

Research Article

Effect of an Educational Intervention on Cervical Cancer Screening Knowledge Among Mothers Receiving Primary Health Care in Rivers State, Nigeria

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Abstract

Although screening services for cervical cancer have been proven to be effective, the lack of knowledge about the importance of screening is a significant challenge for women in Nigeria, especially women attending primary health care facilities. Incorporating health education directly into the routine of maternal child health services could enhance knowledge and enable better decision making about cervical cancer preventative services. This study evaluated the effect of a structured educational intervention on knowledge of cervical cancer screening among mothers bringing their children for Penta1 immunization at selected Primary Health Care facilities in Rivers State, Nigeria. A quasi-experimental one-group pre-test/post-test study was conducted among 500 mothers aged 25–44 years attending 24 selected PHC facilities between October and November 2024. Baseline data were collected using a validated interviewer-administered questionnaire. Participants subsequently received a structured educational intervention comprising interactive lectures, visual presentations, group discussions, and question-and-answer sessions. Knowledge was reassessed one month after the intervention using the same instrument. Descriptive statistics summarized participants' characteristics and knowledge levels, while the Wilcoxon signed-rank test assessed changes in knowledge scores. Effect size was calculated to determine the practical significance of the intervention. Baseline knowledge of cervical cancer screening was generally inadequate. The mean knowledge score increased significantly from 6.70 ± 4.98 before the intervention to 12.33 ± 1.26 after the intervention, representing a mean improvement of 5.63 points (95% CI: 5.18–6.08; $p < 0.001$). Overall, 397 (79.4%) participants demonstrated improved post-intervention knowledge, while the intervention produced a large educational effect ($r = 0.78$). Significant improvements were observed across all assessed knowledge domains, including awareness of cervical cancer, recognition of HPV as the causative agent, knowledge of screening methods, recommended screening intervals, and the benefits of early detection. The structured educational intervention substantially improved knowledge of cervical cancer screening among mothers attending PHC immunization clinics. Integrating routine cervical cancer education into maternal and child health and immunization services within Primary Health Care could strengthen women's knowledge, promote informed health-seeking behaviour, and support Nigeria's progress toward achieving the WHO cervical cancer elimination targets.

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Keywords

Cervical Cancer Screening, Educational Intervention, Health Knowledge, Pental Immunization, Primary Health Care, Nigeria

1. Introduction

Cervical cancer remains one of the most preventable yet devastating cancers affecting women globally. Persistent infection with high-risk human papillomavirus (HPV) is the principal cause of cervical cancer, accounting for more than 95% of cases [1]. Despite the availability of effective preventive measures, including HPV vaccination, cervical cancer screening, and early treatment of precancerous lesions, the disease continues to impose a substantial public health burden, particularly in low- and middle-income countries (LMICs). Approximately 604,000 new cases of cervical cancer and 342,000 related deaths occurred worldwide in 2022, with nearly 90% of these deaths occurring in LMICs, where access to preventive services remains inadequate [1, 2].

The unequal distribution of cervical cancer reflects disparities in health system capacity, awareness, access to screening, and availability of preventive services. While many high-income countries have achieved substantial reductions in cervical cancer incidence and mortality through organized screening programmes and HPV vaccination, many countries in sub-Saharan Africa continue to experience increasing disease burden because screening coverage remains low and women frequently present with advanced disease [3, 4]. Recognizing this disparity, the World Health Organization (WHO) launched the Global Strategy to Accelerate the Elimination of Cervical Cancer as a Public Health Problem, which aims to achieve 90% HPV vaccination coverage, 70% screening coverage, and 90% access to treatment for cervical disease by 2030 (the 90–70–90 targets) [5]. Achieving these targets requires strengthening Primary Health Care (PHC), expanding equitable access to screening services, and improving public awareness through sustained health education.

Nigeria bears one of the highest cervical cancer burdens in Africa. Cervical cancer is the second most common cancer among Nigerian women and remains a leading cause of cancer-related deaths despite the availability of effective screening methods [1, 6]. Although national policies and professional guidelines recommend routine cervical cancer screening for eligible women, utilization remains consistently low across the country. Studies conducted in different regions of Nigeria have identified inadequate knowledge, poor awareness, misconceptions, financial constraints, fear of diagnosis, sociocultural beliefs, and limited access to screening services as major barriers to screening uptake [7–9]. These barriers are often more pronounced among women receiving care at the Primary Health Care level, where preventive health services remain underutilized.

Primary Health Care provides a strategic platform for delivering integrated preventive health interventions because it serves as the first point of contact with the health system for most families [10]. Routine maternal and child health services, particularly childhood immunization clinics, provide repeated opportunities to reach women with evidence-based health education beyond the immediate needs of their children. Mothers bringing their children for Pental immunization represent an especially important population because they are already engaged with PHC services and can be reached efficiently with interventions that promote preventive health behaviours. Integrating cervical cancer education into these routine contacts has the potential to improve knowledge, dispel misconceptions, increase awareness of available screening services, and encourage future participation in screening programmes without requiring additional clinic visits.

Health education remains one of the most cost-effective strategies for improving knowledge and influencing health-seeking behaviour. Structured educational interventions that combine interactive teaching, visual learning materials, group discussions, and opportunities for participant engagement have consistently demonstrated positive effects on knowledge and preventive practices across diverse public health settings [11–14]. In the context of cervical cancer prevention, improved knowledge is associated with greater awareness of risk factors, better understanding of screening recommendations, increased perceived susceptibility, and a higher likelihood of utilizing screening services [12, 15]. Nevertheless, evidence on the effectiveness of structured educational interventions delivered through routine PHC immunization services remains limited in Nigeria.

Most previous Nigerian studies have focused on assessing knowledge or screening practices among university students, healthcare workers, antenatal clinic attendees, or women receiving care in secondary and tertiary health facilities [7–10, 13]. Comparatively little attention has been given to mothers attending routine childhood immunization clinics, despite their regular interaction with the PHC system and the potential for integrating preventive health education into these services. Generating evidence from this population is important because it provides practical insights into how existing PHC platforms can be leveraged to strengthen cervical cancer prevention without creating parallel programmes.

This study is novel because it evaluates the effectiveness of a structured educational intervention among mothers bringing

their children for Penta1 immunization at selected PHC facilities in Rivers State, Nigeria. Unlike previous studies that primarily assessed knowledge levels or screening practices in hospital-based populations, this study examines whether routine immunization clinics can serve as effective entry points for improving cervical cancer knowledge through integrated health education. The findings provide evidence to support the incorporation of cervical cancer education into maternal and child health services, thereby contributing to PHC strengthening and Nigeria's progress toward achieving the WHO cervical cancer elimination targets.

Therefore, this study assessed the effect of a structured educational intervention on knowledge of cervical cancer screening among mothers bringing their children for Penta1 immunization attending selected Primary Health Care facilities in Rivers State, Nigeria.

2. Methods

2.1. Study Area

The study was conducted in Rivers State, located in the South-South geopolitical zone of Nigeria. Rivers State has a projected population of over eight million people and comprises 23 Local Government Areas (LGAs). The state's Primary Health Care system, coordinated by the Rivers State Primary Health Care Management Board (RSPHCMB), provides preventive, promotive, and curative services through an extensive network of PHC facilities. Routine maternal and child health services, including childhood immunization, are delivered across these facilities, making them appropriate settings for implementing community-based health education interventions.

2.2. Study Design and Population

A quasi-experimental one-group pre-test/post-test study was conducted to evaluate the effect of a structured educational intervention on knowledge of cervical cancer screening among mothers bringing their children for Penta1 immunization at selected Primary Health Care facilities in Rivers State, Nigeria.

Participants' knowledge was assessed before the intervention (pre-test) and reassessed one month after the intervention (post-test) using the same validated questionnaire. This design enabled the measurement of changes in knowledge attributable to the educational intervention within the same group of participants. The study population comprised mothers aged 25–44 years bringing their children for Penta1 immunization at selected PHC facilities during the study period. This population was selected because routine immunization clinics provide regular opportunities to reach women with preventive health education while they access essential maternal and child health services. Participants were eligible if they: were

mothers aged 25–44 years; attended the selected PHC facilities for their child's Penta1 immunization; provided written informed consent; and were available to participate in both the pre-intervention and post-intervention assessments. Mothers who declined participation, were seriously ill at the time of data collection, or were unavailable for the post-intervention assessment were excluded from the study.

2.3. Sample Size and Sampling Techniques

The sample size for this quasi-experimental one group pre-test/post-test design was determined based on Cohen's standardized effect size for paired mean comparisons.

$$n = \left(\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{d} \right)^2$$

where n is the required sample size; $Z_{1-\alpha/2} = 1.96$ corresponds to a 95% confidence level; $Z_{1-\beta} = 0.84$ corresponds to 80% statistical power; and d is Cohen's standardized effect size. There was a lack of adequate information provided in published Nigerian cervical cancer education intervention studies to calculate the effect size and hence, a moderate standardized effect size (Cohen's $d = 0.50$) was used, as recommended by Cohen (1988) for behavioural and health sciences.

Based on these assumptions, the minimum sample size used was determined to be 32 participants. Adding 20% attrition rate increased the minimum sample size to 40 participants. The adequacy of this calculation was confirmed using G*Power version 3.1.9.7 [29].

However, the intervention was part of a larger study that recruited and followed 500 eligible women. So, the intervention component included all eligible participants. The final sample was well greater than the minimum sample size, which provided a boost to statistical power, greater precision in the estimated intervention effect, greater robustness of the study results for subgroup analyses and greater generalizability of the study findings.

A multistage sampling technique was used. The first stage of the study involved the selection of the Local Government Areas (LGAs) in Rivers State, using simple random sampling technique. Twenty-four (24) Primary Health Care (PHC) facilities that offered routine immunization services for pentavalent vaccine first-dose (Penta1) were randomly selected in the second stage.

At the last stage, mothers who attended the selected PHC facilities at the time of their child's 1st dose of pentavalent vaccine (Penta1) were then sampled systematically. The sampling interval was calculated for each facility as the average number of eligible attendees per month / the number of eligible attendees selected as a sample for the facility. The first (k) eligible people were selected by simple random sampling from which a random starting point was selected. Subsequently, all mothers bringing their babies to Penta1 immun-

ization with an infant at the facility were selected until the required sample size for the facility was reached (eligible mother presenting her infant for Pental immunization was selected).

Eligibility was determined at the time of routine registration while recruitment went on across the study period until the required sample size was achieved at all the selected PHC facilities. All participants who were enrolled in the study then underwent the baseline (pre-intervention) assessment and then were given the educational intervention. The same study instrument was used to assess changes in knowledge and uptake of cervical cancer screening. A post-intervention assessment was conducted one month after the intervention among the same cohort of participants using the same study instrument to evaluate changes in knowledge. All participants who completed baseline and 1 month post intervention follow-up assessment were included in the analyses.

2.4. Data Collection Procedure and Instrument

Data were collected using a structured interviewer-administered questionnaire developed from relevant literature and previously validated instruments assessing cervical cancer knowledge. The questionnaire consisted of four sections covering: socio-demographic characteristics; knowledge of cervical cancer; knowledge of cervical cancer screening; sources of information regarding cervical cancer.

Knowledge items included awareness of cervical cancer, causative factors, risk factors, signs and symptoms, available screening methods, recommended screening intervals, eligibility for screening, and preventive measures.

The instrument was reviewed by experts in public health, epidemiology, and reproductive health to establish content and face validity. It was pretested among mothers attending a comparable PHC facility outside the study area, and necessary modifications were made before the main study. The questionnaire demonstrated acceptable internal consistency, with a Cronbach's alpha coefficient of 0.78.

2.5. Educational Intervention

The intervention consisted of a structured educational programme designed to improve participants' knowledge of cervical cancer and cervical cancer screening. This is based on the effects of the model constructs and adopting healthy behavior. Educational sessions were delivered by trained health educators using standardized teaching materials developed from World Health Organization recommendations and the Nigerian National Cancer Control Programme.

The intervention included: interactive lectures; PowerPoint presentations; illustrated educational posters; printed information leaflets; group discussions; question-and-answer sessions.

Key topics covered included cervical cancer epidemiology, risk factors, symptoms, HPV infection, available screening

methods, recommended screening intervals, eligibility for screening, benefits of early detection, and available screening services within the health system.

Each educational session lasted approximately 45–60 minutes and was delivered immediately after completion of the baseline assessment.

2.6. Outcome Measure

The primary outcome was participants' knowledge of cervical cancer screening.

Knowledge was assessed using a composite score derived from responses to the knowledge questionnaire. Each correct response was awarded one point, while incorrect or "don't know" responses received zero points. Total scores were calculated before and after the educational intervention, with higher scores indicating better knowledge.

2.7. Data Analysis

Data were entered into Microsoft Excel, cleaned, and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA).

Descriptive statistics were used to summarize participants' socio-demographic characteristics and knowledge scores. Continuous variables were presented as means and standard deviations (SD), while categorical variables were summarized using frequencies and percentages.

The Wilcoxon signed-rank test was used to compare pre-intervention and post-intervention knowledge scores because the paired data did not meet the assumption of normality. Effect size (r) was calculated to determine the magnitude of the intervention effect and interpreted using Cohen's criteria. A 95% confidence interval (CI) was reported where appropriate, and statistical significance was established at $p < 0.05$.

2.8. Ethics Approval and Consent to Participate

Ethical approval for this study was obtained from the Research Ethics Committee, Faculty of Basic Medical Sciences, Rivers State University (Approval No. RSU/FBMS/REC/24/151). Administrative approval was also obtained from the Rivers State Primary Health Care Management Board and the management of the participating Primary Health Care facilities. Written informed consent was obtained from all participants before data collection. Participation was voluntary, and confidentiality and anonymity were maintained throughout the study.

3. Results

3.1. Socio-demographic Characteristics of the Participants

A total of 500 mothers bringing their children for Pental

immunization participated in both the pre-intervention and post-intervention assessments, resulting in a response rate of 100%. The mean age of the respondents was 32.28 ± 5.28 years. Most participants were within the 25–29-year age group, followed by those aged 30–34 years and 35–44 years. The majority were married, had attained at least secondary education, and were engaged in informal or self-employed occupations.

Most respondents identified as Christians and were of the Ikwerre, Ogoni, Kalabari, or other indigenous ethnic groups of Rivers State. Approximately half resided in urban communities, while the remainder lived in rural areas. The detailed socio-demographic characteristics of the respondents are presented in Table 1.

Table 1. Sociodemographic characteristics of Respondents (N=500).

Characteristic	Frequency (N=500)	Percentage (%)
<i>Age at last birthday</i>		
25-29	183	36.60
30-34	148	29.60
>35	169	33.80
<i>Marital status</i>		
Unmarried	63	12.60
Married	437	87.40
<i>Highest level of education completed</i>		
At most Secondary	350	70.00
Post-Secondary	150	30.00
<i>Employment status</i>		
Unemployed	326	65.20
Employed	174	34.80
<i>Average monthly income</i>		
<₦ 30,000	238	47.60
₦ 30,000 - 50,000	177	35.40
>₦ 50,000	85	17.00
<i>Place of residence</i>		
Rural area	237	47.40
Urban area	263	52.60
<i>Age at first menstruation</i>		
<15 years	306	61.20
>15 years	194	38.80
<i>Age at first sexual contact</i>		
<15 years	45	9.00
15-18 years	222	44.40
>18 years	233	46.60
<i>Multiple sexual partners</i>		
No	460	92.00
Yes	40	8.00
<i>Family has a medical history of cervical cancer</i>		

Characteristic	Frequency (N=500)	Percentage (%)
No	491	98.20
Yes	9	1.80
<i>History of abortion</i>		
No	356	71.20
Yes	144	28.80
<i>Parity</i>		
Nulliparous	81	16.20
Uniparous	180	36.00
Multiparous	239	47.80

3.2. Baseline Knowledge of Cervical Cancer Screening

Before the educational intervention, participants demonstrated generally poor knowledge of cervical cancer and cervical cancer screening. Although many respondents had heard of cervical cancer, substantial knowledge gaps were observed regarding its causes, risk factors, screening methods, recommended screening intervals, eligibility for screening, and the

role of human papillomavirus (HPV) in disease development.

The overall mean pre-intervention knowledge score was 6.70 ± 4.98 , indicating inadequate baseline knowledge among the study population. Less than half of the participants correctly identified cervical cancer as a preventable disease, while misconceptions regarding screening eligibility and available screening methods were common. Detailed responses to individual knowledge items are presented in [Table 2](#).

Table 2. Distribution of Participants' Knowledge Levels Before and After the Educational Intervention (N = 500).

Knowledge Level	Pre-intervention, n (%)	Post-intervention, n (%)
Poor knowledge	231 (46.2)	0 (0.0)
Good knowledge	269 (53.8)	500 (100.0)
Total	500 (100.0)	500 (100.0)

3.3. Changes in Knowledge Across Individual Domains

Improvements were observed across every component of the assessment. The greatest gains were recorded in participants' understanding of HPV as the primary cause of cervical cancer, the purpose of cervical cancer screening, recommended screening intervals, and the importance of early detection. Knowledge of available screening methods, including

the Papanicolaou (Pap) smear and visual inspection techniques, also improved considerably following the intervention.

Similarly, participants demonstrated a better understanding of women eligible for screening and recognized that cervical cancer can be prevented through regular screening and timely treatment of precancerous lesions. These findings suggest that the educational programme effectively addressed major misconceptions identified during the baseline assessment. Detailed comparisons between pre-intervention and post-intervention responses are presented in [Table 3](#).

Table 3. Comparison of Respondents knowledge of Cervical Cancer screening before and after the educational intervention (N =500).

Question	Frequency (N = 500)	Pre-test (%)	Post-test (%)	% change (correct answer)	p-value
1 Have you heard of cervical cancer?					
Yes	438	68.00	87.60	+19.60	0.000
No	62	32.00	12.40		
2 May have cervical cancer without any signs or symptoms?					
Yes	428	74.40	85.60	+11.20	0.000
No	72	25.60	14.40		
3 What are the most common symptoms of cervical cancer?					
I know (Pain during sex, Post-coital bleeding, Vaginal bleeding or Foul-smelling vaginal discharge)	443	36.20	88.60	+50.40	0.000
I do not know	57	63.80	11.40		
4 Can cervical cancer be prevented and treated?					
Yes	438	39.20	87.60	+48.40	0.000
No	62	60.80	12.40		
5 Can cancer of the cervix be cured at the first stage?					
Yes	434	47.40	86.80	+39.40	0.000
No	66	52.60	13.20		
6 Do you know that you could get screened for cervical cancer?					
Yes	443	41.20	88.60	+47.40	0.000
No	57	58.80	11.40		
7 What benefits of cervical cancer screening do you know?					
I know (Decreasing chances of an abortion, Early detection, or Early treatment)	440	44.40	88.00	+43.60	0.000
I do not know	60	55.60	12.00		
8 Is cervical cancer a killer disease?					
Yes	454	68.00	90.80	+22.80	0.000
No	46	47.40	9.20		
9 Cervical cancer is associated with HPV infection					
Yes	452	58.40	90.40	+32.00	0.000
No	48	41.60	9.60		
10 Early detection cervical cancer					

Question	Frequency (N = 500)	Pre-test (%)	Post-test (%)	% change (correct answer)	p-value
by screening is helpful					
Yes	441	39.60	88.20	+58.60	0.000
No	59	60.40	11.80		
11 Have you heard of cervical cancer screening methods?					
Yes	444	70.80	88.80	+18.00	0.000
No	56	29.20	11.20		
12 Pap test is used for detection of cervical cancer					
Yes	436	75.60	87.20	+11.60	0.000
No	64	24.40	12.80		
13 If cervical changes are found early, are they curable?					
Yes	437	46.40	87.40	+41.00	0.000
No	63	53.60	12.60		
14 Screening interval?					
Every 3 years	437	72.00	87.40	+15.40	0.000
I do not know	63	28.00	12.60		

3.4. Effect of the Educational Intervention on Knowledge

Following the structured educational intervention, participants demonstrated marked improvements across all assessed knowledge domains. The proportion of respondents providing correct responses increased substantially for questions relating to cervical cancer risk factors, HPV infection, symptoms, available screening methods, recommended screening intervals, and the benefits of early detection.

The mean post-intervention knowledge score increased to

12.33 ± 1.26, representing a mean improvement of 5.63 points compared with the baseline assessment. The Wilcoxon signed-rank test showed that this improvement was statistically significant ($Z = -16.801$, $p < 0.001$), indicating that the educational intervention had a significant positive effect on participants' knowledge of cervical cancer screening.

Overall, 397 (79.4%) participants demonstrated improved knowledge following the intervention, while knowledge scores remained unchanged or declined among a small proportion of respondents. The calculated effect size ($r = 0.78$) indicated a large educational effect, suggesting that the intervention produced not only statistical significance but also substantial practical improvement in knowledge. See Table 4.

Table 4. Comparison of Pre- and Post-Intervention Knowledge Scores among Participants (N = 500).

Outcome	Negative Ranks n (%)	Positive Ranks n (%)	Ties n (%)	Z	p-value
Knowledge score (Post vs. Pre)	68 (13.6)	397 (79.4)	35 (7.0)	-16.801	<0.001*

3.5. Overall Change in Knowledge Level

Classification of participants according to overall

knowledge level further demonstrated the effectiveness of the intervention. Before the intervention, the majority of respondents had poor knowledge of cervical cancer screening, with only a small proportion demonstrating satisfactory knowledge.

Following the educational programme, the distribution shifted markedly toward good knowledge, reflecting a substantial improvement in participants' understanding of cervical cancer prevention and screening.

The observed improvement in knowledge level was statistically significant and consistent across most socio-demographic groups, indicating that the intervention was effective in improving knowledge irrespective of participants' background characteristics.

4. Discussion

This study evaluated the effect of a structured educational intervention on knowledge of cervical cancer screening among mothers bringing their children for Penta1 immunization at selected Primary Health Care facilities in Rivers State, Nigeria. The findings demonstrated that the intervention produced a substantial improvement in participants' knowledge of cervical cancer and cervical cancer screening. Significant gains were observed in overall knowledge scores and across all assessed knowledge domains, indicating that structured health education delivered through routine PHC services can effectively improve women's understanding of cervical cancer prevention.

The low baseline knowledge observed before the intervention is consistent with evidence from many low- and middle-income countries, where limited awareness remains one of the greatest barriers to cervical cancer prevention. Despite global efforts to expand HPV vaccination and cervical cancer screening, many women continue to have inadequate knowledge of the disease, its risk factors, and available preventive services, particularly in resource-constrained settings [16-18]. In sub-Saharan Africa, poor awareness is frequently attributed to limited access to health information, low health literacy, sociocultural misconceptions, and weak integration of cervical cancer education into routine Primary Health Care services [8, 19]. Similar findings have been reported across Nigeria, where studies consistently demonstrate inadequate knowledge of cervical cancer among women attending Primary Health Care facilities, antenatal clinics, and community health programmes [8-11]. The baseline findings from this study therefore reflect broader systemic challenges in cervical cancer prevention rather than isolated knowledge gaps within the study population.

The significant improvement in knowledge following the educational intervention demonstrates the effectiveness of structured health education in addressing these deficiencies. The observed increase in mean knowledge scores and the large intervention effect indicate that relatively brief, well-designed educational sessions can substantially improve women's understanding of cervical cancer prevention. This finding is consistent with previous intervention studies conducted in Nigeria, Ghana, Kenya, Ethiopia, and other LMICs, which have shown that structured educational programmes signifi-

cantly improve knowledge, attitudes, and willingness to participate in cervical cancer screening [12-14, 18, 19]. Unlike passive health messages, structured educational interventions provide opportunities for interaction, clarification of misconceptions, and active participant engagement, which improve information retention and facilitate behavioral change.

One notable finding was the marked improvement in participants' knowledge of HPV as the primary cause of cervical cancer. Before the intervention, awareness of HPV infection was poor, reflecting findings from previous Nigerian studies that reported limited understanding of the causal relationship between HPV and cervical cancer [20, 21]. Following the intervention, participants demonstrated a substantially better understanding of HPV infection, its mode of transmission, and its role in cervical cancer development. This improvement is particularly important because knowledge of HPV has been associated with greater acceptance of preventive measures, including HPV vaccination and routine cervical cancer screening [22, 23].

Knowledge also improved considerably regarding cervical cancer screening methods, recommended screening intervals, and eligibility for screening. These findings are important because women who understand when and where screening should be undertaken are more likely to seek preventive services than those with limited knowledge. Similar improvements have been reported following educational interventions delivered through community outreach programmes, reproductive health clinics, and PHC facilities in several African countries [24-27]. The present findings further support the growing body of evidence that educational interventions should form an integral component of national cervical cancer prevention strategies.

The success of the intervention may also be explained by its delivery through routine Penta1 immunization clinics. Childhood immunization services are among the most frequently utilized PHC services in Nigeria and provide repeated contact between healthcare providers and mothers during the early months of a child's life [28]. This existing interaction creates a practical and cost-effective opportunity to deliver preventive health education without establishing separate service platforms. Integrating cervical cancer education into routine maternal and child health services could therefore improve awareness while minimizing additional demands on health system resources. Such integration is consistent with the principles of comprehensive Primary Health Care, which emphasize the delivery of multiple preventive interventions through existing community-based services.

The findings of this study have important implications for the implementation of the WHO Global Strategy to Accelerate the Elimination of Cervical Cancer as a Public Health Problem. The WHO strategy aims to achieve 90% HPV vaccination coverage, 70% screening coverage, and 90% treatment of women with cervical disease by 2030 [5]. Achieving these targets requires more than expanding screening services; it also depends on ensuring that women understand the importance

of screening and know where and when to access available services. The present study demonstrates that structured educational interventions delivered through PHC immunization clinics can contribute to this objective by strengthening knowledge, which represents a critical first step toward increasing screening uptake. Incorporating cervical cancer education into routine PHC services would therefore support Nigeria's efforts to achieve the WHO 90–70–90 targets while strengthening preventive health service delivery.

Beyond the WHO elimination strategy, the findings are also relevant to broader health system goals, including Universal Health Coverage (UHC) and Sustainable Development Goal 3, which emphasize equitable access to quality preventive healthcare. Strengthening health education within PHC facilities can improve health literacy, promote informed decision-making, and reduce inequalities in access to cancer prevention services, particularly among women in underserved communities. Leveraging existing immunization and maternal health platforms to deliver cervical cancer education represents a sustainable and scalable approach that aligns with Nigeria's ongoing PHC revitalization efforts.

A major strength of this study is its focus on mothers bringing children for Pental immunization, a population that has received limited attention in previous Nigerian intervention studies. Most published research has evaluated educational interventions among healthcare workers, university students, antenatal clinic attendees, or women attending secondary and tertiary hospitals. By evaluating mothers attending routine childhood immunization clinics, this study identifies an underutilized but highly accessible population for cervical cancer education and demonstrates how existing PHC services can be leveraged to expand preventive health interventions. This context-specific evidence contributes to the growing literature on integrated service delivery and offers practical guidance for policymakers seeking to strengthen cervical cancer prevention within Nigeria's PHC system.

Although the educational intervention produced substantial improvements in knowledge, several limitations should be acknowledged. The absence of a control group limits the ability to attribute all observed improvements exclusively to the intervention, although the magnitude of the observed changes strongly suggests a meaningful intervention effect. The use of self-reported responses may also have introduced social desirability bias, while the relatively short follow-up period did not permit assessment of long-term knowledge retention or subsequent cervical cancer screening behavior. Future studies should employ randomized controlled or controlled quasi-experimental designs with longer follow-up periods to evaluate whether improvements in knowledge translate into sustained screening uptake and other preventive behaviors.

Overall, the findings demonstrate that structured educational interventions delivered through routine PHC immunization services can substantially improve knowledge of cervical cancer screening among mothers. Integrating such interventions into maternal and child health programmes represents a

feasible, low-cost strategy for strengthening cervical cancer prevention and accelerating progress toward national and global cervical cancer elimination goals.

5. Conclusion

The structured educational intervention significantly improved knowledge of cervical cancer and cervical cancer screening among mothers bringing their children for Pental immunization at selected Primary Health Care facilities in Rivers State. Participants demonstrated substantial improvements in their understanding of cervical cancer risk factors, HPV infection, screening methods, screening recommendations, and the benefits of early detection, confirming the effectiveness of structured health education delivered through routine PHC services.

These findings demonstrate that childhood immunization clinics provide an effective platform for integrating cervical cancer education into existing maternal and child health services. Strengthening health education within Primary Health Care can improve women's knowledge, support informed health-seeking behavior, and create opportunities for increased participation in cervical cancer screening programmes. The findings provide evidence for policymakers that integrating cervical cancer education into routine immunization clinics is a feasible, scalable and cost-effective strategy for strengthening primary health care and accelerating progress toward cervical cancer elimination in Nigeria.

Abbreviations

HPV	Human Papillomavirus
LMICs	Low- and Middle-Income Countries
Pap	Papanicolaou
PHC	Primary Health Care
SPSS	Statistical Package for the Social Sciences
VIA	Visual Inspection With Acetic Acid
WHO	World Health Organization
CSS	Cervical Cancer Screening

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Data Availability Statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no competing interests.

Authors Contributions

Igeny Philip Uku: Conceptualization, Data curation, Methodology, Project administration, Writing – original draft

Priscillia Nyekpunwo Ogbonda: Data curation, Investigation, Supervision, Validation, Writing – review & editing

Siyeofori Belema Dede: Investigation, Methodology, Writing – review & editing

Ihuoma AaronWali: Methodology, Writing – review & editing, Data curation

Clement Kevin Edet: Data curation, Writing – review & editing

Anthony Ike Wegbom: Investigation, Methodology, Supervision, Writing – review & editing

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