‘Leaving No-one Behind’: Mainstreaming Gender in Flood Early Warning Systems

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Abstract

Flooding is a recurrent problem affecting countries across the globe, causing suffering to people, and destroying livelihoods and homes in its wake. The disastrous effects have led to the implementation of several disaster mitigation strategies aimed at curbing flood-induced socio-economic losses. Early warning systems are extensively regarded as a critical component to disaster risk reduction initiatives. Significantly reducing the loss of lives and property by issuing early warnings to communities at risk, allowing adequate lead-time for evacuation. Notwithstanding its documented success stories, the efficiency of early warning systems is often undermined by the high flood-induced mortality rates of women, demonstrating a glaring gender gap. This is an indication that gender dimensions are at play beforehand, throughout, and in the aftermath of flood disasters. This paper uses the early warning system model to evaluate the deliberation of gender in warning dissemination channels. Disaster risk mitigation initiatives that maintain a gender-blind approach intensify the vulnerability of women and fortify gender imbalances. We utilize desktop analysis and employ intersectionality theory to emphasize the lived experiences of rural women’s accessibility to early warning systems. Rural women’s participation in early warning initiatives is likely to be obstructed by their prescribed gender roles, patriarchal norms, and the lack of ownership of prevailing resources to access early warning information. Consequently, the integration of a gender perspective will not only improve the effectiveness of early warning systems, but will similarly go a long way towards saving the lives of women, particularly those in rural areas.

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Introduction

The current climatic variability, coupled with global warming has, in most cases, led to extreme weather patterns characterized by heavy precipitation in most parts of the world. Consequently, heavy rainfall has been recognized as a major causal factor of disastrous flooding occurrences. These events are commonly associated with intense or prolonged rainfall that often leads to the flooding of land adjacent to riverbanks or other bodies of water. The causation of floods is attributed to a combination of human-made and natural dynamics. The occurrence of floods leads to extensive damage of property, livelihoods, the disruption of communication systems, and can leave millions of people stranded. Sayed and Gonzalez (2014:145) infer that 'floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss, floods can damage and devastate homes, farms, displace families, pets and livestock, damage crops, and disrupt agriculture and business'. Drawing from a compilation of expansive literature on climate and natural disasters, it is reasonable to regard floods as the most destructive natural hazard, causing enormous suffering to people and devastation of properties across the globe. Prominent disaster scholars, such Armah et al. (2010), Cisse and Seye (2015), Fisher (2010), Demetriades & Esplen (2008), Denton (2002), Cannon (2002), Diagne (2007), Baig and Sharif (2013), Blaikie *et al.* (1994), and Sultana (2010), clearly pronounce the catastrophic socio-economic impacts of flooding on people's wellbeing and livelihoods.

To contextualize the perspectives of the above-mentioned scholars, Perera et al. (2019:6) notes that 'water-related disasters account for an overwhelming 90 per cent of all-natural disasters globally, since the year 2000 through to the end of 2018 a total of 5 338 water-related disasters have been reported and led to over 326 000 fatalities and economic losses of more than USD1.7 trillion globally'. Consequently, poor nations and poor communities tend to be on the receiving end as they are more likely to bear the disastrous impact of floods compared to their wealthier counterparts. A study by Perera et al. (2019) on all flood disasters, between the years 2000 and 2018, depicts Asia as the hardest hit continent (41%), followed by Africa (21%). Further analysis of these flood disasters in Asia and Africa displays

that rural dwellers are the most vulnerable populace to flooding. It is important to emphasize that even though the impact of a disaster can be the same within a community, the existing incongruent societal systems create differences in the vulnerability of individuals and households. Pelling (1997:204) notes that 'vulnerability is determined by a households' resource characteristics (economic, political, social, demographic, psychological and environmental) and, in this case, their appropriateness in reducing the likelihood of their living space being flooded and the scale and distribution of impacts should flooding occur'. Vulnerable communities are likely to find it difficult to cope and to recover from the disastrous impacts of a flood when exposed. This is a viewpoint validated by Zikhali's (2018) study, which illustrates the differences in communities' vulnerabilities when exposed to flooding by displaying how the rural settlements in sub-Sahara Africa had suffered the greatest impact from flooding in comparison to urban areas.

For Smith, Brown and Dugar (2017:425), 'flooding has a particular impact on rural communities, affecting livelihoods, especially subsistence agriculture activities and killing livestock which is of critical importance to poor communities'. Mustafa (1998:304) is of the notion that poor rural areas in Pakistan are continually exposed to floods because, 'the national level policies are heavily urban-based and make for an uneven level of development and vulnerability between the urban and the rural areas'. This indicates that vulnerability is extremely noticeable when there is an overlap between spatial and societal marginalization. According to Adger (2006:270), 'vulnerability is driven by inadvertent or deliberate human action that reinforces self-interest and the distribution of powers in addition to interacting with physical and ecological systems'. Therefore, it is defensible to contend that one's vulnerability to natural disasters does not exist in isolation from social, economic, and political facets within communities. The use of an intersectionality lens is fundamental in understanding how societal facets can proliferate one group's vulnerability to natural disasters over another.

Theoretical Framework

This paper utilizes the intersectionality theory to articulate the effects gender has on individuals' accessibility to flood early warning systems. Presently, gender is intermittently considered as an integral feature of early warning

systems. As a consequence, gender is repetitively placed on the backburner when considering flood early warning dissemination. The non-inclusion of gender in flood disaster situations conceals the nuances and needs of women who face grave challenges in their adaptation to disaster situations. The use of the intersectionality theory restricts one from generalizing women's experiences and allows the realization that individuals are positioned differently in accordance with social strata (Raza 2017; Carbado & Harris 2019). According to Gopaldas (2013:90), the 'theory of intersectionality refers to the interactivity of social identity structures such as race, class, and gender in fostering life experience, especially experiences of privilege and oppression'. For Santos and Toomey (2018), the intersectionality perspective helps one understand the overlapping systems of oppression and class. Consequently, class and status become significant intersecting determinants of rural women's vulnerability to flooding disasters because they are likely to be at a greater risk than urban dwellers. In support of this assertion, Pongponrat and Ishil (2018:134) note that, 'when a disaster affects the marginalized rural population, the impact is normally greater when compared to urban areas which enjoy a greater level of responsiveness and recovery process'. Similarly, Diagne's (2007) study, conducted in Saint Louis (Senegal), similarly discloses that the districts that were occupied by poor communities were greatly affected by the floods of 1988 and 2000 because their socio-economic and political segregation increased their vulnerability to natural disasters. Since time immemorial, disaster scholars have demonstrated that women from poor socio-economic backgrounds are more vulnerable to flood disasters (Reyes & Lu 2016; Fisher 2010; Blaikie *et al.* 1994; Denton 2002; Zikhali 2018; Cannon 2002; Diagne 2007). Rural women's vulnerability to flooding disasters is further increased by prescribed gendered roles that inhibit them from accessing early warning systems.

Flood Early Warning Systems

The injurious effects of flooding events are exacerbated by feeble disaster risk reduction strategies and poor disaster preparedness in households and at institutional levels. If communities are not forewarned about an encroaching flood disaster, they will have little time to take appropriate actions to reduce casualties. Therefore, proper, efficient and effective disaster mitigation initiatives are likely to reduce the impact of flood disasters. To this end,

numerous structural and non-structural flood mitigation initiatives have been produced. Structural measures comprise the physical construction of levees, spillways, and diversion channels in areas prone to floods. Non-structural flood mitigation measures are centered on the viable communication channels with individuals or communities at risk, these involve flood awareness campaigns and activities associated with forecasting and disseminating flood information. Both measures are crucial components of disaster risk reduction efforts and should supplement each other. However, it is prudent to highlight that non-structural measures, particularly early warning systems, are widely regarded as being integral to any flood disaster preparedness strategy, particularly amongst vulnerable groups. Therefore, flood early warning systems are essential disaster mitigation tools. The United Nations Disaster Risk Reduction defines an early warning system as:

> an integrated system of hazard monitoring, forecasting and pre-diction, disaster risk assessment, communication and preparedness activities systems, and processes that enable individuals, communities, government, business, and others to take timely actions to reduce disaster risks in advance of hazardous events (UNDRR 2017:17).

Studies by Cools et al. (2016), UNISDR (2015), Smith *et al.* (2017), Pappenberger *et al.* (2015), Thielen-del Pozo *et al*. (2015), and Gautam (2014) have documented several success stories that display how efficient early warning systems can reduce the vulnerability of communities to flooding disasters. It is important to highlight that flood early warning systems are framed within the Hyogo Framework for Action (HFA) and the Sendai Framework for Action Disaster Risk Reduction (SFDRR). HFA was enacted in 2005 by the United Nations (UN) to curb disaster-related impacts before 2015 (UNDRR 2005). The failure of the HFA to create a significant impact on the reduction of disaster-induced casualties saw the establishment of the SFDRR in 2015, intending to adhere to the HFA's commitment. At the moment, early warning systems are a critical component of the current SFDRR (UNISDR 2015). More significantly, early warning systems directly address SFDRR target seven which focuses on, 'substantially increasing the availability of and access to multi-hazard early warning systems and disaster risk info and assessments to people' (UNISDR 2015).

Components of a Flood Early Warning System

A systematic review of disaster literature depicts a common consensus that early warning systems comprise four key components. These include risk knowledge, monitoring and forecasting, warning and dissemination, and response capability (Cools, Innocenti & O'Brien 2016; UNISDR 2015; Smith *et al.* 2017; Shrestha *et al.* 2014; Perera *et al.* 2019; Demerittt, 2014; Liu *et al.* 2018; Brown *et al.* 2019; Pappenberger *et al.* 2015). The success of an early warning system is dependent on the four components and weaknesses in any of these components will undermine its success. Risk knowledge is considered to be the foundation of early warning systems, it involves, 'assessing and mapping key hazards, vulnerabilities, and exposure' (Smith *et al.* 2017:426). Risk knowledge, furthermore, entails a superior understanding of the interpretation of water levels for communities living adjacent to waterbodies. Apart from mapping out key hazards, risk knowledge benefits communities by identifying and distinguishing safe evacuation routes to be used during a flood disaster. Monitoring and forecasting activities involve the observation and analysis of hazards. Hazard monitoring and forecasting must be scientifically sound to enable accurate and timely warnings to be communicated to communities at risk. Efficient monitoring and forecasting systems frequently reduce the loss of lives, consequently, averting a hazard from developing into a disaster.

The warning and dissemination component discusses the transmission and communication of the hazard warning. The underlying factors of this component are concerns of the access to and understanding of warnings being issued. Warnings are communicated in several ways, for example, 'flood-prone Nepal has a mechanism that conveys bulk short messaging service (SMS) directly to communities at risk at local and district levels, they also use conventional ways such as a handheld megaphone, loudspeakers, and sirens' (Perera *et al.* 2019:12).

The final component of an early warning system investigates communities' responsiveness capabilities after the issuance of a warning. In most cases, awareness campaigns, training, and education are used to equip people with the necessary skills and knowledge to ensure that they will have the capability to respond appropriately to a hazard warning. According to Cools et al. (2016:20), 'forecasting floods is only one aspect of an early warning system, an effective early warning system is one that issues

warnings upon which action is taken'. This provides evidence that the last two components of an early warning system are extremely critical since people can only act if they understand the warning being issued. Therefore, 'warnings must be conveyed promptly, particularly in vulnerable and remote locations and should use clear information expressed in non-technical language' (Perera *et al.* 2019:19). Response capabilities can be fortified by ensuring that the early warning messages are disseminated in the fastest and simplest possible ways so that they are easily understood by target groups. The 2014 floods in Nepal are a great demonstration of the importance of an early warning message to people because communities residing in the Karnali River basin were given a three-hour lead-time to evacuate, giving them sufficient time to act appropriately and reducing the likelihood of casualties (Smith *et al.* 2017). From the evidence discoursed, it is feasible to infer an early warning system model, as presented below:

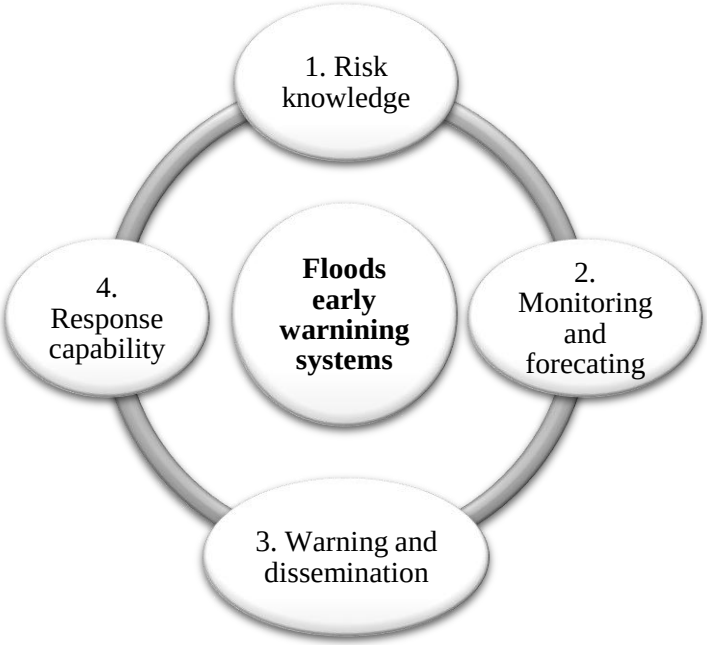

Figure 1: An early warning system model

The early warning system model illustrates the mitigation of a flood disaster spanning across the four components, from hazard detection to the response capabilities of communities. At some level, flood early warning systems have been recognized for having a momentous contribution to the reduction of human and property loss. Writers like Nieland & Mushtaq (2016), have gone to great lengths articulating and extolling the virtues of early warning systems as a panacea to flood disaster-induced losses. Moreover, in recent years a significant number of countries have made significant investments in early warning systems. The Chinese government has injected more than 28 billion Renminbi (RMB) in upgrading its flood early warning systems (Liu *et al.* 2018). This trend, captured by Perera *et al.* (2019:16), states that, 'flood early warning systems effectively mitigate flood risk impacts, the increase in their number, combined with structural and non-structural measures reduce the mortality rate by 45 per cent'. They demonstrate how the flood-induced mortality rates have fallen over the years, 'from 6 025 death per annum in 2000 to 3 331 deaths in 2017' (Perera *et al.* 2019:16). Noticeably, at first glance, this displays the ability of early warning systems to curb mortality rates. Still, what is not cogitated in the statics obtainable is the fact that there has been an inordinate exodus from flood-prone areas in the past decade. The relocation of people from high flood risk regions has had a significant impact on the reduction of flood-induced mortality rates and should be considered in the formulation of disaster statics. Apart from placing great emphasis on the 45% drop in mortality rates, statistics fail to utilize a wholistic, exhaustive approach when releasing statistics on flood-induced mortality rates. Quantitative researchers tend to shy away from presenting the reality entrenched in this celebrated sharp decline, which contributes to the perpetuation of women's vulnerability to flood disasters.

Despite substantial investments and technical advancements in early warning systems, women persistently represent a higher mortality percentage than men in any flood event. Consequently, both the World Health Organization (WHO) and Plan International (IP) have estimated that women are fourteen times more likely to die in a disaster situation than men (Neumayer & Plümper 2007; Reyes & Lu 2016; MacGregor 2010). Research by Ugwu and Ugwu (2013) in Nigeria statically concurs with the WHO and IP's findings because of the 148 women who reportedly lost their lives to floods. Madhuri (2016) penned that out of the 138 000 killed in the 1991

Bangladesh cyclone, the majority of the fatalities were women. A consistent pattern was traceable in a study by De Silva and Jayathilaka (2014) whereby 91 % of the adults affected by the 2004 tsunami in Sri Lanka were women. Fisher (2010) confirms that the 2004 tsunami produced higher mortality rates for girls and women in Sri Lanka compared to boys and men.

Given the extensively acknowledged view that the mortality rate of women in disaster situations remains higher than that of men, the question remains; why is it that disaster risk reduction strategies have not earnestly cogitated gender? The HFA failed to yield the desired outcomes because issues of gender were incessantly treated as add-ons to disaster risk management instead of prioritizing them as integral components to their disaster management programs. National reports submitted at the World Conferences on Disaster Reduction during the HFA operational period exhibited that little attention was devoted to the mainstreaming of gender in disaster management by national governments (UNISDR 2015). The overall failure of the HFA between 2005 and 2015 is an indication that gender is a necessary element to women's struggles and over-looking it in disaster management can be a recipe of disaster.

The attention of disaster scholars ought to be on the need for gender-sensitive early warning systems. It is a truism that early warning systems have traditionally been fundamentally gender blind as a result of insignificant deliberation on the societal differences between men's and women's lived experiences. This articulation finds support in Brown *et al.*'s. (2019) argument that, 'marginalized gender groups risk been excluded from disaster risk reduction policies, strategies and decision-making as the disaster risk reduction processes are not currently designed to enable them to engage'. The reason offered is that the integration of a gender perspective will not only increase the effectiveness of early warning systems but will correspondingly go a long way in saving the lives of women, those in rural areas in particular. The use of the early warning system model shown above illustrates how existing early warning systems are an impediment to women's participation. It is imperative to highlight a dearth of studies that provide a comprehensive analysis of the operational state of early warning systems. Credit can marginally be extended to Cools *et al.* (2016:17), who note that, 'while some success stories of early warning systems are documented from developing and developed countries, publications that systematically analyze the effectiveness of the whole early warning system

process are rare'. This calls for contemporary disaster scholars to identify structural and non-structural challenges that remain within early warning systems' components that undermine their effectiveness.

Communicating Flood Early Warnings

The first two components are established on scientific connotations, which is, consequently, the reason that they ought to be scientifically rigorous. Users should be in a position to interpret gauge readers, conduct risk calculations, and be equipped with better computing techniques to forecast and monitor hazards. Saravi *et al.* (2019) and Thorndahl *et al.* (2017) outline how satellites and artificial intelligence are increasingly utilized to improve risk knowledge and hazard forecasting. The last two components are founded on the social scientific factors of the early warning system model. These components focus on problems regarding community involvement and the integration of local knowledge since early warning systems have to adapt and consider local conditions (Demeritt 2014; Gautam 2013). Valuing local knowledge can enhance the effectiveness of early warning systems, Cools *et al.* (2016) study exhibits how local knowledge from both the societies of Egypt and Mali balanced scientific knowledge in categorizing the intensity of floods. The social scientific characteristic of an early warning system is fundamental because it is aligned to communities' responses to the problem. Cools *et al.* (2016:119) state that 'the communication of an early warning is the crucial step between the forecasting itself and the acting upon a warning'. It cements every part together to ensure that no one is left behind. It is ineffective to develop a complex and impeccably positioned hazard forecast mechanism which does not result in action. This was evident in Cambodia, where local people, mostly women, failed to respond to the early warning that was issued because of the technical language that was used to convey the warnings (Dutta, Basnayake & Ahmed 2015). So, for an early warning system to be deemed successful, it must issue a precise, timely, and, most significantly, a comprehensive warning for communities at risk to act upon. Likewise, an effective early warning system is one that ensures inclusivity so that all people receive, understand, and respond appropriately to early warnings. Unfortunately, current early warning systems have intensified the vulnerability of women to flood disasters owing to a prevailing gender-blind approach.

Gendering Warning and Dissemination Channels

The exacerbation of the vulnerability of women to floods is an indication that the social nature of natural hazards needs to be reconnoitered since analyzing women's susceptibility to floods facilitates the provision of a more accurate and comprehensive gender-sensitive approach upon which impartial disaster response and recovery strategies can be developed. Mavhura (2019) believes that understanding the construction of vulnerability to disasters is important because the survival of communities is threatened. Similarly, a case study on a flood-risk reduction project conducted in Sri Lanka, by De Silva and Jayathilaka (2014), concludes that the root cause of vulnerability to floods lies within the social and economic processes existing within society. Findings from the Sri Lankan case study are analogous with Fordham's (1998:127) argument that 'disaster vulnerability cannot be separated from vulnerability in everyday living, and this is seen most clearly through unequal access to resources arising from structural inequalities embedded within national and international socio-economic systems'. Therefore, gendering vulnerability to flood disasters is a crucial aspect of disaster risk mitigation and it endorses a culture of resilience, particularly amongst women. Gender refers to the culturally and socially constructed expected behavioral norms accorded to women and men. Enarson (1999) delineates gender as a central organizing principle in social life that shapes people's values, expectancies, and perceptions of their prescribed gendered roles. Likewise, MacGregor (2010:228) identifies gender as 'a discursive social construction that structurally organizes virtually every aspect of social life in all cultures'. In this regard, gender becomes a powerful force that shapes individuals' interpretations of their social-worlds, and gender has an influential role in how individuals articulate and respond to flood early warnings.

Gendered studies on disasters' early warning systems are restricted, it is one area that disaster literature has failed to capitalize on. Brown et al. (2019:8) asserts that, 'limited research has focused specifically on the connection between gender and early warning systems'. Women are often overlooked, and they are the least empowered to participate and to act upon a flood early warning. For instance, women are less involved in early warning systems due to gendered assumptions and gendered domestic roles. As a result, men are entrusted with the responsibility of sharing early warning

messages. In Nepal, 91% of men participated in flood early warning systems, compared to 37% women (Brown *et al.* 2019). Therefore, early warning systems ought to incorporate these systemic barriers that exclude women from participating wholly in such initiatives. The consideration of gender is paramount in ensuring improved disaster preparedness. The gender-blind approach propagates gender inequality which leads to social marginalization affecting women's accessibility to early warnings. Gender inequality translates into fewer educational prospects for women which adversely affects their mastery and capacity to cognize early warnings. Disaster literature has exposed that fewer women participate in early warning systems, resulting in more casualties and significant repercussions for women.

Inadequate gender consideration is accommodated when formulating early warning dissemination channels and strategies. Common channels of information dissemination regarding early warning systems usually involve announcements in newspapers, television, radio, messages via mobile phones, and community awareness programs. A gender-blind approach would simply assume that women have access to these information channels and communication platforms, hence, they will all be aware of the impending disaster. In their review of early warning systems, Perera et al. (2019) place excessive emphasis on how the integration of social media, smartphones, and the internet into warning dissemination systems means almost everyone will act as a disseminator. This implies that people can utilize social media channels to receive and relay warnings timeously. A gendered approach would consider the accessibility and usage of such modern amenities by women, especially those residing in rural flood-prone areas. Warnings communicated to people through their mobile phones may reinforce the vulnerability of rural women to floods because they will be unaware of such communication if they do not own a mobile phone. Ferdous & Mallick (2018) note that gender bias perceptions hinder women from accessing modern amenities such as mobile phones as they are perceived as a bad influence for women. It is, therefore, not surprising that their study discovered that, 'only 18 out of 120 women respondents owned mobile phones, whilst 115 out of 120 male respondents owned a mobile phone, the 5 males who did not own phones were elderly and unable to operate one' (Ferdous & Mallick 2018:6). Brown *et al.* (2019) noted a huge disparity in warning dissemination channels in Peru and Nepal, with men preferring SMS

warnings while women preferred verbal dissemination. After probing, they realized that the preference of women for verbal communication was because of lower levels of mobile phone ownership and levels of literacy. Such findings are an indication that women's limited access to modern technology proliferates their vulnerability to natural disasters. The best practical option accessible to women is verbal communication; failure to respond to this sustains fortifying gender disparities and decision-making powers.

Gendering early warning systems to natural disasters is not only confined to women's ownership of mobile phones; it incorporates concerns regarding the ability of women to use these mobile devices as well as the feasibility of mobile phones' network coverage and usage in rural areas. Numerous issues can undermine the effectiveness of mobile phone usage in rural communities. Ncube-Phiri et al. (2014:6) rightfully note that, 'although cellphones are now common in most rural communities in Chadereka the network coverage is very poor making it difficult to transmit messages and most of the times cell phones will be turned off because people do not have the means to charge them'. The same line of consideration pertains to various other communication channels, such as televisions, radios, the internet, and newspapers, which recognize the need for an audit of individual literacy levels in this context. This emphasizes concerns of access to education, the participation of women in community forums, and their mobility which are greatly influenced by cultural norms. The emphasis should not be exclusively centered on dispatching early warning messages to people but to ensure that these important messages are transmitted directly to the most vulnerable groups by employing gender-sensitive early warning systems.

Early warning systems have actively entrenched gender inequality and gender prejudice since warnings are more likely to be disseminated to men with the supposition that they will share the message with their household. This buttress gender inequalities in accessing warnings, forcing women to rely on men for critical information. For, 'many female respondents shared that even when male family members have migrated to other towns or places within Nepal, it is still the male family member who receives the warning ad relays it back to their families' (Brown *et al.* 2019:20). The 1991 cyclone in Bangladesh is an illustration of gender unfairness entrenched in early warning systems since the information was only shared between men in public gatherings. Women were not directly informed about the imminent cyclone, resulting in a higher number of women who lost their lives

compared to men (Genanet 2004). The assumption is always that women will have to wait and receive information from their husbands. Consequently, the secondary line of communication means that women receive hazard warnings later than men in most instances. At times, men are reported to be hesitant to evacuate as they fear the reality of livelihood loss. They delay until they receive further confirmation before relaying the warning to their wives. A striking distinction in Peru was that 'while women reported needing earlier warnings, men did not think that women needed earlier warnings' (Brown *et al.* 2019:33). Therefore, the reliance of women on secondary communication sources has implications on their disaster response capabilities and preparedness as they will have little time to do so. This also explains why women's mortality rates during and after a flood disaster are always higher than those of men. At the inception of a flood disaster, women find themselves confined to the household trying to salvage household essentials whilst men engage in conducting search and rescue missions.

The maintenance of a gender-blind approach in early warning systems impairs women's struggles, as highlighted by the disastrous impact of cyclone El Niño in Peru. Briceño (2002) argues that El Niño's negative impact on women was enhanced by the notion that the early warning messages were only administered to fishermen as fishing was the main economic activity in the area. Women's economic contributions were overlooked and considered subordinate to those of men (Briceño 2002). The marginalization of women in early warning systems based on economic contribution is highly debatable since there are documented cases where women have played key roles in both economic activities and in transmitting early warning information. For instance, there were no reported deaths in the aftermath of hurricane Mitch because six months before the disaster gender-sensitive educational initiatives were effectively transmitted to the community. Buvinic (1999) highlights that these initiatives enable women to play key roles, leading to effective evacuation procedures well in advance and before the hurricane hit the area. Likewise, women in Nawalapitiya, Sri Lanka, team up with men and established community watch groups dedicated to continuously monitor early signs of landslides throughout the rainy season to reduce disaster casualties (Ariyabandu & Wickramasinghe 2003). This displays that the benefits of gendering early warning systems intersect with families and households. Reasonably, the whole community stands to benefit from such interventions. Women are likely to be more

proactive, act upon the early warning information, and, more significantly, they are more likely to be actively involved during the disaster phase. The realization of gender-sensitive early warning systems is only achievable by mainstreaming and prioritizing gender into national disaster risk and management policies.

Conclusion

The treatise offered contended that gender must be a fundamental consideration in disaster risk reduction strategies. The effectiveness of a flood early warning system lies within its ability to take recognition of the structural differences existing within communities. There is a necessity for gender transformation in current flood warning systems to guarantee that all people have direct access to warnings, that they understand the warning, and that they are similarly equipped to respond appropriately. Rural women, in particular, are faced with matters of patriarchal normative behaviors, such as a lack of mobile ownership, besides their prescribed gender roles which preclude them from contributing to the public arena. The assumption that early warnings should be sent to the head of the household with the view that men will relay to the message reinforces male domination while increasing the vulnerability of women to floods. If the evacuation procedure is delayed, women find it more difficult to evacuate once the flooding has commenced. There are several underlining gendered norms that make it difficult for women to maneuver in flood waters; these relate to carrying household utensils, the economy of care, their clothing, and their inability to swim or climb. The considerations of such gender imbalances in society will advance the effectiveness of flood early warning systems as women are capable of developing a culture of resilience in flood-prone communities. It is on this basis that there is a call for women to be completely involved in all four components of the early warning system model. Moreover, warning dissemination channels should be easily accessible to women to sever the restraint of their reliance on men for warnings. Gender prejudice approaches tend to perpetuate gender inequality which often leads to domestic violence and the persecution of women, even in the aftermath of a flood event. This is an area that future researchers should consider, connecting gender-based violence to flood disasters cannot be ignored.

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