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The Role of Education in Community-Based Surveillance: Measuring Knowledge Improvement in Vaccine-Preventable Disease Detection and Reporting Amongst Community Stakeholders in the Federal Capital Territory, Nigeria

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Abstract

Background: Community-Based Surveillance (CBS) plays a critical role in the early detection and reporting of communicable and vaccine-preventable diseases, especially in resource-limited settings. However, limited community awareness and training often hinder effective participation. This study evaluates the impact of CBS training on disease detection knowledge and reporting practices among community members in Kwali and Abaji, Federal Capital Territory (FCT), Nigeria.

Methods: A quasi-experimental pre- and post-intervention design was employed involving 264 purposively selected community stakeholders (Kwali: n=144; Abaji: n=120). Participants included religious leaders, traditional rulers, health workers, and volunteers. A structured questionnaire assessing knowledge of CBS principles, disease symptoms, and outbreak reporting procedures was administered before and after the training. Data were analyzed using descriptive statistics and McNemar's test to determine statistically significant changes in knowledge.

Results: Post-training scores significantly improved across both locations. In Kwali, correct response rates increased from an average of 42.3% pre-test to 72.8% post-test. Abaji showed similar improvement, with scores rising from 40.5% to 74.1%. McNemar's test revealed statistically significant knowledge gains ($p < 0.05$) in 90% of the questions in Kwali and 100% in Abaji. Areas with the most improvement included vaccine-preventable diseases, surveillance components, and symptom recognition. A few knowledge areas, such as cholera and monkeypox symptoms, showed limited gains in Kwali.

Conclusion: CBS training significantly enhanced community members' knowledge and preparedness for disease surveillance in both Kwali and Abaji. The findings underscore the effectiveness of structured community education in strengthening grassroots public health systems. Continued investment in regular training, supportive supervision and close mentorship is recommended to sustain and deepen these gains.

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Keywords: Community-Based Surveillance, Vaccine-Preventable Diseases, Disease Detection, Public Health Training, Outbreak Reporting, Nigeria.

1. Introduction

1.1. Background of the Study

Infectious diseases remain a major public health threat, particularly in low-resource settings, with Nigeria experiencing recurrent outbreaks of vaccine-preventable diseases such as measles, yellow fever, cholera, and cerebrospinal meningitis (1). Community-Based Surveillance (CBS) is emerging as a critical strategy in enhancing surveillance of priority diseases especially in African countries based on the IDSR strategy adopted by many African countries. CBS involves the engagement of local residents by training them in the identification and reporting of suspected cases of epidemic prone disease thereby playing a critical role in outbreak control. When local leaders are trained on identification and reporting of vaccine preventable diseases, it facilitates the early recognition of these diseases within the community and leads to timely response, thereby reducing the associated morbidity and mortality. For example, it has been shown to be instrumental in efforts to eradicate polio and combat Ebola, demonstrating its value in strengthening disease surveillance (2).

While surveillance systems are essential for early detection and outbreak prevention, their effectiveness is often hindered by gaps in community participation and reporting leading to undetected outbreaks in communities (3). In addition, despite its proven benefits, many communities still lack adequate training, limiting their ability to contribute effectively to public health interventions (4). In addition, there are few studies which have shown knowledge improvement amongst community members trained on community-based surveillance, which is core in the effective implementation of this strategy (5).

This study is significant as it provides critical insights into the effectiveness of community-based surveillance (CBS) training in improving disease detection and reporting among community members. Strengthening CBS is essential for enhancing early detection and response to vaccine-preventable and communicable diseases, ultimately contributing to improved public health outcomes. By evaluating changes in knowledge and reporting practices following CBS training, the findings from the study will provide evidence that informs public health practice and helps policymakers design more effective community-driven interventions.

Additionally, the use of a comparative analytic approach aims to highlight regional differences in knowledge retention and reporting behaviors, allowing for tailored training programs that address specific community needs. This research also promotes sustainable health practices by emphasizing the role of community members in disease surveillance and outbreak prevention. Furthermore, the study contributes to the growing body of scientific literature on CBS, providing empirical evidence that can support future research and policy formulation in public health surveillance systems.

The specific objectives of this study therefore are to assess community members' baseline knowledge of community-based surveillance (CBS) and vaccine-preventable diseases symptoms, evaluate the impact of CBS training on community members' knowledge by comparing pre- and post-training knowledge levels between the participating communities.

2. Material and methods

2.1. Study Area

The Federal Capital Territory is the seat of government and features many government institutions and agencies, commercial areas and international organizations. It has a projected population of over 7 million people as it is estimated to have a growth rate of 9.3% which is the highest in the country. Unlike other states which are divided into local government areas, the FCT, is politically divided into 6 area councils and 62 wards. The area councils are Abaji, Bwari, Gwagwalada, Kuje, Kwali and Abuja Municipal Area Council.

The FCT has a heterogenous population with gbagi and hausa being the predominant language. The FCT has a mix of urban and rural economies, however, it is predominantly urban, with the Abuja municipal area council as its central area. Many rural settlements exist in surrounding areas, including Kwali, Bwari, Kuje, and Abaji, where traditional lifestyles and farming are prevalent.

The FCT has a surveillance structure in place which begins with community informants who are linked to health facilities called the surveillance focal sites. The community informants are periodically trained on identification of epidemic prone diseases and reporting. They are expected to report rumours or alerts of vaccine preventable diseases to the health facilities. The health facilities clustered within an area council then reports to the area council diseases surveillance and notification officers who verifies the alert and investigates if the alert is verified as true. The DSNO reports to the state and the state to NCDC.

2.2. Sampling Technique

A multistage sampling technique was used in this study to select the study participants.

- Stage 1: A line list of the 6 area councils in the FCT was developed from 2 two area councils (Kwali and Abaji) were randomly selected.
- Stage 2: From each selected area council, all the clusters in which the training would occur were selected.
- Stage 3: All participants who showed up as community key informants based on their status as either healthcare workers, community leaders or volunteers in the primary health facilities were recruited into the study.

2.3. Study Design

A quasi-experimental was used to evaluate the impact of the training on disease detection and reporting among community members regarding knowledge improvement.

2.4. Study Population

The study population were community members which include traditional leaders, healthcare workers, women leaders and other key members of the community.

2.5. Inclusion Criteria

Community members who were available to participate in the training and serve as community informants.

2.6. Exclusion criteria:

Community informants who did not show up for the training in the two selected area councils.

2.7. Sample Size Determination

A total of 264 study participants were recruited into the study with 120 from Abaji and 144 from Kwali. These were the participants who showed up for the training in both area councils.

2.8. Data Collection

Structured questionnaires were administered before and after a training on community-based surveillance. The questionnaire assessed Knowledge of CBS, Identification of vaccine-preventable diseases, Recognition of symptoms of priority communicable diseases and Disease reporting practices. The data were subsequently entered into an excel and subsequently cleaned for analysis.

2.9. Data Analysis

Pre- and post-test data were analyzed using descriptive statistics for each of the area councils. The performance of the participants for each question asked were expressed in frequencies and proportions. A comparison of the pre and post test scores were assessed for statistical significance using the Mc Nemar Test and p-values greater than 0.05 were considered statistically significant.

2.10. Ethical consideration

Ethical approval was obtained before data collection, and informed consent was secured from all participants. Confidentiality and anonymity were maintained, ensuring no personally identifiable information was disclosed. Participation was voluntary, with the right to withdraw at any time. Data were securely stored and used solely for research purposes.

3. Results and discussion

The sex distribution of participants across both councils were strongly male-dominated, Kwali 81.3% and Abaji 81.7%. While the majority of the participants in Kwali were concentrated within the age group 36–45 (40.3%) and 26–35/≥46 (both 29.9%), Abaji skewed older with 46+ highest at 37.5%, then 36–45 at 27.8% and 26–35 at 18.1%. Majority of the participants in Abaji had substantially higher tertiary education (48.3%) versus Kwali (26.4%); Kwali had more with primary education (34.7%) compared with Abaji (10.8%). There was similar representation of religious leaders (~21%) and traditional rulers (~13–15%) in both councils. Patent Medicine Vendors present only in Kwali (5.6%); community health workers, traditional healers, women/youth leaders appear in both, but at modest proportions (generally <12%).

Table 1 Sociodemographic characteristics of the respondents

Variables	**Kwali (n=144)**	**Abaji n=(120)**
	Frequency (%)	Frequency (%)
Gender		
Male	117 (81.25)	98 (81.7)
Female	27 (13.02)	22 (18.3)
Age		
26-35	43 (29.9)	26 (18.1)
36-45	58 (40.3)	40 (27.8)
46 and above	43 (29.9)	54 (37.5)
Education		
No formal education	5 (3.5)	9 (7.5)
Primary education	50 (34.7)	13 (10.8)
Secondary education	51(35.4)	40 (33.3)
Tertiary education	38 (26.4)	58 (48.3)
Role in the Community		
Religious leader	31 (21.5)	30 (20.8)
Traditional ruler	19 (13.2)	21 (14.6)
Community health worker	6 (4.2)	9 (6.3)
Traditional healer	15 (10.4)	10 (6.9)
Bone Setter	4 (2.3)	3 (2.1)
Patent Medicine Vendor	8 (5.6)	0
Women Leader	17 (11.8)	9 (6.3)
Youth leader	14 (9.7)	10 (6.9)

Table 2 This showcases the pre & post training performance of the participants with regards to disease identification & reporting in Kwali Area Council. The largest absolute knowledge gains with respect to disease identification were around examples of vaccine-preventable diseases: +58.8% (41.2 → 100%), Diphtheria symptoms: +45.1% (54.9 → 100%), Measles symptoms: +36.8% (47.9 → 84.7%) and Yellow Fever: +28.5% (61.8 → 90.3%). While several items moved to 100%, Monkeypox knowledge slightly declined -3.5% (75.7 → 72.2) and Cholera showed marginal gain +1.4% (88.2 → 89.6). For the reporting domain, notable gains were observed for questions that bordered on tools for reporting: +29.8% (54.2 → 84.0%), Effective prevention measures +26.9% (25.0 → 51.9%), Surveillance frequency: +26.3% (68.1 → 94.4%) and Critical reporting information: +9.1% (82.6 → 91.7%). Who to notify changed little (+0.7%).

Table 2 Pre and post training performance of participants based on disease identification & reporting in Kwali Area Council

Question	Pre-Training (%)	Post-Training (%)	Knowledge Change (%)
Disease Identification			
What is community-based surveillance?	61.7	66.7	5
Primary purpose of community-based surveillance?	52.1	69.9	17.8
Essential components of disease surveillance?	25	43.1	18.1
Examples of Vaccine-preventable diseases?	41.2	100	58.8
What are the key Measles symptoms?	47.9	84.7	36.8
What are the key Yellow fever symptoms?	61.8	90.3	28.5
What are the key Diphtheria symptoms?	54.9	100	45.1
What is the Neonatal tetanus cause?	71.5	90.3	18.8
What are the key Cerebrospinal meningitis symptoms?	66.7	89.6	22.9
What are the key Acute flaccid paralysis symptoms?	75.7	96.5	20.8
What are the key Monkeypox symptoms?	75.7	72.2	-3.5
What are the key Cholera symptoms?	88.2	89.6	1.4
Fever and rash in a child (Likely disease)?	88.2	100	11.8
Sudden weakness in legs (Likely condition)?	80.6	100	19.4
Multiple cases of diarrhea after drinking water (Likely disease)?	81.3	100	18.7
Disease Reporting			
Who to notify first in an outbreak?	87.5	88.2	0.7
Critical information when reporting?	82.6	91.7	9.1
Tools for reporting diseases?	54.2	84	29.8
Effective disease prevention measures?	25	51.9	26.9
Surveillance frequency?	68.1	94.4	26.3

Table 3: This showcases the pre & post training performance of the participants with regards to disease identification & reporting in Abaji Area Council. The largest absolute knowledge gains for disease identification were around Surveillance frequency: +41.7% (32.5 → 74.2%), who to notify (reporting): +38.3% (36.7 → 75.0%), Primary purpose of CBS: +32.2% (36.1 → 68.3%), Yellow fever symptoms: +30.0% (42.5 → 72.5%), Essential surveillance components: +25.0% (43.5 → 68.5%), Neonatal tetanus & CSM: +26.7% and +25.2% respectively. There were moderate knowledge gains across many clinical items such as Vaccine-preventable diseases +22.0%; Diphtheria +23.9%; AFP +18.3%; Cholera +14.2%; measles +16.6. Minimal knowledge gain was noted for symptoms of Monkeypox +6.7%; fever & rash +7.5%; sudden weakness +11.7%. Overall, the participants in Abaji showed larger improvements in reporting-related knowledge (who to notify, surveillance frequency, and reporting tools) compared with baseline.

Table 3 Pre and post training performance of participants based on disease identification & reporting in Abaji Area Council

Question	Pre-Training (%)	Post-Training (%)	Knowledge change (%)
Knowledge of community-based surveillance			
What is community-based surveillance?	50.8	71.7	+20.9
Primary purpose of community-based surveillance?	36.1	68.3	+32.2
Essential components of disease surveillance?	43.5	68.5	+25.0
Disease Identification			
Vaccine-preventable diseases?	40.1	62.1	+22.0
Measles symptoms?	59.2	75.8	+16.6
Yellow fever symptoms?	42.5	72.5	+30.0
Diphtheria symptoms?	32.8	56.7	+23.9
Neonatal tetanus cause?	35.8	62.5	+26.7
Cerebrospinal meningitis symptoms?	35.6	60.8	+25.2
Acute flaccid paralysis symptoms?	59.2	77.5	+18.3
Monkeypox symptoms?	53.3	60.0	+6.7
Cholera symptoms?	60.0	74.2	+14.2
Fever and rash in a child (Likely disease)?	59.2	66.7	+7.5
Sudden weakness in legs (Likely condition)?	60.8	72.5	+11.7
Multiple cases of diarrhea after drinking water (Likely disease)?	56.7	74.2	+17.5
Diseases Reporting			
Who to notify first in an outbreak?	36.7	75.0	+38.3
Critical information when reporting?	40.5	66.7	+26.2
Tools for reporting diseases?	48.3	74.2	+25.9
Effective disease prevention measures?	43.8	66.7	+22.9
Surveillance frequency?	32.5	74.2	+41.7

All listed identification items show statistically significant improvements in both councils (p-values mostly <0.0001) except for Cholera in Kwali ($p = 0.1556$) despite a small +1.4% change and Monkeypox in both area councils. Although there were small but negative change in Kwali (Knowledge change Kwali -3.5%, $\chi^2 = 5.04$, $p = 0.0248$) and modest positive change in Abaji (+6.7%, $p = 0.0046$). The Biggest significant changes were seen in examples of vaccine-preventable diseases: Kwali +58.8% (χ^2 84.6, $p < 0.0001$); Abaji +22.0% (χ^2 26.4, $p < 0.0001$).

Table 4 Statistically Significant Differences in the proportion of knowledge improvement based on disease identification in Kwali and Abaji Area Councils

	KWALI			ABAJI		
Question	Knowledge change (%)	χ^2	p-value	Knowledge change (%)	χ^2	p-value
What is CBS?	5	7.2	0.0073	20.9	25.1	<0.0001
Primary purpose of CBS	17.8	25.6	<0.0001	32.2	38.6	<0.0001
Surveillance components	18.1	26.0	<0.0001	25.0	30.0	<0.0001
Examples of Vaccine-preventable diseases	58.8	84.6	<0.0001	22.0	26.4	<0.0001
What are the key Measles symptoms?	36.8	52.9	<0.0001	16.6	19.9	<0.0001
What are the key Yellow fever symptoms?	28.5	41.0	<0.0001	30.0	36.0	<0.0001
What are the key Diphtheria symptoms?	45.1	64.9	<0.0001	23.9	28.7	<0.0001
What is the Neonatal tetanus cause?	18.8	27.1	<0.0001	26.7	32.0	<0.0001
What are the key Cerebrospinal meningitis symptoms?	22.9	32.9	<0.0001	25.2	30.2	<0.0001
What are the key Acute flaccid paralysis symptoms?	20.8	29.9	<0.0001	18.3	21.9	<0.0001
What are the key Monkeypox symptoms?	-3.5	5.04	0.0248	6.7	8.0	0.0046
What are the key Cholera symptoms?	1.4	2.02	0.1556	14.2	17.0	<0.0001
Measles diagnosis	11.8	16.9	<0.0001	7.5	9.0	0.0027
AFP diagnosis	19.4	27.9	<0.0001	11.7	14.0	0.0002
Cholera diagnosis	18.7	26.9	<0.0001	17.5	21.0	<0.0001

Table 5: Statistically significant differences in disease reporting (Kwali vs Abaji) With regards to disease reporting and notification, Abaji showed very large, statistically significant improvements across reporting items (all $p < 0.0001$): Who to notify: +38.3% (χ^2 45.96), Surveillance frequency: +41.7% (χ^2 50.04). Reporting information, tools, prevention measures: all ≥+22.9% with strong χ^2 and $p < 0.0001$. Kwali improvements were significant for most reporting items except "Who to notify" which had minimal knowledge change +0.7% which was not statistically significant ($p = 0.3154$). The most substantial and statistically significant gains in Kwali area councils were seen in reporting items such as Reporting tools (+29.8% , χ^2 42.91, $p < 0.0001$), Prevention measures (+26.9%, χ^2 38.74, $p < 0.0001$) and Reporting information (+9.1%, χ^2 13.10, $p = 0.0003$).

Table 5 Statistically Significant Differences in the proportion of knowledge improvement based on disease reporting in Kwali and Abaji Area Councils

Question	KWALI			ABAJI		
	Knowledge change (%)	χ^2	p-value	Knowledge change (%)	χ^2	p-value
Who to notify	0.7	1.01	0.3154	38.3	45.96	<0.0001
Reporting info	9.1	13.10	0.0003	26.2	31.44	<0.0001
Reporting tools	29.8	42.91	<0.0001	25.9	31.08	<0.0001
Prevention measures	26.9	38.74	<0.0001	22.9	27.48	<0.0001
Surveillance frequency	26.3	37.87	<0.0001	41.7	50.04	<0.0001

Key overall takeaways

- Training produced substantial, statistically significant improvements in knowledge for most disease identification and reporting items in both councils.
- Kwali had dramatic gains on specific clinical identification items that reached 100% for some answers (vaccine-preventable diseases, diphtheria), but little change on the question "who to notify."
- Abaji showed larger, significant improvements in reporting and surveillance practice knowledge (notably who to notify and surveillance frequency).
- Monkeypox knowledge did not improve in Kwali (small decline) and improved only modestly in Abaji; cholera showed minimal improvement in Kwali and moderate gain in Abaji.

4. Discussion

The findings of this study showed that majority of the participants were males, where in both area councils, 8 out of every 10 participants were men. This can be explained by the fact that majority of the participants were religious and traditional rulers, which are positions in the society that are usually male dominated. Similar observations have been reported in Nigeria's surveillance workforce, where male dominance persists among DSNOs and community informants (6,7). However, there is a need to include more women as key informants, educating them as well on community case definition of epidemic prone diseases. This is because they are usually the primary caregivers of household members who fall ill and would certainly be able to recognize increases in the number of reported cases of vaccine preventable diseases when there is an outbreak (8,9).

Compared to the participants in Kwali Area Council who had a lower level of education, those in Abaji had a higher level of education with the majority having attained tertiary level of education. As shown in similar studies, higher education has implications for faster assimilation and retention of knowledge gained for practice (10,11). Evidence from Edo and Anambra States confirms that education level correlates with improved recognition of syndromes and preventive practices (12,13).

This study also revealed that there was large knowledge gain with respect to disease identification around examples of vaccine preventable diseases in both area councils, evidenced by majority of the question items moving to 80-100%. This has been corroborated in similar studies, which showed improvement in knowledge of community-based definitions for several epidemic prone diseases (14,15). While it was observed that there was a decline in knowledge of case definition for Monkeypox in Kwali, there was a minimal improvement (+6%) observed in Abaji. This reflects challenges in community recognition of Monkeypox, which have been documented in Nigeria (16,17). Cholera also showed minimal improvement in Kwali, consistent with reports of local perceptions of diarrheal illness frequently blur distinctions between cholera and other similar conditions (18)

Overall, the knowledge gain should be able to translate into more rapid detection of diseases and reporting for prompt public health actions. While there were improvements in the knowledge of reporting systems (who to notify, reporting information and reporting tools) in both area councils, overall, the participants in Abaji showed larger improvements in reporting related knowledge compared with baseline. Similar CBS trainings in Nigeria have demonstrated significant post test improvements in reporting pathways and surveillance frequency (19,20). However, Kwali Area Council had minimal change on “who to notify.” This is critical as unclear reporting channels delay outbreak verification and case investigation (21).

In terms of disease identification, reporting and surveillance frequency, both area councils showed statistically significant differences with Abaji showing larger statistically significant differences. This implies that the sensitization impacted knowledge. This therefore means that the method of delivery of knowledge was effective and there was actual knowledge transference which has the potential for rapid disease identification, reporting and documentation. However, there remains the need to provide further clarity to the participants on the case definitions for Monkeypox and cholera (16,18).

The public health implications of these findings are substantial. Enhanced surveillance by training community stakeholders equips them with the requisite skills and knowledge that facilitates community participation for early diseases identification and notification. Thus, it leads to early identification of emerging health threats, better allocation of resources, and more timely public health responses. This not only supports improved health outcomes but also strengthens the overall resilience of the public health system.

The key recommendations therefore include targeted refresher in Kwali on “who to notify”. This should emphasize immediate reporting for priority syndromes, weekly/zero reporting routines, and critical data elements; use IDSR job aids and drills. Focused modules on mpox and cholera case recognition by deploying visual rash atlases, localized symptom phrasing, stigma-sensitive risk communication, and clear sample/verification pathways. Gender-inclusive informant recruitment by increase female community informants and pair mixed-gender teams to improve household access, trust, and case-finding sensitivity. Education-tailored materials, using simplified, pictorial case definitions and plain-language reporting guides in Kwali; leverage higher-education assets in Abaji for peer mentoring. Sustainment of the gains of the training through close supportive supervision systems and mentorship.

4.1. Study Limitation

This study only measured the change in knowledge of the participants’ pre and post training as it relates to disease detection, reporting, documentation and prevention. These may not translate into actual practice. However, this study has provided statistical evidence to show that structured community-based training carries great potential to improve knowledge of participants from grassroot communities and should be invested in by policy makers. This is because it has great public health implications for the health security of the nation. There is need for further research to ascertain if the knowledge gain resulted to improved identification and reporting of alerts of vaccine preventable diseases by the key informants in their communities.

5. Conclusion

The study has provided evidence to show that CBS training significantly enhanced community members’ knowledge and preparedness for disease surveillance in both Kwali and Abaji. The findings underscore the effectiveness of structured community education in strengthening grassroots public health systems. It also highlights the gaps in inclusive participation, particularly the contributions of women as in health security at the grassroot in these communities. Sustained investment in regular capacity building, community engagement, and continuous supportive supervision and mentorship will be essential to deepen the gains in knowledge for it to effectively translate into practice. Ultimately, reinforcing surveillance systems at community levels offers Nigeria a pathway to safeguard public health, mitigate future epidemics, and strengthen overall health security.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

Contribution of authors

Muoghalu Ebere Favour and Momoh Jenny Adonoreli conceptualized and designed the study, coordinated field implementation, and supervised data collection. Muhammad Abdulrahman contributed to study design, data analysis, interpretation of results, and drafting of the manuscript.

Balami Kumshida Yakubu, Oyeniyi Benjamin Shola, and Lukman Ademola Lawal supported training delivery, monitoring of community-based surveillance activities, and review of the study methodology.

Okonkwo Lawrence Ikechukwu, Thomas Emmanuel, Moses Matawa, Yakubu Emmanuel, and Tuosel Audu facilitated community mobilization, participant recruitment, and data collection at the Area Council level. Ishak Mohammed provided technical oversight on surveillance content, contributed to data interpretation, and critically reviewed the manuscript for intellectual content.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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