has placed the MOH as the lead for all health-related DRM activities, from the national to the district level. The inclusion of disaster preparedness and adaptation as one of the objectives in the current national health policy is evidence of government efforts to integrate DRM activities in the health sector. The main hindrances to strengthening capacity for DRM implementation are limited preparedness, suboptimal risk assessment, and inadequate funding allocation to DRM activities. As a result, DRM seems to be stronger on paper and intent, but weak in practice as observed at local levels where adaptation to disasters occurs.

This study concludes that to ensure effective and full implementation of the WHO African Regional Strategy for Health, the government, with support from non-state actors, should develop a cost-effective financial model that makes funding available for disaster preparedness and mitigation, including ensuring capacity for comprehensive risk and vulnerability assessments. As the world aims for full operationalization of the Sendai Framework, the results from this study suggest that the development of policies and establishment of institutions incorporating health need to be supported by similar community resilience strengthening interventions that are informed by data that identifies the vulnerabilities of disaster-prone communities. Strengthening community health systems should be at the center of such interventions as healthy communities are better able to adapt to disasters. Although this study was focused on flooding as the hazard, and Nsanje District as the study site, some of its findings are applicable to other hazards such as drought or disease outbreaks. The findings are also applicable to other districts as they are guided by the same pieces of legislation, which are implemented and coordinated by the same structures at the national level and through similar arrangements at the local level. Therefore, the approach used in this study for assessing the implementation status of DRM strategy for the health sector can serve as a model framework for other districts in Malawi, as well as for other low- and middle-income countries in respect of the implementation of the Sendai Framework.

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CHAPTER 4

DETERMINE THE FACTORS ASSOCIATED WITH COMMUNITY RESILIENCE TO FLOOD RISK IN TA NYACHIKADZA AND NDAMERA IN NSANJE DISTRICT

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CHAPTER 4. MEASURING COMMUNITY FLOOD RESILIENCE AND ASSOCIATED FACTORS IN RURAL MALAWI

In the previous chapter, we assessed the capacity for and implementation status of the disaster risk management (DRM) strategy for the health sector in Malawi both at national and district levels. The chapter revealed that while the country made great strides in strengthening its DRM approach, there were limitations regarding availability of comprehensive risk assessment data, scarce DRM skilled human resources and limited funding. These findings are important and call for the need to focus on context- and hazard specific factors at community level, that if targeted, would result in communities that are more prepared to adapt to climate induced flooding.

The current chapter presents results of a study undertaken to measure community flood resilience and its associated factors. The chapter addresses the need for community-level data on community-level factors that are important for resilience to flooding. The conceptual and empirical identification of such factors is important as, if acted upon, will result in the identification of intervention pathways that could result in strengthened community capacities to adapt to incessant flooding while protecting human health and livelihoods.

The current chapter will begin by presenting the conceptual definitions of key terms and frameworks that have been advanced for community resilience measurement. This is followed by a presentation of how the study was conducted, the results and discussion sections. The results from this chapter are important, particularly for this thesis, as they present an empirical heuristic framework for understanding the role of public health in DRM for resilience strengthening that goes beyond the biomedical aspects of health to include the social, political, economic and governance factors.

Abstract:

Resilience research and practice have conceptual and empirical challenges of how to understand, characterize and measure resilience, particularly at community level. Using a multidimensional framework and through cluster analysis, bivariate methods and multivariable-adjusted binary logistic regression modelling, we developed a context and hazard specific construct of community flood resilience and investigated its predictor variables. The factors defining the community flood resilience construct captured the community needs to withstand disasters through purpose-built infrastructure, early warning systems for preparedness and utilization of local human capacity for adaptation. Access to services for improved health and psychosocial well-being were significantly associated with being more flood resilient. Additionally, sense of place and resistance to relocation were presented as key elements of resilience, maintaining community system function, and preserving livelihoods. The study further found that these key factors would not be adequate to guarantee community flood resilience outside the transformative capacity of a well-resourced village civil protection committee that can prepare and respond to flood emergencies. Our results suggest that, in the context where policymakers seek to strengthen community resilience without relocating people, a focus on public health and on strengthening and utilizing local capacities as adaptation, are key in disaster risk management policymaking and implementation.

Keywords: flooding; resilience; climate change; resilience measurement; disaster policy; Malawi

1. Introduction

Recent data have shown that, because of climate change, flooding has become a global threat, with flood events already increasing in frequency and magnitude (Centre for Research on the Epidemiology of Disasters, 2018). Flooding results in injuries, morbidity, and mortality, among other impacts, posing a challenge for public health and sustainable development. It is estimated that about 1.47 billion people, or 19% of the world population, are directly exposed to substantial risks of flooding of which 89% live in low- and middle-income countries (Rentschler & Salhab, 2020). Of the 132 million people who are estimated to be living in both extreme poverty (under $1.9 per day) and in high flood risk areas, 55% are in Sub-Saharan Africa (Rentschler & Salhab, 2020). Over 50% of the African population lives in rural areas, with many reliant on floodplains and rivers for food production and other livelihood activities (Lumbroso, 2020). This suggests heightened vulnerability for the Sub-Saharan Africa region in the event of flooding. Hence, the international scientific community's interest in improving current understanding of community flood resilience and relevance for sustainable development, particularly in low- and middle-income countries. Despite this growing interest, literature points to definitional and measurement challenges for the concept of resilience particularly at community level where adaptation to disasters occur.

The definition of resilience as a concept and resilience thinking as an analytical approach has been highly contested (Rodina, 2017; Patel, 2017) making its operationalization difficult (Ntontis et al., 2018). On one hand, resilience is viewed as a quality or outcome of socio-economic processes that inform it (Manyena, 2006) and on another, it is conceptualized as a process or adaptive capacity than a measure of stability or an outcome. Despite the multiple and continuous redefinitions of the term from different disciplines (natural, social, physical, environmental, etc.) and levels (individual, groups, community, organisation and national), resilience has emerged as a dominant discourse in the sustainable development agenda with a focus on partly strengthening community disaster risk adaptation capacity. Based on a systematic review of African-based resilience scholarship, the Resilient Africa Network (RAN) provided a more general definition of resilience as the capacity of people and systems to mitigate, adapt to, and recover and learn from shocks and stresses in a manner that reduces vulnerability and increases wellbeing (RAN, 2015). This definition aligns with the conceptualization of resilience as adaptive capacity as opposed to an outcome.

The relationship between flood risk management and the livelihood of people who make a living on natural resources, such as floodplains, is of crucial concern to enhancing community resilience, improving public health and the achievement of sustainable development goals. This is mainly because the development and implementation of resilience strengthening policies should not only be consultative from a social justice and inclusive perspectives but should also be seen to be protecting livelihoods and promoting the well-being of the affected people. In line with this, global policy discourses are now in agreement that, to address the adverse effects of climate change, the water governance sector needs to take a resilience and transformative approach (Salinas Rodriguez et al., 2014). As a result, Dewulf et al (2019) note that there is growing reference to community flood resilience and its cognate terms such as water resilience (Erickson, 2015; Falkenmark and Rockstrom, 2010; Rockström, Falkenmark, Folke, et al., 2014) and catchment resilience (Adger, Brown, Butler and Quinn, 2021) to capture the growing need for transformation in the water governance sector as it relates to drought and flood management and climate change adaptation, among other areas of focus (Shin et al., 2018; Xu & Kajikawa, 2017). Despite this observed need to transform, the water sector has been critiqued for delaying the adoption of innovative and transformative practices to strengthen resilience including accepting some level of flooding as normal (White et al., 2016). This observed gap is likely informed by the multiple definitions and conceptualizations of resilience that have inexorably challenged the water sector and its operationalization of resilience (Johannessen & Wamsler, 2017).

In the context of flood risk management, there are multiple approaches to resilience varying from a narrower focus on preserving the existent stability of physical infrastructure to more inclusive conceptualizations that emphasize socio-ecological factors in the context of complex adaptive systems (White & O'Hare, 2014). Informed by the latter conceptualization, which seem to accept transformation and change, Bulti, Girma and Megento (2019) provided a hazard specific definition of community flood resilience as ability of a community - and all of its socio-ecological and socio-technical networks across temporal and spatial scales - to maintain or rapidly return to desired functions in the face of flood events, to adapt to change, and to transform systems that affect the current and future adaptive capacity.

From a resilience measurement perspective, both conceptual and empirical studies have shown that the community level is an important scale on which to build resilience that can enhance both the individual/household and wider population level outcomes (Cote and Nightingale,

2012). The characterization and measurement of resilience at community level goes beyond a purely socio-ecological systems understanding by incorporating social subjective factors, e.g., perceptions and beliefs as well as the wider institutional environment and governance settings that shape the capacities of communities to build resilience (Ensor and Harvey, 2015). Yet, the community remains poorly theorized with little guidance on how to measure resilience building processes and outcomes (Kruse et al., 2017). Both terms – resilience and community – incorporate an inherent vagueness (Patel et al., 2017) and raise, as Norris et al. (2008) put it, concerns with variations in meaning. In addition, attempts to review resilience measures focusing on specific hazard are limited (Bulti, Girma and Megento, 2019). Considering the conceptual vagueness and variations of community and resilience, only a few approaches have tried to characterize and measure community resilience comprehensively (Cutter et al., 2014).

Considering these measurement challenges, the definition of community flood resilience by Bulti, Girma and Megento (2019) above becomes important for three reasons: (1) its focus on a specific hazard (i.e., flood) which is a critical element of specificity in measurement, (2) its conceptualisation of a community as encompassing socio-ecological and socio-technical networks, which goes beyond the economic and physical indicators and, (3) its focus on adaptation, which is a long-term concept, inclusive of ex-ante (pre-flooding) preparedness and mitigation efforts (Keating et al., 2014) which are important for a comprehensive disaster risk management (DRM) approach.

Given the noted gaps in defining and measuring resilience at community level, this paper, adopts, for the reasons cited above, the definition of community flood resilience by Bulti, Girma and Megento (2019) to further fill the knowledge gap by using empirical data to construct the variable 'community flood resilience' and quantitatively investigate the factors associated with being resilient to flooding as evidenced by support for government to implement policies that reduce vulnerability of people in the existing communities without relocating them to alternative land (*'community agency'*). Thus, the study provides an empirical heuristic framework for conceptualizing and measuring community resilience to flooding.

1.1 Resilience conceptual and analytical framework

This section presents a multidimensional heuristic framework for understanding, characterizing, and measuring community resilience flooding used in this paper. To that end, we briefly discuss the historical evolution and conceptualizations of resilience from different

research strands, point out the gaps and how our quantitative approach helps to address some of these identified gaps.

With its roots in the field of ecology (Holling, 1973), the term resilience has found increasing popularity in the fields of engineering (Davoudi et al. 2012; Holling 1996), socio-ecological systems (Holling, 1973), psychology (Berkes and Ross, 2013; Norris et al. 2008), economics (Hallegatte, 2014) and disaster risk management (Keating et al., 2016). Despite this growing interest in resilience application across disciplines, there is no consensus in its definition and measurement (Bene, 2013) with some measurement frameworks designed to operate in multiple shocks while others are designed to be hazard and context specific. In its earlier definitions, resilience was considered to imply the ability of a system to return to its equilibrium state after a temporary disturbance, commonly equated to the concept of stability (Holling, 1973). However, the widespread adoption of resilience among disciplines has led to ambiguity surrounding definitive application of the concept with over 70 definitions in literature (Fisher, 2015). With time, elements of system flexibility to absorb change (Walker, Holling, Carpenter, & Kinzig, 2004) and capacity to adapt, learn and self-organise (Doorn, Gardoni and Murphy, 2018) were added to the definition to account for emerging strands of resilience research such as socio-ecological (complex-adaptive systems) and systems (ecological) resilience.

The main arguments for the shift from a purely engineering informed definition to more inclusive definitions and approaches are informed by the need to account for social and the ecological dimensions of resilience (Mao et al., 2017). When resilience is defined from a unidimensional (engineering or systems or socio-ecological) perspective, the importance of one set of factors (physical infrastructure or governance or human livelihoods) is given prominence over others (Davidson, 2010; Duit, Galaz, Eckerberg and Ebbesson, 2010; Methmann and Oels, 2015). Available evidence suggests that beyond the physical infrastructure (built structures), human capital assets such as health conditions (Weldegebriel & Amphune, 2017), gender (Llorente-Marrón, Díaz-Fernández, Méndez-Rodríguez, González Arias, 2020), population pressure (Donner & Havidán, 2008), and household interest in learning and practicing adaptive flood-based farming practices (Nguyen & James, 2013), are key determinants of flood resilience. Unidimensional frameworks, especially those informed by the natural sciences revealed conceptual challenges that call for a comprehensive community resilience framework (Cote and Nightingale, 2012; Kruise et al., 2017).

With the increase in disaster frequency and magnitude, and the importance of bottom-up interventions at community level where adaptation to disasters occur and social capital is displayed through neighbours helping each other, the call for comprehensive resilience framework application has increased. In these calls, resilience is presented as a concept with potential to help integrate disaster risk management, sustainable development and climate change adaptation concerns (Adger 2021; Béné et al. 2012; Berkes and Folke 1998). Broadly, these theorists argue that a holistic concept of resilience is needed for a better understanding of the relationships among human, financial, natural, social, and physical systems. An answer to these calls seems to have come from Martin-Breen and Anderies (2011) who developed a three interdisciplinary multidimensional conceptual framework (Engineering resilience, Systems resilience, and Resilience in complex-adaptive systems) that accounts for over 50 years of practical application in comprehensive community resilience assessment. Through this interdisciplinary spectrum of resilience, the authors emphasized the need for resilience assessment to investigate the capacity of communities to prepare for any disturbances pre-event and being able to resist the impacts (Engineering resilience), cope with the effects and maintain functionality throughout the disturbance (Systems resilience), and then adapt and learn post-disturbance to increase future resilience (Complex adaptive systems) (Martin-Breen and Anderies, 2011). This framework is aligned with the definition of community flood resilience adopted for this study as they both capture the aspects of hazard specificity, the importance of social aspects of risk management and the need for long term adaptation to characterize how the two communities interacted with their ecological environment.

The authors argue that resilience should be considered as a multidimensional construct that cover all the three frameworks although certain aspects maybe more desirable than others at any one point and scale of measurement. This argument is also supported by the United Nations (UN) World Food Programme's (WFP) (Constas, Frankenberger, & Hoddinott, 2013) who posit that resilience is a capacity explained by or composed of multiple dimensions. Martin-Breen and Andreries (2011) also argue against over-emphasis on finding a united definition of resilience as such calls fail to acknowledge the fluidity of the concept in different contexts. Along this interdisciplinary spectrum of resilience, this paper focused on addressing one key question regarding community flood resilience, namely, what are the pre-flooding, during flooding and post-flooding factors that help build community flood resilience for different groups of communities that are incessantly affected by floods, but choose to stay in harm's way? To answer this question, we first derived, through measurement, the hypothetical

construct of flood resilience before exploring relationships among factors. Through this approach, the study addresses some of the conceptual challenges associated with defining and measuring resilience by capturing the subjective aspects of social change and transformation, the interrelationships between resources, people's actions and learning in shaping individual and collective perceptions that may help with the characterization and development of a typology of community flood resilience.

2. Materials and Methods

2.1 Research design

This study is based on secondary analysis of population-based survey data collected to assess the level of support for flood mitigation policy options in the two traditional authorities (TAs) Nyachikadza and Ndamera, in southern Malawi. A deliberative polling® based repeat cross-sectional survey, with pre-deliberative and a post-deliberative event assessment, was conducted (Figure 2). This study analyzed the post-deliberative event survey data as it was considered to be the final and well-informed scores that participants had made in their support for various flood risk management (FRM) policy options to strengthen community flood resilience.

2.2 Explanation and justification of the case selection

In Malawi, about 40% of all documented disasters are a result of flooding (Nillson, Shela & Chavula, 2010). In 2019, Malawi experienced heavy rainfall which resulted in flooding that affected 15 out of its 28 districts (Government of Malawi, 2019) with devastating effects on about 1 million people (Centre for Research on the Epidemiology of Disasters, 2019). The floods also affected pregnant and lactating mothers who need high nutritional food diets, and deepened levels of child malnutrition, especially in Neno and Mangochi districts (Government of Malawi, 2017), where over 45% of children are already stunted (Government of Malawi, 2019). The flood-induced devastation occurred against the backdrop of limited government capacity for preparedness (Kita, 2017a; Dewa, Makoka and Ayo-Yusuf, 2021), and limited coping capacity at community level (Dewa, Makoka and Ayo-Yusuf, 2021; Mijoni & Izadkhah, 2009; Kita, 2017b), pointing to the need for strengthened community disaster/flood resilience. The Nsanje district of Malawi in southern Africa, which is particularly prone to flooding, is home to two communities called Traditional Authorities (TA), Nyachikadza and Ndamera

(Figure 4.1). The two TAs are adjacent to each other, with the former being on lowland and the latter situated on high ground. Due to this topography, the lowland is incessantly flooded by water from the Shire River which forms most of the border of the lowland community with all its neighbours. When floods occur, residents of the lowland community find refuge in the upland community (TA Ndamera). Due to the fertility of soils on the lowland, particularly following a flood, people from the higher ground also rely on the lowland for agricultural production. Research indicates that the lowland has capacity to produce enough food to feed the whole district (Lilongwe University of Agriculture and Natural Resources, 2018).

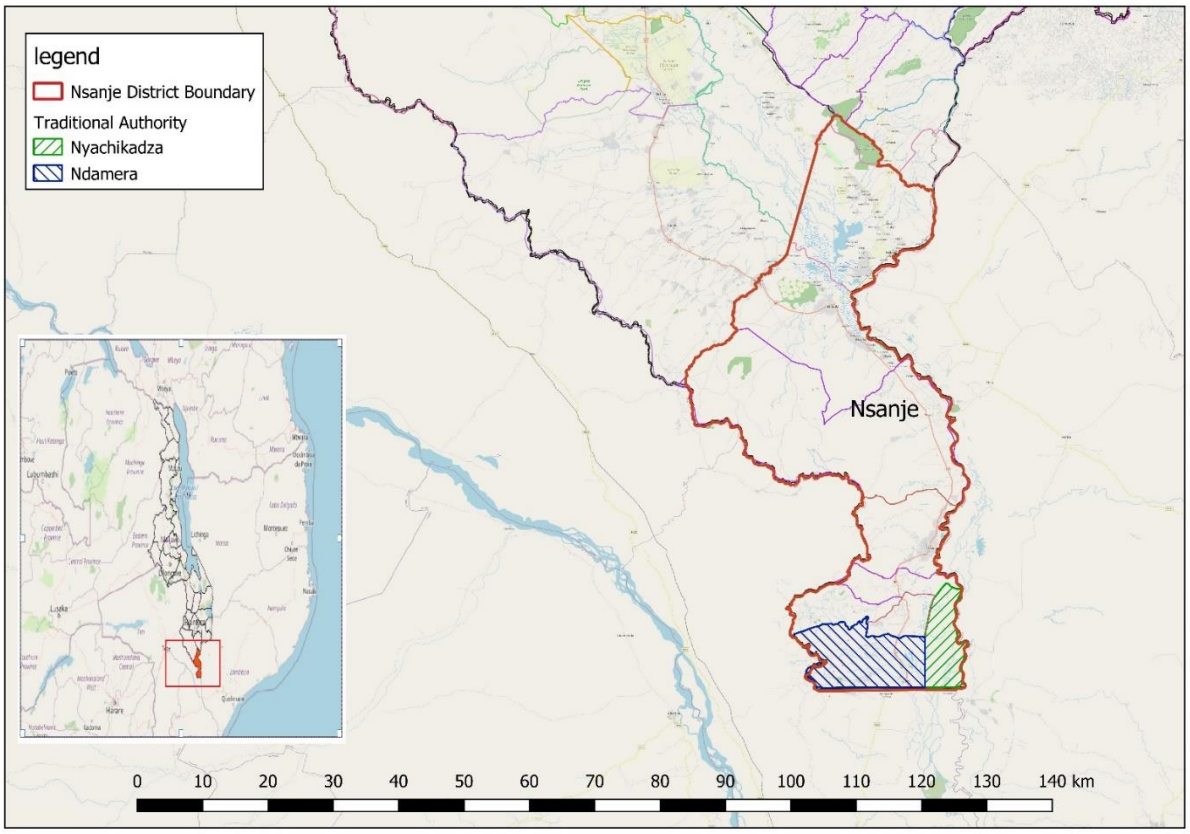

Figure 7 Location of Traditional Authorities Ndamera and Nyachikadza in Nsanje district of Malawi

TA Nyachikadza is home to over 1,000 households located across nine (9) Group Villages (GVs). The community is affected by frequent flooding. When flood waters come, residents of TA Nyachikadza seek refuge in the neighbouring TA Ndamera (Resilient Africa Network, 2017). TA Ndamera has 28 GVs. Of these, 14 GVs are neighbours with TA Nyachikadza. In these 14 GVs, around 80% of the households grow crops in the wetlands of Nyachikadza. Half of these households own land in the wetlands of Nyachikadza, and the remaining half grow

their crops on rented land (Resilient Africa Network, 2017). In general terms, these two communities depend on each other due to the recurrent flooding and the need for food production.

Following the devastating flood of 1997, the Government of Malawi (GOM) was reported to have declared the lowland community a flood prone area, prohibiting anybody from staying in the area and banning the provision of social services, including construction of a health facility, in the area as a way of forcing people to relocate (Resilient Africa Network, 2017). However, people in the lowland community have disregarded the government directive and continued to stay in the area. The question remains what makes them resilient to flood risk, and hence their choice to stay in the flood prone area.

Because the 2 communities' inherent characteristics of being the most affected by floods (RAN, 2017), coupled by their reciprocal relationship based on socio-ecological model of coping with flooding following government's directive prohibiting provision of essential services and increasing their vulnerability, the two communities were selected for this study.

2.3 Participants and sampling

The DP participants were selected through a four-stage sampling technique previously published in detail elsewhere (Dewa, Makoka and Ayo-Yusuf, 2022). Briefly, in the first stage, two (2) TAs (Nyachikadza in the lowland and Ndamera in the upland) from Nsanje District were purposively selected (Ames, Glenton, & Lewin, 2019) and considered two strata from which participants would be drawn. TA Nyachikadza was selected as the worst affected by flooding among all TAs in the district (Odukoya, Anebelundu, Afolabi, & Usenobong, 2015) while TA Ndamera was selected due to its experiences with flooding and adjacence to TA Nyachikadza. People from TA Nyachikadza temporarily relocate to TA Ndamera for shelter in times of flooding, while people from Ndamera plant their food crops on TA Nyachikadza's fertile floodplains following a flood (Resilient Africa Network, 2017).

The second stage involved the selection of Group Villages (a political administrative level immediately below the traditional authority constituting more than one village, grouped to the discretion of the Chief, as described in the Chiefs Act (https://www.lawcom.gov.mw/law-commission-report-review-chiefs-act; accessed on 01 March 2022)) (GVs). In TA

Nyachikadza, 5 out of 9 GVs were selected while in TA Ndamera, 7 out of 14 GVs were selected using simple random sampling technique. The total number of GVs in each TA was used in the distribution of selected GVs. The third selection stage involved a random selection of 40 households from each GV.

Obtaining a representative sample was important for the DP for generalization to the rest of the two communities' population. Sample size calculation took into consideration three factors of confidence level, the degree of variability in the population and the desired level of precision (Kish, 1965; Israel, 2013). Thus, we assumed a 95% confidence level (Yamane, 1967), 0.5 degree of variability which refers to the distribution of attributes in the population representing maximum variability in a population which is used as a standard in sample size determination in academic practice and 7% level of precision (Kish, 1965). The following finite sample size calculation was used:

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

where:

n = sample size,

p = proportion of population containing the major interest,

z = Z-statistic corresponding with confidence level,

e = confidence interval,

N = population size.

With the projected population sizes (National Statistics Office, 2017) of 8,370 for the 7 GVs in TA Ndamera and 4,157 for selected GVs in TA Nyachikadza, using the above formula, the calculated sample sizes were 192 and 187, for the selected GVs by TA, respectively. The calculated sample sizes were then rounded up to 200 for each TA before estimating an attrition rate of 20% between pre- and post-DP surveys resulting in 240 targeted participants for each TA and 480 for the study. The fourth stage involved the listing of all households in the two TAs to form a sampling frame. Out of the 480 households identified, adults over the age of 18 years were listed from which one member was randomly identified to participate in the survey with no option for replacement in subsequent data collection stages. Out of 484 participants who completed the pre-DP survey, about 468 (97.5%) completed the post-

DPsurvey using a paper-based structured questionnaire, consisting of the same questions as the pre-DP questionnaire.

2.5 Data collection

Data collection was conducted using a seven-step community consultative approach called Deliberative Polling® (DP) (Fishkin & Luskin, 2005). Applied for the first time in southern Africa, and for the fourth time in Africa (Malawi) (OECD, 2020), the approach involved the following seven steps (Figure 4.1), as previously published elsewhere (Dewa, Makoka and Ayo-Yusuf, 2022) and outlined below (Figure 4.2).

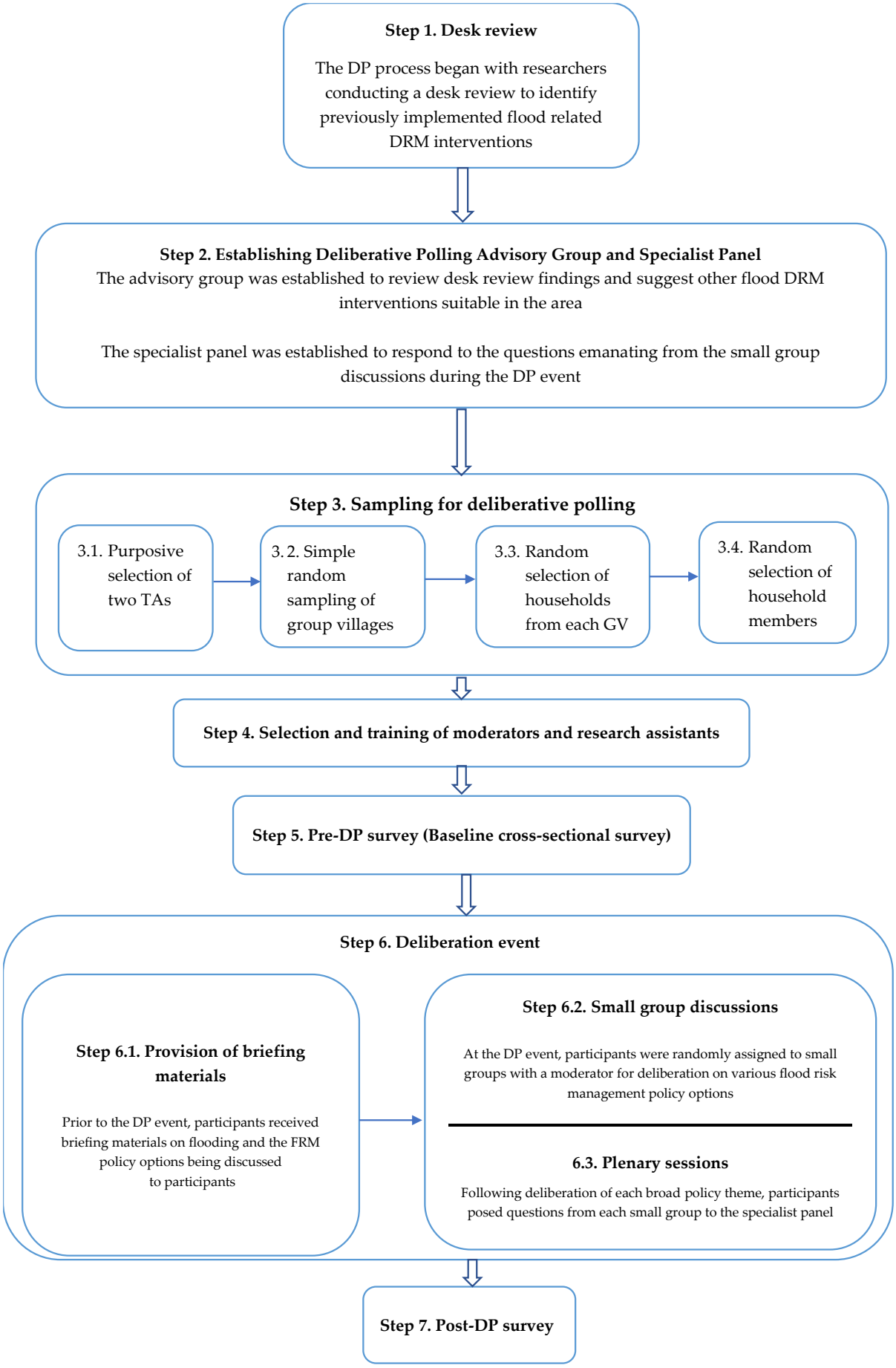

Figure 8 The DP data collection flow process

Source: Dewa et al., 2022

While the study questionnaire was completed by individual participants representing a household, the measurement of resilience in this study is to a large extent reflective of community-level flood resilience because of the following factors, namely (1) data was collected from a representative sample drawn from the two communities; (2) participants completed the questionnaire after small groups and plenary discussions of various policy options with fellow community members (Dewa, Makoka and Ayo-Yusuf, 2022); (3) participants had an opportunity to get clarification from a panel of experts on collective questions they would have had in their small group discussions and; (4) the questionnaire had many factors speaking to community-level factors which required the completing individual to reflect on their household and the community they represent, as opposed to their individual perception.

2.6 Data analysis

Figure 4.3 presents the data analysis process followed for this study.

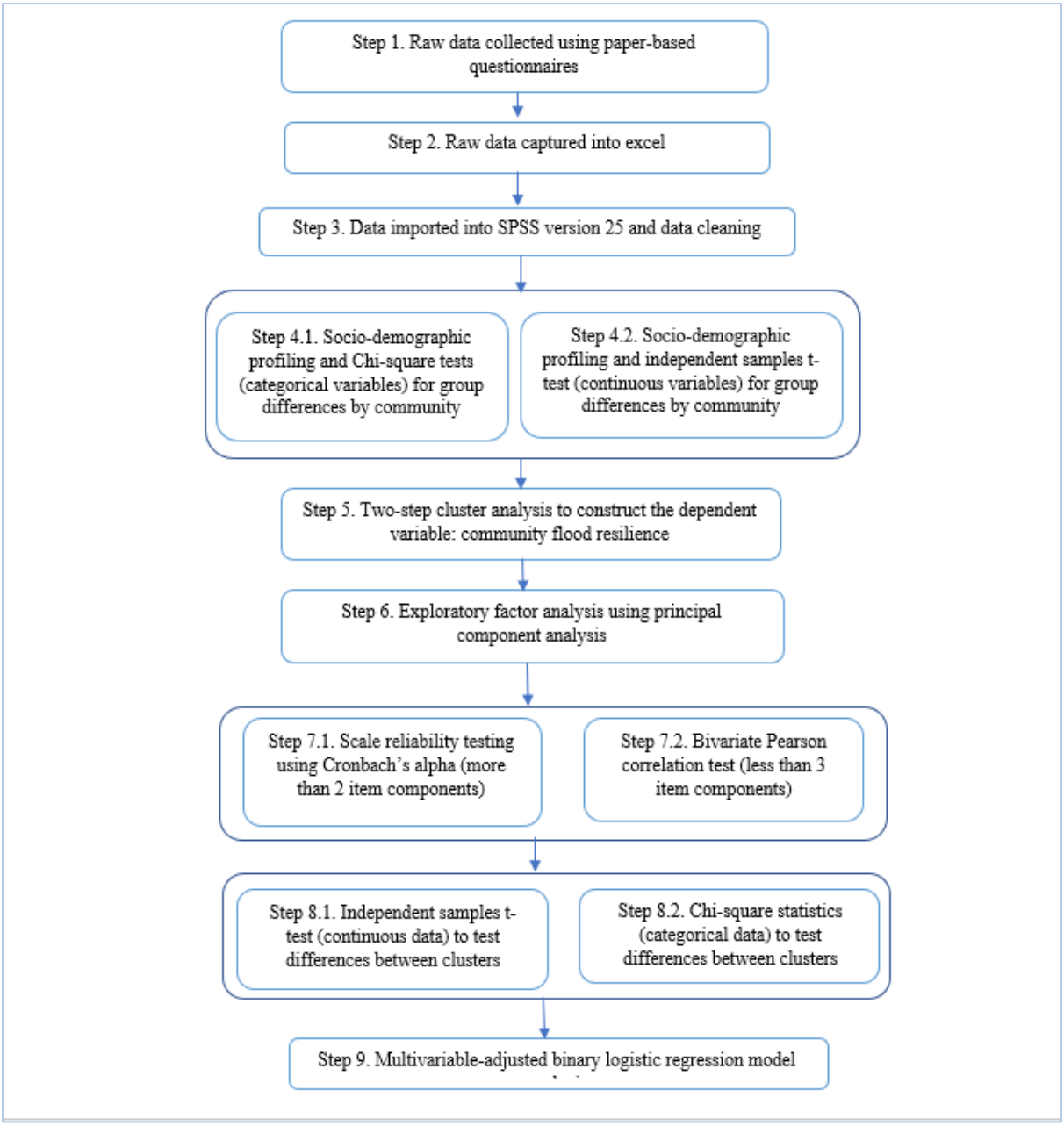

Figure 9 Data analysis process

The primary data was captured in excel before being imported into and analysed using IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, N.Y., USA). Group differences for categorical and continuous data were tested using Chi-square statistics (Shi, DiStefano, McDaniel, Jiang, 2018) and independent sample t-tests (Tabachnick & Fidell, 2007), respectively. All tests were two-tailed and statistical significance was set at $p<0.05$. Data analysis involved a nine-step process (Figure 4.3) including data cleaning, descriptive statistics, cluster analysis, principal component analysis, scale reliability testing, bivariate analysis and multivariable-adjusted binary logistic regression.

Operationalizing the dependent variable (measure of community flood resilience)

Because community flood resilience is a latent variable that is not directly observable, this study used an observable variable as its proxy (d'Errico, Romano, & Pietrelli, 2018). The use of a proxy for measuring resilience was also reported by Lee et-al (2009) in a study conducted to understand the resilience of African Americans after hurricane Katrina. The authors reported that for Katrina evacuees, resilience was considered to mean perseverance, the ability to work through emerging difficulties, as well as maintaining optimistic views on recovery. In the current study, the flood mitigation policy domain, with (nine) 9 actions/policy options, on reducing vulnerability within the existing communities (Table 1) without relocating people (*community agency*) was conceptually conceived to imply community flood resilience (Keogh, Apan, Shahbaz, et al., 2011; Isa, Sugiyanto, & Susilowati, 2018).

A community flood resilience composite variable was computed by identifying different homogeneous groups that existed in the sample through a two-step cluster analysis (Tkaczynski, 2017). The rationale for using cluster analysis is that it can use both continuous and categorical variables to determine an optimal number of clusters in a sample. Two-step cluster analysis is also capable of empirically identifying important combinations as opposed to using *a priori* structure (Conry, Morgan, Curry, et al. 2011).

To conduct a two-step clustering, the flood mitigation policy priority on reducing vulnerability within the existing communities without relocating people (Table 8) was conceptually conceived to imply community flood resilience (Keogh, Apan, Shahbaz, et al., 2011; Isa, Sugiyanto, & Susilowati, 2018). To that end, a two-step cluster analysis was conducted to identify community cluster profiles with substantial similarity in source grades (Laurien et al., 2020), as grouped by the nine (9) factors identified (Table 8), thereby developing a multidimensional typology of community flood resilience as guided by Martin-Breen and Anderies' (2011) three interdisciplinary conceptual framework of resilience. All 9 factors were loaded for classification analysis and respondents who scored the policy options (factors) high were, for classification purposes, considered more resilient than the others since reducing vulnerability while supporting community agency is considered central to strengthening resilience (Wood, 2007).

Table 8 Actions or Policy options for reducing vulnerability in existing communities used for constructing the dependent variable (responses on a 0-10 Likert scale 0 considered being least import and 10 being most important)

a. Construct a dyke along the Shire River from Nsanje District Centre to TA Nyachikadza (a distance of around 40 Km)
b. Construct a dyke along the Shire River from Nsanje District Centre to TA Nyachikadza **with labour from the communities** coordinated by the District Council as part of the Public Works Programme
c. Allow TA Nyachikadza communities to 'access' land upland to temporarily relocate during floods and return afterwards.
d. Allow communities to remain but develop an effective flood-early warning system.
e. Sensitize TA Nyachikadza communities on flood early warning.
f. Develop places of safety for children and vulnerable groups (elderly, sick) when flood warnings are administered.
g. Put in place effective life-saving measures (such as petrol boats, life jackets, etc.) in all strategic places to be used to rescue people during floods
h. Have the VCPC, ACPC and DCPC consider indigenous knowledge systems (IKS) in flood early warning.
i. Have all the Area Civil Protection Committees (ACPCs) and Village Civil Protection Committees (VCPCs) along the Shire River form an alliance to share information about flood early warning.

Operationalizing the independent variables (predictors of community flood resilience)

In addition to 12 socio-demographic factors of participants, 23 questionnaire items (Table 9 and Table 10), also on a Likert scale of 0 to 10, drawn from two flood risk management broad domains of relocation and resettlement and population pressure, gender and social services, were considered potential predictor variables for the dependent variable: community flood resilience.

Table 9 Actions or Policy options for resettlement and relocation used as predictor variables

a. Facilitate the relocation of TA Nyachikadza community to suitable land in the high land area **within the same district**
b. Facilitate the relocation of TA Nyachikadza community to the best suitable land **anywhere in Malawi**
c. Should only proceed with resettlement after it has developed a plan that is approved by the TA Nyachikadza community
d. Provide legal title to land for TA Nyachikadza community members before relocation
e. Facilitate a complete relocation but allow communities to continue using their land for crop cultivation
f. Prohibit provision of any social service (hospitals, schools, etc.) in TA Nyachikadza as a way of 'forcing' people to relocate
g. Provide increased social services (e.g. schools, health centres) in TA Ndamera if people are relocated there
h. Facilitate TA Ndamera's access to the low land for crop cultivation in exchange for hosting TA Nyachikadza's residence in the upland (TA Ndamera)
i. Facilitate increased agricultural production in TA Ndamera

Table 10 Actions or Policy options for population pressure, gender and social services used as predictor variables

a. Provide wide access to free family planning services
b. Construct a health centre in TA Nyachikadza so long as people live there

c. Have families consider their land resources in deciding how many children to have
d. Increase the use of temporary shelters for evacuation instead of classrooms
e. Use community by-laws to restrict child marriages
f. poor families with children of school-going age should only receive a cash transfer if they enroll their children to school
g. adults with children of school-going age should only participate in the Public Works Program if they enroll their children in school
h. Establish collective storage facilities for food in the uplands (by the people from the lowlands)
i. Provide adequate security in evacuation centres to ensure that women and girls are protected from abuse and rape
j. Allow families to be able to stay together during flood evacuations
k. Allow households with persons who are vulnerable and sick be prioritized during flood evacuations
l. Promote the capacity building of the VCPCs to know how to respond to emergencies
m. Promote village savings and loans to provide alternative income sources for women
n. Ensure a woman should not lose the family land if her husband dies

Exploratory factor analysis (EFA) was conducted by means of principal component analysis (PCA), using a correlation matrix, to explore, from the 23 questionnaire items (Table 9 and Table 10), items that could be reliably grouped satisfactorily to constitute the various community flood resilience dimension scales. Items with communality scores of <0.40 were excluded from further PCA (Osborne, Costello, & Kellow, 2008). Items that were not considered satisfactory were used as index measures of a specific community flood resilience dimension. The scale items were factor-analyzed using the eigenvalue cut-off of >1 (Cheplyaka, 2017). Variance was based on rotated sums of squared loadings and the Varimax with Kaiser Normalisation was used as the orthogonal rotation method as it maximizes the loading of each variable on one of the extracted factors while minimizing the loading on all other factors (Weide & Beauducel, 2019). The loadings represent correlation between the individual flood mitigation options and the patterns. Flood mitigation options with positive loadings were positively associated with a policy pattern while negative loadings were inversely associated. PCA was conducted on both communities combined.

The scale items obtained from the PCA were subjected to a test for internal consistency as a measure of scale reliability as depicted by the Cronbach alpha value, using a minimum acceptable level of >0.69 (Taber, 2018; Cortina, 1993). All scale items with alpha values below 0.7 were used as stand-alone items in the logistic regression model to explore their associations with the odds of a represented household being resilient. A bivariate Pearson correlation test was conducted as a reliability test for a component with less than three items (Eisinga, te Grotenhuis, & Pelzer, 2013). Group differences of the clusters were tested using chi-square statistics and t-test for categorical and continuous data, respectively. All factors with $p \leq 0.2$ in

a bivariate analysis were included in the multivariable-adjusted binary logistic regression analysis and only those with $p<0.05$ were retained in the final model.

Investigating factors associated with community flood resilience

To understand the corelates of resilience to flooding, a multivariable-adjusted logistic regression model (Hidalgo & Goodman, 2013) was conducted using an enter method (Ranganathan, Pramesh, & Aggarwal, 2017). Using this approach, all input variables (PCA scales and individual indices), including socio-demographic factors, were entered simultaneously. After obtaining a full (saturated) model, backward stepwise regression (Bursac, Gauss, Williams, et al. 2008) was applied to eliminate insignificant variables from the model to generate a parsimonious model as the final model. A binary logistic regression model was built, with being more or less resilient as outcome or dependent variable, and potential predictors adjusted for age, gender, and community. All statistical significance was defined using a 2-sided and p-value < 0.05.

2.7 Study validity

To ensure both internal and external validity (Patino and Ferreira, 2018), the study was designed based on a participatory (bottom-up) process using substantial input from stakeholders from the affected communities including the identification of policy options for flood risk mitigation, selection of the expert panel from district stakeholders to advise on specialized topics such as policy, among others, for context specificity, a key tenet in resilience measurement. The data collection team, guided by a multidisciplinary team of research experts from Stanford University (United States of America), University of Pretoria (South Africa), Makerere University (Uganda) and Lilongwe University of Agriculture and Natural Resources (Malawi), were all recruited locally with a good understanding of both English and the local language, Chichewa. As this study used a DP method, in a situation that required consultation of an entire community about their opinions on a policy aspect, representativeness was essential. To that end, a random selection of participants from the two communities was conducted to ensure that they are representatives of the socio-demographic profile of the two communities for generalizability within the study communities. Although the purpose was not to generalize the results to other similar communities, this study developed a community flood resilience analytical framework that can be replicated in other communities with similar characteristics and produce results with important public health policy implications. In

subsequent multivariable binary logistic regression, the analysis controlled for community so that the association between the resilience latent construct and its predictors could be assessed independent of any differences that could be because of the community from which participants came from.

3. Results

As the first step to understanding the characteristics of study participants, a comparison of socio-demographic factors between the two study communities (lowland and upland) was conducted (Table 11). This is followed by a presentation of results from cluster analysis, bivariate analysis, the EFA and the multivariable-adjusted binary logistic regression model.

3.1. Comparison of socio-demographic factors between the two study communities (lowland and upland)

Table 11 Socio-demographic factors between the two study communities

Variables	Category	TA Ndamera (Upland) (n=222)	TA Nyachikadza (lowland) (n=246)	p-value
Age	18-29	20.7%	20.3%	
	30-49	45.9%	41.1%	
	50-69	27.5%	30.5%	
	70+	5.9%	8.1%	
				0.599
Gender	Male	52.3%	73.6%	
	Female	47.7%	26.4%	
				0.000* **
Current occupation	Farmer	89.6%	97.2%	
	Non-Farmer	10.4%	2.8%	
				0.001 **
Marital status	Married	82.0%	82.5%	
	Single	3.2%	5.3%	
	Divorced	1.8%	3.3%	
	Widowed	13.1%	8.9%	
				0.259
Highest level of education	None	24.8%	22.4%	
	Primary	45.5%	63.8%	
	Secondary	29.7%	13.8%	
				0.000* **

Have a member of the family chronically ill	Yes	13.5%	13.8%	
	No	86.5%	86.2%	
				0.923
Household size	<=3	10.8%	9.3%	
	4-9	80.6%	82.9%	
	>=10	8.6%	7.7%	
				0.809
Ownership of land in both communities	Yes	60.8%	14.6%	
	No	39.2%	85.4%	
				0.000* **
Membership to the Village or Area Civil Protection Committees	Yes	34.7%	14.2%	
	No	65.3%	85.8%	
				0.000* **
Having an alternative place to go during times of a flood	Yes	27.5%	65.4%	
	No	72.5%	34.6%	
				0.000* **
Having any training or education on disasters or flooding	Yes	28.4%	26.0%	
	No	71.6%	74.0%	
				0.566

The data shows that the samples from the two communities differed significantly in terms of socio-demographic factors (Table 11). Compared to those in the upland, a significantly higher proportion of those in the lowland were males, farmers, had more formal education, and fewer proportion were members of village or area civil protection committees. Furthermore, a lower proportion of those from the lowlands as compared to those from uplands owned land in both communities (14.6% vs. 60.8%; $p<0.000$). However, a higher proportion of those in the lowlands as compared to those from the uplands indicated they had an alternative place to go during floods (65.4% vs. 27.5%; $p<0.000$).

3.2. Community flood resilience construct

The two-step cluster analysis identified two cluster groups with a fair cluster quality (average silhouette measure of cohesion and separation) of 0.4 (Table 12). The clusters were built around strong support for three (3) flood mitigation items, namely, construction of a dyke along the Shire river (natural capital for engineering resilience) from Nsanje district council to

lowland, construction of a dyke using labour (human capital for systems/ecological resilience) from the local communities, and allowing lowland community to stay but developing early warning systems (physical capital for complex adaptive systems resilience). The two clusters were logically labelled 'more flood resilient' (n=296, 63.8%) and 'less flood resilient' (n=168, 36.2%) with ratio of sizes of 1.76. Thus, through cluster analysis, this study managed to derive a dichotomous construct 'community flood resilience' as measured by the three variables differentiating the two identified clusters.

Table 12 Results of a two-step cluster analysis to construct the community flood resilience index

Variable	Cluster 1- 'More resilient' score (n=296)	Cluster 2- 'Less resilient' score (n=168)	Importance
Construction of a dyke along the Shire River (Engineering resilience)	9.26	3.77	0.93
Construction of a dyke using labour from the local communities (human capital for systems/ecological resilience)	9.09	3.47	1.00
Allowing lowland community to stay but developing early warning systems (physical capital for complex adaptive systems resilience)	9.17	5.92	0.54

Cluster quality (average silhouette measure of cohesion and separation) = 0.4; Ratio of sizes = 1.76.

3.3. Description of identified principal component flood risk management actions/policy options

Six (6) flood risk mitigation patterns, which explained about 60.87% of the total variance (total flood mitigation items variability) were retained by the overall PCA (Table 13).

Table 13 Principal Components (PC) loading matrix and explained variances for five community flood resilience policy option patterns identified

Component items	Sense of place **(α= 0.902)**	Sense of caring **(α= 0.580)**	Child education support **(r= 0.652) ***	Family wellness **(r= 0.220) ***	Women empowerment **(α= 0.457)**	System function**
Provide increased social services (e.g., schools, health centres) in TA Ndamera if people are relocated there	0.820					
Facilitate TA Ndamera's access to the low land for crop cultivation in exchange for hosting TA Nyachikadza's residence in the upland (TA Ndamera)	0.790					
Facilitate increased agricultural production in TA Ndamera	0.787					
Should only proceed with resettlement after it has developed a plan that is approved by the TA Nyachikadza community	0.769					
Facilitate a complete relocation but allow communities to continue using their land for crop cultivation	0.745					
Provide legal title to land for TA Nyachikadza community members before relocation	0.721					
Prohibit provision of any social service (hospitals, schools, etc.) in TA Nyachikadza as a way of 'forcing' people to relocate	0.714					
Facilitate the relocation of TA Nyachikadza community to the best suitable land anywhere in Malawi	0.709					
Facilitate the relocation of TA Nyachikadza community to suitable land in the highland area within the same district	0.617					
Construct a health centre in TA Nyachikadza as long as people live there	0.590					
Promote the capacity building on VCPCs to know how to respond to emergencies		0.741				
Allow households with persons who are vulnerable and sick to be prioritized during flood evacuations		0.740				
Provide adequate security in the evacuation camps to ensure women are protected		0.518			0.302	
Adults with children of school-going age should only participate in the Public Works Program if they enroll their children in school			0.889			
Poor families with children of school-going age should only receive a cash transfer if they enroll their children in school			0.879			
Have families consider their land resources in deciding the number of children to have				0.702		

Ensure a woman should not lose family land if her husband dies				0.670		
Use of community by laws to restrict child marriages					0.688	
Provide wide access to free family planning services					0.620	
Promote village savings and loans to provide alternative income sources for women				0.400	0.425	
Allow families to be able to stay together during flood evacuation						0.922
% of Variance	**25.531**	**8.179**	**8.065**	**6.922**	**6.917**	**5.259**
Cumulative %	**25.531**	**33.709**	**41.775**	**48.697**	**55.614**	**60.874**

***** Bivariate Pearson Correlation test, **Single item component
Kaiser-Meyer-Olkin measure of sampling adequacy = 0.866; Bartlett's test of sphericity significant, p=0.000

The first PC factor had the largest number of items on resisting relocation, namely, approved resettlement plan; access to social services, access to lowland for cultivation; increasing services and agricultural production upland; relocation to suitable land anywhere; complete relocation with access to land; relocation to suitable land upland; provision of legal title to land; facilitating access to land for food production by upland community in exchange for hosting the lowland community; and construction of a health centre in lowland. This PC, which somewhat captures the communities' resistance to relocation and an expression of 'sense of place', was named *"Sense of place"* and accounted for 25.53% variance in flood risk policy option patterns. The second PC was loaded with issues to do with prioritisation of vulnerable and sick people in flood emergencies, strengthening response capacity of Village Civil Protection Committees (VCPC), and ensuring adequate security in evacuation camps. This PC, which somewhat captures elements of social capital assets, contributed 8.18% of the total variance with positive factor loadings and was named *"Sense of caring"*.

Two (2) items relating to keeping children in school (families to participate in public works programmes if their children are enrolled in school and families to receive disaster cash transfers if their children are enrolled in school) were captured in a PC called *"Child education support"*. This third PC, which captures elements of human capital assets, had a variance contribution of 8.07%. The fourth PC identified also had two items, namely, having families consider their land resources in deciding the number of children to have and ensuring women do not lose family land if their husband dies. This PC had a total variance contribution of 6.92% and was named "*Family wellness*". The fifth PC had three items, namely, use of community by-laws to restrict child marriages, provision of wide access to free family planning services, and promoting village savings and loans to provide alternative income sources for women. This PC had a total variance contribution of 6.92% and was named "*Women empowerment*". The

sixth PC identified had one item about allowing families to stay together during flood evacuation. This PC contributed 5.26% variance, and was named "*System function*," as it captures elements of continuity of the family unit.

A scale reliability analysis for the component items produced varying scales' reliability, with a Cronbach alpha ranging between 0.457 and 0.902 for three patterns with more than two component items (Table 13). One (1) pattern, that is, "*Sense of place*" (α =0.902) produced very good (>.8) (Ursachi, Horodnic and Zait, 2015) internal consistency. The other two patterns had alpha values below the minimum acceptable level of 0.70 (Taber, 2018), hence the component items were used as standalone items in subsequent analysis. Based on 468 complete observations, bivariate Pearson Correlation tests for the two-item components produced a strong (>0.6) (Mukaka, 2012) and statistically significant coefficient for *Child education support* (r=0.652, p=0.000). Therefore, the direction of the relationship is positive, meaning that the items in this component tend to increase together and were considered a scale measuring the same underlying construct. The correlation coefficient for the component "Family wellness" (r=0.220, p=0.000) was considered weak and probably not a scale measuring the same underlying construct (Mukaka, 2012), therefore, the individual items were used as standalone items in subsequent analysis.

3.4. Factors that differentiated the more from the less flood resilient households

Table 14 presents results of differences between the 'more flood resilient' and 'less flood resilient' households from the bivariate analysis for categorical variables.

Table 14 Comparison of socio-demographic factors between the more resilient and less resilient clusters

Variables	**Less flood resilient (n=168)**	**More flood resilient (n=296)**	**p-value**
Gender			
Male	87 (51.8%)	208 (70.3%)	
Female	81 (48.2%)	88 (29.7%)	
			0.000* **

Marital status			
Married	137 (81.5%)	246 (83.1%)	
Single	4 (2.4%)	15 (5.1%)	
Divorced	1 (0.6%)	11 (3.7%)	
Widowed	26 (15.5%)	24 (8.1%)	
			0.010*
Ownership of land in both communities			
Yes	74 (44.0%)	97 (32.8%)	
No	94 (56.0%)	199 (67.2%)	
			0.016*
Having an alternative place to go during times of flooding			
Yes	54 (32.1%)	164 (55.4%)	
No	114 (67.9%)	132 (44.6%)	
			0.000***
Education level			
None	43 (25.6%)	66 (22.3%)	
Primary	81 (48.2%)	175 (59.1%)	
Secondary and above	44 (26.2%)	55 (18.6%)	
			0.057
Traditional authority (Community)			
TA Ndamera (Upland)	124 (73.8%)	97 (32.8%)	
TA Nyachikadza (Lowland)	44 (26.2%)	199 (67.2%)	
			0.000***
Occupation			
Farmer	159 (94.6%)	275 (92.9%)	
Non-Farmer	9 (5.4%)	21 (7.1%)	
			0.558
Household size			
<=3	17 (10.1%)	29 (9.8%)	
4-9	135 (80.4%)	246 (83.1%)	
>=10	16 (9.5%)	21 (7.1%)	

			0.637
Disaster training			
Yes	42 (25.0%)	85 (28.7%)	
No	126 (75.0%)	211 (71.3%)	
			0.448
Age			
18-29	39 (23.2%)	55 (18.6%)	
30-49	72 (42.9%)	131 (44.3%)	
50-69	47 (28.0%)	87 (29.4%)	
70+	10 (6.0%)	23 (7.8%)	
			0.625
Health status (Household member living with chronic illness)			
Yes	22 (13.1%)	42 (14.2%)	
No	146 (86.9%)	254 (85.8%)	
			0.781
Village Civil Protection Committee member			
Yes	42 (25.0%)	70 (23.6%)	
No	126 (75.0%)	226 (76.4%)	
			0.737

*p<0.05, **p<0.01, ***p<0.001

The data shows that the two clusters differed significantly in terms of gender (p=0.000) with more males (70.3%) in the more resilient cluster. The two clusters also differed significantly in terms of marital status (p=0.010). Participants differed significantly in terms of community of residence (p=0.000). The two clusters were also significantly different both in terms of ownership of land in both communities and having an alternative place to go during a flood (p=0.000). From the participant characterisation table (Table 11) comparing the two communities, it was noted that there were more participants from the lowland with an alternative place to go during a flood, compared to participants from the upland. Conversely, participants from the upland had proportionally more ownership of land in both communities (p=0.000) compared to participants from the lowland.

Like Table 14, Table 15 presents the differences between the 'more flood resilient' and 'less flood resilient' clusters, for continuous variables.

Table 15 Bivariate analysis comparing the more resilient and less resilient clusters with regards to scores (continuous variables)

Variable	**Less flood resilient (n=168)**	**More flood resilient (n=296)**	
	Mean (± SD)	**Mean (± SD)**	**P-value†**
Sense of place	4.60 (2.97)	6.86 (2.62)	0.000***
Child education support	8.75 (1.96)	8.85 (1.91)	0.576
Promote the capacity building of the VCPCs to know how to respond to emergencies	8.11 (2.16)	8.94 (1.69)	0.000***
Allow households with persons who are vulnerable, and sick to be prioritized during flood evacuations	8.20 (2.32)	9.10 (1.60)	0.000***
Provide adequate security in evacuation centres to ensure that women and girls are protected from abuse and rape	8.93 (1.87)	9.18 (1.58)	0.137
Provide wide access to free family planning services	8.89 (1.97)	9.32 (1.51)	0.010*
Use community by-laws to restrict child marriages	9.17 (1.60)	9.36 (1.55)	0.223
Promote village savings and loans to provide alternative income sources for women	9.04 (1.67)	9.24 (1.60)	0.188
Ensure a woman should not lose the family land if her husband dies	8.93 (2.32)	8.84 (2.31)	0.666

Have families consider their land resources in deciding how many children to have	7.30 (3.05)	7.83 (2.80)	0.062
Allow families to be able to stay together during flood evacuations	7.39 (3.43)	8.19 (3.10)	0.011*

†Independent sample t-tests; *p<0.05, **p<0.01, ***p<0.001

Data shows that the two clusters differed significantly in terms of sense of place (p=0.000), strengthening capacity of civil protection committees (p=0.000), allowing households with people who are sick and vulnerable to be prioritized during evacuations (p=0.000), access to free family planning services (p=0.010) and allowing families to stay together during flood evacuations (p=0.011).

3.5. Multivariable analysis of the factors associated with community flood resilience

Table 16 presents results of a multivariable-adjusted binary logistic regression model of the factors significantly (p<0.05) associated with community flood resilience controlled for age, sex and community.

Table 16 Multivariable-adjusted binary logistic regression model of the factors associated with community flood resilience in TAs Nyachikadza and Ndamera, Nsanje District, Malawi.

Variables		**Odds Ratio**	**95% C.I. for Odds Ratio**		
			Lower	**Upper**	**Sig.**
Sense of place	(per unit increase in support)	1.251	1.123	1.394	0.000***
Community/TA location	Upland (Ndamera)	Ref.			
	Lowland (Nyachikadza)	4.610	2.274	9.346	0.000***
Ownership of land in both communities	Yes	Ref.			

	No	.540	.310	.940	0.029*
Having an alternative place to go during times of a flood	Yes	Ref.			
	No	1.659	1.009	2.730	0.046*
Provide wide access to free family planning services	(per unit increase in support)	1.198	1.042	1.377	0.011*
Promote capacity building of the VCPCs to know how to respond to emergencies	(per unit increase in support)	1.163	1.026	1.318	0.018*
Allow households with persons who are vulnerable, and sick be prioritized during flood evacuations	(per unit increase in support)	1.324	1.166	1.504	0.000***
Allow families to be able to stay together during flood evacuations	(per unit change)	1.145	1.065	1.232	0.000***

*p<0.05, **p<0.01, ***p<0.001

The results indicate that participants who resisted relocation and expressed a stronger sense of place had 1.251 times higher odds of being more flood resilient (95% C.I.=1.123 – 1.394; p=0.000). It is noteworthy that staying in the lowland (flood prone area) was 4.610 times more likely associated with being more flood resilient (95% C.I.=2.274 – 9.346, p=0.000). Participants who did not own land in both communities had 0.540 times lower odds of being more flood resilient (95% C.I.=0.310 – 0.940, p=0.029) compared to those who owned land in both communities. Participants who were in favor of the provision of free family planning services were 1.198 times more likely to be more flood resilient (95% C.I.=1.042 – 1.377, p=0.011). Similarly, those who were in favor of having families stay together during a flood evacuation were 1.145 times more likely to be more flood resilient (95% C.I.=1.065 – 1.232, p=0.000). Participants in support of allowing households with persons who are vulnerable, and sick to be prioritized during flood evacuations were 1.324 times more likely to be more flood resilient (95% C.I.=1.166 – 1.504, p=0.000). Support for strengthened capacity of VCPCs to know how to respond to emergencies was strongly associated with being more flood resilient (OR=1.163, 95% C.I.=1.026 – 1.318, p=0.018). Surprisingly, participants without an alternative place to go during a flood were 1.659 times more likely to be more resilient compared to those with an alternative place (95% C.I.=1.009 – 2.730, p=0.046).

4. Discussion

The factors associated with community flood resilience, in this study, coalesced at the intersection of the need for improved access to public health services, sense of place (resistance to relocation), existential learning from past flooding experience and the need for human capital development for community flood preparedness.

The need for wide access to free family planning services (possible proxy for access to basic primary health care), having families stay together during a flood evacuation (psycho-social health and possible proxy for community's sense of connection and maintaining system function) and prioritization of the sick and vulnerable members of the community during a flood (possible proxy for community's sense of caring and maintaining system function) collectively expressed the importance of public health services in disaster risk management and climate adaptation. From a disaster risk science perspective, these health elements capture both coping (staying together during evacuation and prioritization of the sick and vulnerable) in the short-term (Ulrichs, Slater, & Costella, 2019) and adaptation strategies (having access to free family planning services) (Daramola, Oni, Ogundele, & Adesanya, 2016). The centrality of health and well-being in flood resilience science and strengthened DRM capacity is supported by De Souza (2014) and as suggested by Bayntun (2012), resilient health systems are better able to protect themselves and human life from the public health impacts of disasters. This finding is also supported by a study conducted by the Resilient Africa Network (RAN) (2016), in Uganda, in which they concluded that DRM and climate change mitigation interventions would be incomplete without mainstreaming family planning as it has an impact on population pressure, which in turn, increases disaster risk. Rockstrom (2003) has called such factors resilience parachutes due to their focus on enabling communities and ecosystems to move significantly (if not rapidly) from situations of vulnerability, for example, if families are separated during flood evacuation, towards a maintained system that can continue functioning ex-post flooding.

Most of the study participants were recalcitrant to government's resettlement and relocation policy position with higher odds of being more flood resilient among participants living in harm's way (flood-prone community). While resistance has been perceived by some to be detrimental to the capacity to adapt (Liao, 2014), it has also been conceived by others, as in this study, as an inherent element of strengthening resilience (Hegger, Driessen, Wiering, et

al., 2016; Restemeyer, Woltjer, & van den Brink, 2015). Results of this study capture resistance and a strong sense of place as essential elements of resilience, perhaps informed by learning from existential experience of previous floods the two communities have, for years, endured with little to no support from government. Learning from past disaster experiences is considered an essential element of adaptive and transformative capacities for resilience (Aslam, Teo, Goonetilleke, et al., 2021). Nava (2022) captures learning from disasters and learning through disasters as two essential elements of organisational processes emerging in the aftermath of a disaster. As learning from and through disasters are essential elements of resilience, this study captured this phenomenon through evidence suggesting that participants from the lowland (with higher odds of being more flood resilient) did not own land in both the upland and the lowland but they had an alternative place (in the upland) to run to during a flood. This finding reveals two communities that have learnt to interact with their socio-ecological environment to sustain their livelihoods (Baudoin, Henly-Shepard, Fernando, et al., 2014) and therefore can risk living in harm's way. This observation is consistent with the results of a study conducted in Jakarta that showed that, for poor families, living in flood prone areas was necessary for a livelihood (Hellman, 2015) as they paradoxically depend on the same river that causes flooding. The results discussed here demonstrate that this study has managed to present a community flood resilience framework that accounts for previous conceptual challenges relating to failure of other resilience conceptualizations and measurement approaches to capture soft elements of community (lived values) that are often considered difficult to measure.

At the onset of a flood, the first responders are the trained personnel within the affected communities, in this case, the village civil protection committee members. This is considering that external help is usually delayed due to limited access and communication challenges (Islam & Walkerden, 2014). Therefore, it is essential that these first responders have adequate knowledge and skills to prioritize at-risk populations and facilitate safe and effective community evacuation. Thus, such capacity is required to make use of the other capitals discussed above. Results from the regression model identified the capacitation of the village civil protection committees (proxy for social support asset) to respond to flooding as one of the factors significantly associated with being more flood resilient. This seems to suggest that for the short-term absorptive capacities to be effectively deployed, social support linked to human capital development is an important and needed transformative capacity – a finding supported

by other similar resilience studies (Department for International Development, 2011; Guiteras, Jina, & Mobarak, 2015).

The results of this study reveal that sense of place, health and community wellbeing are linked, and yet, distinct dimensions of resilience. As Masterson, Enqvist and Stedman (2019) note, loss of place attachment and meaning, in this case, through relocation, may have emotional and mental health effects on the affected people. Therefore, interventions that seek to measure and strengthen the resilience of flood prone communities should not only look at physical infrastructure and economic related indicators, but also into the social determinants of health. These social determinants of health, supported by strengthened or skilled community disaster civil protection committees (human capital development) have potential to build and sustain the much-needed capacities for communities to maintain system function, cope and sustain livelihoods in the face of adversity.

4.1 Contribution to the science of resilience

This paper has presented cluster analysis as an effective method for empirically deriving, through measurement, and constructing an abstract typology of community flood resilience and still maintaining capability to understand underlying context specific community level common characteristics of resilience using data collected at household level. While we acknowledge that the two communities studied differed topographically (upland and lowland) and in their interaction with flooding, the identification of a common typology of these community resilience characteristics helps policy makers and stakeholders in identifying intervention pathways that transcend community sub-group differences with potential to improve the well-being of the affected people, from a systems approach. Thus, the study makes contribution to previously observed scarcity of empirical evidence of resilience measurement at community level (Bulti, Girma and Megento, 2019). To account for sub-group differences, which has been the major point of critique for the systems approach (McClymont, Morrison, Beevers and Carmen, 2020), this study also identified context specific predictor variables associated with being more resilient to flooding through a disaggregation of data for different sub-groups in the sample population.

From a conceptual perspective, this study found that the latent construct of community flood resilience, as measurement derived, captured all the three elements (Engineering resilience,

systems resilience, resilience in complex adaptive systems) of the conceptual model of resilience (McClymont, Morrison, Beevers, & Carmen, 2020). From an engineering and systems (ecological) resilience perspective, this study has shown that the construction of a dyke to ward off flooding and the provision of Early Warning Systems (EWS) to alert communities of an impending flood would enable the communities to continue with their livelihood activities while maintaining system function, with minimum impairment, thereby strengthening community flood resilience. This finding is in line with Chambers (2014) and Curtin and Parker's (2014) postulation that strengthening ecological resilience increases system persistence and adaptation in the face of disruptive change. The resilience element related to the extent of support for use of labour from the local communities in the construction of a dyke captures the ability of the communities to reorganize themselves and collectively respond to a crisis, which is an essential element of complex adaptive systems for adaptation, learning and transformation. Collectively, the three elements, as derived from this study, capture a strong emphasis of community agency and social capital through an accentuation of what the two communities can do for themselves and the need to strengthen their capacities, as opposed to focusing on their vulnerability to flooding and relocating them to mitigate flood risk. Thus, this study confirms resilience as a multi-dimensional concept and validates the theoretical model of the three frameworks of resilience (McClymont, Morrison, Beevers, & Carmen, 2020) at measurement level, with empirical support of predictors of community flood resilience.

A study by Lee et-al (2009) found that for hurricane Katrina evacuees, resilience was considered to mean perseverance, the ability to work through emerging difficulties, as well as maintaining optimistic views on recovery. These findings found expression in this study in that being resilient was associated with staying in harm's way ('*perseverance'*) and the need to strengthen the ability of households to cope during flooding through staying together and prioritising the sick and vulnerable ('*ability to work through emerging difficulties'*) and strengthening community flood preparedness through capacitation of VCPCs which seem to capture the element of optimism of recovery if the necessary adaptation capacities are strengthened. Similarly, findings from the study by the Resilient Africa Network (RAN) in Southern African communities (RAN, 2017), suggested that environmental stability (defined as construction of a dyke and establishment of early warning systems in the current study) has a direct positive effect on human capital (knowledge and skills) development (operationalized as capacitation of VCPCs in the current study), which in turn, contributes positively to wealth creation and food security. As wealth creation and food security were considered important

dimensions of resilience in the RAN study, it is conceivable that being more flood resilient would be strongly associated with factors that would protect the livelihoods of the people most at risk of flooding. Such convergence of empirical findings from different spatial and temporal scales confirms the heuristic conceptual and analytical approach, developed based on participatory (bottom-up) approach using substantial input from potential stakeholders (Norris et al., 2008), used in this study as effective in understanding, characterizing, and measuring resilience in the context of disaster risk management and climate adaptation.

4.2 Study limitations

This was a cross-sectional study, hence the caution in making any causal inferences. Furthermore, this was a quantitative study with no explanatory qualitative information to provide all of the context for the participants' responses that may fully explain some of the observations made on the data. In addition, the study participants were mostly male (63.5%) which could have resulted in biased reporting or choice of supported flood risk mitigation options. However, to address these limitations, this quantitative study followed on a qualitative deliberative event at which all the flood mitigation policy options were discussed among all the participants, and a panel of experts availed to provide explanations on aspects that were not clear to the participants before they completed the survey. It can be argued that participants had balanced information on all the policies to be able to make independent informed decisions about their own choices. In the calculation of the community flood resilience construct, we make a normative assumption that responses to the question regarding reducing vulnerability within the communities (community agency) represent flood resilience. This assumption was based on previous resilience literature showing that commitment to remain in a flood prone area despite the prospect of continued future flooding (Keogh, Apan, Shahbaz, et al., 2011; Sugiyanto, & Susilowati, 2018) can be conceptualised as resilience. In addition, reducing vulnerability while supporting community agency is considered central to strengthening resilience (Wood, 2007). The findings of this study provide a foundation for further mixed method studies to understand why poor people living in flood prone areas in similar settings in low- and middle-income countries choose to continue staying there despite the obvious risks to their health and livelihoods

5. Conclusions

This study sought to contribute to knowledge on resilience and resilience measurement as a growing area of research and development by using empirical data to construct the variable 'community flood resilience' and quantitatively investigating the factors associated with being more resilient to flooding. The community flood resilience construct, in this study, was defined by three factors, namely, the construction of a dyke to ward off flooding, the provision of Early Warning Systems and the construction of a dyke using labour from the local community. Therefore, we conclude that, empirically, the construct captured all the three elements (Engineering resilience, systems resilience, resilience in complex adaptive systems) of the earlier conceptual model of resilience. Thus, the approach taken in this paper is considered to be comprehensive as it captured the soft elements of resilience that are often considered difficult to measure. While resilience measurement was at community level, our analytical approach enabled us to also investigate the differential sub-population factors that make other population groups more vulnerable than others. The conceptual and measurement achievements of this study were achieved mainly due to the participatory design of the study that galvanized the two communities to action by providing them with context specific information about flooding, its effects and various actions/policy options available to them.

As the results of this study accentuated and buttressed the central role of public health and the need to understand the interactions between affected people and their ecological environment in addition to the physical environment factors, this confirms resilience as a multidimensional concept. However, the level of importance of the various dimensions may differ depending on the context. In this case, public health service provisioning was presented as an important yet missing component for the two communities to function effectively. In addition, the socio-ecological factors may have been considered important as they captured the already existing flood adaptation mechanism that undergird the livelihood and well-being of the two communities. The confirmation of importance of human capacity (knowledge and skills) development for disaster preparedness and predictor of community flood resilience in this study, as was captured in other studies in the African region, shows the importance of directly capacitating people living in flood prone communities as the first responders to disaster situations. Finally, resistance to relocation as a flood mitigation strategy was shown to be a strong statement by the affected communities in defiance of a government relocation plan, and an expression of a strong sense of place. It is also a call to stakeholders to support community members' efforts to continue living within the existing community but implement interventions

that would reduce communities' risk and promote sustainable development of the community. The study further demonstrates that affected communities in this study, and in similar settings in low- and middle-income countries, are not ideal recipients and implementers of policies, but rather they are knowledge generating labs capable of making decisions on matters of policy that affect their lives and wellbeing. Therefore, this study makes the following specific recommendations to policymakers:

- Policymakers need to recognize that communities have the capacity to self-organise and develop context-specific flood coping and adaptation practices that with time become recursive and part of their everyday life and inherently a key determinant of their resilience to flooding.
- Over and above the construction of protective physical infrastructure, policy makers need to put socio-ecological interactions and processes at the centre of understanding flood resilience which imply the need to highly participatory and inclusive policy development consultations. Such consultations should be geared towards galvanizing communities to identify possible interventions or actions that can be implemented to reduce their vulnerability while at the same time, sustaining their livelihoods.
- Governments should provide, and allow other stakeholders to provide, social services that strengthen the human capital assets of communities to be able to adapt to the flooding situation as long as people live in harm's way. Provision of such services or support will instil a sense of community agency and autonomy to determine their future which may nurture a less contentious attitude among the affected people when they interact with policy makers.

Despite its limitations, for example, being purely quantitative, this study has provided a heuristic resilience measurement framework and a foundation for further mixed method studies to understand why poor people living in flood prone areas in similar settings in low- and middle-income countries choose to continue staying there despite the obvious risks to their health and livelihoods.

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Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author.

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CHAPTER 5

EXPLORING THE LOCAL COMMUNITY'S PERCEIVED MEASURES OF FAIR FLOOD RISK MITIGATION POLICY ADAPTATION AND IMPLEMENTATION

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CHAPTER 5

The last chapter sought to measure community flood resilience and its associated factors. It provided a conceptual framework for the measurement of disaster resilience at community level. In addition, it emphasized the importance of public health and the need to understand the interactions between affected people and their ecological environment in addition to the physical environment factors, thereby confirming resilience as a multidimensional concept. Results also revealed that flood affected communities are not ideal recipients and implementers of DRM policies, but rather they are knowledge generating labs capable of making decisions on matters of policy that affect their lives and wellbeing. The major question that remains is how policy makers and practitioners can consult these communities on policy matters that have often been considered difficult to comprehend especially among poor rural people.

The current chapter presents an innovative approach to community consultation. First, it presents various community consultative methods in both literature and practice before it demonstrates why a deliberative approach was chosen for this study. Findings from this study agree with those from the previous chapter on factors associated with community flood resilience. Like the previous chapter, community members in this study identified the need for government to implement interventions that strengthen systems for health service delivery including issues related to population control, gender and provision of other social services.

This empirical convergence between findings from the two studies, in a way, demonstrates the scientific contribution of this thesis to the development of scientific inquiry approaches that can be applied within public health to generate evidence for improved health outcomes and strengthened resilience at community level. Results from the current chapter also triggers discussions around what communities perceive as fair adaptation within the climate justice and just transition discourse. Again, a further confirmation that for public health policy interventions to be successful, policymakers and practitioners need to consult the affected communities in a way that is considered just and fair towards protecting and promoting human health and livelihoods.

5. ASSESSING RURAL COMMUNITIES' SUPPORT FOR FLOOD MITIGATION POLICIES TO STRENGTHEN COMMUNITY DISASTER RESILIENCE IN MALAWI

Abstract

As disasters increase in frequency and magnitude with adverse effects on population health, governments will be forced to implement disaster risk management policies that may include forced relocation. Ineffective public consultation has been cited as one reason for failure of these policies. Using the deliberative polling method, this study assessed the capacity of poor rural community people to participate in flood risk management policy priority setting and the impact of providing accurate and balanced information on policies by comparing pre-and post -deliberation data. The study also assessed the level of trust on whether government and community would use the results of this study. Results indicated strong community support for policy options to reduce vulnerability in existing communities, and strong resistance to relocation. As all the top five ranked policy options were concerned with population pressure, gender, and social service issues, which are all conceptually considered social determinants of a healthy community, this study concludes that public health considerations are central to flood risk policy development and implementation. The study revealed high levels of trust in government and the community relating to flood risk management, which policymakers in low-to-middle income countries can capitalise on for meaningful community consultation for effective disaster risk management.

Key Words: policy, deliberative polling, climate change, flood risk management, disaster risk reduction, Malawi

1. Introduction

The World Meteorological Organization's [1] global estimates indicate that there was a five-fold increase in disasters in the period 2000-2009 compared to the period 1970 to 1979 due to climate change. Between 1970 and 2019, weather-related disasters accounted for 50% (over 11 million) of all recorded disaster events and 45% (just over 2 million) of all reported disaster-related deaths world-wide. In this period, Africa recorded 1,695 weather-related disasters, accounting for 15% of global weather-related disasters, of which, 60% were floods. These weather-related disasters resulted in the loss of 731,747 lives, that is, 35% of all deaths associated with weather-related disasters globally [1]. Floods negatively affect the functioning of communities and public health systems [2], particularly in flood prone communities [3]. If not mitigated, these adverse effects result in health-compromising conditions of public health importance and pose a challenge to the resilience of communities, with negative impacts on the functioning and sustainable development of these communities.

Global weather-related sudden onset disasters are predicted to increase in frequency and magnitude [4]. Scientists and policymakers argue that this will heighten the need for governments to declare all areas in harm's way inhabitable, resulting in the relocation of many people to safer places, among other disaster risk management (DRM) interventions. However, evidence suggests that relocation poses further public health risks such as food insecurity, limited access to health care, increased morbidity and mortality, and social disintegration, inter-alia, if not planned and implemented properly [5]. Consequently, many people refuse to be relocated [6] with evidence showing examples of some communities that have been relocated but returned to their original homes. Such examples include the reoccupation of the city of Old Gediz in Turkey following the 1970 earthquake [7], the failed resettlement from Banaba Island in the Pacific in the 1940s [8], the resettlement during the Ethiopian drought of the mid-1980s, the case of the Carteret Islands in Papua New Guinea, and that of the Newtok community in Alaska [9]. Both the World Bank (2001) [10] and Ferris (2011) [6] suggest that where resettlement cannot be avoided, it should be done in a sustainable way that improves livelihoods and living standards of the affected people and implemented only after meaningful consultation with communities.

Since the 1970s, a community-based disaster risk management (CB-DRM) approach emerged and gained traction among policymakers and governments as it held promises for more community involvement in DRM policy formulation and implementation [11-12]. Within the

broad CB-DRM framework, a hazard specific concept, community-based flood risk management (CB-FRM), emerged as the key sub-approach to strengthening community resilience in the face of flooding [13-14]. Community-based flood risk management has been defined to mean the processes and activities undertaken to clearly define flood risks, developing, and implementing sustainable, socially, and environmentally sensitive and cost-effective measures that reduce flood risk and strengthen community flood resilience [15-16]. From a CB-FRM perspective, communities are seen as knowledge generating and containing systems that are important in flood-risk related policy development and implementation and should be involved or consulted in flood risk management (FRM) policy development and implementation [17]. Despite the acknowledgement of the importance of community-based approaches to FRM, more than 30-years following its evolvement, evidence suggests that there are still challenges on how to effectively consult communities [12].

Community involvement or consultation with people living in disaster prone areas is considered good practice in public health policy making [18-19], in policy forming and priority-setting activities [20] and in the governance and design of public services [21]. Community consultation takes several forms including search conferences, citizens' juries, consensus conferences, charrette, residents' feedback panels [22-23], deliberative polls [24], focus groups [25-26] and role-playing [27]. Florin and Dixon (2004) [21] define public involvement in the health sector as "*the involvement of members of the public in strategic decisions about health services and policy at local or national level*" [28] (p. 159).

There is increasing evidence that communities can contribute in a meaningful way to policy decisions, but this requires an interactive and deliberative approach [29]. Ineffective public consultation has been cited as one of the reasons why disaster risk reduction (DRR) policies have failed in many countries [30]. It is reported that public consultation in policy making is often limited in such instances and only considered by governments later in the policy making process [31]. The drafting of policies is often based on subjective assessments of situations, with the bottom-up approach only involving a selected few in leadership positions [31-33]. This not only stifles community contribution to policies but also robs citizens of the opportunity to engage with policy issues that affect their livelihood and often result in failure of relocation initiatives as noted in the examples above. The resultant relocation policy contestation between government and citizens arises from the proposition and implementation of policies that are deemed rational and effective by policymakers with little or no consideration of its implications

on the day-to-day lives, lived values and livelihoods of the affected people. Consulting affected communities and understanding what people value most in DRM policy development and implementation could lead to the adoption of policies that are perceived to be fair both in process (procedural justice) and outcomes (distributive justice) [34]. Thomas and Twyman (2005) [35] define procedural fairness as how and by whom decisions on adaptive responses are made [35]. On the other hand, distributive fairness focuses on the allocation of "*wealth, rights, honours and other benefits, and duties*" [36] (p. 15).

In addition to community consultation, other studies have shown that higher levels of trust in government lead to increased willingness of disaster affected people to follow government recommendations on adaptation, such as the adoption of COVID-19 prevention measures [37-38] or getting vaccinated against seasonal influenza [39]. Government transparency and timeous communication of accurate disaster adaptation information have been identified as predictors of increased trust in government [40]. Furthermore, evidence demonstrates that perceived fairness of government [41], individual support and willingness to cooperate [42], and inclusive policy making [43] are key enablers for governments to gain public trust during crises.

Given the above and the potentially cumbersome nature of community consultation, how to effectively consult communities and seek their opinions in an adequately representative and unbiased manner remains a challenge [30]. This study explores three questions:

- Can poor rural communities exposed to flooding effectively participate in DRM policy making and priority-setting if they are provided with accurate and comprehensive information about the hazard?
- If they can effectively participate, what FRM policy options do people living in flood prone areas support and what do these policy choices tell us about absorptive and adaptive capacities required for community flood resilience strengthening?
- What is the level of trust of the flood affected people in government and community governance structures adopting and implementing FRM policy priorities they set through community consultation processes?

We address the first question by assessing if provision of comprehensive and balanced information about the effects of flooding on people's health and well-being and an opportunity

to discuss among themselves and with a panel of experts result in study participants changing their choices of FRM policies using a repeated measure design. Such changes and maintained mean scores for policy options are conceptually considered measures of poor rural communities' capacity to engage with FRM policy priority-setting processes in the context of social justice and fair adaptation to climate change. The identified FRM policy options will lead to a discussion around context-specific absorptive and adaptive community capacities required for strengthening community flood resilience. Moreover, given evidence suggesting that trust in government is a predictor for successful DRM policy implementation, we assess the communities' level of trust in government and community governance systems adopting and implementing the identified priorities. The extent of implementation of FRM policy options identified through such community consultative processes can be conceptually considered a measure fair adaptation [34].

2. Community consultation for flood risk management

Community consultation is extoled and widely implemented as a means of improving the formulation and implementation of public policy and priority-setting [44-46] in various fields including public health. It is common to find terms such as 'community engagement', 'community partnerships', 'bottom-up' initiatives, 'triple bottom line' planning, 'stakeholder input' and 'community reference groups' when referring to community consultation in the parlance of public policy and FRM [47]. Beyond being informed by the moral dimensions of social justice, equality, and participatory democracy [48-49], the increasing search for representative and systematic approaches to community consultation is rooted in the theoretical and conceptual view that communities are knowledge generation and containing systems. The capacity to generate knowledge is at the core of these communities' ability to conduct meaningful social life [50]. It is through the construction and use of knowledge of different kinds- common sense, experiential, transcendental, folk wisdom, and scientific- that communities make intersubjective social life possible, meaningful, and progressive [51]. The conceptual and theoretical contributions of this body of literature suggest that policymaking is a negotiated exercise shaped by multifaceted socio-structural and cultural complexities that characterise communities.

Given this theoretical basis, community consultation is presented as a process through which community individuals and policymakers are perceived, and see themselves, as resourceful and active citizens who can engage with each other and collaborate on all matters concerning the

wellbeing of their community [52]. Thus, engaging communities in FRM is presented as important in ensuring that FRM initiatives are considered fair, equitable and effective towards meeting the flood risk adaptation needs of the community in the long-term [53]. Following this argument, community consultation plays an enlightening role by explaining and clarifying to the policymakers the competing views, meanings, and lived-values [54] and life-events as expressed by the community members through their participation. However, even the proponents of genuine community participation are said to harbour fear of an uninformed citizenry or decisions based on inadequate opinion polling [55-56].

In the African region where half of the population lives in rural areas, with many paradoxically reliant on floodplains and rivers for their livelihoods [57], CB-DRM approaches, including CB-FRM, with a strong element of community consultation have emerged [13]. This is mainly because of the realisation that communities living in flood prone areas have a lot to lose when disasters such as flooding occurs and, they stand to benefit from FRM interventions if developed and implemented with their involvement. the greatest deal to lose when disaster strikes, but also the most to benefit from risk reduction activities [58]; thus, FRM is presented here as a quintessentially local affair where adaptation occurs. Local communities own a creative set of approaches based on the LK and that empowers them to live in the flood-prone areas, accepting the paradigm shift from fighting with floods to living with them [59]. Despite this promise, actual community consultation processes have been said to have remained sub-optimal [47] and ineffective [60].

In their report on ideas for community consultation, Carson and Gebler (2001) capture ten (10) principles for making community consultation work [52]. These are: (i) making consultations open, fair, and subject to evaluation, (ii) timely, (iii) inclusive, (iv) community-focused, (v) interactive and deliberative, (vi) effective, (vii) matter, (viii) well-facilitated, (ix) cost-effective and (x) flexible. The principles of community consultation being inclusive, interactive, and deliberative relate to the important need for enhanced representation and the need to build deliberative capacity [61] which is essential for ensuring citizens can participate in policymaking processes that are often highlighted as complex. Search conferences [62], deliberative polls/televoting [63], citizens' juries [64], consensus conferences [65], focus groups [66], charrettes [67], residents' feedback panels [68-69] and role-playing [27] are some methods that are considered to hold promise for optimizing representativeness and creating deliberative spaces for effective community consultation [61].

Given the multiple nature of these community consultation methods and their suitability to different contexts and research questions, Carson and Martin (1999) developed a matrix with guiding questions that should be considered for making a choice of one method over the others [70]. Examples of questions include whether participants are required to determine the consultation or research questions, if the envisaged approach require randomisation in sample selection, the sample size required, whether community consultation participants need to meet face-to-face, time involved in consultative meetings and the time required from inception of consultations to findings [70]. For example, if a consultative process is required that allows participants to help to determine the key questions, the authors suggest that practitioners select either a search conference, a consensus conference, or a charrette. The main disadvantage with these methods is that they are more applicable at the strategic planning and vision setting stage and therefore are not conclusive and would require additional consultations to be done [70]. If a consultative process is required within which the key questions are already determined, the authors suggest that practitioners select either a deliberative poll, or a citizens' jury, or a focus group. In addition, the latter methods are said to be more effective in situations where the purpose for consultation is to find out what an entire community thinks about a policy aspect and representativeness is essential. Such representativeness should be achieved through random selection of participants [63].

While the determination of the hazard of focus (flooding) had been made since, across Africa, floods have overtaken droughts in terms of the number of people impacted [57], the researchers still needed to determine, with the community, the overall guiding FRM policy options for strategic planning and vision setting. In addition, because floods affect the whole community, albeit in different ways depending on the level of vulnerability of individual members, it was important for the researchers to conduct a consultation process with the whole community, thus a representative sample of the community was needed. It is here that the Deliberative Polling ® (DP) approach's ability to marry high level strategic vision setting and community level consultation can be used to optimise community consultation, a key tenet of the DP as espoused by the original developers of the approach [63]. Furthermore, the DP approach was considered ahead of other consultative methods because it is the only method capable of handling a bigger sample size (over 200 participants) required to achieve representativeness. The DP approach also proved to be effective in the tracking of changes in opinions which reflected increase in

shared knowledge and ability of poor rural communities to participate in often considered difficult policy priority setting processes.

The DP approach is a citizen-based data generation method which seeks to reframe public opinion research and contribute to the process of developing interventions that respond to the felt needs of the people [63]. It is based on the principle that when people have accurate and comprehensive information, they reach informed decisions and make quality contributions to policy and programs [63]. The DP is thus described as the gold standard for consulting people on development issues such as community flood resilience. It is a call to governments to move beyond structural mitigation in their approaches to policy development and implementation to comprehensively address lived values [34] of at-risk communities in a way that sustains their livelihoods and well-being. Thus, this study, applied, for the first time in southern Africa [71], a deliberative polling approach to explore the capacity of flood prone communities to participate in FRM policy priority setting, to ascertain what policies they supported and their level of trust in governance systems implementing the recommendations of the consultative process.

3. Data and Methods

3.1. Research design

This was a mixed methods study with both quantitative and qualitative data collected and used to assess community members' level of support for flood risk management policy options and the communities' level of trust in governance systems to adopt their recommendations for FRM. A DP-based repeat cross-sectional survey, with pre-deliberative and a post-deliberative event assessment, was conducted (Figure 5.1). In between the surveys, a facilitated deliberative event was conducted at a local primary school to collect qualitative information on opinions held by participants on FRM policies. The conduct of the deliberative event in between the surveys allowed for assessment of the impact of the deliberations among participants on their support for various FRM policies. Data collection methods followed a seven-step process previously published elsewhere [60] and described below. The study was approved by the

University of Pretoria's Faculty of Health Research Ethics Committee in South Africa and the National Committee on Research in the Social Sciences and Humanities[5] in Malawi.

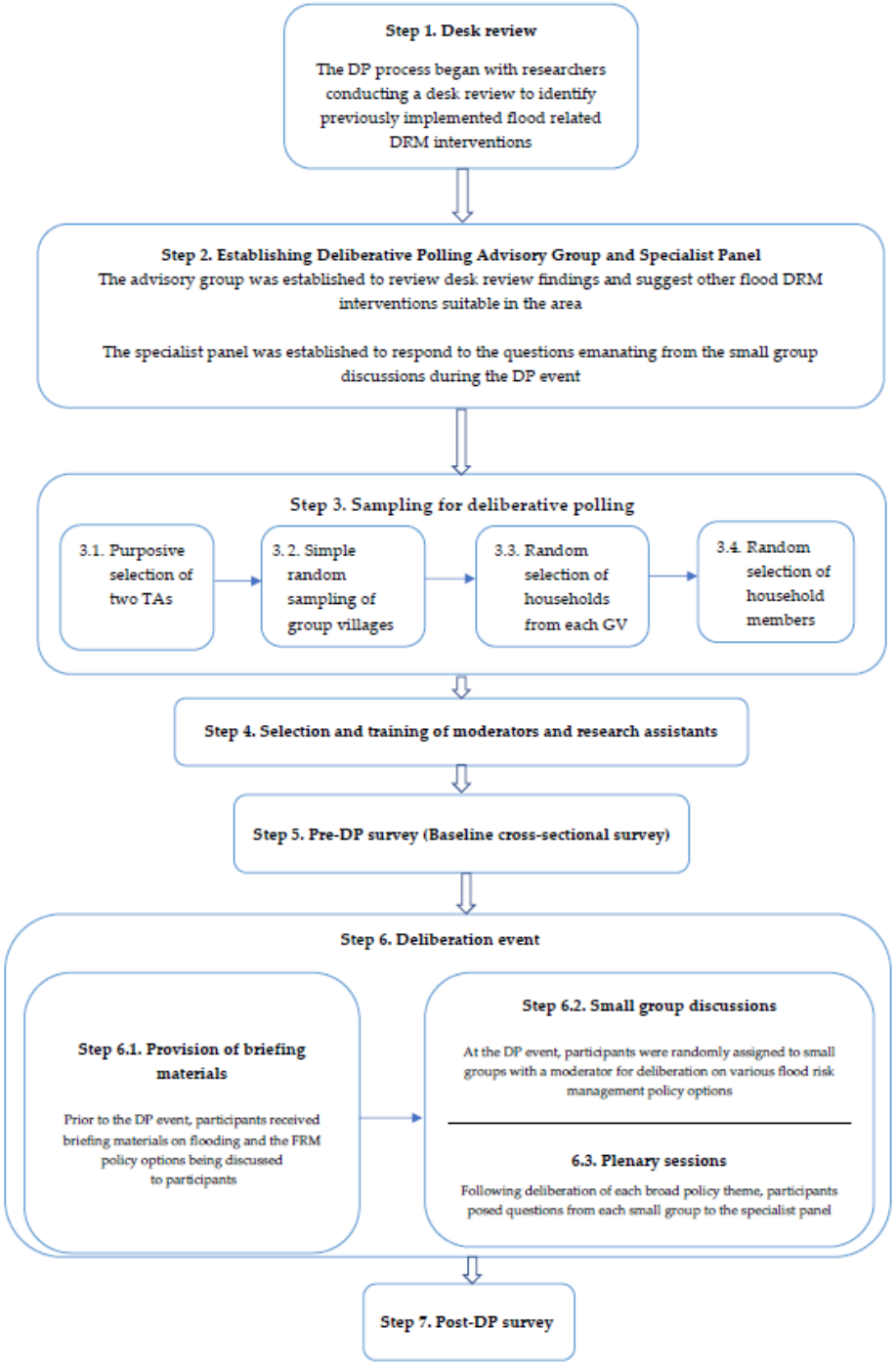

Figure 10 The DP data collection process flow

5 https://www.ncst.mw/national-committee-on-research-in-the-social-sciences-and-humanities/

3.2. Case studies

Malawi is one of the poorest southern African countries, and it is affected by flooding. Serious flooding took place in 1989, 1997, 2001, 2015 [72], with Cyclone Idai causing the most recent floods of 2019. The Cyclone Idai induced flooding in 2019 affected about 975,600 people and caused 672 injuries and 60 deaths [73]. The most affected areas were in the lowland Nsanje district in the south of the country. Flooding frequently occurs due to high siltation in the Shire River, and cultivation in the Ndindi Marsh, which limits its ecological function of trapping the waters and reducing the incidence of flooding [74].

The Nsanje district of Malawi lies in the Lower Shire River valley. It is surrounded by Mozambique on the south and the Shire River to the north and the east. Nsanje is the poorest of the total 28 districts in Malawi and is virtually dependent on government and NGOs [75]. Most income in the district comes from smallholder farming which is almost entirely dependent on rain-fed agriculture. This renders the district vulnerable to climate variability, particularly drought and flooding, with devastating effects on crop production. Livestock production and fishing are other economic activities that sustain lives of many [76]. In response to the incessant floods and resulting deaths in Nsanje district, the Government of Malawi (GOM) declared Traditional Authority (TA) Nyachikadza a flood-prone area and barred people from staying in the area [74]. However, the people of TA Nyachikadza have refused to be relocated. Government, in response, has prohibited other service providers from delivering social services, including public health in the TA, as a way of forcing the community to relocate, thereby compounding the community's vulnerability [74].

This deliberative polling study was conducted in TAs Nyachikadza (lowland prone to flooding) and Ndamera (upland where flood victims seek refugee) in Nsanje district (Figure 2). The district is subdivided into nine Traditional Authorities, two of which are TA Nyachikadza (lowland) and TA Ndamera (upland). TA Nyachikadza is home to over 1,000 households, which are located across nine group villages (GVs). The community is affected by frequent flooding. When flood waters come, residents of TA Nyachikadza seek refuge in the neighbouring TA Ndamera [74]. TA Ndamera has 28 Group Villages (GVs). Of these, 14 GVs are neighbours with TA Nyachikadza. In these 14 GVs, around 80% of the households grow crops in the wetlands of Nyachikadza. Half of these households own the land in the wetlands of Nyachikadza, and the remaining half grow their crops on rented land [74]. In general, these

two communities depend on each other due to the recurrent flooding and the need for food production.

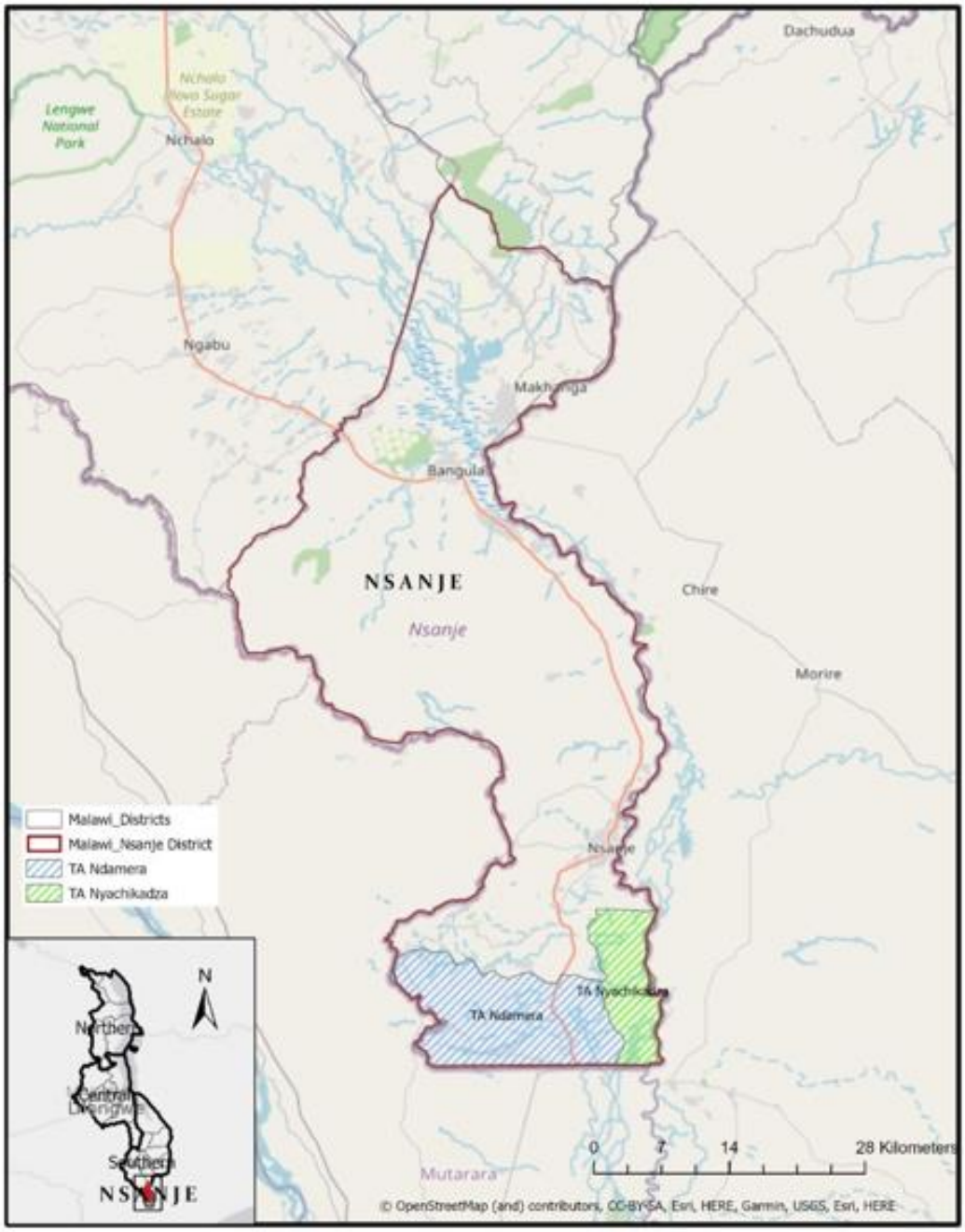

Figure 11 Location of Traditional Authorities Ndamera and Nyachikadza in Nsanje district of Malawi

3.3. Data collection

3.3.1. Desk review to identify previously implemented DRM interventions

The DP process began with a desk review conducted by the researchers to identify DRM interventions previously implemented both in Nsanje district and elsewhere in similar flooding situations. The review included the identification of advantages and disadvantages of each policy option to facilitate discussions with both the community advisory group and the DP participants.

3.3.2. Deliberative Polling Advisory Group

Following the desk review, the researchers identified different stakeholders in Nsanje district who would form a DP advisory group. The advisory group, comprising 28 participants, was made up of representatives of various government ministries and departments, the district council, local political and community leaders, local and international NGOs operating in Nsanje, community-based organizations and a representative from the office of the district Member of Parliament. The identification and constitution of a local advisory group was done to promote local ownership, buy-in and to ensure contextual relevance of the flood risk management options to be deliberated on at community level. The purpose of the advisory group was to also provide expert experiential advice on flood risk management options previously implemented in the two traditional authorities and to review the feasibility of options identified through desk review. Following the identification of the advisory group, a meeting was convened to review the potential flood risk management options identified through desk review and to seek suggestions on additional interventions to be tabled for deliberation by community participants and for consideration by government for implementation.

After discussion, a list of 32 policy options emerged and these were grouped into three broad policy priorities, namely, (i) proposals on relocation and resettlement; (ii) proposals on reduced vulnerability in existing communities; and (iii) proposals on population pressure, gender, and social services. The broad policy priorities and their various options (items) were used in the design of a standard questionnaire and briefing materials for use during the survey and deliberative event. A specialist panel was identified through purposive expert sampling, based on their knowledge and experience with the three broad policy priorities. This panel comprised a District Disaster Risk Management Officer, a Clinical Officer at Ndamera Health Centre, a Programme Manager from a local NGO (Foundation for Community Support Services) that had been working in the district since 2000, and an Agricultural Extension Development Officer in the Ministry of Agriculture, Irrigation and Water Development from within Nsanje

District. The purpose of the specialist panel was to serve as an expert consultative body that would respond to questions emerging from the DP participants in their small group discussions. The experts also provided information and clarification on the implications of the various policy options raised in the DP.

3.3.3 Sampling

The DP participants were selected through a four-stage sampling technique. During the first stage, two (2) TAs from Nsanje District, one from the upland (TA Ndamera) and another from the lowland (TA Nyachikadza), were purposively selected due to their vulnerability and experience of flooding, being the worst affected among all TAs in the district. In the second selection stage, five (5) Group Villages (GVs) and seven (7) Group Villages were selected from TAs Nyachikadza and Ndamera, respectively, using the simple random sampling technique. The distribution of the GVs was proportional to the number of GVs in each TA. In the third stage, a random selection of 40 households from each GV was conducted using stratified random sampling.

The sample size was determined, taking into consideration three factors -- desired level of precision, confidence level and the degree of variability in the population [77-78]. A determination of the sample size was considered an important step to achieving a scientifically rigorous DP that would confer confidence in the results and allow inferences to be made. To this end, we employed the procedure set out by Yamane (1967), assuming a 95% confidence level [79], 7% level of precision and 0.5 degree of variability [78]. The DP applied the finite sample size calculation formula below:

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

Where:

n = sample size;

p = proportion of population containing the major interest

z = Z-statistic corresponding with confidence level;

e = confidence interval; and

N = population size.

Using the above formula and the Malawi National Statistical Office's 2017 projected population in the sampled 7 GVHs in TA Ndamera was 8,370[6] for TA Ndamera, the **minimum** sample size for Ndamera was 192. Similarly, for TA Nyachikadza the projected population in the sampled 5 GVHs was 4,157. Using this population, the minimum sample size that was obtained for TA Nyachikadza was 187. The two calculated sample sizes were rounded up to 200 per TA. Furthermore, we estimated an attrition of about 20% between pre- and post-DP surveys, hence a target sample of 240 per TA (a total of 480 for the study) was targeted. In the fourth stage, a listing of all households in TAs Nyachikadza and Ndamera formed the sampling frame for the sampling process. From the 480 households identified, household members older than 18 years were listed and one member was randomly selected from each household to participate in the survey without any option for replacement later in the deliberative event and post event survey.

3.3.4. Selection and training of moderators and research assistants

Twenty-four (24) qualified and experienced research assistants were recruited and trained on the DP methodology, the conduct of the DP surveys and to moderate small group discussions with community members. The training of research assistants was guided by DP experts from Stanford University's Centre for Deliberative Democracy.[7]

3.3.5. Pre-DP survey (Baseline cross-sectional survey)

The pre-DP survey was conducted two-weeks before the DP. Trained research assistants collected data from participants using a paper-based structured questionnaire consisting of flood risk management policy options or proposals centered on the three broad policy priorities identified during the meeting with the advisory group. Participants also had to confirm their availability to attend the DP event. Each participant was issued a numbered card that was subsequently used to identify them for the DP event, and without which, they would not be allowed to participate in the deliberation and the post-DP survey.

3.3.6. Deliberation

3.3.6(a). At the Deliberative Event: Briefing Materials

6 The 2018 Malawi Population and Housing Census Report indicates a population of 33,679 for TA Ndamera and 7,643 for TA Nyachikadza.
7 https://cdd.stanford.edu/

The DP event was conducted from 3 to 4 June 2017. Guided by previously published protocols [24,80], briefing materials were made available to the participants, ensuring such materials were carefully balanced and comprising pros and cons for each of the 32 policy options that were developed by the advisory group. In addition, a fifteen-minute video was prepared in local language, based on the balanced briefing materials, and addressing the topic of the DP, the recurrent flooding and how the communities were affected. The video was shown to participants upon arrival at the DP event. The video also captured the aim of the deliberations, which was to facilitate a face-to-face conversation among the participants, and for participants to provide government and other DRM stakeholders with their informed opinions on the flood risk policy options they deemed appropriate to their context. Each participant was also given a written version of the briefing materials in the local language, *Chichewa*, which served as a guide to the issues for discussion with the moderators.

3.3.6(b). At the Deliberative Poll: Small Group and Plenary Sessions

Participants were randomly assigned to 24 small groups of about 20 people each after screening and confirmation of their identity and proof of participation in the pre-DP survey. Each small group was led by a trained research assistant, acting as a moderator with support from the researchers. The groups deliberated, over two days, on the three broad policy priorities, with moderators leading discussions as guided by the 32 policy options. All discussions were audio recorded, with participants consent, as a way of collecting qualitative data. At the end of each small group session for each broad policy priority, the participants would come up with questions around flood risk management policy options they would not have understood. All the unique questions identified from each group were presented to the experts in plenary and responses to each question given in plenary for the benefit of all participants.

3.4 After the Deliberative Event: Post-DP survey

After the small group deliberations and plenary sessions with experts, about 97.5% (468) of the participants completed the post-DP survey, using a paper-based structured questionnaire, consisting of the same questions as the pre-DP questionnaire. To ensure confidentiality, research assistants were assigned to assist participants from different groups to the ones they moderated. Participants were asked to rank the importance or unimportance of each of the policy options pertaining to the three broad flood risk management policy priorities (relocation and resettlement; reducing vulnerability within the existing communities; responding to population pressure, gender issues and social services) on a Likert scale from 0 to 10, where 0

is extremely unimportant, 10 is extremely important, and 5 is exactly in the middle. An illustrative policy option could, for example, be for government to, '*Construct a dyke along the Shire River from Nsanje District Centre to TA Nyachikadza (a distance of around 40 Km*)' (Supplementary file 1). The primary purpose of conducting a post-DP survey was to gauge whether participants had changed their opinions after the small group discussions and plenary sessions. The resulting changes in opinion represents the conclusions the participants reached after having an opportunity to deliberate on the important flood risk management issues facing their community.

3.5 Data analysis

Data analysis for this study was conducted in three stages. Firstly, analysis was conducted for each of the observed measures. Second, case specific analysis was conducted to assess the scores for each TA. Third, comparative analysis was conducted to assess the differences in scores of the two communities. In all cases, analysis was conducted comparing the scores for both the pre and post deliberation data. The pre- and post-deliberation surveys were matched for each participant. The analysis, using IBM SPSS Statistics for Windows, version 25, examined the pre- and post-deliberation data using paired samples t tests. The paired comparison tests excluded "don't know" and missing data. Significance was tailed at p-value less than 0.05. The paragraphs below briefly explain how each stage of analysis was conducted.

For both communities, there were thirteen (13) demographic and socioeconomic variables used to profile the participants for both communities. Eleven (11) of these were categorical while two (2) were continuous. In addition, there were thirty-two (32) policy options posed for deliberation covering three topics: resettlement and relocation, reducing vulnerability in existing communities and population pressure, gender, and social services. The participants were asked to rate the 32 options in importance on a scale from zero (extremely unimportant) to ten (extremely important), with five in the middle for all continuous variables. Measurement specific analysis was conducted by computing frequencies, calculating percentages and mean scores for each community and for the overall population.

Case specific analysis, for each TA and combined, was conducted by computing mean scores for each variable using pre -and post-deliberation data separately and combined. Changes in the rating of policy options were computed by subtracting the pre-survey/baseline scores from

the post-survey/end-line scores. To determine whether there were statistically significant differences between the pre- and post-test scores, a paired samples t-test was conducted.

Comparative analysis was conducted to assess if there were any differences between the two communities using demographic and socioeconomic variables. Sample characteristics were compared between communities using an independent *t* test and Pearson chi squared test for continuous and categorical variables, respectively. In addition, analysis to assess changes in rating scores for each policy option between the pre- and post-DP surveys for each TA and the overall population was conducted. We explored whether percentage changes computed were statistically significant by performing a paired samples *t* test. For the overall population, the top-five rated proposals were the ones that had best survived all the DP event counterarguments as evidenced by ranking of post-DP indices.

The small group deliberations and the plenary discussions were audio recorded. Transcriptions were done by group in *Chichewa* before being translated to English. Thematic analysis [81] was used to analyse qualitative data obtained from the deliberative event. A deductive analysis approach was used in which the three broad policy priorities were treated as major themes and their specific 32 policy options as guiding preconceived sub-themes. Data was categorised under each of these themes and analysed for a better subjective and explanatory understanding of the quantitative results and any changes in opinion after deliberation.

4. Results

This section presents the results from this study. In this respect, Table 17 shows the demographic and socioeconomic profile of participants from the two study communities.

Table 17 Demographic and socioeconomic profile of study participants by traditional authority (TA or community)

Variables	Category	TA Ndamera Upland n=222		TA Nyachikadza lowland n=246		p-value
		n	%	n	%	
Gender	Male	116	52.3%	181	73.6%	
	Female	106	47.7%	65	26.4%	
						0.000* **
Current occupation	Farmer	199	89.6%	239	97.2%	
	Non-Farmer	23	10.4%	7	2.8%	
						0.001 **
Marital status	Married	182	82%	203	82.5%	
	Single	7	3%	13	5.3%	
	Divorced	4	2%	8	3.3%	
	Widowed	29	13%	22	8.9%	
						0.259
Highest level of education	None	55	24.8%	55	22.4%	
	Primary	101	45.5%	157	63.8%	
	Secondary	66	29.7%	34	13.8%	
						0.000* **
Have a member of the family chronically ill	Yes	30	13.5%	34	13.8%	
	No	192	86.5%	212	86.2%	
						0.923

Ownership of land in both communities	Yes	135	60.8%	36	14.6%	
	No	87	39.2%	210	85.4%	
						0.000* **
Membership to the Village or Area Civil Protection Committees	Yes	77	34.7%	35	14.2%	
	No	145	65.3%	211	85.8%	
						0.000* **
Having an alternative place to go to during times of a flood	Yes	61	27.5%	161	65.4%	
	No	161	72.5%	85	34.6%	
						0.000* **
Having any training or education on disasters or flooding	Yes	63	28.4%	64	26%	
	No	159	71.6%	182	74%	
						0.566
Age [Years]	n/a	43.3		44.1		**0.613**†
Household size [children]	n/a	6.2		6.4		**0.335**†
Perception of economic value of the Shire River [Mean score]	n/a	8.41		8.36		**0.836**†
Perception of risk posed by the Shire River [Mean score]	n/a	6.33		6.85		**0.074**†

TA denotes Traditional Authority (Community)

p-value measures differences across rows

*p<0.05, **p<0.01, ***p<0.001; †Independent samples *t*-test

The data shows that while the targeted sample size was 240 for each community, the actual sample size for the lowland community was higher with six (6) participants who may have requested to participate in the study and, for ethical reasons, could not be turned away. The proportional differences across gender between the two communities were statistically significant with more males from the lowland than the upland ($p<0.001$). In both communities, over 80% of the participants were married and close to 14% indicated that they had a family member who was living with a chronic illness. Most of the participants from the lowland community were farmers compared to the upland community with statistically significant differences ($p<0.01$). All female participants ($n=65$) from the lowland were farmers. There were differences between the two communities regarding highest level of education, with significantly more people with primary education as their highest level of education in the lowland, and those with secondary education as their highest level of education in the upland community ($p<0.001$). Paradoxically, there was a relatively higher percentage of participants from the upland community who were members of the Village or area Civil Protection Committees as compared to those from the lowland community which had higher risk of flooding ($p<0.001$). Over 70% of the participants from both communities did not have any training or education on disasters or education.

A significantly greater proportion of those from the upland community compared to those from lowland owned land in both communities ($p<0.001$). The following quote support this finding: *"I agree with what he said because this is what is happening. Do you know that most people from Ndamera are in Nyachikadza? As we speak, people are in the lowlands cultivating the crops. The river doesn't flood every day. It's only the first 3 month, in January, February and March. After that we go back to our land to continue farming."* Group 9 Participant

As expected, there was a significantly greater proportion of participants (65.4%) from the lowland who had an alternative place to go to during a flood compared to their upland counterparts ($p<0.001$). One deliberative event participant captured the reciprocal exchanges that existed between the two communities for sustaining livelihoods:

"The exchange of land is already in progress, some people in Ndamera have been given land to cultivate in Nyachikadza. To be honest, a lot of people from Nyachikadza have houses here in the upland. This is what we already do" Group 19 Participant

In both communities, perception of economic value was relatively higher compared to the perception of risk posed by the Shire River. The mean score for economic value of 8.41 for the upland community and 8.36 for the lowland community was not significantly different. Similarly, the perception of risk with mean score of 6.33 for the upland community and 6.85 for the lowland community was not statistically different.

4.1. Shift in the level of community support for various flood mitigation policy options

This section presents results of the impact of providing accurate and balanced information on a range of DRM policy options for resilience to flooding, by comparing pre-and post-DP event data. The results are presented for each community and for the overall sample. The mean scores with statistically significant differences between pre- and post-DP scores are indicated. The observed differences in opinion and the different effects of the DP event on scores of the two TAs could be because of the two TAs' different experiences with the adverse effects of flooding and their disparate coping and adaptation mechanisms.

4.1.1. Relocation and resettlement proposals

Table 18 presents results of the policy priority on resettlement and relocation of the lowland community and its various policy options.

Table 18 What government should do regarding relocation and resettlement

Variable	TA Ndamera			TA Nyachikadza			Total		
	Pre	Post	Margin (Δ) Post -Pre	Pre	Post	Margin (Δ) Post -Pre	Pre	Post	Margin (Δ) Post -Pre
1. Facilitate relocation of TA Nyachikadza community to suitable land in high land area within same district	7.11	6.64	-0.47	1.35	2.32	0.97**	4.06	4.35	0.29
2. Facilitate relocation of TA Nyachikadza community to best suitable land anywhere in Malawi	3.84	4.77	0.93**	0.35	0.79	0.44**	2.00	2.68	0.68***
3. Should only proceed with resettlement after it has developed plan that is approved by TA Nyachikadza community	6.97	6.93	-0.04	2.54	3.11	0.57*	4.64	4.92	0.28
4. Provide legal title to land for TA Nyachikadza community members before relocation	7.02	6.31	-0.71**	1.83	3.06	1.23*	4.29	4.60	0.31
5. Facilitate complete relocation but allow communities to continue using land for crop cultivation	8.01	7.71	-0.30	2.36	3.93	1.57*	5.04	5.72	0.68***
6. Prohibit provision of any social service in TA Nyachikadza as way of 'forcing' people to relocate	4.43	4.61	0.18	0.86	1.2	0.34	2.55	2.82	0.27
7. Provide increased social services in TA Ndamera if people are relocated there	7.99	7.43	-0.56*	1.6	2.02	0.42	4.63	4.59	-0.04
8. Facilitate TA Ndamera's access to low land for crop cultivation in exchange for hosting TA Nyachikadza's residence in upland (TA Ndamera)	6.12	6.08	-0.04	0.95	1.05	0.1	3.40	3.44	0.04
9. Facilitate increased agricultural production in TA Ndamera	6.92	7.32	0.4	1.24	1.82	0.58*	3.93	4.42	0.49**

TA denotes Traditional Authority (Community)

*p<0.05, **p<0.01, ***p<0.001

Overall, almost none of the relocation policy options were considered important, except for facilitating complete relocation with opportunity to continue using land for crop cultivation, which was considered only fairly important, with an aggregate score of 5,72 post-deliberation, having moved significantly from the pre-deliberation score of 5,04. However, there were significant differences between the two communities on perceived importance of the various relocation and resettlement policy options. In general, although deliberation significantly increased support for several policy options, none of the policy options were considered important by those in TA Nyachikadza (lowland community) even after deliberation as indicated by mean scores less than five (5). In contrast, most of the policy options for relocation and resettlement were considered fairly important (supported) by those from TA Ndamera (upland community), as indicated by mean scores of 5 and above, except for two, namely, '*facilitate relocation of TA Nyachikadza community to best suitable land anywhere in Malawi'* and *'prohibit provision of any social service in TA Nyachikadza as way of 'forcing' people to relocate.'*

The upland sample of participants had statistically significant negative changes after deliberation on policy options that had to do with provision of legal title to land compared to the lowland community inhabitants before relocation ($p<0.01$) and provision of increased social services in the upland if people are to be relocated there ($p<0.05$). For the lowland community, despite producing mean differences that were statistically significant between the pre and post DP scores, all post-DP mean scores remained below five (5), showing a lack of support for the intervention items. The following quote illustrates the lowland community's resistance to intervention options regarding relocation and captures three reasons for such recalcitrance. These included a heightened sense of attachment to ancestral land, ability to adapt to flooding using early warning systems (EWS) based on monitoring water levels, and the increased food production capacity of the flood prone area which also attracts people from the upland:

"We cannot move from Nyachikadza because ***we were born there and our parents have died there****. Furthermore, when we see the water levels rising,* ***we are able to know that those waters are harmful, we then run****. People from Ndamera also come to settle in our land for cultivation. We cannot relocate because* ***Nyachikadza is very fertile and we produce a lot of crops****. We cannot relocate."* (Participant Group 9)

4.1.2. Reducing vulnerabilities in the existing communities

This section presents results of the second policy priority pertaining reducing vulnerabilities in the existing communities (Table 19).

Table 19 What government should do regarding reducing vulnerability in existing communities

Variable	TA Ndamera			TA Nyachikadza			Total		
	Pre	Post	Margin (Δ) Post -Pre	Pre	Post	Margin (Δ) Post -Pre	Pre	Post	Margin (Δ) Post -Pre
1. Construct a dyke along the Shire River from Nsanje District Centre to TA Nyachikadza	6.38	5.21	-1.17***	7.87	9.12	1.25**	7.16	7.27	0.11
2. Construct a dyke along the Shire River from Nsanje District Centre to TA Nyachikadza with labour from communities coordinated by District Council as part of the Public Works Programme	6.67	5.09	-1.58***	7.90	8.82	0.92**	7.32	7.05	-0.27
3. Allow TA Nyachikadza communities to 'access' land upland to temporarily relocate during floods and return after	5.77	7.38	1.61***	6.51	7.64	1.13**	6.16	7.52	1.36***
4. Allow communities to remain but develop an effective flood-early warning system	5.79	7.14	1.35***	8.40	8.78	0.38*	7.16	8.00	0.84***
5. Sensitize TA Nyachikadza communities on flood early warning	7.49	8.15	0.66**	8.51	9.07	0.56**	8.03	8.64	0.61***
6. Develop places of safety for children and vulnerable groups (elderly, sick) when flood warnings are administered	8.42	8.65	0.23	7.97	7.79	-0.18	8.18	8.20	0.02
7. Put in place effective life-saving measures (such as petrol boats, life jackets, etc.) in all strategic places to be used to rescue people during floods	7.93	8.37	0.44	8.33	8.84	0.51**	8.14	8.61	0.47***
8. Have the VCPC, ACPC and DCPC consider indigenous knowledge systems (IKS) in flood early warning	7.49	7.09	-0.40	7.61	7.16	-0.45*	7.56	7.13	-0.43***
9. Have all the Area Civil Protection Committees (ACPCs) and Village Civil Protection Committees (VCPCs) along the Shire River form an alliance to share information about flood early warning	8.23	8.50	0.27	8.27	8.31	0.04	8.25	8.40	0.15

TA denotes Traditional Authority (Community)

*p<0.05, **p<0.01, ***p<0.001

In the overall sample, all policy options had mean scores above 6 compared to the previous policy proposal on relocation and resettlement which had all mean scores below 6 in the overall sample. TA Nyachikadza (lowland) had relatively higher mean scores compared to TA Ndamera (upland) mean scores across almost all the policy options, representing stronger support for the policy proposal on reducing vulnerabilities in the existing communities among the flood prone lowland community participants.

The four most favoured policy options under this policy priority for the overall sample as measured by the biggest positive and statistically significant shift in opinion between pre and post-DP were, *'Allow TA Nyachikadza communities to 'access' land upland to temporarily relocate during floods and return afterwards', 'Allow communities to remain but develop an effective flood-early warning system', 'Sensitize TA Nyachikadza communities on flood early warning,' and 'Putting in place effective life-saving measures (such as petrol boats, life jackets, etc.) in all strategic places to be used to rescue people during floods.'* Overall, the highest mean difference (1.36; $p<0.001$) was on allowing the lowland community people to 'access' land upland for temporary relocation during floods and returning afterwards. This option also registered the highest change among both the upland participants (1.61; $p<0.001$) and those from the lowland (1.13; $p<0.01$). It is evident that participants from both communities agreed on the need for government to put in place flood risk management measures that would enable and support existing mutually supportive coping and adaptation mechanisms practiced by the two communities. The following quote illustrates this position:

"***This is what we do**, when floods occur, we move to the uplands, when the levels have lowered, we go back and work on our fields. This is a good policy option. Complete relocation is what we don't want"* (Participant Group 11)

It is also important to note that, in the overall population and for the lowland community, the policy option on having the VCPC, ACPC and DCPC considering indigenous knowledge systems (IKS) in flood early warning, had a statistically significant negative change. In addition, while the policy options on construction of a dyke recorded a statistically significant negative change following deliberation among the upland community, they recorded a statistically significant positive change among the lowland community. The following quotes from two participants, one from the lowland and another from the upland, in the same group discussion are illustrative of this disagreement:

"The government should just construct a dyke because we have everything we need in Nyachikadza. Nothing comes from the upland and goes to the lowland. We don't buy anything there because we produce all we need. A dyke should be constructed." Participant Group 1

"A dyke will not be the best solution because heavy rains and water come with a lot of pressure that may even damage the dyke. They should settle here and go back to just cultivate. Otherwise, lives will be lost." Participant Group 1

4.1.3. Population Pressure, Gender and Social Services

Table 20 presents results pertaining to the third policy priority on population pressure, gender and social services.

Table 20 What government should do regarding population pressure, gender, and social services

Variable	TA Ndamera			TA Nyachikadza			Total		
	Pre	Post	Margin (Δ) Post -Pre	Pre	Post	Margin (Δ) Post -Pre	Pre	Post	Margin (Δ) Post -Pre
1. Provide wide access to free family planning services	8.52	9.35	0.83***	8.45	9.00	0.55***	8.48	9.17	0.69***
2. Construct a health centre in TA Nyachikadza so long as people live there	5.07	6.59	1.52***	9.34	9.58	0.24*	7.32	8.16	0.84***
3. Have families consider their land resources in deciding how many children to have	6.99	7.68	0.69**	6.97	7.59	0.62**	6.98	7.64	0.66***
4. Increase the use of temporary shelters for evacuation instead of classrooms	8.88	8.89	0.01	8.80	8.50	-0.30	8.78	8.68	-0.10
5. Use community by-laws to restrict child marriages	8.70	9.35	0.65***	8.76	9.24	0.48***	8.73	9.29	0.56***
6. Poor families with children of school-going age should only receive a cash transfer if they enroll their children to school	8.82	9.16	0.34**	8.84	9.02	0.18	8.83	9.08	0.25**
7. Adults with children of school-going age should only participate in the Public Works Program if they enroll their children in school	7.99	8.67	0.68***	8.14	8.45	0.31	8.07	8.56	0.49***
8. Establish collective storage facilities for food in the uplands (by the people from the lowlands)	6.78	6.28	-0.50	5.19	3.87	-1.32***	5.94	5.01	-0.93***
9. Provide adequate security in evacuation centres to ensure women and girls are protected from abuse	9.16	9.21	0.05	9.01	8.99	-0.02	9.08	9.10	0.02
10. Allow families to be able to stay together during flood evacuations	7.14	8.20	1.06***	7.65	7.62	-0.03	7.41	7.89	0.48**
11. Allow households with persons who are vulnerable, and sick be prioritized during flood evacuations	8.30	8.88	0.58***	8.57	8.69	0.12	8.44	8.78	0.34**
12. Promote the capacity building of the VCPCs to know how to respond to emergencies	8.54	8.53	-0.01	8.80	8.68	-0.12	8.68	8.61	-0.07
13. Promote village savings and loans to provide alternative income sources for women	8.76	9.33	0.57***	9.08	9.03	-0.05	8.93	9.18	0.25**
14. Ensure a woman should not lose the family land if her husband dies	9.32	9.16	-0.16	9.31	8.61	-0.70***	9.31	8.87	-0.44***

TA denotes Traditional Authority (Community)

*p<0.05, **p<0.01, ***p<0.001

It is observed that the indices on what government should do regarding population pressure, gender and social services were high across the two communities relative to the other two policy proposals. This is also true for the overall sample which registered mostly positive and statistically significant mean differences between the pre- and post-DP mean scores for 64% of the policy options. The policy option on ensuring that a woman should not lose family land if her husband dies recorded negative changes across the two communities and in the overall sample following deliberation. These changes were statistically significant in the overall sample and for the lowland community. The following quotes shed light into small group discussions that may have informed this decline:

"It is important to ensure that women do not lose their family land because they need to use that land to take care of their children and to send their children to school. But if the woman is still young and if she gets married to another man then it is better that she loses the land". Participant Group 5

"*Chuma chili mu nthaka (*Wealth is in the ground (in agriculture)), *therefore women should not lose the land. But if there are no children between this widow and the late husband the woman needs to lose the land" (*Participant Group 7)

The policy option on government establishing collective (for both upland and lowland communities) storage facilities for food in the uplands had the lowest mean scores (marginal support) across the two communities and in the overall sample post-DP, with a statistically significant negative changes after deliberation in the overall sample (pre-DP=5.94, post-DP=5.01, $p<0.001$) and in the lowland community. The following quote is an example of some reasons given that explain the marginal support for this policy option:

"We cannot agree with that; same way the government cannot establish a Malawian collective food storage in Zambia." (Participant Group 6)

The most supported policy options under this policy proposal, with highly significant positive changes, i.e., positive changes that maintained or improved their scores to above nine (9) between pre- and post-DP, include issues to do with provision of free family planning services, restricting child marriages, developmental projects to support child education, women

empowerment through village savings and loans, and provision of adequate security for girls and women in evacuation centres. Among these five, the last option did not change significantly but was considered strongly supported on the basis that it maintained a high mean score (above 9) across communities and combined. In addition, the lowland community strongly supported the policy option regarding *'construction of a health centre in TA Nyachikadza so long as people live there.'* The need for a health facility was explained in the broad sense of addressing public health emergency beyond flooding to include disease outbreaks. The following quote is illustrative:

"This is what we have been looking for because in the past we had a health centre. We lose a lot of people through diseases than floods, for example, per last year 7 people died due to Cholera while only 2 died due to floods, so we need this." (Participant Group 1)

4.1.4. Top five policy options supported by the communities

The presentation of results for shifts in opinion between the pre- and post-DP above identified the policy options that were strongly supported under each policy priority. The DP event produced statistically significant positive and negative changes of opinion in 19 (59.4%) out of 32 policy options. This section presents the top five policy options supported by the two communities across the 32 policy options. For this study, the top-rated proposals were the ones that had best survived all the DP event counterarguments as evidenced by ranking of post-DP indices. Thus, the aspects scoring 9 and above, out of a maximum of 10 scores, were considered the topmost policy options for government intervention. The top five policy options for the overall sample all concerned the policy priority focused on population pressure, gender, and social services.

The highest ranked policy option was about *use of community by-laws to restrict child marriages* (mean score=9.29). The illustrative quote below is a plea made by one of the participants to their fellow community members which demonstrates that child marriage was a common harmful social practice in the two communities that should be stopped.

"*This is an important law … this is what should be done. Am asking you my friends that in this room to please let your children go to school first. As much as we all want an in-law who can help us out at our homes, but our children's school needs must come first. Our children should be independent in the future."* (Participant Group 4)

The second ranked policy option was regarding *promoting village savings and loans to provide alternative income sources for women* (mean score=9.18). The following quote supports this:

"Village Savings and Loans must really be promoted to increase our sources of income. We are enjoying being in these groups because whenever you run out of money for food, you explain to the group, and they willingly provide a loan. In that way you reduce the burden on yourself and on your husband. You are also able to pay school fees using that money." (Participant Group 8)

The third most favoured policy option was regarding *provision of wide access to free family planning services* (mean score=9.17). The following quote illustrates this need in the context of women assuming control on birth control issues as well as taking control of their lives and their health.

"*I would like to agree with my fellow women, family planning is very important. You may die young if you can be bearing children every year. We need to take heed of the advice from the hospital. Other men are abusive, they do not accept this issue of family planning, but others are good they provide enough support to a woman on these issues."* (Participant Group 11)

The fourth most highly ranked policy option was to do with *providing adequate security in evacuation centres to ensure women and girls are protected from abuse* (mean score=9.10). The quotes below capture the need for provision of security and complaints or suggestion procedures within the camps.

"It is very true some women are victimised during this period, so the government should really increase the security, this will help prevent women to live in fear." (Participant Group 17)

"I believe we had security in 2015 in the camps that were made. But an issue that was there was that the security personnel started having affairs with women in the camps and women were submissive because they wanted to have favours in receiving food. Government should put in place suggestion boxes where we can be submitting complaints. (Participant Group 10)

The fifth most highly ranked policy option was to do with, *poor families with children of school-going age should only receive a cash transfer if they enroll their children to school* (mean score=9.08). This would ensure that children participate in school for better child development outcomes. The following quote is illustrative:

"This would be very good because if parents are not motivated to send their children to school but they notice that their neighbour is sending all their children to school, and is even receiving a cash transfer on top of that, they will be motivated to send their children to school as well." (Participant Group 4)

An analysis of the topmost supported policy options shows that they mostly related to supporting women and children. We further disaggregated our analysis by sex for these gender related themes to assess the mean scores for male and female participants and how deliberation affected them. Table 21 presents the pre- and post-DP mean scores for these themes.

Table 21 Comparing pre and post means of the study participants on five gender related variables by sex

	Male				Female			
Variable	Pre	Post	Post-Pre	p-value	Pre	Post	Post-Pre	p-value
Provide wide access to free family planning services	8.43	9.17	0.74	0.000***	8.57	9.16	0.59	0.003**
Use community by-laws to restrict child marriages	9.03	9.25	0.22	0.508	9.29	9.36	0.07	0.892
Provide adequate security in evacuation centres to ensure women and girls are protected from abuse	9.12	9.06	-0.06	0.658	9.54	9.17	-0.37	0.504
Promote village savings and loans to provide alternative income sources for women	9.25	9.12	-0.13	0.694	8.91	9.81	0.90	0.103
Ensure a woman should not lose the family land if her husband dies	9.26	8.71	-0.55	0.001**	9.40	9.15	-0.25	0.138

*p<0.05, **p<0.01, ***p<0.001

The data shows that, except for the option on provision of family planning services, the post-DP mean scores for female participants were relatively higher than their male counterparts for the other four (4) options. For both sexes, the option for provision of family planning services recorded a statistically significant positive change. The policy option on ensuring women do not lose family land following the death of their husband recorded a statistically significant negative change among the male participants.

4.1.5. Participants' trust in the use of results by government and community

Three variables that were conceptually considered to indicate participants' expression of confidence that the government and the community would listen to their voices and use the results of the DP, were selected from the questionnaire. The variables included participants' perception of whether, (i) government will take seriously the suggestions and views provided, (ii) government will use the results from the DP event and (iii) the community will use the results from the DP event. A paired samples *t*-test comparing pre and post mean scores of the study participants was conducted. Table 22 presents these results.

Table 22 Comparing pre- and post means of the study participants on three variables measuring participants' expression of trust in government and community using results from the DP

Variable	**All**			
	Pre	**Post**	**Margin (Δ) Post -Pre**	**p-value**
Will the government take seriously the suggestions and views provided?	7.54	7.53	-0.01	0.982
How confident are you the government will use the results from this event?	7.08	7.48	0.40	0.237
How confident are you the community will use the results from this event?	7.32	8.53	1.21	0.018*

*p<0.05, **p<0.01, ***p<0.001

Both pre- and post-DP mean scores show that the study participants maintained a high perception of government and community interest in using the results of the DP process to address the flooding challenges they faced. This was reflected by mean scores of over seven

(7) for all the variables measured. There was a statistically significant positive difference between the pre- and post-DP mean scores of study participants' perceptions of the community interest in using results from the DP event ($p<0.05$).

5. Discussion

5.1. Reciprocal adaptation to flooding and limited participation in DRM activities

The socio-economic and demographic characteristics of the two communities in this study supported by the qualitative data from the deliberative event point to the existence of a reciprocal relationship between the two communities informed by learning from the past flooding experiences and the need for sustaining livelihoods. This is supported by evidence showing that while most of the upland community participants owned land in both communities, for livelihood (lowland) and shelter (upland), inversely, most of the lowland participants only owned land in the low land but had an alternative place to run to in the upland during a flood. The practice of moving to higher ground as a disaster coping mechanism was recorded elsewhere [82] and the concept of learning from and adapting to a disturbance over time is consistent with findings of previous studies [83-85].

Another factor that points to the existence of this reciprocal relationship is the gender distribution and occupation of the participants from the two communities. There were significantly more male participants and participants indicating farming as their occupation from the lowland community compared to the upland community. In addition, all women from the lowland community indicated farming as their occupation. This observation seems to suggest a strong sense of the economic value placed on the lowland in which staying in the lowland was strongly connected with farming as a livelihood activity. Thus, the two communities seem to have adopted both on-farm and off-farm strategies to cope and adapt to the adverse effects of flooding; a coping mechanism observed in flood prone communities in Northern Ghana [86]. In the case of the current study, it appears that most men adopted on-farm while most women adopted the off-farm coping and adapting mechanisms. This reciprocal adaptation captures two (2) elements of Martin-Breen and Anderies' (2011) three interdisciplinary frameworks of resilience; the systems resilience which is defined as coping and maintaining system function in the event of a disturbance and the complex adaptive systems which is defined to include the ability to withstand, learn and adapt, and reorganise in response to crisis [87].

The data also shows that very few participants from both communities were trained in or had education on disasters. In addition, very few participants, particularly from the lowland, indicated that they were members of the village or area protection committees. These findings are consistent with other studies in Malawi [88-90] that have shown an inadequate participation in community-based flood risk management. The lack of willingness to voluntarily participate in community based FRM activities by people living in flood prone communities is inconsistent with evidence showing that willingness to participate and volunteerism are important in community flood risk preparedness [91]. The observed limited participation in DRM activities by participants in this study could be because of government's position of prohibiting provision of social services in the area as a way of forcing people to relocate [74] coupled with the fragmented nature of activities by Non-Governmental Organisations (NGOs) who only implemented DRM activities in specific areas of interest [71] in the Nsanje district under which these two communities fall.

5.2. Potential of poor rural communities to participate in policy priority setting

One of the objectives of this study was to assess if poor rural communities exposed to flooding can effectively participate in DRM policy making and priority-setting of they are provided with accurate and balanced information. With almost a quarter of the participants having no formal education and over half with primary schooling as their highest level of education, this study demonstrated that the DP can be successful in helping poor people in rural communities to balance trade-offs among various policy options and identify those that they consider important for their health and wellbeing. These findings are consistent with findings from other studies [30,92-93]. The choice of supported priorities and the justifications behind them and the observed trends in the mean scores of different policy options between pre- and post-DP surveys reflect this ability of the communities to meaningfully engage with health policy design and implementation. We briefly discuss some of the observations made from this study that necessitate this conclusion.

The ability of the communities to effectively participate in policy priority setting in this study was demonstrated by significant changes, both negative and positive, to the mean scores of nineteen (19) out of all the thirty-two (32) available policy options. These changes reflect the impact of the briefing information provided to the participants during the DP event, the small group deliberations they had with their fellow community members and the opportunity get

clarifications on other policy options from a panel of experts. Thus, with increased knowledge, participants were able to make their final choices on policies they deemed suitable for their context; a finding consistent with the results of an assessment of data from five DPs conducted in the United Kingdom in the 1990s [94]. In addition to the observed changes between pre- and post-DP mean scores, this paper also argues that the maintained high and low mean scores for other policy options reflect that the participants had fully considered those options and still maintained their scores without any significant changes. For example, the policy priorities under resettlement and relocation theme maintained very low scores, mostly below 5 out of 10, while those in the population pressure, gender and social services theme maintained high scores above a mean score of 7 out of 10 in the overall population.

An analysis of the policy options supported across the three themes (resettlement and relocation, population pressure, gender and social services and reducing vulnerability in existing communities) shows a systematic and consistent support for options that would result in minimal disruption to existing ways of coping and adapting with flooding for livelihood sustenance. For example, in the resettlement and relocation theme, participants strongly supported relocation if they would still access the lowland for crop cultivation. In the reduced vulnerability within the same communities theme, study participants strongly supported interventions that would reduce the adverse effects of flooding to people's lives such as establishing early warning systems and provision of life-saving equipment such as life jackets and petrol boats. Strong support for these options was despite none of the topmost rated policy options coming from either of these themes. Thus, the two communities were able to identify specific policy options across different themes that would strengthen their resilience to flooding despite their diminished support for the overall theme.

Support for policy options that would result in minimal disruption to existing coping and adaptation mechanisms is also evidenced by the upland community's significant decrease in support for policy options to do with provision of legal title to lowland community before relocation, increased agricultural production in the upland if people are relocated there. Establishment of collective storage facilities for food in the uplands for both communities also recorded a significant decrease in support among lowland community participants. When looked at collectively, these policy options, if adopted and implemented, would result in significant structural and material changes to the way the two communities functioned and

related with each other. Thus, through DP, the two communities were able to effectively participate and identify priority policy options that would bolster their resilience to flooding.

5.3. The topmost rated flood risk management policy priorities

In this study, the topmost rated proposals were the ones that had best survived all the DP event counterarguments as evidenced by ranking of post-DP indices of 9 and above. As a result, the population pressure, gender, and social services priority was most supported by participants, with all top five favoured policy options falling under this policy priority. These were concerned with access to health care (family planning), child marriages which put women and young girls at risk of increased morbidity and mortality, alternative income streams for women, access to education for children, and security in the evacuation camps for girls. The decision to resist complete relocation seems to be informed by many factors including place attachment, highly fertile floodplains and associated favourable food production capacity in the flood prone area, and participants' learned resilience based on reading flood water levels as early warning and escaping to the upland until the water level subsides. This finding is consistent with previous studies [95, 96, 74, 97].

The identified top priority options have a strong element of gender which could reflect the gendered nature of vulnerability to natural hazards such as flooding. In a study on disaster resilience in flood prone areas, Chisty et al., (2022) found that female members of the community lag in terms of disaster resilience comparing to their male counterparts [98]. As these top five priorities relate to prioritisation of the most vulnerable members of the community and their recognition in DRM policy development and implementation, these findings are in line with those from Chisty et al., (2022) [98] and therefore call for a differentiated approach to consulting communities on the policy priority options they support.

Surprisingly, while it would seem intuitive for people living in flood prone areas to support policies that would reduce the immediate and more direct adverse effects of flooding, the study participants rather strongly supported policy options related to population pressure, gender and social services that would appear distant to the immediate challenge of flooding. This finding shows two adjacent communities that had learnt to live collectively in harm's way while maintaining system function through learning to adapt from historical flooding experiences. This is consistent with the assertion that "*resilience to a disturbance is cultivated through learning from and adapting to that very same disturbance over time*" [84] (p. 736). This

assessment is also consistent with findings of a study conducted to assess community disaster resilience in flood-prone areas in Bangladesh in which the authors concluded that differential scores across different components of the resilience framework indicate that there are gaps in terms of level of resilience as it is experienced by the affected people [98]. In the current study, it appears that participants may have supported policy options that would address the perceived gaps in their existing coping and adapting approaches while they continue staying and accessing the lowland for food production. Thus, we argue that the DP approach enabled the participants to make choices on their preferred FRM policies through discussion and reflections on their flooding experiences.

Following the climate justice discourse, this study argues that community consultations need to consider the distribution of outcomes of a disaster and disaster risk management policies for different population groups in the affected communities. To achieve that, considerations need to be made to the procedural fairness of the consultative process in terms of ensuring representation of all the concerned groups [34,99]. Considering the dominance of gender related policy options among the top-rated priorities, we conducted a sex disaggregated analysis of all the identified priority options. Results indicate that both male and female participants strongly supported the provision of free family planning services in their communities. Given this strong emphasis on strengthening access to health services and that all the top-rated priorities can be considered social determinants of a healthy community, this study concludes that public health considerations are central to the development and implementation of policies that seek to strengthen community capacities required for coping and adapting to flooding.

A sex disaggregated analysis on the policy option to do with ensuring women do not lose family land if their husband dies showed a statistically significant negative change following deliberation among male participants. Qualitative data from the deliberative event seem to suggest that while participants were in support of the policy option, there were some exceptions in which it was considered appropriate for women to lose land following the death of their husband. These include cases where there were no children born out of the marriage and if a woman decides to re-marry. A study on women's land rights in Africa [100] indicate that while landholding in Malawi is based on matrilineal systems, there is no automatic guarantee of women having more decision-making power on land. This finding seems to explain why support for this policy option significantly declined among male participants as they perhaps

feared that its adoption and implementation may result in women holding more decision-making power over land. Thus, this study reaffirms the need for a differentiated approach to community consultation for policy priority setting and implementation. Through the DP approach, this study has managed to apply this differentiated approach through ensuring representativeness and captured both aspects of distributive and procedural fairness in the community consultation process for flood risk policy priority setting.

5.4. Trust in government and community systems

Previous studies have demonstrated that levels of trust towards government, other fellow citizens (community) and science (DP consultative approach) [38,101,102] are essential predictive factors on community support for the development and implementation of disaster mitigation interventions. This study revealed that despite the adverse effects of frequent flooding on their well-being, and failed attempts by government to forcibly relocate them, the affected communities still maintained high levels of trust in governance systems, both at national and community level, to positively respond to their expressed views regarding DRM priorities. In Zimbabwe, lack of trust between duty-bearers and communities regarding proposed DRR interventions resulted in lack of cooperation and resistance by the communities [103]. Therefore, governments and policymakers in low-to-medium income countries, like Malawi, need to nurture and grow the trust that citizens have for effective development and implementation of DRM policies that strengthen community resilience. Given the above, this study concludes that the participants trust the Malawian government and policymakers responsible for developing and implementing policies that seek to reduce vulnerability, protect livelihoods, and address the determinants of health with a focus on the most vulnerable members of the community, and they consider the proposed adaptation to be fair. Beyond trusting government, it is important to note the statistically significant increase in confidence with the community using the results of the DP event. This paper argues that this increase is evidence of an increased sense of community agency in dealing with the flood related challenges they face following deliberation. Thus, this represents an endorsement on the DP process as an effective community consultation method for policy making and implementation.

6. Conclusion

As the number of people affected by floods continue to grow in Africa, governments will be forced to implement flood risk management policies that include forced relocation and resettlement of people with limited planning and participation of the people affected. This study

sought to explore the capacity of flood prone communities to participate in FRM policy priority setting, to ascertain what policies they supported and their level of trust in governance systems implementing the recommendations of the consultative process.

Results of the study have shown that the two neighbouring communities studied had, over time, and learning from the past experiences with disasters, developed reciprocal coping and adaptation mechanisms to enable them to live with floods while sustaining their livelihoods. The changes and sustained low and high mean scores of supported policies between pre- and post-DP surveys was evidence that poor rural community people incessantly affected by flooding can effectively participate in flood risk management policy priority setting if provided with fair, balanced, and comprehensive information about the hazard.

Overall, the two communities converged on five top priorities with minor variations on specific priorities perhaps informed by community specific contexts and available coping and adaptation approaches. An assessment of the top five identified policy options point to the desire by the two communities to have policymakers and practitioners to support their existing coping and adaptation mechanisms through increased access to family planning services, implementing women economic empowerment, supporting children's education, enhancing security of the most vulnerable during flooding response activities, and implementation of laws to end child marriages.

The study has also shown that against the backdrop of a relocation policy contestation between government and the community, the community members had high levels of trust in government and community governance systems adopting and implementing their expressed views through the DP process. An increase in the two communities' confidence in their governance structures adopting and implementing their expressed views points to improved community agency and a conformation of the DP as an effective means for community consultation in flood risk management policy development and implementation. Thus, the DP process managed to reduce complex policy issues to the level of conceptualisation and engagement that common citizens are accustomed to, which makes their involvement meaningful. Meaningful engagement in decision making about flood risk management options and perceived fairness of the consultation process can be strong predictors of community support for disaster risk management policies.

This study concludes that focusing only on relocating the affected people and building physical infrastructure for wading off floods, while sometimes necessary, may not be enough to reduce the adverse effects of flooding on the exposed people. There is need for development and implementation of FRM policies that put issues of gender, health, the welfare of the most vulnerable and human capital development through education and training at the core of strengthening community capacities for coping and adapting with flooding. The development and successful implementation of policies that affect people's wellbeing need to be based on representative consultations that include difference groups of people who will engage in consultations from their perception of risk and level and type of vulnerability. Governments of low- to middle-income countries and their stakeholders need to promote active voluntary participation in local level flood risk management activities by people exposed to flooding. It is also important that training and education on context specific disasters be provided to people living in disaster prone areas as evidence shows that training and education increase communities' preparedness and response capacities.

7. Study limitations

The study did not seek to extensively reconcile differences among different groups of people in the population. While there were some overarching themes and clear convergence of priorities among participants there were also some divergent views, e.g., the declining support for construction of a dyke among the upland community and the increasing in support of the same option among the lowland participants. It was not clear if these divergent views represent community specific entrenched differences in lived values, experiences or conceptualization of flooding and its effects. However, the community specific profiling and the mixed methods approach provided context specific and qualitative explanatory data that provided insights into some observed differences.

Supplementary Materials: The following are available online at www.mdpi.com/xxx/s1, Figure S1: title, Table S1: title, Video S1: title.

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— CHAPTER 6 —

GENERAL DISCUSSION, CONCLUSION AND RECOMMENDATIONS

CHAPTER 6: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

6.1. Introduction

This thesis assessed the capacity for- and implementation status of the WHO African Regional Strategy for Health in Malawi. It also measured community flood resilience and its associated factors in two flood prone communities of Nsanje district in southern Malawi. Furthermore, the thesis, through deliberative polling, assessed the level of community support for various flood risk management interventions. This chapter provides a general discussion demonstrating the central arguments and the logical thread that run across the three studies (Chapters 3, 4 and 5) answering the main questions of this thesis. The conceptual framework presented in chapter 2 guides the discussion and how the findings of the three studies connect with each other. An overview of the findings of the three studies is presented first before a detailed discussion of emerging themes across the three studies. This is followed by a conclusion and areas of further research and recommendations for practice. Limitations of the individual studies and the thesis are also summarized.

The three studies in this thesis revealed that at the institutional, policy and legislative level, Malawi had made a shift from a reactive to a more proactive approach to DRM characterized by the increase in policies that mainstreamed community resilience strengthening and preparedness in anticipation of the recurrence of disasters such as floods.[1] In addition, the DRM structure, as captured in the DRM policy,[2] placed the Ministry of Health (MOH) at the centre of DRM coordination both at national and sub-national levels as guided by the WHO regional strategy and in line with the increased focus on health as pronounced in the Sendai Framework.[3] In terms of resilience measurement and associated factors, this thesis revealed that being more flood resilient was defined in terms of support for constructing a dyke as a flood control measure with the construction work being conducted using labour from the local community (community participation and agency) and the establishment of flooding early warning systems. Empirically, access to basic primary health care, psychosocial health, a strong sense of community connection, maintaining system function for livelihoods and a sense of community caring were captured as required adaptive capacities for community flood resilience. These collectively capture the importance of public health in DRM and climate adaptation. The studies in this thesis also revealed that poor rural community members with

low levels of education can effectively participate in often considered difficult policy making issues if they are provided with adequate and balanced information about the phenomena of interest.

6.2. Discussion

A strong DRM institutional framework not matched with progress at community level

An analysis of the evolution and structure of the Malawi DRM policy framework shows the influences of both the international DRM frameworks such as the Sendai Framework and the role of crisis in policy formulation. The influence of the international frameworks is exemplified by the growth of national policies and strategies, between 2012 and 2019, that emphasized the need for strengthening community resilience for disaster preparedness.[1] As a result of the influence of these frameworks the value of disaster preparedness, particularly at community level, was upheld as a golden standard,[4] and the newly developed DRM policy embodied this new approach.[2] The establishment of health sector subcommittees through the decentralized DODMA structures is evidence of this commitment from government and provides the Ministry of Health (MOH) space to lead all health sector DRM activities in the country. Notwithstanding, this progress and achievement in DRM at institutional, legislative and policy framework levels is contrasted with the lack of progress in addressing the underlying risk drivers at community level.[5] The entire structure of disaster management in practice has[6] remained crisis driven with the government and its stakeholders acting when a disaster strikes and in a fragmented approach with data being collected in areas of interest to the DRM actors.[5]

This study concludes that while Malawi has made significant progress has been made to shift from a reactive crisis management to a more proactive risk management approach, there is a significant gap between national and local level action, as observed in other country evaluations.[7] This is because progress diminishes as activities move closer to the communities. These findings suggest the need for public health research, with the DRM and climate adaptation context, to investigate, at the community and other lower-level tiers, the factors, that when strengthened, would result in the full implementation of the WHO regional strategy for health and other frameworks that can strengthen resilience of disaster affected communities. Such an approach will inform the development, adoption and implementation of disaster risk policies that have community support.

Public health and the social framing of health issues for disaster resilience

In both the study on factors associated with community flood resilience and the flood risk management policies supported by the communities, this thesis revealed the need for government and policy makers to prioritize addressing the social determinants of health both at community level and how they differentially affect specific population sub-groups. As the African region is affected by climate induced disasters[8] and over 50% of its population living in rural areas reliant on floodplains for livelihoods,[9] responses to DRM in public health must go beyond the customary emphasis on epidemiology and biomedical aspects of diseases and establish a solid social context for health concerns and encouraging effective community involvement.

As this thesis established that the nexus of public health, DRM and resilience is incontestable, climate change adaptation is without a doubt central to the mission of public health. It is becoming increasingly important for policy makers to prioritize access to health services including primary health services, mental and psychosocial health, improved health and safety of the vulnerable populations, among others. Such a focus on strengthening long-term community adaptive capacities is essential in reducing the pre-existing burden of disease while strengthening community capacities required for resilience.[10,11] Anugwom also states that focusing on the public health impact of flooding is consistent with medical ethics of beneficence (protection of people from harm now and in the future and more generally in terms of boding good for people), non-maleficence (avoids harm or injury), and justice (equitable and fair to all concerned). Therefore, given Africa's already existing health inequalities even before climate change, the issue of equity resonates with health care.

Addressing health inequalities of a community is a long-term adaptive capacity strengthening intervention. Its focus is on building healthy communities to minimize exposure of people and property from disasters such as floods. Long-term adaptive capacity interventions also help communities to be better prepared, reducing vulnerability and strengthening community resilience.[12] Adaptation to disasters occur at individual, household and community level. Primary health care provisioning is positioned at this level to strengthen community resilience. By focusing on vulnerability and the ability of individuals and communities to recover (resilience), vulnerability reduction places the individuals at risk at center stage and tasks the responsible authorities with enhancing social equity and promoting community cohesiveness, alongside a heightened sense of individual responsibility.[13] As the studies of this thesis

converged on social determinants of health as key factors associated with community flood resilience (at measurement level) and the flood risk management policies supported by the flood affected communities (empirically), this finding represents a strong statement by the two case communities for DRM policymakers and practitioners to make public health a core element in disaster risk management.

The results from this study, particularly those highlighting the limited capacity in generation and use of data at both local and national level aptly point to the need for the African continent to invest in human capital development with a strong focus on data science. Such investments will help the continent to generate and manage data, not only at local level, but nationally and internationally for the development of solutions tailored to address not only challenges experienced at a local level but macro level as well.

Communities are knowledge generating labs that can participate in and influence policy

One of the key messages to have emerged out of this thesis is that communities are knowledge driven systems where knowledge is continuously constructed, in the case of this study, through learning from previous floods, and such learning is used to maintain system function in the face of adversity and sustain livelihoods. This thesis further reveals that DRM policymakers and affected community members belong to two polar spheres characterized by different worldviews. Policy analysis, formulation and implementation, no matter how sophisticated it maybe, does not automatically apply in all communities. There is need for context specific engagements that take into consideration the views of the affected people. The policy formulation process is a social construction.[14] The lived values of affected community members deeply delve into the policymaking process. Evidence from this study support this assertion. In their choice of priority DRM policies, the two communities identified policy aspects that are not directly related to protecting them from floods. They rather focused on long-term aspects that undermined their resilience such as ending child marriages, prioritizing the sick, children and elderly in evacuations, implementing conditional policies to ensure children attend participate in formal education, among others. In these choices is an inherent expression of community agency to protect their livelihoods if policymakers implement interventions that reduce their vulnerability. When given comprehensive and balanced information about flooding, members from the two flood affected communities were able to make informed choices about flood risk management policies they support. By treating the two communities as knowledge systems, this study demonstrated what Shahidullah (1998) called

an enlightened role by explaining and clarifying the competing views of relocation as a flooding risk mitigation measure and community resistance based on attached meanings, and values of social life.[14]

Strengthening community flood resilience requires a multidimensional approach

As the factors that differentiated the more resilient group from the less resilient group captured the multidimensional components of resilience, this study, at measurement level managed to demonstrate the need for an interdisciplinary systems approach to resilience measurement, DRM policy formulation and implementation. Due to the multidisciplinary nature of community resilience, the adoption and use of an interdisciplinary approach in this thesis provided a good theoretical basis for spelling out the nexus of DRM, resilience and public health. Therefore, in DRM for the health sector, a multidisciplinary approach is important in providing linkages not only for conceptual measurement of the concept of resilience but also in its emphasis on the need for concerted efforts of different stakeholders. Without doubt, this thesis has demonstrated that DRM is an area where a multidimensional approach is needed to fully embody and respond to the adverse effects of disasters.

Resilience and demographic variables

Quantitative results of this study revealed that age, gender and marital status were not significantly associated with being more or less resilient contrary to the findings of other previous resilience studies that found these factors to be significant associated with organisational leadership (Reed and Patterson 2007), workplace resilience (Bose and Pal 2020) and metal-health and well-being (Weitzel et al., 2022). The differences in results of the current study and those of the previous studies could be because of contextual differences in which, in the current study, resilience was associated with resistance to relocation and resettlement and a strong sense of place for food security and livelihood. Thus, resilience is presented as associated with efforts and/or choices that protect livelihoods. Furthermore, contextual difference that could explain differences in results in our study as compared to previous studies is the fact that there was an adjoining upland community that provided alternative ‘home’ such that those affected in the lowland were predominantly married male farmers.

6.3. Conclusion

Using a novel methodological framework, characterized by active participation of policymakers and flood affected community members, from study conceptualization to

implementation, this thesis highlighted DRM for health as an important area for climate adaptation that should consider the lived values of affected people. Although climate induced disasters such as flooding are a threat to human health, the processes required for ensuring affected communities adapt could be seen as opportunities for improving population health; thus, DRM presents opportunities for countries to improve health.

The studies in this thesis contribute to knowledge by advancing analytical approaches that can be used by other low-to-middle income countries in assessing capacity for implementation of DRM frameworks and enhancing community consultations and contributions to policy processes and priority setting. To that end, this study provides evidence in support of previous studies on building a strong theoretical and methodological foundation for empirical assessment of community flood resilience from a multidimensional resilience capacity perspective. The study demonstrated not only the role of public health in DRM interventions towards resilience strengthening, but it also identified community considered public health gaps and the lived values that are important for wellbeing and sustenance of livelihoods. Through the publication of key findings in different journals, this study will reach many stakeholders particularly those affected by disasters who can adopt some of the approaches used in this study and the results thereof. For Malawi, the study makes context specific recommendations that, if implemented, could strengthen community flood resilience and vulnerability reduction beyond the current focus on resettlement and relocation as disaster mitigation and prevention interventions.

6.4.Recommendations

Recommendations for public health science

- This study showed that the inadequacy, and often fragmented nature, of vulnerability and risk assessment data was a limiting factor for the full implementation of the DRM for health strategy. Africa, and indeed other low-to-middle income countries, would be better prepared to face future flood risk management challenges with increased access to DRM data. This study recommends that African public health institutions, working in collaboration with other institutions with similar interests, increase their investments in- and run professional courses and degree programmes that seek to strengthen capacity for the generation and use of public health disaster data and science. Such capacity strengthening efforts should include the recognition of family planning as an

important component of building flood disaster resilience as smaller households with well-spaced children would conceivably find it easier to evacuate during disaster.

Recommendations for strengthening capacity for DRM implementation

- As Malawi has developed and strengthened its DRM institutional frameworks, it must proceed to develop a financial model focused on proactive DRM, with increased focus on prevention and mitigation.
- All country DRM levels and structures should ensure availability of disaster risk analysis and mapping data for improved planning and evaluation of DRM interventions.
- Malawi should develop and implement focused and intentional interventions for community-level human capital development for disaster risk management.

Recommendations on community consultation

- As this study demonstrated, where communities are prone to flooding, policymakers and DRM stakeholders should consider adopting deliberative approaches such as the DP to consult communities for increased support and successful development and implementation of evidence-based DRM interventions.
- In line with previous disaster studies on the role of trust in government in DRM interventions, this study has shown that community members have high levels of trust in government and community governance systems for implementation of resilience strengthening interventions. The study recommends, therefore, that the Government of Malawi, and indeed those of other flood prone low-to-middle income countries, should build on this established trust and widely consult communities in the development and implementation of DRM interventions for community disaster resilience.
- To reduce the adverse effects of disasters when they occur, governments, policymakers and DRM stakeholders should increase their focus on community characteristics prior to disasters, such as those that inform improved community health. This study recommends that this includes improving the welfare of women and a focus on human capital development through education support.
- Governments, policymakers and DRM stakeholders must improve the security of girls and women in evacuation centres and prioritise vulnerable populations such as the elderly, children and people living with chronic illnesses in flood response interventions.

Recommendations for community flood resilience measurement

- Research inquiry must be based on specific hazards such as flooding to provide context specific measures of resilience as a way to improve the identification of interventions with high impact potential, and
- Researchers need to strengthen the use of multidimensional approaches to community resilience measurement, incorporating all community capitals and accounting for how they interact towards community resilience.

6.5. Reflections

This section outlines some reflections of the researchers gained from the practical experience of applying the workshop and deliberative polling methods for the studies of this thesis.

- The opportunity provided to rural participants to discuss high-level policy issues with a panel of experts, their fellow community members and provision of briefing materials made the approach unique in that it empowered the participants with accurate information upon which they made their final policy choices.
- The overall DP process carries with it an educational and empowerment benefit in that, in addition to data collection, the briefing materials and opportunities for engagement provided knowledge that some participants did not have prior to their participation. This was reflected in a higher proportion of policy options (17/32) that significantly shifted between pre- and post-DP surveys.
- The use of the workshop methodology, like focus group discussions, require investment in preparatory time engaging stakeholders to ensure their availability to participate in the workshop. Thus, they are time consuming but beneficial in-terms of generating information based on deliberations and consensus of the expert stakeholders gathered in one room. The workshop method, hosted in cities and towns, as in this study, requires strong financial support which students may not afford without external financial support. Considerations of costs related to venue booking and refreshments (usually in hotels) must be made before deciding to use this method for data collection.
- While the deliberative events are guided by a moderator and briefing materials, experiences from this study revealed that the content of what the participants can discuss is not restricted including the use of different local languages and their various dialects. In some cases, participants would not stick to discussion points at hand and

include personal narratives. Thus, the training of moderators by DP experts from Stanford University' Centre for Deliberative Democracy, with over 50-years' experience was helpful to ensure moderators are skilled in handling such situations

- Small group discussions with about 18 participants also presented a challenge as there were no limitations placed on how long each participant could speak. Again, the training of the moderators to ensure that all participants had a chance to voice their opinions was helpful.
- There are also no formal limits placed on how long an individual may speak, although moderators are instructed to ensure that all participants are allowed to have a voice in deliberations. Senior researchers also needed to be available on site supporting the moderators with difficulty situations.
- Despite the provision of informed and balanced information, the DP event held over two days to discuss long-standing policy issues may not have given community members enough time to work through conflicting perspectives for a deeper analysis. Thus, other methods, such as citizen jury, that require about a week of deliberations may produce detailed set of policy recommendations, although these can be considered incredibly expensive.
- As the DP opinion poll require the sample to be representative, challenges associated with collecting baseline data was the need to visit each household in a flood prone area where data collectors had to contend with crossing rivers and streams to collect data. In addition, such studies or visits are associated with participants' perception of potential future material benefits of participating, which in this study, resulted in more participants wanting to take part even when they were not sampled. In this case, the data collectors were trained to convince community members that they will not be excluded from any benefits that may come because of the study.

6.6. Limitations

The study on assessing DRM capacity and implementation status was limited to two participatory workshops, one conducted at the national level and another in one district of Malawi. The participation of the DODMA in these workshops may have influenced how the other participating organizations' representatives responded to or agreed with the scores provided. However, requests were made for supporting documents to substantiate suggested scores, thereby validating the scoring. In addition, the workshop conducted at the national level

and the reflections shared on national DRM policies and practices helped to ensure generalizability of study findings, with a caution that there could be district performance differences.

The study on resilience measurement and associated factors was a cross-sectional study, hence the caution in making any causal inferences. Furthermore, this was a quantitative study with no explanatory qualitative information to provide all the context for the participants' responses that may fully explain some of the observations made on the data. In addition, the study participants were mostly male (63.5%) which could have resulted in biased reporting or choice of supported flood risk mitigation options. However, to address these limitations, this quantitative study followed on a qualitative deliberative event at which all the flood mitigation policy options were discussed among all the participants, and a panel of experts availed to provide explanations on aspects that were not clear to the participants before they completed the survey. It can be argued that participants had balanced information on all the policies to be able to make independent informed decisions about their own choices. In the calculation of the community flood resilience construct, we make a normative assumption that responses to the question regarding reducing vulnerability within the communities (community agency) represent flood resilience. This assumption was based on previous resilience literature showing that commitment to remain in a flood prone area despite the prospect of continued future flooding[15,16] can be conceptualised as resilience. In addition, reducing vulnerability while supporting community agency is considered central to strengthening resilience.[17]

The study on the deliberative rural community consultation did not seek to extensively reconcile differences among different groups of people in the population. While there were some overarching themes and clear convergence of priorities among the participants, there were also some divergent views, e.g., the declining support for construction of a dyke among the upland community and the increase in support of the same option among the lowland participants. It was not clear if these divergent views represented community specific entrenched differences in lived values, experiences, or conceptualization of flooding and its effects. However, the community specific profiling and the mixed methods approach provided context specific and qualitative explanatory data that provided insights into some observed differences.

This study did not assess the effectiveness of the DRM structures in Malawi as this was not part of the scope of the study. In addition, as the study was conducted at national and district levels, it did not individually assess the capacity of local level structures such as the VCPCs, the ADC and the ACPCs as these were assessed as part of the broader DRM framework.

Overall, this thesis was limited in its usage of secondary data that was collected for different purposes specifically for objectives 2 and 3. Thus, analysis was based on already collected data and could be limited by data available in testing some of the constructs. To address this overall limitation, this thesis was based on a comprehensive review of the DRM environment, not only in Malawi, but also in the Africa and SADC regions which provided broad context which could be related to the findings of the studies in this thesis. In addition, the convergence of findings across the three studies of this thesis, as well as with other previous studies, including those from different geographies, is testament to the robustness of the methodological approach used in this thesis. This thesis represents one of the studies that used a multidimensional approach to studying resilience, a call that has, for long been made by many researchers and practitioners, thus, it feels an important gap in disaster risk management.

6.7.Areas for further research and practice

- As the study to assess capacity for and implementation status of the WHO Regional Strategy for Health was conducted prior to 2022, a full assessment covering more districts is needed to generate more data and to present the full picture of capacity and progress made towards achieving all the nine targets.
- Further research is needed to assess the level of decentralization of Malawi's recently developed policies and strategies focused on resilience strengthening at community level and make recommendations based on identified gaps and opportunities.
- As climate change adaptation and DRM requires a long timeframe in public health planning, it is important that continuous research be conducted to keep track with and discover emerging characterizations of the nexus between public health, DRM and community resilience.
- Researchers adopting the analytical approaches used in this study are encouraged to document and report how they applied them and, through citation of this work, how applicable the approaches were in different contexts.

- More research is needed in other countries to assess the role of public health and health ministries in DRM in line with the emphasis on health in the Sendai Framework.
- Further research is needed to understand, in detail, the MOH Disaster Risk Management Coordination role to provide evidence for the effectiveness of the structure within the broader DODMA structure. Such a study will be helpful in identifying and documenting achievements, gaps, challenges, and opportunities that can be implemented for a strengthened health system and structure and approach to resilience strengthening.

6.8. References

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APPENDICES

Appendix 1- Deliberative polling questionnaire with consent form

Gauging Citizens' Voice on Alternative Policies for Responding to Vulnerability Challenges Associated with Flooding in Nsanje District, Malawi.

INFORMED CONSENT FORM

- My name is _____ from the School of Health Systems and Public Health of the University of Pretoria in South Africa. We are conducting a study to assess the implementation status of the Disaster Risk Management (DRM) strategy for health in the context of fair adaptation. The study also seeks to explore factors associated with community resilience to flooding in Nsanje district in Malawi.

- This research will involve your participation as an individual (by answering questions in a focus group discussion) that will take about two hours per session. There will be about three sessions conducted over a five day period to balance your work requirements and your participation in the study. The study will be conducted in Lilongwe at a venue to be identified. In Nsanje, the study will be conducted at the District Centre.

- You are being invited to take part in this research because we feel that your experience as a responsible citizen can contribute towards a policy option to address the vulnerability of communities in Malawi in general and Nyachikadza and Ndamera in particular.

- Your participation in this research is entirely voluntary. It is your choice whether to participate or not.

- There will be no direct benefit to you, but your participation is likely to help us find out more about how to promote the resilience of communities and address the challenges brought about by frequent flooding in TA Nyachikadza and TA Ndamera.

- We will not share any information or answers with anyone, including your colleagues, family, friends, or anyone else outside the FGD participants. The answers that you give will not be linked to your name in our records. Your identity will not be disclosed when this study is published. For record-keeping purposes only, we will assign you a unique study identification number. Only this number appears on our research documents; we will not put your name on these documents. Also, the interviews will be kept on a password-protected computer to which only the research staff will have access.

If you have any questions, feel free to ask them now or at any point during the focus group discussion or by contacting my Supervisors (Professor Ayo-Yusuf Tel: +27125214111 and Dr. Donald Makoka Tel: +265-888-930-830).

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant_____

Signature of Participant_____ Date _____
Day/month/year

Read the following to the participant:

I will be asking questions to you on a 0 to 10 scale. Please respond to each question by saying a number from 0 to 10 or by showing all the fingers on your palm. For example, saying 0 means you think an issue is **extremely unimportant** and saying/showing 10 means it is **extremely important**. The number 5 is exactly in the middle. The higher the number you choose, the more importance you are giving the issue. And, if you don't know, you can just say don't know.

Note for interviewer:

Further note: the highest rating, the level of 10 on the scale is only for the very most important priorities. If you were making a shopping list some items would go first as they would be most important-- you would be sure to buy those. Other items would go later as they would be less important and you would buy those only if you had resources left. On the 0 to 10 scale below, please indicate how important or unimportant you think these options are. Feel free to use all the points on the scale, where 0 is not important at all, all the way up through 10, where 10 is for the most important items on your list, the very top priorities. Please give lower numbers for the items that are less important.

Comments:

Code questionnaire |__|__|__|

Code Interviewer |__|__|__|

Telephone Number |__|__|__|__|__|__|__|__|__|__|

1st Visit	**2nd Visit**	**3rd Visit**
Date: |__|__|__|__|__|__| **Start time:** |__|__| h|__|__|mn **End time:** |__|__| h|__|__|mn	Date: |__|__|__|__|__|__| **Start time:** |__|__| h|__|__|mn **End time:** |__|__| h|__|__|mn	Date: |__|__|__|__|__|__| **Start time:** |__|__| h|__|__|mn **End time:** |__|__| h|__|__|mn

Let's Begin!

1. To begin with, all in all, on a 0 to 10 scale, where 0 is no value at all, 10 is as much value as can be, and 5 is exactly in the middle, how much economic value does the Shire river provide you?

No value at all					Exactly in the middle					As much value as can be		Don't Know
0	1	2	3	4	5	6	7	8	9	10		99

2. And, on a 0 to 10 scale, where 0 is extremely risky, 10 is extremely safe, how much risk does the Shire river pose to you?

Extremely risky					Exactly in the middle					Extremely safe		Don't Know
0	1	2	3	4	5	6	7	8	9	10		99

3. On a scale from 0 to 10 where 0 is extremely unimportant, 10 is extremely important and 5 is exactly in the middle, how important or unimportant are the following for the **government to do**?

	Extremely unimportant					Exactly in the middle					Extremely important		Don't Know
a. Facilitate the relocation of TA Nyachikadza community to suitable land in the high land area **within the same district**	0	1	2	3	4	5	6	7	8	9	10		99
b. Facilitate the relocation of TA Nyachikadza community to the best	0	1	2	3	4	5	6	7	8	9	10		99

suitable land **anywhere in Malawi**													
c. Should only proceed with resettlement after it has developed a plan that is approved by the TA Nyachikadza community	0	1	2	3	4	5	6	7	8	9	10		99
d. Provide legal title to land for TA Nyachikadza community members before relocation	0	1	2	3	4	5	6	7	8	9	10		99
e. Facilitate a complete relocation but allow communities to continue using their land for crop cultivation	0	1	2	3	4	5	6	7	8	9	10		99
f. Prohibit provision of any social service (hospitals, schools, etc.) in TA Nyachikadza as a way of 'forcing'	0	1	2	3	4	5	6	7	8	9	10		99

people to relocate													
g. Provide increased social services (e.g. schools, health centres) in TA Ndamera if people are relocated there	0	1	2	3	4	5	6	7	8	9	10		99
h. Facilitate TA Ndamera's access to the low land for crop cultivation in exchange for hosting TA Nyachikadza's residence in the upland (TA Ndamera)	0	1	2	3	4	5	6	7	8	9	10		99
i. Facilitate increased agricultural production in TA Ndamera	0	1	2	3	4	5	6	7	8	9	10		99

4. How important or unimportant would you rate the following factors in considering whether you will be willing to relocate?

	Extremely unimportant					Exactly in the middle					Extremely important		Don't Know
a. Quality of land	0	1	2	3	4	5	6	7	8	9	10		99

where I would be relocated													
b. Leadership legitimacy in the new TA	0	1	2	3	4	5	6	7	8	9	10		99
c. Access to social services like health and education	0	1	2	3	4	5	6	7	8	9	10		99
d. Available livelihood sources	0	1	2	3	4	5	6	7	8	9	10		99
e. Whether or not the whole community move together to the new place	0	1	2	3	4	5	6	7	8	9	10		99
f. Whether or not I will still have access to current ancestral land	0	1	2	3	4	5	6	7	8	9	10		99
g. Potential for conflict with people in the new	0	1	2	3	4	5	6	7	8	9	10		99

area of relocation													

5. And, on the same scale, the following are some questions about what the government should do regarding reducing vulnerability in the existing communities**.**

	Extremely unimportant					Exactly in the middle					Extremely important		Don't Know
a. Construct a dyke along the Shire River from Nsanje District Centre to TA Nyachikadza (a distance of around 40 Km)	0	1	2	3	4	5	6	7	8	9	10		99
b. Construct a dyke along the Shire River from Nsanje District Centre to TA Nyachikadza **with labour from the communities** coordinated by the District Council as part of the Public Works Programme	0	1	2	3	4	5	6	7	8	9	10		99
c. Allow TA Nyachikadza communities to 'access' land upland to temporarily relocate during floods and return afterwards.	0	1	2	3	4	5	6	7	8	9	10		99
d. Allow communities to remain but develop an effective flood-early warning system.	0	1	2	3	4	5	6	7	8	9	10		99

e. Sensitize TA Nyachikadza communities on flood early warning.	0	1	2	3	4	5	6	7	8	9	10		99
f. Develop places of safety for children and vulnerable groups (elderly, sick) when flood warnings are administered.	0	1	2	3	4	5	6	7	8	9	10		99
g. Put in place effective life-saving measures (such as petrol boats, life jackets, etc.) in all strategic places to be used to rescue people during floods	0	1	2	3	4	5	6	7	8	9	10		99
h. Have the VCPC, ACPC and DCPC consider indigenous knowledge systems (IKS) in flood early warning.	0	1	2	3	4	5	6	7	8	9	10		99
i. Have all the Area Civil Protection Committees (ACPCs) and Village Civil Protection Committees (VCPCs) along the Shire River form an alliance to share information about flood early warning.	0	1	2	3	4	5	6	7	8	9	10		99

6. How important or unimportant would you rate the effectiveness of the following methods of communications for early warning flood information?

	Extremely ineffective					Exactly in the middle					Extremely effective		Don't Know
a. Telephone voice	0	1	2	3	4	5	6	7	8	9	10		99
b. Telephone SMS	0	1	2	3	4	5	6	7	8	9	10		99
c. Beating drums	0	1	2	3	4	5	6	7	8	9	10		99
d. Whistles	0	1	2	3	4	5	6	7	8	9	10		99
e. Other Indigenous methods (e.g. animal migration)	0	1	2	3	4	5	6	7	8	9	10		99

7. On the same scale, the following are some questions about what the government should do regarding population pressure, gender and social services.

	Extremely unimportant					Exactly in the middle					Extremely important		Don't Know
a. Provide wide access to free family planning services	0	1	2	3	4	5	6	7	8	9	10		99
b. Construct a health centre in TA Nyachikadza so long as people live there	0	1	2	3	4	5	6	7	8	9	10		99
c. Have families consider their land resources in deciding how many children to have	0	1	2	3	4	5	6	7	8	9	10		99
d. Increase the use of temporary shelters for evacuation instead of classrooms	0	1	2	3	4	5	6	7	8	9	10		99
e. Use community by-laws to restrict child marriages	0	1	2	3	4	5	6	7	8	9	10		99

f. poor families with children of school-going age should only receive a cash transfer if they enroll their children to school	0	1	2	3	4	5	6	7	8	9	10		99
g. adults with children of school-going age should only participate in the Public Works Program if they enroll their children in school	0	1	2	3	4	5	6	7	8	9	10		99
h. Establish collective storage facilities for food in the uplands (by the people from the lowlands)	0	1	2	3	4	5	6	7	8	9	10		99
i. Provide adequate security in evacuation centres to ensure that women and girls are protected from abuse and rape	0	1	2	3	4	5	6	7	8	9	10		99
j. Allow families to be able to stay together during flood evacuations	0	1	2	3	4	5	6	7	8	9	10		99
k. Allow households with persons who are vulnerable and sick be prioritized during flood evacuations	0	1	2	3	4	5	6	7	8	9	10		99
l. Promote the capacity building of the VCPCs to know how to respond to emergencies	0	1	2	3	4	5	6	7	8	9	10		99

m. Promote village savings and loans to provide alternative income sources for women	0	1	2	3	4	5	6	7	8	9	10		99
n. Ensure a woman should not lose the family land if her husband dies	0	1	2	3	4	5	6	7	8	9	10		99

8. On another 0 to 10 scale, where 0 strongly disagree and 10 is strongly agree, is **how strongly would you disagree or agree with the following statements?**

	Strongly disagree					Exactly in the middle					Strongly agree		Don't Know
a. Relocation is necessary for basic livelihood	0	1	2	3	4	5	6	7	8	9	10		99
b. Current early warning notifications are ineffective	0	1	2	3	4	5	6	7	8	9	10		99
c. Staying on one's traditional/ancestral land is worth the risk of being caught in a flood	0	1	2	3	4	5	6	7	8	9	10		99
d. Majority of people in our village do not want to relocate	0	1	2	3	4	5	6	7	8	9	10		99
e. I find it easy to move my family out to uplands even when the floods have started.	0	1	2	3	4	5	6	7	8	9	10		99

f. In the event of a flood, I find government response is adequate.	0	1	2	3	4	5	6	7	8	9	10		99

Now, we are back to questions on a 0 to 10 scale. Where 0 means not at all serious, 10 means completely serious and 5 is exactly in the middle.

9. How serious or not do you think the **government will take into account your views** and suggestions provided in this event**?**

Not at all serious					Exactly in the middle					Completely serious		Don't Know
0	1	2	3	4	5	6	7	8	9	10		99

10. And, where 0 is not at all confident, 10 is completely confident, and 5 is exactly in the middle, how confident are you **the government will use the results** from this event?

Not at all confident					Exactly in the middle					Completely confident		Don't Know
0	1	2	3	4	5	6	7	8	9	10		99

11. And, where 0 is not at all confident, 10 is completely confident, and 5 is exactly in the middle, how confident are you **the community will use the results** from this event?

Not at all confident					Exactly in the middle					Completely confident		Don't Know
0	1	2	3	4	5	6	7	8	9	10		99

12. And, how strongly would you agree or disagree with the following statements. Where 0 is strongly disagree, 10 is strongly agree and 5 is exactly in the middle.

	Strongly disagree					**Exactly in the middle**					**Strongly agree**		**Don't Know**

a. People with different views from mine often have very good reasons for their opinions	0	1	2	3	4	5	6	7	8	9	10		99
b. I consider myself capable of participating in politics	0	1	2	3	4	5	6	7	8	9	10		99
c. Public officials care a lot about what people like me think	0	1	2	3	4	5	6	7	8	9	10		99
d. Most public policy issues are so complicated that a person like me can't really understand what's going on	0	1	2	3	4	5	6	7	8	9	10		99
e. People like me don't have any say about what the government does	0	1	2	3	4	5	6	7	8	9	10		99

Now we are coming to some questions to which not everyone may know the answer. If you come to one to which you don't know the answer, just say so, and move on to the next one.

13. In which months are flood most likely to occur?
    a. November, December, January
    b. February, March, April
    c. May, June, July
    d. August, September, October
    e. Don't Know

14. Which of following types of livelihood are more vulnerable to flooding?
    a. Crop production and livestock production
    b. Crop production and petty trading
    c. Crop production and semi-skilled work

d. Crop production and casual labor
e. Don't Know

15. Which of the following statement is correct?
    a. Females are permitted by law to get married after their first menstrual cycle.
    b. Females are permitted by law to get married when they reach 18 years of age.
    c. By law, females must be married by 18 years of age.
    d. Females are permitted by law to get married when marriage propose is made.
    e. Don't Know

16. On average, for Malawi, how many children does each family have?
    a. 3
    b. 6
    c. 9
    d. 12
    e. Don't Know

17. Which of the following statements is TRUE?
    a. When the Shire River floods into the Ndindi Marsh, the Nyachikadza community gets seriously affected.
    b. The Government of Malawi declared TA Nyachikadza as a flood-prone area and prohibited any individual from staying in the area.
    c. There is a high risk of increased spread of HIV during the relocations.
    d. When they temporarily relocate to Ndamera, there are always serious problems with WASH facilities, leading to outbreaks of cholera and other associated diseases, which affect members of both communities.
    e. All of the above.
    f. Don't Know

18. Now, there are some things that people find more or less important for themselves or society to have. On a 0 to 10 scale, where 0 is extremely unimportant, 10 is extremely important and 5 is exactly in the middle, how important or unimportant would you say each of the following is to you?

	Extremely unimportant					Exactly in the middle					Extremely important		Don't Know
a. Making one's own choices	0	1	2	3	4	5	6	7	8	9	10		99

b. Not having to worry about food or shelter	0	1	2	3	4	5	6	7	8	9	10		99
c. Having a safe community	0	1	2	3	4	5	6	7	8	9	10		99
d. Making sure everybody has clean air and water	0	1	2	3	4	5	6	7	8	9	10		99
e. Earn as much money as possible	0	1	2	3	4	5	6	7	8	9	10		99
f. Making sure that government does what the people want	0	1	2	3	4	5	6	7	8	9	10		99
g. Promoting economic growth	0	1	2	3	4	5	6	7	8	9	10		99
h. Having a well-educated society	0	1	2	3	4	5	6	7	8	9	10		99

Finally, a few questions about you.

1. Have you received any training or education on disasters or flooding?
    a. If so, what type of training, such as first aid?
2. Do you and/or your family have an alternative place to go to during times of a flood?
    a. If so, where ?
3. Are you a member of the Village or Area Civil Protection Committee?

a. Name.....
b. Gender.....
c. Age |__|__|
d. Marital Status
    a. Married
    b. Single
    c. Divorced
    d. Widowed
e. Highest Level of Education

i. None
ii. Some primary school
iii. Primary school
iv. Some secondary school
v. Secondary school
vi. Some high school
vii. High school
viii. Some college
ix. College
x. Vocational School

g. Current Occupation:

1. Farmer
2. Professional/technical/managerial
3. Entrepreneur
4. Merchant
5. Teacher
6. Student
7. Other:

h. How many children do you have in your household? |__|__|

Do you have anyone in the household who is chronically ill? (Include list of diseases from previous questionnaire)

i. What is your current household size?
|__|__|

j. How much land does your household own (lowland) in Acres?

k. How much land does your household own (upland) in Acres?

Evaluation Questions (post-deliberation only)

Finally, some questions about the discussions you have engaged in over the past couple days.

On a scale of 0 to 10, where 0 is "a waste of time", 10 is "extremely valuable" and 5 is exactly in the middle, how valuable was each of the following in helping you clarify your positions on the issues?

1. The small group discussions

A waste of time					Exactly in the middle					Extremely valuable		Haven't thought much about it
0	1	2	3	4	5	6	7	8	9	10		99

2. The briefing materials

A waste of time					Exactly in the middle					Extremely valuable		Haven't thought much about it
0	1	2	3	4	5	6	7	8	9	10		99

3. The plenary session

A waste of time					Exactly in the middle					Extremely valuable		Haven't thought much about it
0	1	2	3	4	5	6	7	8	9	10		99

4. The event as a whole

A waste of time					Exactly in the middle					Extremely valuable		Haven't thought much about it
0	1	2	3	4	5	6	7	8	9	10		99

And how strongly would you agree or disagree with each of the following statements?

	Disagree Strongly	Disagree Somewhat	Neither agree nor disagree	Agree Somewhat	Strongly Agree
5. My group moderator provided the opportunity for everyone to participate in the discussion	1	2	3	4	5
6. The members of my group participated relatively equally in the discussions	1	2	3	4	5
7. My group moderator sometimes tried to influence the group with his or her own views	1	2	3	4	5
8. My group moderator tried to make sure that opposing arguments were considered	1	2	3	4	5
9. The important aspects of the issues were covered in the group discussions	1	2	3	4	5
10. I learned a lot about people very different from me - about what they and their lives are like	1	2	3	4	5

Appendix 2: Assessing DRM capacity questionnaire with consent form

Questionnaire

INFORMED CONSENT FORM IN ENGLISH

Disaster risk management implementation in Malawi: policy options for resilience to adverse impacts of flooding in Nsanje District

- My name is _____ from the School of Health Systems and Public Health of the University of Pretoria in South Africa. We are conducting a study to assess the implementation status of the Disaster Risk Management (DRM) strategy for health in the context of fair adaptation.
- This research will involve your participation in a group as part of a workshop that will take about one day. The study will be conducted in Lilongwe at a venue to be identified. In Nsanje, the study will be conducted at the District Centre.
- You are being invited to take part in this research because we feel that your experience as a responsible citizen can contribute towards a policy option to address the vulnerability of communities in Malawi in general.
- Your participation in this research is entirely voluntary. It is your choice whether to participate or not.
- There will be no direct benefit to you, but your participation is likely to help us find out more about how to promote the resilience of communities and address the challenges brought about by frequent flooding in Malawi.
- We will not share any information or answers with anyone, including your colleagues, family, friends, or anyone else outside the workshop participants. The answers that you give will not be linked to your name in our records. Your identity will not be disclosed when this study is published. For record-keeping purposes only, we will assign you a unique study identification number. Only this number appears on our research documents; we will not put your name on these documents. Also, the interviews will be kept on a password-protected computer to which only the research staff will have access.

If you have any questions, feel free to ask them now or at any point during the focus group discussion or by contacting my Supervisors (Professor Ayo-Yusuf Tel: +27125214111 and Dr. Donald Makoka Tel: +265-888-930-830).

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant_____

Signature of Participant_____ Date _____

Day/month/year

Questions:

	DRM strategy target 1: Incorporated DRM into their national health legislation, national health policies and health sector strategic plans				
	Institutional Framework (Policies, Strategies and Legal Frameworks)				
	Question				
Legal framework	***1.*** With respect to your national disaster legislation, which of the following statements are accurate?	Yes Completely	Partly	No, not at all	Don't know
	a. A National Disaster Act has been promulgated				
	If question a is yes, does the NDA address the following:				
	b. Establishes a national Disaster Risk Management (DRM) system				
	c. Establishes a Disaster Management Committee (DMC)				
	d. Identifies a coordinating agency i.e. National Disaster office (NDO)				
	1. With respect to your national health legislation, which of the following statements are accurate?				
	a. National Health-related Legislation has been promulgated				
	b. Does any National Health-related Legislation contain provisions for DRM (if so, please list them below)				
	a.				
	ii.				
	iii.				
	c. If b is yes; are DRM provisions congruent with provisions in the Disaster Act (if so, for which? Please list them below)				
	i.				
	ii.				
	iii.				
	d. If b is yes; does the legislation mandate and empowers the Minister or Senior MOH officer to lead the HS in matters of DRM (if so, for which? Please list them below)				
	i.				
	ii.				
	iii.				
Policy Framework	**3**. In terms of National DRM policy, which of the following statements are accurate?				
	a. A National DRM policy (or equivalent) has been promulgated				
	b. The HS is represented in the national Disaster Management Committee (DMC)				
	c. DRM provisions are congruent with provisions in the Disaster Act				
	d. Mandates and empowers the Minister or Senior MOH officer to lead the HS in matters of DRM				
	e. Other relevant policies pertaining to DRM have been promulgated (if so, please list them below)				
	i. Climate change policy; Nutrition policy; Food security policy; Gender policy;				
	ii. Housing policy; National HIV and AIDS policy; Child protection policy; Education policy				
	iii. National social support policy				
	Health policy; Elderly and Disability policy				
	Malawi decentralisation policy; National sanitation policy				

	4. In terms of the HS related DRM policies, what is the status of the following:				
	a. A National Health Policy incorporating DRM Provisions (or equivalent)				
	b. Policy requiring health institutions to have and practice an emergency/disaster plan				
	c. Policy requiring health institutions to have a Business Continuity Plan				
	d. Policy on the Safe Hospital program				
	e. Policy includes involvement of foreign medical personnel in emergency and disaster response				
	f. Policy on post event treatment of casualties (pre-hospital and hospital)				
	g. Policy on identification and handling of bodies				
	h. Policy on post event epidemiological surveillance and disease control				
	i. Policy on basic sanitation and sanitary engineering				
	j. Policy on health management in shelters or temporary settlements				
	k. Policy on training health personnel and public on HS DRM				
	l. Policy on medical supply donations				
	m. Provision for community involvement in DRM at local level				
	n. Other:				

DRM strategy target 2: Identified, assigned responsibility to and equipped a unit in the MOH to coordinate the implementation of DRM interventions for the health sector				
Question				
1. With respect to your national disaster legislation, which of the following statements are accurate?	Yes Completely	Partly	No, not at all	Don't know
e. Mandates the MoH (department or Minister/ Senior MOH officer) with general DRM responsibilities				
f. Mandates the MoH (department or Minister/ Senior MOH officer) specifically for the HS aspects of the national emergencies				
g. Mandates the MoH (department or Minister/ Senior MOH officer) specifically for the responsibility for Health emergencies/disasters such as pandemics.				
h. Mandates other government departments/agencies associated with the HS with DRM responsibilities.				

DRM strategy target 3: Established functional health sector subcommittees in district multi-sectoral coordination committees on DRM					
Questions (Health Sector Coordination Mechanism)	Yes Completely	Partly	No, not at all	Don't know	
5. Which of the following statements relating to the district DRM Structure are accurate?					
a. A Disaster Management Committee (DMC) has been established.					
b. Involves representation from **all** sectors and key stakeholders.					
c. Responsibilities of members are **clearly** defined.					

d. A HS sub-committee has been established with clear responsibilities for the HS dimensions of DRM					
e. During humanitarian crisis a cluster coordination is activated and works closely with the existing coordination mechanism					
6. How would you categorize the level of functionality of the Disaster Management Committee?	Very Low	Low	Adequate	High	Very High
Not established or established but **does not involve** all key actors; responsibilities **not clearly** defined**; rarely** meets.					
Involves **some** key district players; responsibilities **somewhat** defined; rarely meets; has a HS subcommittee.					
Involves **most** key district players; responsibilities **reasonably well** defined; meets **occasionally on an ad hoc basis** and has a HS subcommittee					
Involves **all** key district players; responsibilities are **clearly** defined; meets **occasionally but regularly**; has sector subcommittees including a HS subcommittee					
Involves **all** key district players; responsibilities are **clearly** defined; meets **regularly and frequently**; has sector subcommittees including a HS subcommittee					
7. Which of the following statements relating to the HS DRM Structure are accurate?	Yes Completely	Partly	No, not at all	Don't know	
a. Are DRM functions integrated into the functions of the HS Committee?					
b. The HS Committee performs Health DRM advisory functions to the District DMC.					
c. The HS Committee performs emergency response functions.					
d. A District Health Disaster Coordinator (HDC) has been appointed.					
e. Within the MoH, the HDC reports to (choose one) :					
f. The HDC has sufficient resources to lead the HS DRM Program					
8. In terms of HS personnel available specifically for the DRM program, which of the following are valid statements?					
a. The HS Coordinator has technical and administrative support structures within the MoH					
b. There is a budget line for the HS DRM					
c. The health Disaster Coordinator also has other responsibilities					
d. Apart from the health disaster coordinator, there are other professional and administrative staff					
e. Is staffing level for HS DRM adequate?					
9. Does the District Health Committee structure address the following elements?					
a. Emergency Preparedness, response and recovery SOPs					
b. Administrative instructions, SOPs, and ToR					
c. Medical attention including mass casualty management, hospitals and ambulatory services					
d. Environmental health					
e. Epidemiological surveillance					
f. Nutrition					
g. Temporary settlements/camps					
h. Supplies					
i. Transportation					
j. Coordination (partners…)					

k. Requests and donations						
l. Public information						
m. Vulnerability and Risk Assessment						
n. Resilience building						
o. Mitigation						
p. Post-disaster recovery						
q. Monitoring and Evaluation						
10. How would you categorize the level of functionality of the District Health Committee with regards to DRM?	Very Low	Low	Adequate	High	Very High
Not established or established but **does not involve** all key actors; responsibilities **not clearly** defined**; rarely** meets.					
Involves **some** key district players; responsibilities **somewhat** defined; **rarely** meets; **rarely** formulates health related advice to the DMC.					
Involves **most** key district players; responsibilities **reasonably well** defined; meets **occasionally on an ad hoc basis;** formulates health related advice to the DMC **occasionally;** reviews **some** of the HS plans.					
Involves **all** key district players; responsibilities are **clearly** defined; meets **occasionally but regularly**; **regularly** formulates health related advice to the DMC**;** reviews **most** of the HS plans.					
Involves **all** key district players; responsibilities are **clearly** defined; meets **regularly and frequently**; **regularly** formulates health related advice to the DMC**;** reviews **all** of the HS plans.					
11. Considering the HS key stakeholders, how would you categorize the overall level of quality (availability and training) of human resources earmarked for HS DRM?					
Few if any HS stakeholders have DRM dedicated personnel; **very few** are trained in DRM and are **not** integrated in the HS DRM structure/system					
Some HS stakeholders have DRM dedicated personnel; **few** are trained in DRM and are **loosely** integrated in the HS DRM structure/system					
Most HS stakeholders have DRM dedicated personnel; **some** are trained in DRM and **most** are somewhat integrated in the HS DRM structure/system.					
All HS stakeholders have DRM dedicated personnel; **most** are trained in DRM and **all** are integrated in the HS DRM structure/system.					
All HS stakeholders have DRM dedicated personnel; they are **all** trained in DRM and all are **highly** integrated in the HS DRM structure/system.					

	DRM strategy target 4: Conducted health disaster risk analysis and mapping in a multi-sectoral approach					
	Health Emergency Risk Assessment and Information Management					
	Risk identification					
Hazard assessment	**12**. From a Ministry of Health (MoH) perspective, what is the level of availability and usefulness of hazard information?	Very Low	Low	Adequate	High	Very High
	National priority hazards **not** defined and **little** relevant information useful to planners is available in non-scientific terms.					
	National priority hazards **not** defined and **some** relevant information useful to planners is available in non-scientific terms. Hazard information exchange/sharing network does not exist.					

	National priority hazards **somewhat** defined and **some** relevant information but **not available** from central national repository (in some cases, this could be in the Health Sector (HS) itself). Planners have to search a variety of sources and some information is understandable by non-technical planners. Information useful mainly at the HS (Macro) but not detailed enough for the health facility level (Micro).					
	National priority hazards **clearly** defined and **all** relevant information **readily available** from central national repository (in some cases, this could be in the HS itself). Information is provided on request and in a manner understandable by planners. Information useful both at the HS (Macro) and health facility level (Micro).					
	National priority hazards **clearly** defined and **all** relevant information **readily available** from central national repository (in some cases, this could be in the HS itself). Updated information is provided to users' network as available in a manner understandable by planners. Information useful both at the HS (Macro) and health facility level (Micro).					
Vulnerability assessment	**13**. In terms of the HS **vulnerability assessment**, which of the following statements are valid?	Yes Completely	Partly	No, not at all	Don't know	
	a. Vulnerability assessment conducted					
	b. Conducted as part of a broader national vulnerability assessment.					
	c. Conducted separately to supplement the broader national vulnerability assessment					
	d. Is based on the national priority hazards					
	e. Includes consideration of all HS stakeholders					
	f. Includes consideration of the health system building blocks					
	Further Comments or Explanations:					
Risk assessment	**14**. If the health risk assessment was conducted, which of the following statements are valid?					
	a. Risk Assessment conducted					
	b. Updated database on priority health risks is available and accessible					
	c. Conducted as part of a broader national risk assessment.					
	d. Conducted separately to supplement the broader national risk assessment					
	e. Is based on the national priority hazards					
	f. Includes consideration of the health system building blocks					
	15. In terms of HS facilities, which of the following statements are valid?					
	a. A Vulnerability assessment, Risk mapping and Management (VRAM) methodology/process for HS facilities is available					
	b. The VRAM process for HS facilities feeds into the community VRAM process.					
	c. HS facilities are required to perform VRAM and HSI.					

DRM strategy target 5: Incorporated emergency and disaster early warning, preparedness, response and recovery indicators into the district surveillance and health information systems				
Surveillance and Information Management	Yes Completely	Partly	No, not at all	Don't know
16. District health information system (DHIS):				

a. Does it provide disaggregated data for health emergency management at district levels?				
b. Does it define triggers/ threshold for switching from routine to emergency reporting?				
17. District and interdistrict information sharing:				
a. Are the emergency information mechanisms established at all levels including community level and are trained staff available?				
b. Does the information management system facilitate reporting to national and other mandatory reporting requirements?				
c. Does an emergency reporting system exist with resources and trained staff available?				
d. Does the emergency reporting system generate data used to provide efficient tracking of victims and resources?				
e. Does it collect data from all relevant stakeholders?				
18. Surveillance systems:				
a. Do emergency and surveillance managers have access to relevant data (including: trauma and injuries, communicable diseases, vector borne diseases, water quality, nutrition, non-communicable diseases and food safety)?				
b. Are epidemic intelligence activities in place, including early warning capacity (baseline estimates, trends and thresholds for alert and action defined at the primary response level, regular analysis of epidemic prone disease etc) to recognize and report within 24hrs any event that may be of potential public health concern?				
c. Does the surveillance system provide sufficiently trained staff and network infrastructure, including surge capacity, to adequately respond to an event?				
d. Do they include standardized protocols with defined roles and responsibilities and procedures for data collection, management, analysis and dissemination?				
e. Is there a link with agricultural, veterinary and disease surveillance systems to share data?				
19. Rapid health needs assessment.				
a. Does it involve the health sector fully in planning, preparation and implementation?				
b. Do concerned health professionals receive appropriate training in Initial Rapid Assessment (IRA) application?				
c. Do mechanisms exist to allocate resources and to initiate actions based on IRA date?				

DRM strategy target 6: Established emergency and disaster response and recovery operations, based on national standard operating procedures, and capable of supporting cross-border interventions

	Response and recovery planning					
Planning framework	**20**. In terms of the HS plans addressing DRM, what is the status of the following:	Yes Completely	Partly	No, not at all	Don't know	
	a. National Health Sector Strategic Plan has a DRM component					
	b. All Hazard National Health Disaster Operational Plan					
	c. Hazard specific contingency plan					
	d. Model (template) district emergency/disaster plan					
	e. Model health institution Business Continuity Plan					
	f. Other:					
	g. Other:					
	h. Other:					
Planning process and plan content	**21**. In terms of planning process, which of the following apply? All plans have been :					
	a. Developed with the participation of all HS stakeholders					

	b. Developed in coordination with the NDO (National and District Disaster Office)					
	c. Endorsed by the NDO					
	d. Subjected to a table-top exercise involving all key HS stakeholders					
	e. Exercised in a simulation					
	f. Modified on the basis of lessons observed					
	g. Endorsed by the National Health Sector Committee					
	h. Approved by the Disaster Management Committee					
	i. Activated					
	22. In terms of plan content, which of the following statements are valid in respect to the All Hazard District Health Disaster Operational Plan					
	a. Is based on a national VRAM					
	b. Is based on a HSI					
	c. Involves all HS stakeholders including private sector and NGOs					
	d. Addresses coordination of international humanitarian assistance in the health sector					
	e. Addresses treatment of casualties (pre-hospital & hospital)					
	f. Addresses identification and handling of bodies					
	g. Addresses epidemiological surveillance and disease control					
	h. Addresses basic sanitation and sanitary engineering					
	i. Addresses health management in shelters or temporary settlements					
	j. Identify objectives and actions for recovery					
	k. Addresses human and material resources for the National Health Sector Committee in terms of DRM					
	l. Considers vulnerable groups					
	m. Is gender-sensitive					
	n. Contents a public awareness and information component.					
	o. Highlights administrative and logistics arrangements					
	23. In terms of exercises related to the All Hazard National Health Disaster Operational Plan, indicate the number of occurrences of the following activities:	In the Past Year	In the past 2 years	In the past 3 years	Don't know	No
	a. DIstrict Disaster/Emergency Committee tabletop exercises.					
	b. High level command and control tabletop exercises involving the District Emergency Operational Centre (DEOC) and the District Disaster/Emergency Committee					
	c. General tabletop exercises involving all stakeholders					
	d. National level simulations involving all stakeholders.					

	DRM strategy target 7: Instituted a preparedness planning and management process that includes plan development, pre-positioning of essential supplies, resource allocation, simulations, evaluations and annual updating based on all risks prevalent in the country					
	Response and Recovery Operations Readiness					
HS INSTITUTION/FACILITY LEVEL READINESS	**24**. With a focus on Sub-national **Emergency/Disaster Plans**, please provide the following:					
	Type	**Number with Emergency Plan**				
	a. Health Districts					
	b. Regions/Provinces					
	24 © Does Nsanje district have an emergency/disaster plan?					
LOGISTICS AND SURGE SUPPORT READINESS	**25**. In terms of logistical resources and support needed for disasters, which of the following statements are valid?	**Score**	Yes Completely	Partly	No, not at all	Don't know
	a. Ambulance services have a surge capacity for disasters					
	b. Disaster relief supplies are stockpiled and centrally controlled					
	c. A system for maintaining medical supplies is in place.					
	d. A system for redistributing medical supplies is in place.					
	e. Mechanisms, other than routine normal administrative procedures, allowing for the rapid mobilization of resources after an event occurs.					
	f. A health communication system has been established that links all HS stakeholders and is based on several means of communication such as telephones, fax, internet and radio, and its nexus is located in the MoH.					
	26. Medical equipment and supplies to pre-hospital activities, hospital, temporary health facilities and public health.					
	a. Are essential supplies for emergency operation defined based on risk analysis?					
	b. Based on risk analysis, is the identified quantity of medical equipment and supplies for health emergencies readily available?					

	c. Is there periodic testing of medical supplies and disposal of expired /inappropriate items in accordance with established guidelines?					
	d. Are maintenance rotation and safe storage of medical equipment and supplies in stockpiles done in accordance with established guidelines?					
	e. Is there a distribution system including cold chain, established for medical supplies and equipment for health emergencies?					
	f. Do procedures for the exceptional procurement of medical supplies (not on the basic equipment list) exist?					
	27. Pharmaceutical services.					
	a. Are essential medicines for emergency operations defined based on risk analysis?					
	b. Based on risk analysis, are sufficient quantities of pharmaceuticals, equipment and supplies for health emergencies readily available?					
	c. Are periodic testing of pharmaceuticals items done in accordance with established guidelines?					
	d. Are periodic disposal of expired/inappropriate items done in accordance with established guidelines?					
	e. Are maintenance, rotation and safe storage of pharmaceuticals and equipment in stockpiles done in accordance with established guidelines?					
	f. Does a distribution system for pharmaceuticals and equipment to health emergencies exist?					
	g. Do procedures exist for the exceptional procurement of pharmaceuticals (not on the essential drugs list)					
	28. Surge capacity for district health sector response.					
	a. Do mechanisms exist for the rapid mobilization of additional resources (personnel, equipment and materials) at district level?					
	b. Are there procedures for the pre-positioning and release of essential supplies to high risk areas?					
	c. Do mechanisms exist for networking of public health, diagnostic and curative health facilities (e.g. assigning roles as first and second receivers, chain of referral etc.)?					

	d. Is there capacity to dispatch patients to hospitals outside the affected area while maintaining life-support/critical care (ventilation, incubator etc.?					
	29. Management of pre-hospital medical operations.					
	a. Is a system in place to manage medical activities on the scene?					
	b. Is a standardized triage system in place?					
	c. Is there a system in place for medical evacuation and dispatching to the appropriate health care facilities?					

	DRM strategy target 8: Instituted health facility and community resilience building, and preventive interventions based on disaster risk analysis and mapping				
	Community Support Interventions				
Community Level Risk Assessment	**30.** With respect to your district DRM process, which one of the following statements describes community involvement in vulnerability and risk assessment?	Yes Completely	Partly	No, not at all	Don't know
	a) There is a mechanism to facilitate communities involvement in vulnerability and risk assessment				
	If question a is yes,				
	b) Communities are well informed on the parameters of the vulnerability and risk assessment				
	c) Communities knowledge is captured among parameters for vulnerability and risk assessment				
	d) Communities have identified their own vulnerability and capacities				
Community level preparedness	**31.** In terms of Preparedness, which of the following statements are valid in respect to the communities?				
	a) There is a community disaster preparedness and coordination committee				
	b) There is a community disaster plan based on community hazard, vulnerability and risk assessment				
	c) There is prepositioning or access to essential stocks for first aid and handling of dead bodies				
	d) The community disaster plan is harmonized with the district and other bordering communities plans				
	e) There is a community early warning system for disasters				
Community level DRM structure	**32**. In terms of community level disaster risk management structure, which of the following statements are valid?				
	a) There is a community based development committee in all communities				
	b) There is a district community/village health worker's programme				
	c) The district community/village health worker's programme includes disaster mitigation				
	d) The ToR of the community based committee include Health DRM consideration				

	e) The ToR and training curriculum of community/village health workers include DRM				
	Information, Education and Communication				
Communication strategies	**33.** Risk communication strategies for public and media**.**				
	a. Are based on risk assessments?				
	b. There are coordination mechanisms in place involving stakeholders to ensure information for public and media is consistent?				
	c. Are there pre-established information dissemination procedures?				
	d. Are ongoing emergency preparedness activities communicated systematically to the public and the media?				
	e. Do they target minority and vulnerable populations as well?				
	f. Is the function of a spokesperson defined?				
	g. Do coordination mechanisms exist between stakeholders to ensure information consistent?				
	h. Do pre-established information and dissemination procedures (for communicating risk to responders involved in emergency operations) exist?				
	i. Is information on specific risks and self protection measures for responders involved in emergency operations prepared, regularly updated and disseminated?				
Pre-Post event DRM related public health awareness	**34.** Which of the following statements related to pre-event health public information are valid?				
	a. Database with public health awareness messages related to identified hazard				
	b. A program for the development of health DRM material and its dissemination to the general public has been established				
	c. Health DRM information is disseminated through the internet				
	d. Health DRM information is disseminated through radio and television.				
	e. Health DRM information is disseminated through the print (pamphlets, posters)				
	f. Health DRM information is disseminated through other means (specify)				
	g. Public Information is accessible and available in the relevant language(s) for the different ethnic/cultural groups in the country				
	h. Public information materials developed are gender sensitive in content and in distribution mechanism.				
	i. Public information materials developed address vulnerable groups				
	j. The level of public awareness of DRM health issues, including pandemics, is measured regularly				
	k. The quantity and frequency of disaster health information disseminated to the general public is based on the public awareness assessment.				
	l. Protocols exist for all health related public information announcements to be controlled by the District Health Committee and coordinated through the DEOC (District emergency operation centre) or equivalent.				
	m. Public information materials for dissemination in shelters have been prepared in advance of potential events				
	n. Public Information is accessible and available in the relevant language(s) for the different ethnic/cultural groups in the country				
	o. Public information materials developed are gender sensitive in content and in distribution mechanism.				
	p. Public information materials developed address vulnerable groups				
Human resource capacity development	**35.** Human resource development:				

	a. Does human resource plan for emergency management based on defined competencies?				
	b. Does a database of trained staff for emergency management exist and is it maintained?				
	c. Do procedures exist to integrate interdistrict and district volunteers into service delivery in emergency situations?				
	36. In terms of Health personnel training, which of the following are valid statements?				
	a. DRM is included in the ***training*** curricula for Health practitioners.				
	b. DRM is included in the ***education*** curricula for Health professionals				
	37. Training and education.				
	a. Are the frequency and the content of trainings and the number of participants based on needs assessments?				
	b. Does a needs-based training plan exist?				
	c. Are the contents of curricula defined according to competencies?				
	d. Are curricula and training materials harmonized across stakeholders?				
	e. Does a formal mechanism exist to review and revise curricula?				
	f. Are exercises and drills a part of training?				
	g. Are opportunities provided for emergency management training?				
	h. Are resources for training programmes allocated and available?				
	38. In terms of HS DRM related training, which of the following courses/training are available and were conducted in the past year?				
	Courses/training	Yes	No		
	a. Mass casualty management				
	b. Disaster hospital planning				
	c. Epidemiological surveillance				
	d. Water and sanitation				
	e. Supply management				
	f. Mental health				
	g. Management of dead bodies				
	h. International assistance coordination				
	i. Chemical accidents				
	j. Shelter management				
	k. Needs Assessment and Planning				
	l. Risk Communication				
	m. Vulnerability and Risk Assessment and Mapping (VRAM),				
	n. Hospital Safety Index (HSI) assessment				
	o. Emergency response and recovery SOPs				
	p. Minimum Initial Services Package (MISP),				
	q. Others (specify)				
	Further Comments or Explanation:				

Appendix 3: UP, SHSPH Academic Advisory Committee approval

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Denkleiers • Leading Minds • Dikgopolo tša Dihlalefi

Faculty of Health Sciences
School of Health Systems and Public Health

26 June 2018

Dr O Dewa
12174051
PhD (Public Health)

Dear Dr Dewa

Approval Academic Advisory Committee

This serves to confirm that your protocol was served at the Academic Advisory Committee via e-mail on 25 June 2018.

Your title: ***Disaster risk management implementation in Malawi: policy options for resilience to adverse impacts of flooding in Nsanje District,*** was approved.

Please ensure that this title is reflected on your dissertation.

You can now submit to ethics.

Sincerely

Dr Bernice Harris
Chairperson
SHSPH Academic Advisory Committee

cc Dr F Senkubuge

School of Health Systems and Public Health
University of Pretoria
Private Bag x323
Pretoria South Africa 0001

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http://www.facebook.com/SHSPH

Appendix 4: UP, Faculty of Health Sciences Research Ethics Committee approval

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.
- FWA 00002567, Approved dd 22 May 2002 and Expires 09/20/2022.
- IRB 0000 2295 IORG0001762 Approved dd 22/04/2014 and Expires 09/14/2020.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences Research Ethics Committee

26/07/2018

Approval Certificate
New Application

Ethics Reference No: 365/2018

Title: Disaster risk management implementation in Malawi: policy options for resilience to adverse impacts of flooding in Nsanje District

Dear Mr Ozius Dewa

The **New Application** as supported by documents specified in your cover letter dated 21/07/2018 for your research received on the 24/07/2018, was approved by the Faculty of Health Sciences Research Ethics Committee on its quorate meeting of 25/07/2018.

Please note the following about your ethics approval:
- Ethics Approval is valid for 1 year
- Please remember to use your protocol number (365/2018) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, or monitor the conduct of your research.

Ethics approval is subject to the following:
- The ethics approval is conditional on the receipt of **6 monthly written Progress Reports**, and
- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

Additional Conditions:
- Approval is conditional upon the Research Ethics Committee receiving permission letters from Malawi and researcher to correct the PICD 2: Participants on page 2 - missing the "P".

We wish you the best with your research.

Yours sincerely

Dr R Sommers; MBChB; MMed (Int); MPharMed,PhD
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health).

☎ 012 356 3084 deepeka.behari@up.ac.za / fhsethics@up.ac.za http://www.up.ac.za/healthethics
Private Bag X323, Arcadia, 0007 - Tswelopele Building, Level 4, Room 60 / 61, 31 Bophelo Road, Gezina, Pretoria

Appendix 5: Malawi, National Committee on Research in the Social Sciences and Humanities Ethics approval

NATIONAL COMMISSION FOR SCIENCE & TECHNOLOGY
Lingadzi House
Robert Mugabe Crescent
P/Bag B303
City Centre
Lilongwe
Tel: +265 1 771 550
+265 1 774 189
+265 1 774 869
Fax: +265 1772 431
Email:directorgeneral@ncst.mw
Website:http://www.ncst.mw

NATIONAL COMMITTEE ON RESEARCH IN THE SOCIAL SCIENCES AND HUMANITIES

Ref No: NCST/RTT/2/6 **5th November 2018**

Mr Ozius Dewa,
University of Pretoria,
Pretoria,
South Africa.

Email: oziusd@gmail.com

Dear Mr Dewa,

RESEARCH ETHICS AND REGULATORY APPROVAL AND PERMIT FOR PROTOCOL NO. P.09/18/316: DISASTER RISK MANAGEMENT IN MALAWI: POLICY OPTIONS FOR RESILIENCE TO ADVERSE IMPACTS OF FLOODING IN NSANJE DISTRICT

Having satisfied all the relevant ethical and regulatory requirements, I am pleased to inform you that the above referred research protocol has officially been approved. You are now permitted to proceed with its implementation. Should there be any amendments to the approved protocol in the course of implementing it, you shall be required to seek approval of such amendments before implementation of the same.

This approval is valid for one year from the date of issuance of this approval. If the study goes beyond one year, an annual approval for continuation shall be required to be sought from the National Committee on Research in the Social Sciences and Humanities (NCRSH) in a format that is available at the Secretariat. Once the study is finalised, you are required to furnish the Committee and the Commission with a final report of the study. The committee reserves the right to carry out compliance inspection of this approved protocol at any time as may be deemed by it. As such, you are expected to properly maintain all study documents including consent forms.

Wishing you a successful implementation of your study.

Yours Sincerely,

Yalonda .I. Mwanza

NCRSH ADMINISTRATOR
HEALTH, SOCIAL SCIENCES AND HUMANITIES DIVISION

For: VICE CHAIRPERSON OF NCRSH
Committee Address:
Secretariat, National Committee on Research in the Social Sciences and Humanities, National Commission for Science and Technology, Lingadzi House, City Centre, P/Bag B303, Capital City, Lilongwe3, Malawi. Telephone Nos: +265 771 550/774 869; E-mail address: ncrsh@ncst.mw

Appendix 6: UP, Faculty of Health Sciences Research Ethics Committee ethical renewal approval

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

Institution: The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 22 May 2002 and Expires 03/29/2022.
- IORG #: IORG0001762 OMB No. 0990-0279 Approved for use through February 28, 2022 and Expires: 03/04/2023.

Faculty of Health Sciences Research Ethics Committee

11 February 2022

Approval Certificate
Annual Renewal

Dear Mr O Dewa,

Ethics Reference No.: 365/2018 – Line 2
Title: Disaster risk management implementation in Malawi: policy options for resilience to adverse impacts of flooding in Nsanje District

The **Annual Renewal** as supported by documents received between 2022-01-13 and 2022-02-09 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on 2022-02-09 as resolved by its quorate meeting.

Please note the following about your ethics approval:

- Renewal of ethics approval is valid for 1 year, subsequent annual renewal will become due on 2023-02-11.
- Please remember to use your protocol number (365/2018) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

Ethics approval is subject to the following:

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

On behalf of the FHS REC, Dr R Sommers
MBChB, MMed (Int), MPharmMed, PhD
***Deputy Chairperson** of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria*

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health)

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Fakulteit Gesondheidswetenskappe
Lefapha la Disaense tša Maphelo