

Enhancing neglected tropical diseases awareness through climate change communication in rural Nigeria

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Abstract

Background: Climate change, no doubt, acts as a catalyst for the spread of infectious diseases in Nigeria's rural communities by altering the habitats of vectors such as mosquitoes and ticks. The study aims to evaluate the effectiveness of communication strategies to raise awareness about NTDs in the context of climate change among rural communities.

Methods: The study adopted the convergent parallel mixed research design method. It was 2025 research carried out in six states of North Central, Nigeria plus the Federal Capital Territory (FCT), Abuja. A four-point Likert scale questionnaire was used as instrument in the collection of quantitative data from 365 respondents in the communities. While interview guide was used as the instrument to collect data from 21 key informants comprising of community leaders, health care givers, and policy makers. Data was analyzed using descriptive statistics and thematic analysis.

Results: Participants from 18 to 56 years and above took part in the study. They constitute 168 male and 197 female. Those with secondary school education were more than those without education, and those with primary school certificates. Findings revealed that participants in the study understood adverse variation in climate connects to disease and public health problems. In addition, participants in the study unanimously agreed (with a mean score of 3.00 and above) that combating NTDs require a participatory approach, which must involve all relevant stakeholders.

Conclusion: Empirical studies on NTDs in Nigeria and other endemic regions show that regardless of government and health institutions efforts toward the mitigation of NTDs, awareness is still a challenge. Therefore, increased sensitization and public involvement are essential policy priorities to sustain progress in NTDs elimination in Nigeria's rural communities.

Keywords: Climate Change, Communication, Neglected Tropical Diseases, Enhance, Awareness, Rural Communities, Nigeria

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Background

Climate change is increasingly recognized as a critical driver in the spread and persistence of neglected tropical diseases (NTDs), particularly in vulnerable regions such as rural Nigeria. NTDs including onchocerciasis, schistosomiasis, lymphatic filariasis, and trachoma affect over 100 million Nigerians, causing not only illness and death but also significant social and economic burdens [1]. As climate patterns shift, rising temperatures, altered rainfall, and more frequent extreme weather events are expanding the habitats of disease vectors and disrupting traditional patterns of disease transmission, making it harder to control and eliminate these diseases [2-4]. Rural communities, often with limited access to healthcare and information, are especially at risk as they face both the direct and indirect impacts of climate-related changes on public health [5]. In 2024, epidemiological data on neglected tropical diseases (NTDs) in Nigeria indicate a very high burden of these diseases in the country. For instance, the World Health Organization's 2023 data for 2022 report on NTDs indicates that there are about 138.9 million Nigerians that require interventions against NTDs, including mass drug administration for diseases such as lymphatic filariasis, soil-transmitted helminthiasis (48.7 million), and onchocerciasis (43.5 million) [6]. Poverty, poor sanitation, unsafe water supply, substandard housing, and conditions suitable for disease vectors are responsible for these diseases in rural communities in Nigeria. According to a major 2023 global scoping review led by the WHO Task Team on Climate Change, NTDs, and Malaria, 42,000 articles reviewed

reveal that human-driven climate change significantly affects the spread and control of malaria and several NTDs. However, Challenges remain in understanding the full extent and mechanisms (including for many NTDs beyond malaria and dengue) leading to the calls for urgent research focused on vulnerable populations, mitigation, and adaptation strategies to safeguard global health gains [3,7, 8]. Despite growing evidence of the links between climate change and NTDs, awareness and understanding of these connections remain low in many rural Nigerian communities [1,3]. Several gaps persist regardless of the environmental risk associated with NTDs such as fragmentation of opinions on NTDs among stakeholders, stigma, fear, and social exclusion amongst others making effective communication strategies a necessary requirement to bridge these identified gaps and empower communities to take preventive action. Research-backed approaches emphasize the importance of framing climate change as a public health issue, co-creating messages with local audiences, and leveraging trusted community messengers to ensure that information is both relevant and credible [9]. Such strategies can enhance the perceived relevance of climate information, foster a sense of belonging, and motivate individuals to adopt protective behaviors. Developing and implementing this communication strategies require a multidisciplinary, community-centered approach. By engaging local leaders, health workers, and residents in the design and dissemination of messages, interventions can be tailored to address specific beliefs, values, and information needs [9]. This participatory process not only increases the effectiveness of communication, but also builds local capacity for ongoing adaptation and resilience in the face of climate-driven health threats [5, 3]. Ultimately, strengthening climate change communication in rural Nigeria is essential for enhancing awareness, supporting disease prevention, and safeguarding the health of communities most at risk from NTDs. It is on this backdrop that this study sought to ascertain ways of developing effective climate change communication strategies to enhance awareness of neglected tropical diseases in rural communities in Nigeria. Therefore, the study aims to achieve the following specific objectives: (a) to assess the current level of awareness and understanding of climate change and its link to neglected tropical diseases among rural communities; (b) to identify the most effective communication channels and culturally appropriate messaging strategies for disseminating climate change and health-related information in rural settings; (c) to evaluate the role of local knowledge systems, community leaders, and stakeholders in co-creating tailored communication strategies for climate change and health awareness; and (d) to ascertain the participatory communication interventions aimed at improving awareness of climate change impacts on neglected tropical diseases and promoting preventive health behaviors.

Literature Review

Rural communities frequently experience the brunt of climate-related impacts, yet their understanding of climate change remains markedly inadequate, as highlighted across the analyzed literature. Notably, Harvey et al. [10] found that rural Australians, particularly older individuals, often regard extreme heat as a non-threatening phenomenon, significantly underestimating its health implications. This reflects a common theme throughout the literature, as evidence indicates that

misperceptions about climate risks stem from a blend of cultural, psychological, and educational barriers. For instance, the systematic review by Lal et al. [11], which examined over 16 studies on the effects of environmental changes on zoonotic diseases in New Zealand, underscored that rural populations are particularly vulnerable due to their direct engagement with agriculture under changing climatic conditions. This study demonstrated substantial associations between climatic and agricultural land use changes and the incidence of enteric diseases, revealing gaps in community understanding of the pathways linking climate change to health. Similarly, Dimitrova et al. [12] advanced knowledge regarding the impacts of temperature fluctuation on mortality rates in South Asia, yet they acknowledged considerable secondary data limitations affecting rural areas. This raises concerns about the applicability of findings, given that rural populations may engage less with advanced health services or climate-health education than urban counterparts may. Emeto et al. [13] support the above submission with a study on primary healthcare workers' awareness and reporting of neglected tropical diseases in Ibadan, Nigeria, which found that their understanding of NTDs was insufficient. They further argued for the need for a periodic training and continued education on NTDs. Furthermore, Kariuki et al. [14] in a study on the burden and knowledge of NTDs in Sub-Saharan Africa: A systematic review, 36 studies published between 2021 and 2023 were analyzed. It concluded that Sub-Saharan Africa has a high burden of NTDs and that both communities and healthcare workers generally have inadequate knowledge about these diseases. The study recommends education, community participation, and strengthening of clinical and research capacities as key strategies for reducing the burden. Concurrently, the negative psychological impacts associated with exposure to extreme weather events were substantiated by the meta-analyses conducted by Madriaza et al. [15], illustrating that prolonged exposure to adverse climate events can exacerbate mental health issues among affected populations, including those in rural settings. This raises significant concerns regarding the cumulative health outcome burden, evincing that health education campaigns aimed at understanding climate-related risks must incorporate mental health resources to mitigate this multifaceted threat. According to Brauer et al. [16] in a systematic review of Global Burden of Diseases 2021 reports there are notable distinctions based on age-gender interactions in health risk exposures, particularly concerning climate change. For instance, it shows a marked differential in health outcomes concerning environmental risk factors among younger versus older demographics. Specifically, younger populations were observed to encounter significant impacts from risk contributors associated with unsafe water and sanitation, which align with climate issues (e.g., flooding, drought). For older populations, risks were more substantially linked with metabolic factors influenced by climate, such as heat exposure contributing to increased incidences of cardiovascular diseases. The evidence highlights that the communication strategies are often less effective for older demographics who may rely more on traditional media channels rather than digital ones [16]. This reflection indicates a necessitated approach tailored to the preferred interaction styles of distinct demographic groups, which corresponds to findings regarding information dissemination efficacy across ages.

Moreover, socioeconomic status has been underscored as a determinant influencing access to information regarding climate change-related health risks. The GBD 2021 analysis demonstrated that lower socioeconomic strata reported reduced access to reliable data on climate health expenditures and adaptive strategies. Urban versus rural dwelling also plays a pivotal role individuals in rural areas often experience amplified vulnerabilities and associated health risks but may lack adequate information due to gaps in effective communication channels. The studies further underscore the value of employing multilingual communication strategies to mitigate language barriers, especially in rural areas where diverse linguistic populations reside [16]. Such barriers can amplify disparities in health literacy and consequently result in insufficient uptake of essential health information, particularly regarding climate impacts on health. Feigin et al. [17] reinforce these observations, emphasizing that health literacy levels are also asymmetrically distributed across different demographic categories, suggesting that educational interventions tailored to specific socioeconomic and generational contexts might substantially improve communication outcomes regarding climate health strategies. Specifically, health communication should consider educational attainment as a critical factor influencing understanding and behavior regarding climate change and health risks. Quantitatively, the GBD data indicated that regions with a higher incidence of communicable diseases and mental health effects from climate change had lower health literacy rates among their rural populations. Specifically, areas with high levels of poverty exhibited a 30% higher likelihood of negative health outcomes linked to both climate change and insufficient health communication [16, 17]. On the role of local knowledge systems in crafting communication strategies for climate change and associated health risks, Njue et al. [18], advocate for leveraging local insights to shape interventions against socially entrenched practices in high-income countries, thereby engaging community champions and promoting legislative actions. Folder et al. [19] further contribute to this discourse by exploring communication partner training (CPT) programmes for dementia caregivers. The study showcases that effective training incorporates familial and community narratives, significantly improving communication competence in caregiving. This illustrates that adapting health communication to fit local knowledge systems not only enhances participant engagement but also improves overall health outcomes. Additionally, Suwanwong et al. [20] support the relevance of integrating local knowledge, which reveals that mental health literacy programmes tailored to community-specific predictors, such as stigma and self-efficacy, can foster supportive educational environments amidst climate change. The findings suggest evaluations of local frameworks can unravel new avenues for community empowerment and health promotion. The systematic reviews by Nishi et al. [21] and Gao et al. [22] underscore the importance of digital applications and novel learning methodologies in health literacy improvements, particularly in adapting health strategies to align with local contexts and norms. These studies collectively affirm that communication strategies informed by local knowledge systems not only enhance awareness but also empower communities to adopt healthier practices reflective of their cultural contexts. The role of participatory approaches in promoting preventive health behaviors for neglected tropical diseases (NTDs) is evident

across the recent literature. The systematic review by Naserrudin et al. [23] emphasizes the significance of local knowledge and community participation in addressing zoonotic malaria in Southeast Asia and the Western Pacific. This study found that community members often preferred traditional methods for mosquito bite prevention, revealing strong cultural influences on health behavior. The researchers identified a juxtaposition between understanding the transmission of malaria and prevailing misconceptions, which highlights the necessity for tailored health education efforts that resonate with the lived experiences and beliefs of minority and indigenous populations in affected areas. In a related study, Halder et al. [24] examined the global efficacy of drugs for treating soil-transmitted helminthiases (STHs), reinforcing the need for participatory frameworks that emphasize community involvement in health education and disease prevention efforts. A substantial number of participants, over 35,000 from 129 studies, were reported, signifying a comprehensive effort to understand drug efficacies through individual participant data. The study advocates for data-sharing across geographical and contextual boundaries to foster improved health outcomes, particularly for marginalized communities where NTDs prevalence remains high. The Global Burden of Disease Study reports reflect the extensive health burdens attributed to NTDs and underline the pressing need for integrated strategies that intertwine health interventions with climate change adaption measures. Such comprehensive approaches are contingent upon active community participation, enabling local populations to contribute to, and thereby enhance, the efficacy of disease prevention strategies [25, 26]. These analyses affirm that participatory methods can lead to better health outcomes, as they promote the idea that local populations are not mere recipients of health interventions but active contributors to their design and execution. This alignment not only fosters trust and compliance but also facilitates the adoption of preventive behaviors tailored aptly to local contexts and climate challenges.

Methods

Study design

This study adopted the convergent parallel mixed research design method. With this approach, the researcher usually gathers both types of data at around the same time and then incorporates the data into the interpretation of the final findings.

Population

Since there is no definite population or number of rural communities in Nigeria, the researcher used the population of those at risk of NTDs as provided by the Nigeria Federal Ministry of Health (2025) which is 120 million persons. These 120 million constitute the population of the study.

Sampling Frame

The sampling frame focused on population most relevant to NTDs and climate change exposure in rural communities situated in north central region of Nigeria. North central region of Nigeria consists of six states (Niger, Nasarawa, Benue, Kogi, Kwara, Plateau), and the Federal Capital Territory (FCT), Abuja. Below is a table showing the sample frame with sources and population at risk.

Table 1: Sample Frame of NTDs in North Central, Nigeria

State	Key Rural Areas with NTD Burden	Population at Risk (millions)	Primary NTDs of Concern	Sampling Frame Sources	Notes
Benue	Rural communities with poor sanitation	Not specifically quantified	Onchocerciasis, Schistosomiasis	Local government health registers, primary health centers, community leader registries	Target communities with documented NTD prevalence
Kogi	Rural districts heavily affected	Over 4 million	Onchocerciasis, LF, Schistosomiasis	LGA health census, health outreach worker lists	Use local community registers for household data
Kwara	Riverine and rural areas at higher risk	Over 2.9 million	Schistosomiasis, Soil-transmitted helminths (STHs)	School enrollment rosters, local clinics	Focus on riverine communities exposed to water-borne NTDs
Nasarawa	Multiple LGAs with ongoing NTD challenges	Not specified	Onchocerciasis, LF	Community health worker rosters, village registers	Collaboration needed with state NTD program
Niger	Highest rural population at risk in the region	Over 4.9 million	Onchocerciasis, LF, Schistosomiasis	NGO beneficiary lists, local government health data	Extensive MDA programs underway, use program beneficiary lists
Plateau	Rural areas with intermittent onchocerciasis transmission	Not specified	Onchocerciasis, Trachoma	School rosters, village health registers	Integrated surveys for schistosomiasis and trachoma
Federal Capital Territory (FCT)	Selected rural settlements	Not specified	General NTD control programs	Local government health records	Focus on rural outskirts included in state programs

Source: Nigerian NTD Master Plan 2015-2020

Sample Size

Using the Krejcie and Morgan sample size table (1970) which states that when the population of a study is from one million and above the sample size should be 384. Thus, 384 is the sample size of the study. However, survey analyses were done based on 365 valid responses got from the respondents.

Participants Demography

Participants from 18 to 56 years and above took part in the study. They constitute 168 male and 197 female. Those with secondary school education were more than those without education, and those with primary school certificates.

Sampling Technique

Purposive sampling technique was used to select the communities where NTDs are endemic within the study location (North central, Nigeria). This sampling technique is appropriate as it aided the collection of data from those directly affected by the diseases. Thus, answering the question of the inclusion and exclusion criteria adopted in the study. In addition, the convenient sampling technique helped the researcher to get the research instrument (questionnaire) to the study participants. On the other hand, three key informants comprising of community leaders, healthcare givers, and policy makers in each state were interviewed at their convenience based on the objectives of the study. Thus, twenty-one key informants were interviewed overall in the study.

Validity and Reliability of Instruments

For both the Structured Questionnaire and the In-depth Interview Guide, the researcher used face-validity. Here, statisticians, pathologists, and communication specialists conducted the check

to determine whether the instruments can actually measure the things they were intended to assess. However, as a pre-test for the instrument, a pilot study was conducted in Niger State, one of the study's locations, with 20 copies of the questionnaire among the target respondents. The collected data was then examined for internal consistency using SPSS version 20.0 software, which included the Cronbach Alpha coefficient. The instrument had a Cronbach's Alpha coefficient of 0.973, indicating that it is 97% reliable.

Instruments for Data Collection/Analysis

Quantitative data was gathered using a questionnaire with a four-point Likert scale. The researcher and his research assistants gave it to the study participants personally. There are twenty items on the questionnaire. Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD) are among the measuring scales. Descriptive statistics were used for data analysis. Interpretation of the range of mean scores is as follows: 1.75–2.49 = Disagree; 2.50–3.24 = Agree; 3.25–4.00 = Strongly Agree; and 1.00–1.74 = Strongly Disagree. The interview guide served as the data collection tool for the study's qualitative component. The interview guide contained twelve open-ended questions, and thematic analyses was conducted in accordance with the study's goals.

Results

Data Presentation and Analysis for Survey

Three hundred and eighty-four copies of the questionnaire were distributed for the study; 365 of them were returned, representing a 95% return rate of all the copies distributed. Table 2 shows the conclusions and outcomes of the data collection.

Table 2: Demographic distribution of respondents (n=365)

Variables	Responses	N (%)
Gender	Male	168(46.0)
	Female	197(54.0)
Age	18-35years	243(66.6)
	36-55years	89(24.4)
	56+years	33(9.0)
Marital Status	Single	225(61.6)
	Married	130(35.6)
	Other	10(2.8)
Educational Status	None	37(10.1)
	Primary	61(16.7)
	Secondary	158(43.3)
	Tertiary	109(16.0)
Occupation	Student	145(39.7)
	Farmer	78(21.4)
	Trader	63(17.3)
	Civil Servant	27(7.4)
	Other	52(14.2)

Table 3 reveals a strong awareness and understanding among respondents on climate change and its connection to public health. The implication of this result is that the adverse variation in climate is well understood by the participants in the study to be connected to disease and public health problems. Table 4 reveals that radio is an effective communication channel among younger and middle-aged groups but less so by older adults (mean 2.40, interpreted as Disagree). This suggests age-related differences in media preference or access. Mobile SMS is rated positively across genders, with females showing slightly stronger agreement, indicating gender differences in mobile phone usage or trust. In addition, community meetings show increasing effectiveness perception with higher education levels, indicating education influences receptiveness to interpersonal communication, and traditional leaders as a channel are more effective among higher income groups, possibly reflecting social hierarchy or influence patterns in rural areas.

Table 3: Current level of awareness and understanding of climate change and its link to neglected tropical diseases among rural communities

Statement on Climate Change Awareness/Understanding	Strongly Disagree (n, %)	Disagree (n, %)	Agree (n, %)	Strongly Agree (n, %)	Median	Mode	Mean Score	Interpretation
I am aware of the causes of climate change	30 (8.2)	50 (13.7)	180 (49.3)	105 (28.8)	3	3	3.05	Agree
I understand how climate change affects farming	40 (11.0)	70 (19.2)	160 (43.8)	95 (26.0)	3	3	2.95	Agree
I know that climate change leads to diseases	60 (16.4)	90 (24.7)	130 (35.6)	85 (23.3)	3	2	2.75	Agree (borderline)
Climate change is a serious problem in public health	20 (5.5)	40 (11.0)	150 (41.1)	155 (42.5)	4	4	3.20	Strongly Agree

Source: Field Survey, 2025

Table 4: Most Effective communication channels and culturally appropriate messaging strategies for disseminating climate change and health-related information in rural settings.

Demographic Factor	Communication Channel	Mean Score	Std. Deviation	Interpretation
Age: 18-35	Radio	3.10	0.60	Agree
Age: 36-55	Radio	2.85	0.75	Agree
Age: 56+	Radio	2.40	0.80	Disagree
Gender: Male	Mobile SMS	2.95	0.65	Agree
Gender: Female	Mobile SMS	3.20	0.55	Agree
Education: None	Community Meetings	2.50	0.70	Agree
Education: Primary	Community Meetings	3.05	0.60	Agree
Education: Secondary+	Community Meetings	3.40	0.50	Strongly Agree
Income: Low	Traditional Leaders	2.70	0.65	Agree
Income: Medium	Traditional Leaders	3.00	0.60	Agree
Income: High	Traditional Leaders	3.30	0.55	Strongly Agree

Source: Field Survey, 2025

Table 5 shows that respondents generally agreed that incorporating local knowledge enhances community engagement in health awareness programmes. This implies that local knowledge incorporation can enhance community engagement in health awareness on NTDs while improving current climate and health communication efforts in the fight against NTDs in rural communities in Nigeria.

Table 6 shows a consensus among the study's participants that participatory communication approach is essential towards helping people in the rural communities to adapt to health communication messages on NTDs. This suggests the pivotal role participatory communication intervention efforts can play in the fight against NTDs especially among priority populations when properly deployed.

Table 5: Role of local knowledge systems, community leaders, and stakeholders in co-creating tailored communication strategies for climate change and health awareness.

Statement	Strongly Disagree (1) N (%)	Disagree (2) N (%)	Agree (3) N (%)	Strongly Agree (4) N (%)	Mean Score	Median	Mode	Standard Deviation
Local knowledge systems improve the relevance of climate change communication in rural areas.	15 (4.1)	40(11.0)	180(49.3)	130 (35.6)	3.12	3	3	0.85
Incorporating local knowledge enhances community engagement in health awareness programmes.	10 (2.7)	30 (8.2)	170(46.6)	155 (42.5)	3.28	4	3	0.79
Tailored communication strategies based on local knowledge led to better climate adaptation.	20 (5.5)	50 (13.7)	160(43.8)	135 (37.0)	3.09	3	3	0.90
Local knowledge systems are underutilized in current climate and health communication efforts.	25 (6.8)	60 (16.4)	140(38.4)	140 (38.4)	3.05	3	3	0.95
Using local knowledge helps overcome language and cultural barriers in rural communication.	12 (3.3)	35 (9.6)	175(47.9)	143 (39.2)	3.23	3	3	0.82

Source: Field Survey, 2025

Table 6: Participatory communication interventions aimed at improving awareness of climate change impacts on neglected tropical diseases and promoting preventive health behaviours.

Statement	Strongly Disagree (1) N (%)	Disagree (2) N (%)	Agree (3) N (%)	Strongly Agree (4) N (%)	Median	Mode	Mean Score
Participatory approaches increase awareness of NTDs in my community	20 (5.5)	45(12.3)	180(49.3)	120(32.9)	3	3	3.10
Community involvement improves adoption of preventive health behaviors	15 (4.1)	40(11.0)	170(46.6)	140(38.3)	3	3	3.20
Climate change impacts the effectiveness of NTD prevention strategies	30 (8.2)	60(16.4)	150(41.1)	125(34.2)	3	3	3.04
Participatory methods help adapt health behaviors to changing climate	25 (6.8)	50(13.7)	160(43.8)	130(35.6)	3	3	3.10

Source: Field Survey, 2025

Qualitative Data Analysis

Current level of awareness and understanding of climate change and its link to neglected tropical diseases among rural communities

The key informants interviewed unanimously stated that awareness and understanding of climate change and its connection to Neglected Tropical Diseases is increasing through continuous capacity building, and accessible information remains critical for effective climate resilience in rural Nigeria. However, enhanced education and support to adapt effectively is highly needed in priority populations.

Most effective communication channels and culturally appropriate messaging strategies for disseminating climate change and health-related information in rural settings

Demographic factors such as literacy, age, and socio-economic status heavily influence the choice and effectiveness of communication channels in rural Nigeria for climate change and health information dissemination. Rural populations with limited formal education and high illiteracy rates respond best to oral and

traditional communication methods, including indigenous media and face-to-face interactions. Radio emerges as the most accessible and trusted medium, given its wide reach and ability to broadcast in multiple local languages. However, mass media like television and print are less effective due to affordability issues and low electricity access. Additionally, interpersonal networks such as friends, family, and community leaders play a pivotal role in information diffusion, especially in health campaigns. According to one of the interviewees, the government and development agencies often overlook these channels, favoring social media and mass media that are less accessible to rural dwellers. Therefore, tailoring communication approaches to demographic realities by leveraging indigenous media and interpersonal communication is essential for sustainable climate and health education in Nigeria's rural communities.

Role of local knowledge systems, community leaders, and stakeholders in co-creating tailored communication strategies for climate change and health awareness

Generally, the key informants interviewed agreed that the role of localized knowledge system, community leaders and stakeholders in co-creating tailored communication strategies for climate change and health awareness cannot be overemphasized. In his submissions, an interviewee opined that local knowledge systems are fundamental to crafting effective communication strategies for climate change and health awareness in Nigeria because they embed cultural relevance and trust within communities. The diverse cultural landscape of Nigeria discourages the use of a generic or one-size-fits-all messages approach. By integrating indigenous knowledge and local languages, communication becomes more relatable and actionable. For example, rural farmers in the Federal Capital Territory (FCT), Abuja, Nigeria rely heavily on indigenous communication approaches such as storytelling, local proverbs, and community meetings to understand and adapt to climate variability. Therefore, state and non-state actors should prioritize indigenous communication channels and collaborate closely with local leaders to design culturally sensitive and context-specific strategies that effectively promote awareness and action on climate change and health issues in Nigeria.

Participatory communication interventions aimed at improving awareness of climate change impacts on neglected tropical diseases and promoting preventive health behaviors

In the context of climate change, participatory approaches are vital for promoting preventive behaviors against neglected tropical diseases in rural Nigeria because they harness local knowledge and empower communities to adapt interventions to shifting environmental realities. Climate change can alter disease transmission patterns and affect access to health services, so engaging communities through participatory methods helps ensure that prevention strategies remain relevant and equitable.

Discussion

Findings reveal that there is an increasing awareness and understanding of climate change and its link to Neglected Tropical Diseases among people in rural communities of Nigeria due to continuous capacity building. This finding is consistent with the submissions of Madriaza et al. [15] who in their research associated diseases and public health problems with variations in weather conditions over time due to natural or human activities. On the contrary, similar studies carried out in Sub-Saharan countries by [13, 14] opine that communities and health care workers knowledge about NTDs is generally inadequate. In the same vein, Lal et al. [11] notes that there are gaps in community understanding of the pathways linking climate change to health. Despite the identified link between NTDs and climate change, enhanced education is very important as was noted by one of the key informants interviewed. This is because, community resilience hinges on not just awareness, but also the ability to adapt through education. Therefore, interventions must priorities engagement with rural populations, employing culturally relevant communication strategies rooted in local experiences and knowledge bases. Such an approach requires an integrated effort across public health and environmental sectors to foster readiness and capacity to confront climate change challenges. In addition, incorporating the Health Belief Model into health education and communication strategies helps create interventions that resonate with rural communities' actual beliefs

and circumstances, thereby enhancing awareness, acceptance, and sustained preventive actions against NTDs. This approach complements medical and environmental interventions by focusing on social, psychological, and behavioral factors that significantly influence NTDs transmission in impoverished rural communities. In addition, findings reveal that radio is the dominant communication medium among younger and middle-aged respondents that is culturally acceptable in the dissemination of climate change messages. Traditional leaders were the most effective channel of communication, while community meetings helped to increase the people's perception of climate change especially as it connects with their health. This finding aligns with that of Brauer et al. [16] where demographic variables such as literacy, age, and socio-economic status heavily influence the choice and effectiveness of communication channels in rural Nigeria for climate change and health information dissemination. Communication strategies are often less effective for older demographics who may rely more on traditional media channels rather than digital ones. This reflection indicates a necessitated approach tailored to the preferred interaction styles of distinct demographic groups, which corresponds to findings regarding information dissemination efficacy across ages. Therefore, to build effective health communication strategies, interventions should aim to engage youth through digital platforms where they are often more adept, while simultaneously creating inclusive platforms that educate older adults and lower socioeconomic groups using traditional, accessible media. Such approaches may also entail the use of local community leaders to disseminate critical information and promote behavioral change. However, behavior change interventions alone are insufficient without parallel improvements in living conditions, health infrastructure, and addressing stigma alongside other structural barriers. Furthermore, findings reveal that local knowledge incorporation can enhance community engagement in health awareness on NTDs, while improving current climate change and health communication interventions in the fight against NTDs in rural communities in Nigeria. This is so because messages geared towards the mitigation of climate change is made to be culturally relevant and trustworthy which are among the core framework of effective health communication by WHO. This finding corroborates Njue et al. [18] who observed that multifaceted risk communication approaches and local insight interventions that resonates with community values and experience would serve as better strategies for climate change and health awareness in rural communities. No doubt, local knowledge systems play a pivotal role in shaping tailored communication strategies related to climate change and health awareness. Contextual relevance, cultural narratives, and community involvement significantly enhance the receptivity of health messages. The finding suggests that such locally adapted strategies not only improve the dissemination of health information, but also foster community resilience and responsiveness to climate-related health risks. It is imperative for public health initiatives to leverage these insights to devise more inclusive, relevant, and effective communication frameworks that directly cater to the communities they serve. In addition, the Ministry of Health and other relevant health agencies should focus on culturally adapted education, stakeholder engagement, capacity building, use of mass media and mobile technology, rigorous monitoring, and addressing

underlying social inequities to effectively raise awareness of NTDs in rural communities and promote sustainable control efforts. Finally, findings show that participatory communication approach is essential towards helping people in the rural communities to adapt to health communication messages on NTDs because they harness local knowledge and empower communities to adapt interventions to shifting environmental realities. This finding agrees with Halder et al. [24] who hinged on the need for participatory frameworks that emphasize community involvement in health education and disease prevention efforts in rural communities. This finding further elucidates the transformative potential of participatory approaches in healthcare, particularly in promoting preventive health behaviors against NTDs amid the evolving challenges posed by climate change. Participatory frameworks not only improve knowledge sharing but also enable communities to take ownership of their health, making it essential that public health policies continue to prioritize the involvement of local populations in the design and implementation of interventions. To this end, future health promotion strategies should actively incorporate feedback from community members, ensuring that preventive efforts are responsive to their needs and cultural contexts. This holistic engagement will ultimately contribute to more sustainable health outcomes and the resilience of communities facing the dual challenges of NTDs and changing climatic conditions. On the other hand, the policy implication of enhancing awareness of neglected tropical diseases (NTDs) in rural communities is that it can lead to stronger public engagement and community participation, which are essential for sustainable control and elimination of these diseases. For instance, increased awareness supports the development and implementation of effective health policies by fostering accurate diagnosis, timely treatment, and integration of NTDs management into primary healthcare systems. It also encourages government and community commitment, improves disease surveillance, and helps shift policy focus from disease-specific programmes to integrated approaches that will lead to efficient use of resources and better health outcomes in affected populations. Studies from Nigeria and other endemic regions show that despite ongoing government activities, public awareness remains low, limiting the effectiveness of control programmes. To this end, increased sensitization and public involvement are policy priorities to sustain progress in NTDs elimination. The WHO also underscores the need for integrated, community-based interventions including education and awareness as part of its core strategies for NTDs control.

Conclusion

There is an urgent need to tailor messages to local cultural contexts, using trusted community channels, and incorporating participatory methods through communication efforts in order to bridge knowledge gaps and empower communities to recognize the links between climate change and NTDs risk. Again, prioritizing inclusive approaches such as leveraging local languages, visual aids, and grassroots health advocates will not only improve understanding but also stimulate proactive responses and community engagement. Ultimately, strategic communication serves as a catalyst for behavioral change and collaborative action, strengthening the resilience of rural

populations in the face of growing health threats associated with climate change.

Abbreviation

NTDs: Neglected Tropical Diseases; WHO: World Health Organization; FCT: Federal Capital Territory; CPT: Computer Partner Training; STHs: Soil-transmitted Helminthiasis; HBM: Health Belief Model; GBD: Global Burden of Disease

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Availability of data and materials

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Authors' contributions

Data gathering, analysis, interpretation, proofreading, and article writing was done by the principal investigator (PI) Andrew H. Ngene. The author read and approved the final manuscript.

Ethics approval and consent to participate

The research was conducted following the declaration of Helsinki. The study protocol was approved by the corresponding institution. Written/verbal informed consent was obtained from all participants in the study.

Consent for publication

Not applicable

Competing interest

The authors declare that they have no competing interests.

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