

Original Article

Assessing the role of training in improving knowledge of cervical cancer and screening competency among rural healthcare workers

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Abstract

Background: Low- and middle-income countries face a high cervical cancer burden but have limited preventive programs, such as cervical screening, often restricted to tertiary hospitals with trained staff. This study evaluated the cervical cancer knowledge of rural healthcare workers in a northeastern Nigerian community and the impact of training on their screening skills. **Methodology:** Eighteen female community health extension workers and women's health providers were trained on cervical cancer screening, with a focus on risk factors, prevention, and sample collection. Cervical smear preparation was also demonstrated. Pre- and post-training questionnaires assessed changes in knowledge. Smears were examined for adequacy. Data were analyzed using SPSS with significance at $p < 0.05$. **Results:** Most (61.1%) participants had good pretest knowledge, identified HPV as a cause, and recognized risk factors like sexual activity and HIV infection, symptoms like abnormal vaginal discharge and bleeding, and Pap smear as an effective screening method. Post-training, 88.9% (16/18) showed significant improvement in knowledge ($p = 0.026$). Knowledge was independent of professional cadre ($p = 0.784$). Cytology smears were adequate in 86.7%. **Conclusion:** Training CHWs can empower them to support cervical screening in resource-limited communities, thereby strengthening screening coverage.

Keywords: Cervical cancer screening; Community healthcare worker; Northeast Nigeria; Under-resourced communities

Introduction

Cervical cancer is one of the most preventable cancers and can be successfully treated if it is detected early.

Annually, approximately half a million new cases and about a quarter of a million deaths are reported

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globally.¹ Since the introduction of the Papanicolaou screening test for cervical smears in the 1950s, countries that implemented this programme at the population level have witnessed a decline in cervical cancer rates.² For example, a decrease of over 50% in incidence and mortality rates has been reported in the United States over the past 40 years, largely due to the widespread adoption of screening via Pap tests.³ Thus, over 42 years (1975–2017), the United States has seen a reduction in the rate from 15 per 100,000 to approximately 8 per 100,000.⁴

In addition to the cytology technique, tests for the detection of high-risk human papillomavirus (hrHPV) and visual inspection with acetic acid (VIA) or Lugol's iodine (VILI) are also used in cervical screening in resource-limited settings. The VIA and VILI methods allow for on-the-spot treatment of observed precancerous lesions, addressing the challenges of recall and loss to follow-up associated with cytology and hrHPV testing, although they share similar sensitivity with cytology testing.^{5,6} Co-testing is also recommended in a triage setting to enhance the overall diagnostic and treatment objectives of the procedure.⁷

Cervical cancer remains a pressing public health issue in low- and middle-income countries (LMICs), where screening rates are suboptimal. Screening comes at an enormous cost in terms of funding and human resources. For example, it is estimated that annually, approximately USD 9 billion is spent on screening and treating HPV-related lesions in the United States.⁸ Most countries in LMICs are not able to afford this enormous health budget. Together with the cost comes the issue of infrastructural and personnel deficits in LMICs, which make operationalising any such preventive scheme difficult.⁹ Therefore, innovative approaches are needed that include cost reduction and community-adaptable screening methods to increase screening uptake.

The cervical cancer screening rate is low in Nigeria, hovering at approximately 9% overall.¹⁰ A key strategy for scaling up uptake in rural communities is integrating cervical screening services into the primary healthcare system. Through culturally appealing mechanisms, spearheaded by community health workers, screening uptake can be reasonably improved among diverse groups of women cost-effectively.¹¹

Although Nigeria has a primary health care (PHC) system in place, there are no standard guidelines for cervical screening implementation at this level of care in the country. A study of four primary healthcare

centres in Ibadan, southwestern Nigeria, by Ndikom *et al.* revealed that cervical screening services were not a part of their promotional health talks.¹² Onyenwenyi *et al.* reported that cervical cancer prevention services were not carried out at a PHC centre in Sango, Southwest Nigeria, and that healthcare workers lacked knowledge about cervical screening.¹³ However, PHC is the closest level of care to the community and predominantly serves the rural populace, where most Nigerians live.¹⁴ The absence of this service in health centres would deny many eligible women access to this preventive care.

Northeast Nigeria has a high burden of HPV infection among women.¹⁵ Screening rates are poorly reported, ranging from approximately 2.9% in a population survey to 9.9% among women attending antenatal clinics in tertiary hospitals.^{16,17} Data also show that the region has the lowest number of gynaecologists in Nigeria.¹⁸ Therefore, there is an urgent need to mobilise the local health workforce through capacity building to fill this gap.

Whereas evidence shows a low cervical screening rate in northeastern Nigeria, there is a paucity of literature focusing on addressing the human infrastructural deficit through training primary healthcare workers in the region. This study investigated the clinical knowledge of cervical cancer and the impact of training on practical cervical screening skills among rural healthcare workers in a northeastern Nigerian community. The findings highlight intervention opportunities that will help address screening deficits in the region and similar resource-limited communities.

Materials and Methods

This interventional study was designed to train female primary healthcare workers in Azare, a community in the Katagum Local Government Area of Bauchi State, Nigeria.¹⁹ It has six primary health centres, a general hospital and a tertiary hospital. Multiple ethnic groups live in the area—mainly Hausa, Fulani and Kanuri—with Islam being the predominant religion.²⁰ Eighteen female healthcare workers, comprising 13 primary health care workers (PHCWs), two nurse practitioners from the General Hospital, and three midwives from the tertiary hospital, participated in the training. All the participants were involved in providing family planning services and/or women's healthcare in their facilities, a key inclusion criterion. The training was a one-day event which emphasised cervical cancer aetiology, risk factors, preventive measures, hrHPV, conventional Pap smears, and liquid-based cytology sample collection and

preparation, as well as visual inspection with acetic acid or Lugol's iodine. The participants engaged in hands-on drills for HPV and Papanicolaou cervical sample collection, preparation, and preservation. De novo semi-structured pre- and post-training questionnaires containing 18 data items, scored 1 for correct and 0 for incorrect responses, were administered to evaluate the training's impact on their knowledge about cervical cancer and its prevention. Participants were taught how to obtain consent, prepare participants, assemble the sample device, position subjects, perform pelvic examinations, use a speculum, and identify the cervix. After sample-taking demonstrations, trainees were supervised in sample collection from women who had been counselled and consented to cervical screening at the clinic.

The training transitioned to a community outreach organised at one of the PHCs, where the trainees participated in cervical sample collection from consented participants. The cytology smears prepared by the trained participants were stained with Papanicolaou stain according to a standard laboratory protocol and were interpreted by a pathologist. The criteria for determining adequate and satisfactory cytology smears were adapted from the Bethesda System for Reporting Cervical Cytology.²¹ and summarised in the supplementary table below

Data analysis was conducted via the Statistical Package for Social Sciences (SPSS) version 20. Categorical variables were analysed with summary statistics, including proportions and percentages. The Wilcoxon rank test (exact) was utilised to assess the

difference in knowledge about cervical cancer and its prevention between the pre- and post-test responses. Furthermore, Fisher's exact test was used to test the associations between participants' cadre and their knowledge of cervical cancer. A p-value of <0.05 was set as the acceptable level of statistical significance.

Ethics approval and consent to participate

This study was approved by the Ethics, Research and Review Committee of the Federal University of Health Sciences Teaching Hospital, Azare. All participants gave written informed consent to participate in this study. No participant-identifying information was collected for this study. All data obtained were reviewed to ensure anonymity before analysis.

Results

Pre-training test outcomes on knowledge about cervical cancer

Table 1 illustrates the trainees' baseline confidence levels. Moderate confidence was noted regarding the causes, risk factors, and symptoms of cervical cancer. The majority (66.7%) expressed uncertainty about treatment options for cervical cancer, whereas a significant proportion (55%) reported a lack of confidence in knowledge about screening modalities. Table 2 presents the participants' responses before and after training, highlighting changes in their perceptions across various topics. Notable knowledge shifts were observed regarding the relationships among HIV, sexual intercourse, HPV, and cervical cancer. In all, 61.1% (11/18) demonstrated good knowledge in the pretest about cervical cancer, correctly identifying HPV as a cause and sexual intercourse and HIV infection as risk factors for the disease.

Supplementary table: Criteria for determining satisfactory conventional cytology smears

Criteria	Satisfactory smear	Unsatisfactory smear
Adequacy (No of squamous cells)	8,000-12,000 cells	< 8,000 cells*
Endocervical/Transformation zone (EC/TZ) cells**	± presence of EZ/TZ cells	± presence of EZ/TZ cells
Cytolysis	Nearly every cell on the slide has cytoplasm	Nearly every cell on the slide lacks cytoplasm
Obscuring factors***	None or < 75% of squamous cells are obscured	> 75% of squamous cells are obscured

*No abnormal cells were found. **The presence or absence of EC/TZ cells is assessed as a quality measure and does not determine the adequacy of cells. *** Obscuring factors include lubricants (for liquid prep smears), inflammatory cells, red blood cells, cervical mucus, and infectious organisms.

Table 3 shows the findings from the pre- and post-training tests regarding knowledge of screening, symptoms,

and treatment of cervical cancer. The responses to some questions were consistent in both the pre- and post-

training tests, indicating a fair level of knowledge in these areas, with few variations between the pre-training and post-training observations. Test questions reflecting improved knowledge included those about symptoms of cervical cancer (vaginal bleeding and concerning vaginal discharge), with an additional two participants responding “True” in the post-training test, increasing the proportion of correct responses from 83.3% to 94% and from 72.2% to 83.3%, respectively. Twenty-two per cent of the participants

who previously responded “false” to the question regarding vulvovaginal itching as a symptom of cervical cancer changed their answer to “yes” in the post-training test, while the remainder maintained their position.

However, no significant difference was found between the pre-training and post-training test scores except for the question concerning methods of cervical screening ($p = 0.046$)

Table 1: Participants’ pretest confidence level of knowledge about causes, risk factors, screening, symptoms and treatment of cervical cancer

Data item	Very not confident (%)	Not confident (%)	Unsure (%)	Confident (%)	Very confident (%)
Knowledge about causes of cervical cancer	5.6	33.3	27.8	33.3	0
Knowledge about cervical screening	5.6	55.5	11.1	27.8	0
Knowledge about cervical cancer risk factors	0	50	11.1	38.9	0
Knowledge about cervical cancer symptoms	0	33.3	27.8	38.9	0
Knowledge about cervical cancer treatment	5.6	5.6	66.6	16.6	0

Table 2: Before- and after-training test knowledge scores for causes, risk factors and mortality in patients with cervical cancer

Data item	Before training (% correct)	After training (% correct)	P value
Aetiology			
Human papillomavirus (HPV)	72.2	88.9	0.257
Risk factors			
Mosquito bite	88.8	100	1.00
Deep kissing	83.3	94.4	0.317
Too much sun exposure	94.4	88.8	0.564
Cervical infection	61.1	66.7	0.317
HIV-positive coinfection	55.6	77.8	0.206
Sexual intercourse	33.3	94.4	0.102
Mortality			
The main cause of cancer mortality	72.2	88.9	0.257

Post-training evaluation

Overall, 11 (61.1%) of the participants had a higher post-training aggregate ranked score than their pre-training score did ($p = 0.026$). This improvement in knowledge was independent of professional cadre ($p = 0.784$). Table 4 shows the participants' confidence in their understanding of cervical cancer. Most of the participants were confident in their knowledge about cervical cancer, except for the

treatment options. Further exploration of the degree to which they felt this training had an impact on them revealed that 12 (66.7%) of the participants strongly agreed that their knowledge about cervical cancer had improved, 14 (77.8%) strongly agreed that the training was likely to change their approach toward cervical cancer prevention, and 17 (94.4%) stated that they were very likely to recommend screening to their clients.

Table 3: Pre- and post-test knowledge of screening, symptoms and treatment of cervical cancer

Data items	Before training (% correct)	After training (% correct)	P value
Screening			
Cervical cancer can be prevented	100	100	1.000
Prevention through screening	94.4	88.9	0.564
Screening modalities	77.8	94.4	0.046*
Age of onset of screening	77.8	66.7	0.317
Symptoms			
Early detection and symptoms	72.2	83.3	0.414
Urinary pain	41.2	41.2	0.480
Vaginal bleeding	83.3	94.4	0.157
Vaginal discharge	72.2	83.3	0.705
Vaginal itching	27.8	55	0.152
Treatment			
Treatment/cure for late-stage disease	66.7	61.1	0.739

* $p\text{ value} < 0.05$

Table 4: Participants' post-training confidence level of knowledge about causes, risk factors, screening, symptoms and treatment of cervical cancer

Data item	Not confident (%)	Little confident (%)	Moderately confident (%)	Confident (%)	Very confident (%)
Knowledge about causes of cervical cancer	0	0	5.6	83.3	11.1
Knowledge about cervical screening	0	0	5.6	83.3	11.1
Knowledge about cervical cancer risk factors	0	0	11.1	50	38.9
Knowledge about cervical cancer symptoms	0	0	5.6	83.3	11.1
Knowledge about cervical cancer treatment	11.1	16.7	22.2	38.9	11.1

Post-survey feedback

To improve training, 10 (55.6%) participants

requested an extended training period with a minimum of 2- 3 days, three (16.7%) suggested advocacy for screening and the HPV vaccine as part of the training, and four participants (22.2%) said they had no improvements to suggest. One participant chose not to provide an answer to this question.

Pap smear performance evaluation

Fourteen (77.8%) participants reported that they had not performed cervical sample collection before this training. Thirty smears were made by the trainees in all and were taken from women aged 20- 55 years who had never been screened before. Smear performance was adequate and satisfactory in 90% (27/30) of the smears, and 3 (10%) smears required repeat sampling. Table 5 shows the different cytological conclusions derived from the smears. Those that showed no cytological abnormality (NILM) were the most common observations, while those that were judged unsatisfactory had few cells and/or extensive cervical mucus obscuring the cellular details.

Table 5: Papanicolaou stain cytological interpretations of smears

Interpretative category	No of observations	Percentage (%)
NILM	23	76.6
LSIL	2	6.7
HSIL	2	6.7
Repeat	3	10%

NILM: Negative for intraepithelial lesion or malignancy

LSIL: Low-grade squamous intraepithelial lesion

HSIL: High-grade squamous intraepithelial lesion

Discussion.

Approximately 80% of cervical cancer cases globally occur in low- and middle-income countries (LMICs).²² The mortality rate from the disease in these regions is also multiple times higher than that in developed countries.²³ The remarkable successes recorded through cervical screening and vaccination against hrHPV infection in high-income countries have not been widely replicated in LMICs because of the absence of similar preventive programs.⁵ This underscores the urgent need for adaptable and effective screening strategies in these populations.^{4,24,25}

Our study revealed that non-doctor primary healthcare providers, such as community health extension workers (CHEWs), nurse practitioners and midwives, possess good baseline knowledge about the rudiments of cervical cancer causation, risk factors, symptoms and screening. The questions

used were designed to test the requisite knowledge of these healthcare workers about cervical cancer for educating the community women whom they serve. An earlier study by Awolude et al²⁶ in southwest Nigeria, reported high baseline knowledge of cervical cancer among community health workers, similar to our observations. These findings suggest that these health workers possess a good understanding of cervical cancer and, with training, can effectively serve as advocates for screening.²⁷ Following the training, we observed a significant overall improvement in knowledge. However, when considered on an item-by-item basis, only one question (modalities for cervical screening, i.e., Pap test and HPV testing) indicated a notable and significant change after training. This can be attributed primarily to the high baseline knowledge of the participants on the one hand and the small number of participants, which may have reduced the study's power to detect a significant effect from the training. Nevertheless, the considerable change in aggregate score after training suggests that training holds promise for equipping these categories of workers to engage in scaling up screening within communities. Future studies should, however, address the concerns raised by participants to achieve more effective training delivery.

Not only did training significantly improve the knowledge of the participants about cervical screening, but the participants also demonstrated reasonable skill in performing cervical sampling. Considering that those who took part in sample collection were doing so for the first time in their careers, screening practices related to specimen acquisition may be efficiently and expeditiously implemented without a large burden of training. Other studies in LMICs have shown that where capacity is provided post-training, trained PHCWs can provide screening directly to women ²⁶, including the ability to recognise cervical precancerous lesions via visual inspection with acetic acid.²⁸

While our study did not investigate the cost implications of deploying PHCWs in cervical screening, the available data show that deploying CHEWs in the community for cervical cancer screening significantly increases screening uptake while reducing loss to follow-up for women on retesting recall. This benefit results in overall cost-effectiveness by eliminating cervical cancer among hard-to-reach women and saving many daily adjusted life years from the disease.²⁹ Considering the sociocultural context within our study

population, involving CHEWs who themselves are from the community and are well-regarded would be a culturally acceptable strategy that would increase their trust in health interventions and improve service uptake.

This study had some limitations. First, participants' prior knowledge about the training may have made them seek information about cervical cancer, leading to good pretraining test scores. However, they were not told about any test beforehand, so the impact on performance is unclear. Second, the post-training test was on the same day, making recall easier, which could have influenced results, but overall improvements seem marginal. Future studies should include follow-up assessments to test retention. Third, the small participant number could have affected the estimates, and attendees might have been more interested or knowledgeable about women's health than non-attendees. A larger, nationwide intervention could have a greater impact. Also, some domain scores, such as knowledge about cervical infection and HIV coinfection, remained lower post-test. We're re-evaluating teaching methods to improve knowledge in these areas.

Conclusion

This study has demonstrated good clinical knowledge of cervical cancer among community healthcare workers, highlighting a promising opportunity for improved cervical cancer screening advocacy in their localities. In addition, where training is provided, they can also fill the void created by the absence of skilled professionals in administering screening in communities. However, more rigorous studies are warranted to investigate further the effectiveness of this approach in cervical screening and other related health interventions at the community level in LMICs.

Competing interest

The authors declare that they have no competing interests.

Authors' contribution

USE, AHN, DAK, HTO, SEA, AG, BB, MG, AO, MS, SHLG, and BMA conceptualised the study. BMA, BB, USE, MUK, SEA and AOM designed the study, and USE performed the histological examination of the prepared cytology slides. USE, AHN, MUK, HTO, SEA and AOM participated in data acquisition, USE, AHN, HTO, SEA, AOM, MUK, AAJ, and SA reviewed, analysed and interpreted the data. USE, MUK, and AAJ contributed to the manuscript preparation. BB, DAK, AG, MG, AO, MS, SHLG, and BMA edited and reviewed the manuscript. All authors read and approved the final

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