

Flood-Risk Early-Warning Communication and Preparedness/Response Behaviour among Residents of Nsukka, Nigeria

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ABSTRACT

Background: Flooding remains a recurring environmental hazard in many parts of Nigeria, with its impacts often exacerbated by inadequate preparedness, delayed responses, and ineffective communication of early warning information. Although flood early warning systems are designed to provide timely information that enables communities to take preventive and protective measures, the effectiveness of such communication in translating warnings into action requires empirical assessment.

Objective: This study investigated the effectiveness of the existing flood-risk early warning communication system in two communities in Nsukka, namely Onuiyi and Ugwuoye.

Method: The study adopted a descriptive survey design, collecting data from 342 respondents across the two communities using a structured questionnaire. The instrument assessed the communication channels used, perceived effectiveness, challenges, and desired improvements in early warning communication. The data were analysed using frequency distributions, simple percentages, mean scores, and standard deviations.

Results: The findings revealed that various mass media and digital media channels were used within a centralised, top-down communication system. Untimely warnings, limited reach, and restricted access were identified as factors undermining the perceived effectiveness of the existing system.

Conclusion: Integrating local social contexts, strengthening grassroots collaboration, and improving communication technologies could enhance flood early warning communication.

Unique Contribution: The study provides empirical evidence on the perceived effectiveness, challenges, and potential improvements of flood-risk early warning communication in Onuiyi and Ugwuoye, Nsukka, Nigeria.

Key Recommendation: The study recommends decentralising Nigeria's existing flood early warning communication system and adopting a community-centred framework that integrates scientific data with local realities.

Keywords: Early warning, communication systems, flood, risk management

INTRODUCTION

Environmental disasters have become major challenges facing developing countries in Africa. In Nigeria, flooding is a recurrent hazard that causes loss of life, destruction of property, and population displacement (Tudunwada & Abbas, 2022). Its effects on food security, water supply, and sanitation further exacerbate its consequences (Ringo et al., 2024). The impacts of flooding in Nigeria over the past two decades have been substantial. During the 2012 floods, approximately 2.3 million people were displaced, 363 people lost their lives, and 16 million people were affected in various ways, while the estimated economic losses amounted to US\$16.9 billion (Oke et al., 2023). Similarly, the 2022 floods claimed 600 lives, affected 3.2 million people, and resulted in estimated economic losses ranging from US\$3.79 billion to US\$9.12 billion, according to figures reported by Oke et al. (2023). Together, these two major flood events affected more than 34 states across the country, underscoring the scale of Nigeria's vulnerability to flooding and the need for effective disaster preparedness and response mechanisms.

One important strategy for reducing the effects of flooding is the establishment of effective early warning systems (EWS). Such systems are built around four key pillars: disaster risk knowledge; detection, observation, monitoring, analysis, and forecasting; dissemination and communication of warnings; and preparedness to respond. When effectively implemented, these pillars can help reduce the impacts of flood hazards (Akujobi & Neji, 2024; United Nations Environment Programme [UNEP], 2026). Establishing, maintaining, and improving early warning systems is therefore an integral component of disaster management, particularly in vulnerable communities that require timely and actionable information (Olajide, 2023). However, the effectiveness of these systems in many developing countries, including Nigeria, is undermined by inadequate infrastructure, limited communication channels, and poor coordination among government agencies, media organisations, and local communities (Ringo et al., 2024).

In Nigeria, the Federal Ministry of Environment, through its Flood and Erosion Control Department, the Nigerian Meteorological Agency (NiMet), and the Nigeria Hydrological Services Agency (NIHSA) are among the institutions responsible for generating or disseminating information relevant to flood risk and early warning. However, warnings issued by these institutions may fail to reach vulnerable populations in a timely and accessible manner because of inadequate communication infrastructure and the absence of effective community-oriented communication strategies (Oke et al., 2023). These challenges are particularly relevant to communities where local environmental conditions increase vulnerability to flooding. Although Onuiyi and Ugwuoye are not situated along a floodplain, their hydrological, geological, and topographical characteristics have contributed to recurrent flooding during the rainy season (Ugwu et al., 2018). The situation is further exacerbated by ineffective warning systems, inadequate and poorly maintained drainage infrastructure, and indiscriminate waste disposal (Ugwu et al., 2018; The Whistler, 2025). These conditions highlight the importance of examining not only the availability of early warning information but also how effectively such information reaches and serves the communities at risk.

Despite the importance of early warning communication in flood risk management, empirical evidence on its perceived effectiveness in flood-prone communities remains an important area for investigation. In particular, understanding the communication channels through which residents receive warnings, their assessment of the usefulness and timeliness of those warnings, and the challenges they encounter can provide insights into the strengths and limitations of existing systems. Against this background, the present study investigates the perceived effectiveness of flood-risk early warning communication in Onuiyi and Ugwuoye,

Nsukka. Specifically, it examines the communication channels used to disseminate flood warnings, residents' perceptions of the effectiveness of the existing system, the challenges affecting early warning communication, and the strategies residents consider necessary for improving the system and strengthening flood risk management.

RESEARCH QUESTIONS

1. What communication channels do residents of Onuiyi and Ugwuoye use to receive flood early warning messages?
2. How do residents of Onuiyi and Ugwuoye perceive the effectiveness of flood early warning communication systems?
3. What challenges do residents perceive as undermining flood early warning communication in Onuiyi and Ugwuoye?
4. What strategies do residents consider appropriate for improving flood early warning communication in Onuiyi and Ugwuoye?

REVIEW OF RELATED LITERATURE

Early Warning Systems (EWS) have existed as long as humans have operated in communities (Kelman and Glantz, 2014). Rooted in the primal instinct for self-preservation, humans have always tried to protect their communities from disasters that could harm them (Olajide, 2023). The United Nations International Strategy for Disaster Reduction (UNISDR, 2017, para 1.) defines an early warning system to be “an integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events.” Globally, these systems revolve around two main approaches, a top-down last mile approach and a people-centered first mile approach.

Due to the perceived gaps in adopting the former for reducing risks in rural communities, various studies have favoured the more people-centered approach (Kelman and Glantz, 2014; Mustafa et al 2015; Marchezini et al. 2018). First mile approaches regarded by a variety of names such as people, citizen, participatory or community-based EWS simply denote systems that have been decentralized to the community level (Marchezini et al. 2018). The United Nations International Strategy for Disaster Reduction (UNISDR) notes that without incorporating the people affected by hazard at the core of the system, no EWS can be effective (Mustafa et al. 2015). The United Nations Office for Disaster Risk Reduction (2020) recommends a comprehensive system that incorporates scientific data, indigenous knowledge, participation of the community members and use of information and communication technology in early warning and response to flooding disaster (UNDRR, 2020).

Towards achieving the long-term goals of the Sendai Framework for Disaster Risk Reduction 2015–2030, the Sustainable Development Goals (SDGs) and the Paris Agreement, the development of a functional and “integrated climate, health and environmental” EWS by 2030 is noted in Nigeria’s Third Nationally Determined Contribution (Echendu, 2020; Federal Government of Nigeria, 2025, p.29). Flood risk early warning communication is a core mandate of Nigeria’s foremost meteorological and hydrological agencies and their corresponding state agencies. While Articles 7(1)(f) and 7(1)(i) of the Nigeria Hydrological Services Agency (NiHSA) (Establishment) Act, 2010 and Nigerian Meteorological Agency (NiMET) (Establishment) Act, 2022 provides for the collection, processing and dissemination of hydrological and meteorological information within and outside Nigeria, Article (7)(c) of

the NiHSA Act specifically provides for cooperation with NiMET in order to “issue forecasts for floods.” These agencies study climatic and weather conditions and are required to disseminate appropriate warnings when they need arises to various communities in the country via mass media channels.

While the monitoring and predicting capabilities of these agencies are exceptional, their information dissemination has been described as modest (Olajide, 2023). The lack of streamlined agency operations, limited reach and timeliness, inadequate hydrological networks across Nigeria, funding, capacity (technical and personnel) have however inundated Nigeria’s EWS frameworks (Oke, Amarnath and Cofie, 2023). With an array of broadcast, print and social media at their disposal, it is argued that there is limited access to EWS especially in rural communities (Olajide, 2023).

THEORETICAL FRAMEWORK

This study is anchored on the Actor-Network Theory (ANT). This theory integrates human and non-human actors into a network through which social, economic and political reality is created (Shim and Shin, 2015). Rather than a binary that distinguishes between a subject and object, ANT proposes a complex network of relationships of both human and non-human actors with both having agency (Latour, 2017). Bruno Latour’s ANT facilitates the understanding of the relationship between human and non-human actors as regards EWS for flood risk management (Inpin et al, 2023). It is in this regard that Choo (2009) in Zwolski (2016, p.4) defines EWS as “a network of actors, practices, resources, and technologies that has the common goal of detecting and warning about an imminent threat so that preventive measures can be taken to control the threat or mitigate its harmful effects.” This links to Kelman and Glantz (2024, p.89) conceptualization of EWS as a social process that comprises “technical components embedded in their social contexts.” By assigning agency to human and non-human actors, the synergy from their evolving network shapes how flood risks are prevented, communicated, reduced and managed.

EMPIRICAL REVIEW

Baudoin et al., (2016) using cases of early warning systems in Kenya, Hawai’i, and Sri Lanka, investigated the conception and application of EWS. The major objective of the study was to explore alternative approaches to EWS that are not limited to detecting risks and issuing warnings. The study adopted a mix of case study and systematic literature review. The findings reveal that all communities have peculiar early warning needs due to their location, available risk information and communication technology. Consequently, the study noted that this requires the tailoring of communication networks. The need to tailor these systems to diverse communities results in challenges such as added costs and implementation bottlenecks. It recommends a transition from a top-down to a more community-centered EWS approach. This can be achieved through the coupling of traditional and scientific-based knowledge systems.

Mustafa et al., (2015) explored EWS in Pakistan from the perspective of gender. They argue that since gender can determine the level of opportunities an individual could have, it could also influence their levels of vulnerability especially to flood events. This could be in form of preparation, response and recovery from such events. The study adopted a focus group discussion and interview. The study found socio-economic challenges that prevented women from accessing warning information. The study also revealed a masculine-centered stereotype that favoured dissemination of early warnings to mostly males who would consequently be able to rescue the female folk in case of disaster. The study recommends for more democratized early warning systems that take into cognizant the needs of all members of the community.

Marchezini et al., (2017) investigated how to build and put a people-centered EWS system in place. They noted that extant literature and even the United Nations International Strategy for

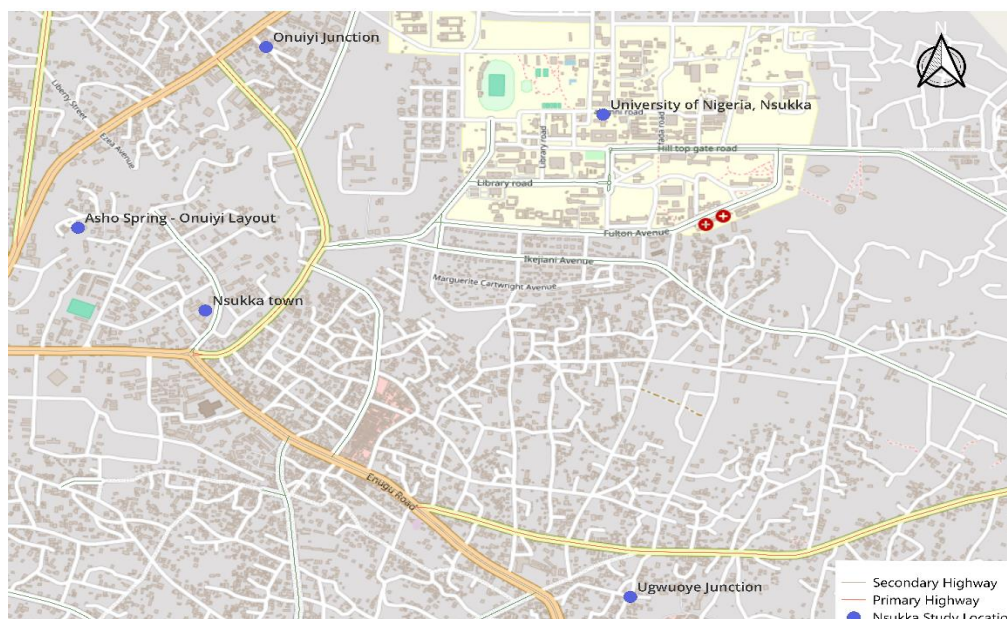
Disaster Reduction (UNISDR) favoured such an approach ideally without seeking means to develop one. The study explored the challenges and measures required to build one in Brazil. The study was carried out through a field work and participant observation in São Luiz do Paraitinga and Cunha, two communities in the Paraitinga watershed. The study discovered that Brazil's centralized control of EWS marked and disaster response that is both hazard-centered and last-mile are some impediments to actualizing a people-centered system. Citizen science initiatives and crowdsourcing were recommended as implementation measures.

Olajide (2023) in his study, "Saving Lives through Effective Flood Warning Communications in Nigeria" noted that despite the catastrophic nature of flooding events in Nigeria and its relationship to climate change, such warning systems are weak. Through an exploration of literature, the study discovered that traditional communication systems have achieved modest success in managing flood events. Olajide's study recommends political communication as a tool for creating awareness about environmental issues and disseminating warnings. The reviewed literature demonstrate support for alternative approaches to EWS that favour citizen participation and a fusion of traditional and scientific methods. It becomes pertinent to study the current centralized system used in Onuiyi and Ugwuoye to ascertain its effectiveness. The present study is anchored on the ANT and adopts a descriptive survey to ensure the incorporation of individual perceptions that are foundational to ascertaining a people-centered EWS, a key consideration missing in the reviewed literature.

METHODOLOGY

The study adopted a descriptive survey design to evaluate early warning communication systems for flood risk management in Nsukka. Nsukka has an estimated population of 486,076 for 2026 (World Population Review, 2026). A sample size of 384 was derived through the Australian Bureau of Statistics (ABS) sample size calculator given the population size, a confidence level of 95%, and confidence interval of 0.05. Multistage sampling was used to determine the population sample. In the first stage, Nsukka was clustered into the three communities that comprise it; Nkpananor, Ihe n'Owerre and Nru (Ugwu, Echiegwu and Okonkwo, 2018). Purposive sampling was used to select Ihe n'Owerre because of peculiar geologic and topographic peculiarities that make it prone to flood events (Ugwu, Echiegwu and Okonkwo, 2018). In the next stage, Ihe n'Owerre was clustered into two districts; Ugwuoye and Onuiyi. 192 questionnaires each were distributed in these districts.

Figure 1: Map of Nsukka town showing study areas



Source: Study Location Coordinates-GIS (Field Study, 2026)

Face and content validity was conducted by an expert in Mass Communication and another in Measurement and Evaluation in the University of Nigeria. The structured questionnaire comprised of demographic and psychographic items with the latter divided into four clusters of seven item statements each. The four clusters relate with the study's four research questions; communication channels, effectiveness, challenges and solutions. A pilot study produced a Cronbach's Alpha reliability coefficient of 0.82 and the instrument was administered by the researchers. Ethical principles of voluntary participation, anonymity, and confidentiality were observed. The data generated from the questionnaire was analyzed with the Statistical Package for the Social Sciences (SPSS) 25. This was done to obtain frequencies, percentages, mean value and standard deviation of the frequencies.

Table 1: Decision Rule Schedule

Response mode	Rate	Real limit	Decision
Strongly Agree/Very High Extent	4	3.50 - 4.00	SA/VHE
Agree/High Extent	3	2.50 - 3.49	A/HE
Disagree/Low Extent	2	1.50 - 2.49	D/LE
Strongly Disagree/Very Low Extent	1	0.50 - 1.49	SD/VLE

Two 1-4 Likert scales were used. The first measuring agreement and the other extent. The study made use of Mean scores equal to or greater than the criterion mean of 2.50 indicated agreement, while mean scores below the criterion mean of 2.50 indicated disagreement.

DATA ANALYSIS AND PRESENTATION

192 questionnaires were distributed and retrieved in Ugwuoye. In Onuiyi, 192 was distributed but only 150 were retrieved in Onuiyi. Altogether, there was a total 342 valid respondents (89.1%).

Table 2: Respondent Distribution

Respondent Distribution				
	Distributed	Returned		
Ugwuoye	192	192	100%	
Onuiyi	192	150	78.1%	
Total	384	342	89.1%	

Source: Field Study (2026)

Table 3: What communication channels do residents of Ugwuoye and Onuiyi use to receive flood early warning messages?

A	Item Statements	SA	A	D	SD	MEAN	STD
1	Radio is a common source of flood warning in my community	69 (20.2%)	217 (63.5%)	51 (14.9%)	5 (1.5%)	3.02	.640
2	I receive flood warnings on social media	83 (24.3%)	202 (59.1%)	45 (13.2%)	12 (3.5%)	3.04	.717
3	Community leaders play an important role in communicating flood warnings	27 (7.9%)	162 (47.4%)	134 (39.2%)	19 (5.6%)	2.58	.717
4	I receive flood warnings over the TV	44 (12.9%)	238 (69.6%)	44 (12.9%)	16 (4.7%)	2.91	.661
5	I receive flood warnings from government agencies	25 (7.3%)	238 (69.6%)	61 (17.8%)	18 (5.3%)	2.79	.647
6	Phone calls and SMS are used to communicate flood warnings	21 (6.1%)	144 (42.1%)	130 (38.0%)	47 (13.7%)	2.41	.800
7	Town criers are used to announce flood warnings	13 (3.8%)	60 (17.5%)	196 (57.3%)	73 (21.3%)	2.04	.736
	CLUSTER MEAN					2.68 (A)	.70

Source: Field Study (2026)

The overall cluster mean of 2.68 indicates a general baseline of agreement among the 342 respondents that multiple communication channels are actively utilized for flood warnings in the community. The respondents indicated agreement that social media platforms (Mean= 3.04) and broadcast channels like radio (Mean=3.02) and T.V (Mean= 2.91) were significant for flood early warning communication in Ugwuoye and Onuiyi. Government agencies (Mean= 2.79) slightly followed the mass media. While community leaders (Mean= 2.58) are an established channel, their use as a channel is not far reaching. The majority of the respondents have not experienced on relied phone calls/SMS and town criers for FEWS in their communities.

Table 4: What is residents' perceived effectiveness of flood early warning communication systems in Ugwuoye and Onuiyi?

Item Statements	VHE	HE	LE	VLE	MEAN	STD
1 Flood warning messages reach residents before flooding occurs	18 (5.3%)	133 (38.9%)	164 (48%)	27 (7.9%)	2.42	.712
2 The warning messages are clear and easy to understand	42 (12.3%)	200 (58.5%)	80 (23.4%)	20 (5.8%)	2.77	.735
3 The information received is accurate and reliable	24 (7.0%)	186 (54.4%)	111 (32.5%)	21 (6.1%)	2.62	.707
4 The messages provide enough time for residents to prepare	28 (8.2%)	137 (40.1%)	148 (43.3%)	29 (8.5%)	2.48	.765
5 Early warning messages have helped reduce flood-related losses	36 (10.5%)	143 (41.8%)	130 (38.%)	33 (9.6%)	2.53	.809
6 Flood warning information is accessible to most residents	19 (5.6%)	117 (34.2%)	170 (49.7%)	36 (10.5%)	2.35	.742
7 The current flood warning system is effective	15 (4.4%)	79 (23.1%)	176 (51.5%)	72 (21.1%)	2.11	.779
CLUSTER MEAN					2.47	.749
					(LE)	

Source: Field Study (2026)

A cluster mean of 2.47 indicates the low perceived effectiveness of early warning communication in these communities. While respondents generally agree that the warning messages are clear and easy to understand (Mean = 2.77) and accurate (Mean = 2.62), they perceive that the system fundamentally struggles with timeliness and reach. Warnings often fail to reach residents before actual flooding occurs (Mean = 2.42), do not provide adequate lead time for preparation (Mean = 2.48), information is not widely accessible to the broader population (Mean = 2.35), respondents perceive that the current flood warning communication system is ultimately ineffective (Mean = 2.11).

Table 5: What challenges do residents perceive to undermine flood early warning communication in Ugwuoye and Onuiyi?

Item Statements	SA	A	D	SD	MEAN	STD
1 Poor communication infrastructure affects the delivery of flood warning messages	118 (34.5%)	199 (58.2%)	24 (7.0%)	1 (.3%)	3.27	.596
2 Some residents do not trust flood warning messages	46 (13.5%)	187 (54.7%)	99 (28.9%)	10 (2.9%)	2.79	.705
3 Low literacy levels make it difficult for some persons to understand warnings	72 (21.1%)	176 (51.5%)	87 (25.4%)	7 (2%)	2.92	.736
4 Government agencies do not provide timely flood warnings	90 (26.3%)	224 (65.5%)	27 (7.9%)	1 (.3%)	3.18	.568
5 Not communicating in local language affects understanding of flood messages	85 (24.9%)	203 (59.4%)	51 (14.9%)	3 (.9%)	3.08	.654
6 Lack of public awareness reduces the effectiveness of flood warnings	65 (19%)	216 (63.2%)	59 (17.3%)	2 (.6%)	3.01	.622
7 Poor mobile network coverage affects communication	89 (26%)	205 (59.9%)	42 (12.3%)	6 (1.8%)	3.10	.666
CLUSTER MEAN					3.05 (A)	.65

Source: Field Study (2026)

Respondents overwhelmingly pointed to technical failures, poor communication infrastructure (Mean = 3.27) and inadequate mobile network coverage (Mean = 3.10) severely hindering message delivery. A vast majority noted that government agencies fail to provide timely warnings (Mean = 3.18). Respondents identified the failure to communicate in local languages (Mean = 3.08), low public awareness (Mean = 3.01), and low literacy levels (Mean = 2.92) as major obstacles, while underlying mistrust in the warning messages (Mean = 2.79) further limits community responsiveness.

Table 6: What strategies do residents prefer for improving flood early warning communication in Ugwuoye and Onuiyi?

Item Statements	SA	A	D	SD	MEAN	STD
1 Flood warning messages should be communicated through multiple channels	174 (50.9%)	164 (48.0%)	4 (1.1%)	0	3.50	.524
2 Community leaders should be more involved in flood warnings	133 (38.9%)	199 (58.2%)	9 (2.6%)	1 (.3%)	3.36	.548
3 Public awareness campaigns should be organized on flood preparedness	131 (38.3%)	201 (58.8%)	9 (2.6%)	1 (.3%)	3.35	.547
4 Warning messages should be translated into local languages	134 (39.2%)	195 (57%)	12 (3.5%)	1 (.3%)	3.35	.563
5 Emergency respond agencies should provide more timely flood information	163 (47.7%)	175 (51.2%)	4 (1.2%)	0	3.46	.522
6 Government should improve communication infrastructure in flood-prone areas	161 (47.1%)	176 (51.5%)	4 (1.2%)	1 (.3%)	3.45	.538
7 Collaboration between government and community organizations will improve flood risk communication	152 (44.4%)	185 (54.1%)	4 (1.2%)	1 (.3%)	3.43	.535
CLUSTER MEAN					3.41 (SA)	.54

Source: Field Study (2026)

Respondents prioritized a diversified and rapid alert system, strongly agreeing that warnings should be broadcast across multiple communication channels (Mean = 3.50) and delivered more promptly by emergency response agencies (Mean = 3.46). Residents prefer the government to improve baseline communication infrastructure in flood-prone areas (Mean = 3.45), while simultaneously localizing the effort by fostering deeper collaboration between state agencies and grassroots organizations (Mean = 3.43). To further bridge the communication gap, respondents highly favoured increasing the direct involvement of community leaders (Mean = 3.36), translating warning messages into local languages (Mean = 3.35), and organizing targeted public awareness campaigns (Mean = 3.35).

DISCUSSION

Diverse communication channels are used for early warning communication in these communities though the extent of usage favours digital and mass media. This is consistent with Olajide's (2023) study which identified Nigeria's warning systems as heavily centralized around federal agencies like NiMET and NiHSA. This top-down communication style is regarded as flawed in addressing the current needs of communities (Marchezini et al. 2018). The tailoring of communication to match the peculiarity of various communities can bridge the gap that exists in the current system (Baudoin et al., 2016). This tailoring process though expensive and administratively burdensome, has the potential to address the peculiar communication needs of these communities (Baudoin et al., 2016).

The current early warning system in Onuiyi and Ugwuoye is perceived to be ineffective. Factors affecting its effectiveness such as timing, reach and access are characteristic of the communication patterns of a centralized EWS (Kelman and Glantz, 2014). Rural areas are not prioritized in early warning systems and many individuals in these rural areas do not have access to mass media disseminated warnings (Olajide, 2023). This timing issue represents a major collapse in the dissemination and communication pillar of the UNDRR's (2017) Sendai framework for effective warning systems. As Oke, Amarnath and Cofie (2023) note, early warning is fundamental to early action. If warnings are delayed, even the most precise hydrological forecasts are ultimately useless for saving lives and property.

Several underlying challenges make this communication breakdown even worse. On a technical level, poor infrastructure, unreliable mobile networks severely limit how well alerts can travel. This matches the caution from Kelman and Glantz (2014) that it cannot be assumed modern technology is always reliable or accessible everywhere. Beyond technical challenges, socio-cultural barriers play a huge role as corroborated in Mustafa et al., (2015). Challenges like low literacy levels, and a failure to translate alerts into indigenous languages can affect disadvantaged groups like women and children (Mustafa et al., 2015).

A mix of different communication channels, translating messages into local languages, and bringing community leaders directly into the process is strongly advocated. This mirrors the first mile concept proposed by Kelman and Glantz (2014), which argues that putting vulnerable communities at the heart of the design process makes people much more likely to accept and act on warnings. While Olajide (2023) advances political communication, Marchezini et al., (2018) supports the adoption of citizen science programmes that blends scientific data with local realities and participation. Both of these approaches grounds EWS as a network of actors that shape social reality (Choo, 2009). This ultimately moves EWS to a socially grounded system recommended by the UNDRR.

CONCLUSION

Based on the results, the study concludes that the reliance on a centralized system and its characteristic top-down communication constantly clashes with the social realities of rural communities. When alerts are not timely, accessible, limited in reach and do not incorporate local languages, it is disconnected from the immediate survival needs of communities. Fixing this disconnect requires shifting disaster communication directly to the grassroots level. A successful warning system includes passing along meteorological data as well as giving people enough time to act. To make this happen, this system needs to move from a one-size-fits-all approach and start partnering directly with local communities. By incorporating the community as trusted messengers and ensuring that all alerts are translated into local dialects, the gap between high-level scientific forecasting and everyday community readiness can be bridged.

RECOMMENDATIONS

1. While using a myriad of channels, early warning communication should be tailored to the uniqueness of various communities.
2. EWS should be decentralized to improve the timing, reach and access of warning messages.
3. The socio-cultural and technical realities of communities need to be considered in designing an early warning communication system.
4. State and federal agencies should initiate participatory citizen science initiatives into their early warning communication framework.

Ethical clearance

Ethical consent was sought and obtained from the participants used in this study. They were made to understand that the exercise was purely for academic purposes, and their participation was voluntary.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Authors' Contributions

Dr. Emeka conceived the study with Sylvia and Chioma reviewing literature. Chime designed the study, Ebubechi and Jonathan administered and collated the data, and Adonai handled the analysis and interpretation, while so and so wrote the initial manuscript. All authors have critically reviewed and approved the final draft, and are responsible for the content and similarity index of the manuscript.

Data availability statement

The datasets on which conclusions were made for this study are available on reasonable request.

Artificial Intelligence (AI) Use Disclosure

The authors declare that no generative Artificial Intelligence (AI) or AI-assisted technologies were used in the writing, analysis, or preparation of this manuscript.

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