



Regular Article

Modulators of Risk Perception in the Cyclone-Prone Wards of Chimanimani District in Zimbabwe

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Abstract Chimanimani District in the Eastern Highlands of Zimbabwe is one of the most at-risk districts for cyclones due to its proximity to the Indian Ocean. Despite it being situated inland, it is one of the locations where cyclonic risk is increasing. As a result, there is a growing population to whom the phenomenon is new, and whose perception of it is not fully explored. This research explores the main modulators of cyclone risk perception in Chimanimani with the purpose of understanding how the population perceives cyclonic risk and why. This information is critical to ensuring the sustainability of cyclone risk management and mitigation programmes. Further, the paper expands the lens of analysis from Western-based modulators to those rooted in Indigenous Knowledge Systems (IKS). The study adopted a qualitative methodology, grounded in phenomenology, to understand the main modulators of risk perception in the study area. The findings of the research point towards two tiers of modulators – those at a micro-level (past experience, credibility of information sources, proximity to risk event, probability factor) and meso-level (visibility of government leadership, indigenous knowledge system, spirituality and religion). At a micro-level, psychological factors were observed to be dominant influencers of risk perception. At the meso-level, Indigenous Knowledge Systems (IKS) and spirituality emerged as strong influences of cyclone risk perception. The study concludes that risk behaviour is ultimately a result of the intricate interactions between individual and societal influences of cyclone risk perception.

Keywords: risk perception, modulators, cyclones, Chimanimani District, indigenous knowledge systems

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1. INTRODUCTION

The impact and burden of disasters fall mostly on people living in poverty in Africa and Asia (Lukamba, 2010; Kawasaki et al., 2020; Asian Development Bank, 2024). Historically, cyclones and their associated impacts have typically impacted coastal countries and regions. However, due to climate change, there is an increased threat of cyclonic activities to landlocked countries. In the southern Africa region, Mozambique and Madagascar bear the brunt of cyclones by virtue of their adjacency to the Indian Ocean. An important context for this paper is that, in the past decade, the increased intensity of cyclonic activity has seen the phenomenon traverse boundaries, impacting inland countries such as Zimbabwe, Malawi and beyond. Reason and Keibel (2004), in their study of the impacts of tropical storm Eline in February 2000, noted that the westbound, inland penetration of the cyclone was unusual since the phenomenon reached the semi-desert regions in Namibia at the western end of the subcontinent. They further noted at that time that less than five percent of tropical cyclones (TC) occurring in the Southwest Indian Ocean over the last 50 years had actually made landfall on the east coast of Southern Africa. This means that there is a growing vulnerable population to whom cyclonic phenomena are new, and their understanding and interpretation of them is not fully understood. Their perception of such events may conflict with the technical assessment of the same leading to potentially unhelpful reactions towards it, and poor risk management in general.

In the last two decades, tropical cyclones have emerged as one of the largest threats to lives and livelihoods in Zimbabwe (World Bank, 2024), despite it being a landlocked country. These cyclones include Eline 2000, Japhet 2003, Dineo 2017, Idai 2019, Chalanje 2020, Eloise 2021 (Chivhenge, 2021), and Freddy 2023 (Aderinto, 2023). In most of these cyclonic events, the Chimanimani District was one of the most severely affected districts, impacted either directly by the eye of the storm or its outer bands, resulting in some degree of damage. For example, cyclone Idai in 2019 is generally considered the most destructive for the district, with the administrative areas of Kopa (Ward 15) and Ngangu (Ward 21) on the Eastern side being the most affected (Munsaka et al., 2021; Chivizhe et al., 2023). This research thus establishes the Chimanimani District in Manicaland Province in Eastern Zimbabwe as a unique risk domain due to its proximity to Mozambique and its increasing experience with cyclonic activity in the past decade. Figure 1 below shows the position of Chimanimani district. The district has been a focal point of climate-related vulnerabilities, particularly due to its exposure to cyclones and associated hazards such as landslides and flooding. However, the actual risk posed by such events cannot solely be attributed to the physical intensity of the hazards, but also how communities perceive and behave in the face of risks. Understanding the factors influencing cyclone risk perception is crucial for designing effective disaster preparedness, early warning systems, and community-based adaptation strategies. For example, in the case of the Chimanimani District, Chanza et al. (2020) noted that during cyclone Idai in 2019, there seemed to be a gap between early warning and action. When the alarm was raised for the incoming cyclone, it was observed that most community members did not immediately react to implement pre-emptive actions to reduce its impact. Another example from Rahman et al. (2021) noted that in Bangladesh, when tropical cyclone Bulbul

was approaching the coast, several coastal residents decided to evacuate only at the last minute, and the evacuation was not completed. This made the human factor a complicating element in cyclone risk management. Aligned to this is Peek and Mileti's (2002) observation that people living in areas prone to natural and anthropogenic hazards sometimes fail to act, or they do very little, to lessen their risk of death, injury, or property damage. In line with this, Sjoberg (1999) concludes that risk perception is one of the major obstacles to rational decision making and is the reason why experts and individuals sometimes have a differing understanding of the risk environment.

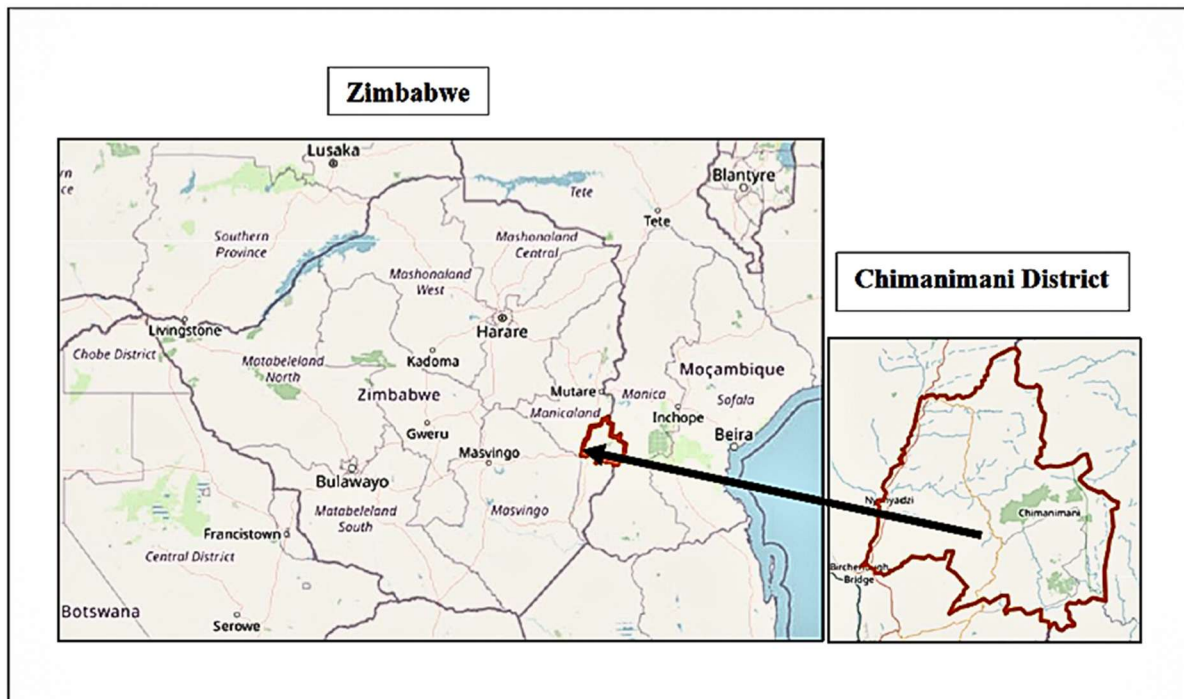


Figure 1. Chimanimani District in eastern Zimbabwe (OpenStreetMap, 2025)

This study investigates risk perception of cyclone-prone communities in the Chimanimani District to establish the factors that influence individual and collective perceptions of cyclone risk in this risk domain. The study presents an opportunity to understand how the community of Chimanimani District perceives disaster and what influences their ability or willingness to act towards it. It is also important to recognise that no two people perceive risk the same. Equally important is understanding why people perceive risk differently, and what causes them to do so. Agrawal (2018) contends that risk perception is vital to understanding which risks people consider to be acceptable and which risk reduction programmes have a better chance of being accepted.

A few concepts are explored in this paper and, collectively, they help with an understanding of how at-risk communities perceive and interact with risk. The overarching concept is that of 'risk perception', and the sub-concept that is the focus of this paper is 'modulators' of risk perception, also referred to as intervening factors. These conceptual issues provide a theoretical framework for this article.

1.1 Risk Perception and Modulation

Risk perception is generally understood as the subjective assessment of the probability of a specified type of disaster happening and how concerned we are of the consequences (Sjoberg et al., 2004). It is also defined as the process by which individuals or societies assign value to an actual or potential risk event. It defines how an individual assesses their own vulnerability to a risk, their level of control toward it and its potential to do harm. Therefore, risk perception has two outcome domains - either something will happen, or it will not (Fletcher, 2022). This assessment is done at two different levels. Firstly, internal psychological factors (micro) play a crucial role in modulating risk perception, while community or societal factors (meso) also play a significant role. As noted by Rohrmann (2008), perceptions are a complex interface of the hazards we face and our own personal philosophies. The idea of modulation of risk perception was first coined by Kasperson et al. (1988) to explain the process by which risk perception is lowered or heightened in response to specific influences. Thus, modulators are defined as intervening factors in risk perception. The authors posit that lowered, attenuated or minimised risk perception may result in a different behavioural reaction to that which is heightened, amplified or exaggerated. This paper will thus discuss in the next section, the micro- and meso-level modulators of risk perception according to some scholars, and the behavioural outcomes that are observed.

1.2 Micro-Level Modulators of Risk Perception

Several scholars have explored micro-level modulators of risk perception which focus on how an individual's psychological and cognitive processes determine how risk is perceived and managed. Some micro-level modulators are discussed in terms of their influence on how risks are perceived. The first modulator of risk perception is *voluntariness*, which is based on the psychometric paradigm that defines psychological processes in risk perception. Jungermann and Slovic (1993) proposed that the perception of risk is attenuated if the risk is chosen voluntarily but amplified if it is imposed. Although risks are different, what is chosen voluntarily is more acceptable than what is imposed. This involves freedom of choice and the perception of one's own autonomy and responsibility. Schmidt (2004) uses the terms 'wanted risk' and 'unwanted risk'. He suggests that a risk can be wanted first because of some expected benefit related to that risk. Secondly, a risk can be wanted if the chosen risk is the best alternative available out of several bad choices. He further contends that being able to choose the best alternative means being able to refuse other worse alternatives within the same environment or context.

A second modulator is that of *controllability*. Risk perception is modulated by an individual's perceived ability to control a risk (Schmidt, 2004). When one perceives a risk as controllable, it provides a sense of security which reduces the perception of its severity. An interesting fact is the different ways in which various authors perceive this controllability. While Schmidt (2004) equates controllability with security, Pedroso de Lima (1993) likens this controllability to an illusion and argues that naturally, people perceive personal risk to be lower than the average risk. This therefore attenuates the risk and creates an illusion of

control. In addition, it appears that people have different thresholds with which they feel comfortable and will adjust the riskiness of their behaviour in the presence of safety measures (Priolo et al., 2025). Adams (1995) calls this tendency the individual's 'risk thermostat' and uses driving imagery to explain this. He notes that this is the reason why people tend to drive faster when they have airbags and child restraints fitted in their cars.

A third micro-level modulator is that of *familiarity or habituation*. This is a function of continued exposure to risk factors. Schmidt (2004) suggests that fear of a known risk is easier lost than that of an unknown. In the same vein, a risk that is present for a long time is attenuated due to habituation even though the technical risk remains the same (Slovic, 1987). The author differentiates familiarity and habituation in this manner: Habituation means that one is getting used to a certain risk, while familiarity means that the affected person actually 'knows' about the risk. Risks that are not faced daily such as nuclear exposure or cyclones may therefore be considered as more dangerous. This is because the consequences of unknown risk are normally perceived as neither familiar nor controllable. According to Schmidt (2004), the uncertainty of being exposed to a risk or not also influences familiarity. If we know we are exposed to a certain risk, we become more familiar with it quickly. Hazard and Seidel (1993) further suggest that if a risk is known to science or the affected person, then the contribution to familiarity is higher than if that risk is unknown. Once a particular risk becomes routine, it breeds familiarity.

A fourth modulator is proposed by Schmidt (2004) who suggests that it makes a big difference if risk is *man-made or natural*. A natural risk tends to be more acceptable than that which is man-made. Man-made risks are usually labelled as being a result of poor judgement, lack of knowledge or irresponsible behaviour. The people who caused this are usually called to immediately manage this risk. Natural risk on the other hand will tend to be tolerated more because it is viewed as an 'act of God', thus unavoidable. 'Natural' disasters do not generate the same level of moral indignation as the 'manmade' hazards described by Beck (1992). As Blokvis (1987) argues, moral indignation puts damage in another light, and the costs are probably perceived as much higher for manmade disasters. These so-called man-made risks seem to be of special concern to the public due to their potential for catastrophe, inequities between the generators of the risk and those bearing its consequences, and the possible irreversible nature of the consequences (Merkhofer, 1987).

More micro-level modulators are proposed. According to Covello and Johnson (1987) and MacCrimmon and Wehrung (1986), *knowledge levels* influence risk perception. When people feel that they have knowledge of a particular risk, their perception of its severity seems to be attenuated. People are more likely to be swayed by expert opinion in areas about which they know nothing than on topics they believe they understand (Siegrist & Cvetovich, 2000). The *media*, according to Wahlberg and Sjöberg (2000) and Kasperson et al., (1988) plays a significant role in influencing risk perception. Risk perception may be modulated by the media via availability of information and public awareness. Through the processes of amplification or attenuation of risk information, the media can influence people's awareness and behaviour towards a risk event.

Fragouli and Theodolou (2015) note that there is a strong relationship between risk perception and risk behaviour. Together with Weyman and Kelly (1999), the authors caution that we must look beyond these micro-level influences and consider the broader social, cultural and environmental influences to truly understand what modulates risk perception. Based on this caution, the next section explores the meso-level modulators of risk perception.

1.3 Meso-Level Modulators of Risk Perception

According to Fletcher (2022), our perceptions transcend the individual level. They are societal constructs reflecting our values, symbols, history and ideology. These are crucial in defining which risk is considered by society as acceptable, and by extension, which behaviour results from it before, during and after disasters. Pidgeon et al. (1992) notes that risk perception is constructed against societal and cultural backgrounds. Based on this, the following discussion explores the higher-level modulators of risk perception.

The first meso-level modulator is that of *risk-benefit distribution* as discussed by Schmidt (2004). Risks that are perceived as fairly distributed in the society are more accepted than risks perceived to be unfairly distributed. The least acceptable situation is when the burden of risk is borne by only a portion of a population and not all. In addition to this, when a benefit is unevenly distributed, it causes conflict. A more acceptable state is when risk and benefit are equally distributed in a society. For example, a low income, subsistence farming community located in a flood plain, with uniform exposure to flood risk, may attenuate the risk of flooding since everyone is exposed to it. On the other hand, once a flood subsides, the community may equally benefit from the rich soil deposits left by the receding flood waters. In such a case, the risks are offset by the expected benefits.

A second meso-level modulator is that of *risk governance and enforcement*. When people are socialised into a culture of risk management, they tend to be more responsive in mitigating risk. On the contrary, if there is laxity in the enforcement of certain risk-related laws, then risk taking becomes rampant (Nemakonde et al., 2024). The enforcement of disaster laws significantly shapes public perceptions of disaster risk and influences community resilience. When governments implement and enforce disaster-related legislation effectively, they provide a structured framework that enhances public understanding of risks and encourages proactive risk reduction behaviours (IFRC, 2023). Clearly articulated guidelines and expectations are therefore necessary for higher levels of risk awareness and preparedness in communities.

On the contrary, IFRC (2023) notes that absence or weak enforcement of disaster laws can lead to diminished public trust and increased vulnerability since people tend to take more risks. This is supported by the UNDRR (2011) which recognises weak governance as a driver of risk and poor decision-making in the face of risk. In Zimbabwe's low-income neighbourhood of Budiriro in Harare, there is a proliferation of illegal settlements in flood-prone, low-lying areas and wetlands. While one may argue that this results from economic pressures and poor access to affordable housing, one major driver is the lack of enforcement

of the urban planning laws (Mbiba, 2022) that are part of the overarching disaster law framework. Poor enforcement of such laws encourages risk taking and exposure to disasters. Poorly enforced or unjust disaster laws can erode public confidence and hinder effective disaster risk management. Therefore, the enforcement of disaster laws plays a crucial role in shaping public perceptions of risk and determining the effectiveness of disaster risk reduction efforts.

A third modulator is the *socio-economic condition* of an area. Ziga-Abortt & Kruse's (2023) research in the low-income, flood-prone areas of Accra in Ghana noted that some people are aware of flood risks but do very little to minimise them. They note that street squatters or low-income dwellers in Accra are reported to be aware that they are living in flood-prone areas and that their housing infrastructures are not flood-proof enough. However, they do little to mitigate this risk despite regular warnings from local authorities. The authors attribute this to structural barriers that such people face which influence their behaviour. For example, the need to be close to where they can generate income. Risk perception is therefore attenuated if the flood-prone area has a livelihoods trade-off. In such a case, it is this paper's contention that to modulate risk perceptions for better behaviour outcomes, authorities have to offer a solution that addresses both needs – flood exposure and livelihoods, otherwise the flood risk becomes subordinate to basic survival.

A fourth modulator for this paper is that of *Indigenous knowledge (IK) or local knowledge (LK) systems*. According to Nel (2008), IK are a reference to the knowledge and practices of indigenous communities derived from their belief systems, as well as their practices and customs. Magadza et al. (2024) note that many societies across the globe use IK as the main point of reference when interpreting disaster events and assigning solutions. The authors further note that when risk management processes deliberately integrate IK in some communities, they are perceived as appropriate and acceptable by those at risk. Additionally, IK encompass ecological, meteorological, and spiritual insights that have been honed over generations, enabling communities to interpret early warning signs such as animal behaviours or plant responses, as indicators of impending disasters (Fletcher et al., 2020). Indigenous knowledge systems (IKS) significantly shape community perceptions of disaster risk by providing culturally embedded frameworks for understanding environmental hazards (Fletcher et al., 2020). Indigenous knowledge driven perceptions may conflict with 'conventional' Western-based perceptions.

Connected to IKS is the concept of spirituality which, in the context of this study, encompasses religion and belief-systems. *Spirituality* is another modulator of risk perception. While spirituality or religion can be viewed as micro-level psychological convictions, they are largely driven by socialisation at family and community level. According to Cvetković et al. (2023), the psychological connection between religions and disasters is manifested in the adaptation or tolerance of negative events by adherents of a religion. Bentzen (2019) further notes that religious people maintain a closeness to their God, which nurtures a sense of meaning and purpose in life and influences the meaning of certain events. In most cases tragedies or disasters are seen as the work of deities or punishment from these deities. Sherry and Curtis (2017) add that the belief system of individuals and communities is a dominant

factor in influencing the way of interpreting and responding to disaster risk. An example is drawn from Holmgaard's (2019) research of tsunami-affected communities in Samoa. The author noted that when asked about the causes of tsunami, both mainline and new church adherents shared experiences of being saved from the tsunami due to divine protection and intervention. Some survivors of the tsunami noted that their house had been spared by the tsunami while those around it had been destroyed because of God's divine protection. Another example by Schuman et al. (2017) is derived from three rural communities of the North-West Province in South Africa. In a study to understand the communities' understanding of climate change, a significant majority of respondents attributed climate change and its negative impacts to God, and noted that there is nothing that they can do in their own capacity to control or manage it.

The preceding discussion on micro-and meso-level modulators of risk perception gives an overview of what exists in literature and other contexts. However, it is imperative that this relates to the study area (Chimanimani District), and the main hazard of concern (cyclones), to understand which are the main modulators of risk perception. The main questions guiding the study are:

- i. What is the hazard profile of Chimanimani District?
- ii. What are the micro- and meso-level modulators of cyclone risk perception in the Chimanimani district, and
- iii. What is the influence of Indigenous Knowledge on cyclone risk perception in Chimanimani?

Because such issues involve an exploration of people's experiences and perceptions, the most appropriate methodology for this study is qualitative, and the analytical approach is phenomenological as discussed in more detail in the following section.

2. METHODS

This section outlines the methods and procedures used to investigate the modulators of cyclone risk perception in Chimanimani district in Zimbabwe, using a qualitative research approach. This study is based on the interpretivist paradigm that posits that there is no one reality. Rather, reality is based on an individual's perceptions and experiences (Robson, 2002). Linked to this position is the argument that the facets of the real world that are distinctly human are lost when they are analysed and "reduced to the interaction of variables" (Hughes & Sharrock, 1997, p. 102). That is, it is considered that there are multiple realities that make measurement difficult, and we can only seek to understand real-world phenomena by studying them in detail within the context in which they occur (Easterby-Smith et al., 2002). The phenomenological approach was chosen due to its utility for studying an individual's lived experiences (Neubauer, 2019). Epistemologically, phenomenological

approaches are based in a paradigm of personal knowledge and subjectivity, and emphasise the importance of personal perspective and interpretation. For this to be effective, Husserl (1983)'s phenomenological method cautions that the researcher must put aside or 'bracket' prior knowledge or experience about the phenomenon to obtain an unbiased and objective description of personal experiences with the phenomenon. This caution was adhered to throughout this research.

The sampling strategy that was used was purposive or judgmental sampling which is a non-probability sampling technique aimed at developing a sample with specific characteristics in research (Barrat et al., 2015). Specifically, participants had to be residents of Chimanimani District, must have experienced any cyclonic events in the past two decades and be willing to participate in the study. The district administrative authorities of Chimanimani were crucial to narrowing down the geographic location where these participants could be found. The final sample was 107 participants.

A semi-structured interview guide was used. For each interview, the purpose of the study and interview was explained, anonymity was assured and then written consent was obtained. The age range of participants was between 18 - 55 years to ensure that they had cognitive maturity, could elaborate their experience cooperatively and had decision-making capabilities in the face of risk. Because memories of past experiences with cyclonic events could invoke some discomfort, the researcher assured each participant that they could opt out of the study at any point. It should be noted that of the 107 interviewed participants, 6 were interviewed via telephone as inclement weather from rains during the data collection timeframe made areas such as Ndakopa and Hlabiso inaccessible. Eight (8) key informant interviews were also conducted with the district development authorities, a councillor of one of the most at-risk Wards, a traditional chief, a representative of the district civil protection committee, one NGO staff member and one business owner at Chimanimani Town Centre. Each interview lasted between 50 and 70 minutes and was conducted wherever the participants were comfortable, for example homes, fields, schools, and business centres. Predictive techniques such as probing, reflection, and paraphrasing were used to extract more information and ensure clarity. Secondary data was available, such as reports, photographs, and maps. Field observations were also used for this study.

Mixed analytical methods were used. The primary analytical approach adopted in this study was Interpretive Phenomenological Analysis (IPA) or existential phenomenology. According to Smith et al. (2009), interpretive phenomenology emphasises the interpretation and understanding of the phenomena, rather than the description. Interpretive phenomenologists acknowledge that the phenomena are always situated in a historical, cultural, and social context, and that the researcher and the participants co-construct the meaning of the phenomena. Interpretive phenomenology aims to uncover the hidden meanings and implications of the phenomena, based on the interpretation of the participants' narratives and the researcher's reflexivity as identified through coding. The coding process had two objectives. Firstly, it was to find congruence with the modulators identified in the theoretical section of the paper. Secondly, it was to establish new themes that are unique to the study area. This was achieved by reading through transcripts to identify and label key

ideas, concepts, and themes from the participants' responses. The process was inductive where codes and themes emerged directly from the data, rather than being predefined. Codes were then refined, merged, split, or removed iteratively, resulting in the development of overarching themes representing modulators of risk perception.

Two levels of phenomenological reduction to reduce study bias were incorporated for scientific rigor and adherence to the assumptions of phenomenology. The first assurance was through 'bracketing' to reduce the researcher's potential bias especially at the stage where codes and meanings were assigned to the study responses. The second level of rigor was established at the data collection phase and involved allocating adequate time per participant for probing, establishment of rapport, and detailed answers. At the end of this analysis process, results were extracted and organised according to the research questions, and these are discussed in the following section according to emerging themes.

3. RESULTS

This section discusses the main findings of the study. The findings are organised according to the three (3) main research questions that were previously outlined.

3.1 The Hazard Profile of Chimanimani District

The hazard profile of Chimanimani district was constructed through reviews of reports, maps and photographs, as well as with key informant interviews.

The 2022 Food and Nutrition Security Profile of Chimanimani District identified four main hazards in the district (Food and Nutrition Council, 2022). The first one is drought that is ranked as very high and mainly affecting Wards 2 - 9, 13, and 16 - 20 of the district. Drought in these wards is aggravated by climate change, global warming, low uptake of traditional grain production and an over-reliance on rain-fed agriculture. The second hazard identified is that of cyclones, also ranked very high, and affecting Wards 1, 7, 9 - 16, and 21 - 23. As noted in the introduction of this paper, the Chimanimani district is prone to cyclones and associated floods and landslides. During the data collection process, the researcher observed areas and points that bore the brunt of cyclones in the past years. For example, the cliffs at Skyline, a topographical landmark on the main road to Chimanimani Village, that still show the scars of cyclone-induced landslides from 2019. Additionally, the area adjacent to Kopa business centre where hundreds of boulders now lay instead of the cluster of buildings that stood there before tropical cyclone Idai. And finally, the bridges that remain in a state of partial repair two decades after tropical cyclone Eline in 2000. A third hazard is that of floods. The district has a topographical profile of mountains and valleys that make it vulnerable to flooding especially in Wards 2, 12, 13, 15, 16B, 3, 5, 8, and 19 - 23. Further, the presence of a dense network of rivers and streams also make it prone to flooding especially when high amounts of precipitation are received, aggravated by improper land-use such as streambank

cultivation. A final hazard is that of malaria whose prevalence is high in Wards 2, 3, 5, 7, 8, 14, 17, 18, and 20 - 23. These four hazards therefore present the main risks to the district. This research uses cyclone risk as a unique context for analysing the modulators of risks perception as discussed in the following section.

3.2 Micro-and Meso-Level Modulators of Risk Perception in the Chimanimani District

In the context of this paper, perceptions of risk origin, risk severity, perceptions of one's ability to control risk, one's own vulnerability and perceptions of the role of stakeholders in a risk event are all critical points of analysis. The modulators identified below either lead to the attenuation (lowering) or amplification (heightening) of cyclone risk perception.

3.2.1 Micro-Level Modulators of Cyclone Risk Perception in the Chimanimani District

Approximately half of the participants, (n = 53), expressed that their *past experiences* with major cyclone events in Chimanimani has resulted in fear and anxiety about the possibility of another cyclone event. These respondents chronicled their past experiences with cyclones such as Eline, Eloise, Idai and Chalane. Idai is generally considered the most destructive one that has ever landed in the district, and the scale of death, destruction and loss was still felt up to the time of the data collection process. Respondents that were directly impacted by it noted that they still have not fully recovered economically and psychologically from the trauma. For example, Participant 19 (Female, 37 years, Ngangu Township) noted:

"Each time I hear about a cyclone, I am forced to relive the helplessness and loss from past events. When I heard over the radio last year that there was another cyclone called Chido, I left for Wengezi [a village 80kms away] where my sister lives until I was sure that there was no danger."

Such self-preserving strategies like temporarily moving out of the area reveal heightened risk perception, driven by past experiences. Therefore, people who have experienced cyclonic events first hand tend to perceive them as a very serious threat. This is in line with the findings of Ohman (2017) whose quantitative research in Sweden showed that previous experience is a strong predictor of higher risk perception even after controlling for gender, origin, income, education and values.

A second participant (Participant 99, Female, 35 years, Kopa Business centre) noted:

"My husband has been missing since 2019 when the cyclone destroyed our village. He was caught in the storm not too far from here. Sometime last year (2024), the government officially declared him dead, together with other missing people. But it does not bring closure. I am doing the best I can to fend for my 4 children and hope that another cyclone does not pass by this area again. The government needs to do more for us."

From this, it is evident that the impact of any cyclone results in physical and psychological impacts in the long term that serve as a driver of risk perception. The scale of loss experienced in the past becomes a reminder of the potential harm in any future event.

Another micro-level modulator in the Chimanimani district is the *credibility of information sources*. The research noted that trust in information sources is an influencing factor of cyclone risk perception in Chimanimani. About a third of respondents, (n = 32), noted that, for them to take risk information seriously and act on it, they must trust the source. For example, the research established that cyclone risk information disseminated through a community radio station known as Chimanimani FM and announcements from the traditional leaders (village headman and the chief) are more respected, trusted and acted upon. On the contrary, cyclone messages received through social media and mobile messaging forums are typically treated with suspicion, and not immediately acted upon, unless the information is verified through first-hand experience. To put this into context, one respondent (Participant 73, Male, 52 years, Kurwaisimba Village) referenced that in the year 2021, when alerts for tropical storm Chalane were issued, a video of purported flooding in parts of Chimanimani and the neighbouring district of Chipinge started circulating in the community. It turned out to be an old video from cyclone Idai in 2019. However, some members of the community had already experienced anxiety and panic, leading to heightened mistrust of information transmitted through social media. Tropical storm Chalane eventually did not make a direct impact on the Chimanimani district, but the psychological damage had already been done. From this recollection, the credibility of the information sources influences the community's perception of the event.

Proximity to a risk event is another modulator identified through this study. One of the questions that was posed to respondents was how significant cyclonic risk ranks as a personal concern. Respondents in Kopa, Ngangu, Chimanimani Town, Ndimba and Ndakopa that were the epicentre of the most severe cyclone Idai in 2019, tend to consider cyclone risk as a significant threat to personal safety. However, respondents in the Saurombe, Mhawe (Biriiri) areas that are about 30km from Chimanimani Town indicated that, while cyclones are significant, they are mostly concerned about intra-seasonal dry spells that affect harvests on an annual basis. It should be noted that at the time of data collection, the district was recovering from the impacts of the El Nino-phenomenon that had caused severe moisture deficit in the area in the previous season. From this, it can be deduced that people at the fringe of a phenomenon tend to have attenuated risk perception, while those that have been directly impacted by it in the past will still consider it a significant threat. These findings are in line with those of Martin et al. (2021) who found that the residents of Bajedi village in Nepal had a heightened fear of landslides due to them residing next to slopes, compared to those in Sunkunda village that were further away from the slopes. People not directly impacted by a disaster event, or those who experience the lighter impacts may underestimate the risks associated with these events, leading to inadequate preparation and heightened vulnerability. This is a crucial point to note in the context of cyclones increasingly impacting areas that have not been impacted before.

The *probability factor* also plays a role in cyclone risk perception in Chimanimani district. One theme from a small section of the respondents, (n = 16), was how the low frequency of direct impact has resulted in lower cyclone risk perception. For example, in December 2024 and January 2025, early warnings were issued through WhatsApp and radio broadcasting for cyclones that did not make direct impact in the communities where data was collected. A response from Participant 51 (Female, 33, Kurwaisimba Village) in the Nda language was:

‘Wanongonyepa kuti cyclone inouya, iyo isingauyi. Hatizii kuti dzimwe nguva ichokwadi ere kana kuti kunyepa, saka tinozomirirawo kuti zviitike’.

Translated, this means that “*they [authorities] send warning for cyclones that do not materialise. It is not always clear whether the cyclone will happen or not, so sometimes we just wait for the event to happen*”. In this case, the probability factor serves to attenuate perceptions of risk since warnings are not always followed by direct impact. While this response may point towards a lack of understanding of cyclone behaviour or the concept of probabilities, scepticism and mistrust lead to public complacency. When warnings are perceived as unreliable, community members may downplay threats.

3.2.2 Meso-Level Modulators of Cyclone Risk Perception in Chimanimani District

Meso-level modulators were also evident in this study. While there is alignment with some modulators discussed in the theoretical section (e.g., IKS and spirituality), there are also some new meso-level modulators evident in Chimanimani. The first is the *visibility of government leadership*. The actions of government in the aftermath of a cyclone can shape perceptions of cyclone risk. According to a public official, when tropical cyclone Idai occurred in 2019, the government immediately declared a state of disaster and mobilised international support for response, recovery, and rehabilitation of the area. For almost three years following that, the activities of NGOs, government and other development partners were very visible in the district – clearing debris, rehabilitating roads and bridges and building some new homes. These efforts were complemented by the scaling up of disaster risk awareness campaigns and the strengthening of sub-district level disaster risk management committees. There was evidence of government leadership in restoring normalcy with the resources available. According to the official, awareness campaigns also helped to heighten risk perception and foster a culture of cyclone risk preparedness.

The research established a comparison between the public official’s sentiments and those of the community participants. Of the people interviewed, 44 respondents revealed a different aspect to this. Firstly, they recognize that the government indeed had been active in disaster risk management since cyclones became a hazard of concern in the district. However, this leadership by the government seems to have led to the attenuation of cyclone risk perception in the community by giving the impression that the government had everything under control. Respondent 96 (Male, 44 years, Kopa Business Centre) noted that:

“Each time cyclones, floods and landslides happened, the government received a lot of support and donations to manage the problem. So, I know that if another serious cyclone occurs, there will be a lot of support. We are simple people without the type of resources needed to reduce the impact of cyclones here.”

From these two responses, there seems to be a contradiction of perspectives. The same disaster risk mitigation and recovery activities by the government which were intended to increase the level of risk perception in the community may appear to be leading to risk attenuation in a sub-section of the community. While officials believe the general cyclone risk perception has been elevated through public campaigns, the community's perception of their own capacity to control the risk without government and external support is low.

A second meso-level modulator derived from this study was *Indigenous Knowledge Systems* (IKS), and the focus of the third research question. One of the key informants interviewed was a traditional chief who revealed that for generations, knowledge about how to monitor and forecast hazards has been passed down from one generation to another. He noted:

“In most cases, by the time early warnings are transmitted from the district administration and radios, we would have already noted some signs. For example, in the mountains, we have a lot of monkeys known locally as dongonda (Samango Monkey) that have a very loud howl. We also have several birds such as the Red-necked Spurfowl, Harlequin Quail, Cape Grassbird, Moustached Grass-warbler, and the Bokmakierie. These monkeys and birds provide a constant soundtrack to our daily lives. During the cyclone season, when there is an unusually eerie silence of these animals and birds, accompanied by thick dark clouds in the eastern part of the district, then that is an indication of an impending storm. We also have our mediums who divine and warn us of calamities.”

This was concurred by a community participant who echoed:

“Our chiefs and headmen occasionally warn us of any dangers that may befall the area. We trust them a lot. They also give us guidance on what we need to do to protect our area. Sometimes there are rituals to protect the area” (Respondent 72, Female, 41 years, Muchadziya Village).

Related to IKS are *spirituality and religion* as the final modulators of disaster risk perception in this study. Various cross-sections of the research participants made direct connections between culture or religion. One question that the research posed to the participants was why they think that there is an increase in cyclone related events in Chimanimani in the past two decades, when there hardly were any events spoken of before the year 2000. About two-thirds of the respondents (n = 68) made direct connections to spiritual and religious reasons. Some of the responses were as follows:

“For a long time, we have worried about the deteriorating morality in this area. Young girls are walking about in revealing clothes, a lot of young men are involved in dishonest

activities. It is no wonder that we are starting to see an increase in cyclones. The deities protecting this area are not happy” (Participant 101, Male, 54 years, Ndimba Village).

There are several sacred pools in this area which have been kept sacred and protected for a long time. Now, for the love of money, these areas have been opened to outsiders and tourists. The mermaids that reside in these pools and should protect the land are increasingly angry and no longer protect us from bad weather conditions unless we stop this” (Participant 68 and 69, Males, Hlabiso Village).

“It is God who brings this kind of punishment to us. Even the bible teaches us that towards the end of times, we shall see an increase in calamities” (Participant 42, Female, 41 years, Nyahode Village).

Based on these responses, cyclones are interpreted as spiritual messages. Spirituality-driven perceptions will conflict with the district authorities’ science-based reasons for increased cyclonic activity, especially when issues of sin and morality are used to justify their increased occurrence. The responses also reveal fatalistic and helpless attitudes of some of these participants, who see little personal capacity to manage and control their own exposure to the phenomenon. Therefore, spirituality in Chimanimani District is a significant driver of risk, while also providing a framework for understanding and perceiving risk events. This is in line with Nhamo and Chikodzi’s (2021) research that found that some residents of Kopa Village in Chimanimani believed that cyclone Idai’s destructiveness was linked to mermaids that were tracking the ill-gotten gains of individuals who had used traditional charms to amass wealth. There is alignment of this in a different part of the world. In the Mediterranean region, Pastrana-Huguet et al. (2022) notes that communities with long traditions of Christian beliefs believe that they are subject to God’s will. Therefore, the author notes that climatological adversities are dealt with through prayers and turning to the Saints for intercession.

While the focus has been on micro-and meso-level modulators of perception, this paper acknowledges the role of macro-level influences on risk perception. Specifically, policy, laws, politics, and governance systems at a broader macro-level can influence ways of thinking, doing and understanding in a population (Lawton et al., 2010). However, this paper sought to spotlight the cognitive and social influences that individuals and communities draw from as they make day to day decisions in the face of risk.

4. DISCUSSION

The following table (Table 1) summarises the modulators of risk perception that were revealed through literature and those that were identified through empirical enquiry in Chimanimani district.

Table 1. Summary of theoretical and empirical modulators

<i>Modulation level</i>	<i>Theoretical dimensions</i>	<i>Empirical findings</i>
<i>Micro-level</i>	<i>Voluntariness</i>	<i>Past experience</i>
	<i>Controllability</i>	<i>Credibility of information sources</i>
	<i>Familiarity and Habituation</i>	<i>Proximity to a risk event</i>
	<i>Man-made versus natural</i>	<i>Probability factor</i>
	<i>Knowledge levels</i>	
<i>Meso-level</i>	<i>Risk-benefit distribution</i>	
	<i>Risk governance and enforcement</i>	
	<i>Socio-economic condition</i>	
	<i>Indigenous knowledge</i>	<i>Indigenous knowledge</i>
	<i>Spirituality</i>	<i>Spirituality</i>
		<i>Visibility of government leadership</i>

From the preceding findings, both micro- and meso-level modulators of cyclone risk perception are evident in Chimanimani District. While the theoretical section identified ‘voluntariness’, ‘controllability’, ‘familiarity/habituation’, ‘man-made versus natural’, ‘knowledge levels’, and ‘media’ as micro-level modulators, the research in Chimanimani revealed ‘past experience’, ‘credibility of information sources’, ‘proximity to a risk event’ and ‘the probability factor’ as the micro-level modulators. With regards to the theoretical meso-level modulators of risk perception, there was some degree of mutuality with the findings in Chimanimani District. IKS and spirituality were noted in the theoretical section as well as the findings from the study. The ‘visibility of government leadership’ was an additional modulator in the primary research. ‘Past experience’ and ‘the credibility of information systems’, ‘IKS’ and ‘spirituality’, were the dominant meso-level modulators. This paper does not suggest that the modulators which did not align with the theoretical modulators are not applicable to Chimanimani District. Rather, the findings are simply reflective of the experiences of the participants in the context of cyclone risk.

The findings reveal that perception in the context of cyclone risk is not just about the nature of a hazard. It applies to a community or individual’s perceptions about its origin, their ability to control it, who is responsible for its management, as well as its relative importance against other priorities. While risk perception is often discussed and analysed from a Western standpoint, the findings showed that indigenous ways of knowing and doing have a strong influence on communities that subscribe to them. These IK systems offer a simplified way of understanding risk information in a manner that aligns with the customs and beliefs of the area. Where science and other belief systems clash with this indigenous system, conflict between authorities and communities may arise. Along the same vein, the paper revealed contradictions in perception by authorities and communities. While authorities generally considered their post-cyclone interventions like awareness campaigns as amplifying to cyclone risk perception, the same interventions resulted in attenuated cyclone risk perception by community members. The government’s active interventions signalled to some sections of the community that the government had the situation under control. While strong government leadership is necessary to lead mitigation and recovery programmes, it may also lead to complacency of people at risk if they are not systematically integrated into the risk management efforts.

5. CONCLUSION

This research has some practical and theoretical implications for disaster risk management and concludes the following. The research showed that the human is an aggregator of influences or modulators at personal and societal level, each serving to either amplify or attenuate perceptions about risk origin, personal vulnerability, capacities to cope and the overall importance of the one hazard versus another. The study revealed the presence of micro- and meso-level modulators. The study also revealed the strong influence of IKS and spirituality as drivers of risk perception in Chimanimani District. This means that traditional leaders and spiritual gatekeepers can be key allies in raising awareness and influencing positive cyclone risk outcomes. Based on these findings, any sustainable risk management programme must recognise risk perception as an enabler or hinderance to disaster risk management interventions in the district. The research also concludes that risk perception must be heightened to influence effective risk management, while attenuated risk perception may result in inadequate action, especially at a personal and household level. Decision makers need to be alert to the factors that amplify and intervene in the perception of risk so that they deliver programmes that are sustainable. Decision makers also need to find a good balance of Western-based versus IKS-based solutions so that they are acceptable to populations with such belief systems. This is especially important in areas such as Chimanimani District where cyclonic risk is a new phenomenon, and a culture of resilience towards it has not yet fully matured.

One limitation of the study is that risk perception has been assessed within the context of one hazard only – cyclones. However, a few opportunities for further research present themselves. (1) Are these modulators applicable to other hazards such as drought and epidemics? (2) Are there any demographic differences in the way cyclone risk is perceived? For example, do men and women view cyclone risks the same, or do different economic profiles have an influence on the way cyclone risk is perceived? (3) Are there any differences in the way the same risk is perceived in different districts of Zimbabwe? Answers to each of these questions will build a deeper understanding of how people at risk respond to different influences in their environment to shape their perception and response towards it.

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