JOURNAL OF THE MEDICAL WOMEN'S ASSOCIATION OF NIGERIA

Established in 2004 APRIL 2026 VOL 11 NO 1

Original Article

Access this article online

Website: www.jmwan.org.ng

Website: www.jmwan.org.ng

https://doi.org/10.71526/jmwan.v11i1.138

Leveraging WhatsApp to Improve Parental Engagement and HPV Vaccine Information Uptake in Nigeria: A Digital Health Intervention Study

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Abstract

Background: This study assessed how socio-demographic characteristics, information sources, and digital engagement influence parental awareness and acceptance of the Human Papillomavirus (HPV) vaccine. It also evaluated the impact of a WhatsApp-based health campaign on vaccine-related knowledge among parents in two Nigerian secondary schools.

Methodology: A one-group pretest/post-test quasi-experimental design was used. The target population included 4,998 parents of female secondary school students. Using multistage sampling, 393 parents with daughters aged 9–14 years were selected across key socio-demographic groups. Data were collected using structured questionnaires administered before and after the intervention to measure awareness, sources of information, and digital behaviours. Analysis was conducted using Microsoft Excel.

Results: Parental age, gender, education, and relationship to the child significantly influenced awareness, with higher levels among mothers, younger parents, and those with tertiary education. Post-intervention, social media use as a primary information source rose from 16.5% to 92.9%, while the proportion of parents reporting no prior information dropped from 59.8% to 1%. Digital engagement showed greater interaction with expert-driven content, while procedural and myth-busting posts had lower participation.

Conclusion: Findings highlight the effectiveness of tailored digital interventions. WhatsApp emerged as an accessible and engaging platform for promoting vaccine education. Socio-demographic characteristics and trust in content type influenced parental responsiveness. WhatsApp-based campaigns can bridge HPV knowledge gaps, increase vaccine acceptance, and offer scalable digital health solutions in resource-limited settings.

Keywords: Cervical cancer, Human Papillomavirus (HPV), WhatsApp-based campaign, Vaccine acceptance.

Cite as: Uzoma FC, Nwanna NV, Dozie UW, Izuchukwu BC, Okoro IL, Ibe SNO, et al. Leveraging WhatsApp to Improve Parental Engagement and HPV Vaccine Information Uptake in Nigeria: A Digital Health Intervention Study. **J Med Women's Assoc Niger.** 2026 Apr;11(1). doi:10.71526/jmwan.v11i1.138.

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Print ISSN: 3043-4742 Online ISSN: 3043-4750

Background

Cervical cancer remains a significant public health concern, ranking as the fourth most common cancer among women globally. Persistent infection with high-risk Human Papillomavirus (HPV) is the primary cause, yet awareness and vaccine acceptance remain major barriers to prevention.[1] The World Health Organization estimates that cervical cancer accounts for approximately 570,000 new cases and 311,000 deaths annually, with over 85% occurring in low- and middle-income countries.[2] Nigeria bears a considerable burden, reporting an estimated 14,089 new cases and 8,240 deaths annually, necessitating urgent interventions.[3,4]

HPV vaccination is a critical preventive measure, yet uptake in Nigeria remains suboptimal due to low awareness, vaccine hesitancy, and limited health communication strategies.[5] WhatsApp's accessibility and interactivity make it a promising tool for enhancing vaccine awareness and acceptance.[6] Studies indicate that awareness campaigns and school-based vaccination programs significantly improve uptake.[7] Parents and guardians play a vital role in adolescent health decisions, and their perceptions influence vaccine acceptance.[8] To bridge gaps in awareness and engagement, digital health technologies, particularly WhatsApp, offer innovative approaches for disseminating tailored health messages and improving vaccine trust.[9-11] Digital platforms provide interactive and peer-driven vaccine education.[12] WhatsApp's accessibility and usability make it a promising tool for vaccine awareness campaigns, as evidenced by initiatives supporting HPV vaccine uptake in Nigeria.[6]

Recent studies highlight the importance of targeted interventions to improve HPV vaccine uptake. Some researchers examined predictors of willingness for HPV vaccination across eight Nigerian states, revealing geopolitical disparities in awareness and acceptance.[13] Similarly, another assessed parental knowledge and satisfaction with HPV vaccination programs in Ogun State, emphasizing the role of outreach and awareness campaigns in increasing vaccine acceptance.[14] According to UNICEF, [15,16] Nigeria's national HPV vaccination campaign showcases the impact of community mobilization and digital engagement in combating vaccine hesitancy.

This study demonstrated how socio-demographic factors like age, gender, education, and parental role significantly shape HPV vaccine awareness among parents of students in two Nigerian secondary schools. By evaluating engagement levels and sources of vaccine information, the research aims to provide insights into optimizing digital health interventions for improved vaccine uptake. Findings will contribute to the growing body of literature on social media's role in health promotion, particularly in HPV vaccine advocacy.

Method

This study employed a one-group pretest/post-test quasi-experimental design, involving 4998 eligible parents from which 393 parents of female secondary school students aged 9 to 14 years were selected through a multistage random sampling method using the Cochran sample size formular. This sample size was derived from the school enrolment size, and the sampling strategy was done to reflect representation across strata. In the first stage, two secondary schools (Girls' Secondary School Ikenegbu (G.S.S.I) and City College Owerri (C.C.O)) were randomly selected by balloting from five available public secondary schools (Owerri City College, Comprehensive Development Secondary School Douglas Road, Girls' Secondary School Ikenegbu, Imo Girls' Secondary School and Urban Development Secondary School) in Owerri municipal. These schools represent over 30% of public secondary schools in the area, with student populations of 1,283 (G.S.S.I) and 900 (C.C.O). In the second stage, systematic random sampling was employed, where student's class lists were used to calculate the sampling intervals (nth term) for selecting participating parents. Initially, a pretest questionnaire evaluated baseline knowledge and attitudes toward HPV vaccination, followed by two months structured digital intervention delivered via WhatsApp, where participants received weekly posts comprising infographics, expert videos, and text-based content on HPV, cervical cancer, vaccine benefits, and related topics. A post-test survey, identical to the pretest, was conducted to assess changes in awareness. By comparing the pretest and post-test results, the study aimed to determine the effect of the awareness campaign on HPV vaccine acceptance among parents of students in Owerri Municipal.

Inclusion criteria:

1. Being a parent/guardian of a female Junior student attending any of the selected female public secondary schools in Owerri Municipal.
2. Giving consent to participate in the study.
3. Being a parent/guardian, utilizing the WhatsApp social media platform as a means of communication.

Exclusion criteria:

1. Parents/guardians who are unavailable during the period of the campaign.
2. Parents/guardians who are visually impaired or suffering from an ailment that may hinder active participation.

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Data collection

A developed questionnaire was used to gather information from parents and guardians. This included demographic details such as age, gender, relationship to the ward, educational level and school attended by the ward. Additionally, the form sought to assess their awareness of HPV, cervical cancer, and the associated vaccination before and after the campaign. Over a two-month period, participants received weekly educational materials on HPV, cervical cancer, and vaccination through WhatsApp groups. These materials covered topics on understanding HPV, cervical cancer overview & screening, vaccine safety & efficacy, personal testimonials, myth-busting & overcoming vaccination barriers as well as expert insights from health professionals. Engagement was monitored based on likes, emojis, comments and poll participation.

Data analysis

The pretest and post-test survey data were analysed using descriptive statistics, including frequency distribution, percentages and comparative tables, to summarize awareness levels and sources of HPV information among the parents. Similarly, social media metrics were analysed to monitor engagement levels.

Efforts to minimise bias and control confounders

To reduce bias and strengthen validity, multistage random sampling ensured diverse representation, while anonymous questionnaires minimized response bias. Uniform messaging across WhatsApp groups prevented exposure bias, and the short two-month interval reduced recall bias. Stratification by age, gender, and education allowed subgroup analysis, enhancing reliability and generalizability.

Sampling size calculation

The Cochran formula was used to generate the sample size since it is suitable for estimating a proportion in a population, which is particularly relevant when examining awareness or acceptance rates. The formula is:

$$n = Z^2 \cdot p \cdot (1 - p) / e^2$$

Where:

- n: Required sample size
- Z: Z-value (standard normal deviate) for a given confidence level (e.g., 1.96 for 95% confidence)
- p: Estimated proportion of the population with the characteristic of interest (if unknown, use 0.5 for maximum variability)
- e: Margin of error (e.g., 0.05 for 5% precision)

$$n = (1.96)^2 \cdot 0.5 \cdot (1 - 0.5) / (0.05)^2 = 384.16 \approx 384$$

Adjusting for a Finite Population

Since the population is finite (N=4,974), the sample size can be adjusted using the finite population correction formula:

$$n_{adjusted} = n / [1 + (n - 1)/N]$$
$$n_{adjusted} = 384 / [1 + (384 - 1)/4,974]$$
$$= 384 / (1 + 0.0771) = 356.5 \approx 357 \text{ participants}$$

Accounting for Attrition

To account for potential attrition and any void instrument, an additional 10% was be added to the sample size:

$$\text{Adjusted sample size} = 357 \times 1.10 = 392.7 \approx 393 \text{ participants}$$

Summary of Participant Flow

a. Data at Every Phase of the Research: 4,998 parents of female students enrolled in two chosen secondary schools may be eligible.

b. Eligibility screening: 460 parents were contacted in accordance with availability and class lists.

c. 410 parents who have daughters between the ages of 9 and 14 and had access to WhatsApp were confirmed eligible (satisfied inclusion criteria).

d. 393 parents were officially enrolled in the study after schedule conflicts, and refusals were taken into consideration.

e. All 393 individuals finished the intervention and post-assessment as part of the follow-up (pretest and post-test).

f. 393 responses (100% of those who finished the post-test) were analysed in the final analysis.

Justifications for not taking part:

a. Fifty parents did not fit the requirements for inclusion (they were neither reachable throughout the campaign nor had access to WhatsApp).

b. Before the pretest, 17 eligible parents chose not to participate.

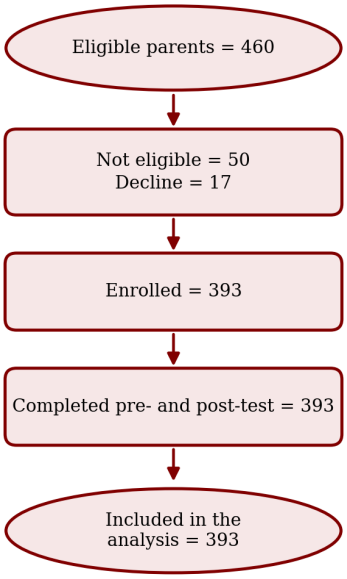


Fig 1: Participants' flow chart

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Results

No missing data were encountered as all participants completed both pre- and post-intervention questionnaires. Table 1 presents the association between selected socio-demographic characteristics and HPV vaccine awareness among parents. Awareness levels varied markedly across age, gender, relationship to the adolescent, education level, and the school attended by their child. Chi-square tests indicated statistically significant differences ($P < 0.05$) in most categories, with higher awareness generally reported among younger age groups, mothers, and those with tertiary education. However, for the school attended by the ward, the chi-square test yielded $P > 0.05$, indicating that the difference in HPV vaccine awareness between G.S.S.I and C.C.O. were not statistically significant. These findings suggest that demographic variables played an influential role in shaping baseline knowledge and highlight key target groups for intensified health education efforts.

Table 2 shows how parental sources of information about the HPV vaccine changed before and after the WhatsApp-based health education intervention. All formal and digital information channels showed notable increases, with social media use showing the largest increase (+463%). The percentage of parents who previously reported having no source of information fell sharply from 59.8% to just 1%, indicating a significant improvement in vaccine-related awareness and outreach effectiveness.

The engagement metrics for every content post shared during the digital intervention are compiled in Table 3. Different themes had different interaction patterns, such as likes, emojis, comments, and poll participation. The highest engagement rates (over 44%) were seen in posts about understanding of HPV, cervical cancer overview, cervical cancer screening, and health professional insights, indicating that participants were very interested in clinical and practical health themes. Although myth-busting and procedural posts received fewer interactions.

Table 1: Socio-demographic factors influencing HPV vaccine awareness among parents

Socio-demographic characteristic	HPV vaccine awareness (n)		HPV vaccine awareness (%)	χ^2 P-value	C.I
	Yes	No			
Age (years)					
< 30	34	17	8.7	33.09 P < 0.05	53.7 – 79.6
30 – 40	46	53	11.7		36.6 – 56.3
41 – 50	48	139	12.2		19.4 – 31.9
Above 50	20	36	5.1		23.4 – 48.6
Total	**148**	**245**	**37.7**		
Gender					
Male	38	26	9.7	15.36 P < 0.05	47 – 71
Female	110	219	28		28.3 – 38.5
Total	**148**	**245**	**37.7**		
Relationship to the ward					
Father	21	21	5.3	44.12 P < 0.05	34.9 – 65.1
Mother	65	187	16.5		20.4 – 31.2
Guardian	62	37	15.8		53.1 – 72.1
Total	**148**	**245**	**37.7**		
Education level					
None	8	36	2	22.9 P < 0.05	6.8 – 29.6
Primary	13	45	3.3		11.7 – 33.1
Secondary	44	79	11.2		27.3 – 44.2
Tertiary	83	85	21.2		41.8 – 57
Total	**148**	**245**	**37.7**		
School attended by ward					
G.S.S.I	81	150	20.6	1.61 P > 0.05	28.8 – 41.2
C.C.O	67	95	17		33.8 – 48.9
Total	**148**	**245**	**37.7**		

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Table 2: Changes in sources of HPV vaccine information pre and post intervention

Source of information on HPV vaccine (multiple choice)	Pretest Frequency (%)	Post-test Frequency (%)	% Shift
Healthcare providers	61 (15.5%)	111 (28.2%)	+81.9%
School health programs	17 (4.3%)	47 (12%)	+179%
Social media	65 (16.5%)	365 (92.9%)	+463%
Family or friends	31 (7.9%)	34 (8.7%)	+10.1%
Television/radio	65 (16.5%)	105 (26.7%)	+61.8%
Internet/websites	53 (13.5%)	83 (21.1%)	+56.3%
None	235 (59.8%)	4 (1%)	–98.3%

Table 3: Digital intervention engagement metrics

Post content	Likes	Emojis	Comments	Poll participation	Engagement rate (%)
Understanding of HPV	59	18	46	61	46.8
Cervical cancer overview	73	16	38	74	51.1
Cervical cancer screening	64	19	45	62	48.3
Vaccine safety and efficacy	45	21	33	49	37.7
Personal stories and testimonials[a]	69	27	43	–	35.4
Myth-busting[a]	40	17	43	–	25.4
HPV vaccination process	43	16	32	40	33.3
Health professional insights	50	31	48	55	46.8
Relevance of cervical cancer screening	55	23	24	53	39.4
Relevance of HPV vaccination	52	16	29	48	36.9
Overcoming barriers to vaccination	63	22	31	57	44

[a] Dashes (–) in the poll participation column indicate that no polls were conducted on the days these posts were shared.

Engagement rate (%) = [Total engagements (likes + emojis + comments + poll participation) ÷ total participants in WhatsApp groups] × 100.

Discussion

This study looked at how parents' knowledge of the HPV vaccine was shaped by sociodemographic factors, information channels, and digital engagement in two secondary schools in Nigeria. The results showed that parental knowledge was significantly influenced by sociodemographic factors, with awareness levels varying by age, gender, education, and relationship to the adolescent. Mothers, younger parents (especially those under 40), and those with a tertiary education were more likely to be aware of the HPV vaccine. These findings are consistent with previous research showing that maternal health literacy and higher educational attainment are powerful predictors of health-seeking behaviour and vaccine acceptance.[17,18] The observed disparities suggest that certain populations (especially fathers, older parents, and those with limited formal education) may require customized outreach strategies.

After the intervention, there was a significant change in the sources of information. More than half of the respondents said they had no reliable source of information about the HPV vaccine before the digital outreach. However, this number sharply decreased to barely 1% following the WhatsApp promotion. This decrease illustrates how well the digital strategy filled in awareness gaps. Notably, the use of social media as the main source of information on vaccines increased by more than 460%. This was followed by notable increases in the use of radio and television, healthcare providers, and school health programs. These findings support previous research on how mobile health (mHealth) interventions can decentralize and spread health messages, particularly in low-resource environments where traditional outreach is limited.[19,20] However, the observed increases across both digital and institutional sources suggest that hybrid approaches (merging social platforms with trusted offline channels) may be particularly effective for reaching broader parent demographics.

The WhatsApp intervention's engagement analytics show complex trends in the way people consume material. Posts about HPV vaccine safety, cervical cancer screening, and expert comments had the highest engagement rates, suggesting that participants were interested in content that was actionable and clinically advised. On the other hand, posts dispelling myths and providing procedural information (such the logistics of vaccinations) drew comparatively less interaction, indicating that factual content might not be enough to maintain interest or involvement. These results are

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consistent with those of Broniatowski, [21] who pointed out that the main factors influencing participation in digital vaccination efforts are emotional appeal, perceived relevance, and trust in the message source. The importance of storytelling in public health communication is further demonstrated by the enthusiastic reception given to narrative-based content, such as firsthand accounts. Future campaigns may benefit from adapting content styles based on real-time feedback, including greater use of multimedia, vernacular expressions, and peer-led discussions to sustain attention and reinforce behaviour change.

This study highlights the revolutionary potential of messaging apps like WhatsApp as instruments for enhancing vaccine literacy in marginalized communities from a public health standpoint. Beyond the confines of a clinic, a dynamic environment for health education is created by the capacity to quickly distribute knowledge, encourage peer discussion, and engage with expert perspectives. It would be crucial to combine these digital activities with school-based initiatives and primary healthcare facilities as Nigeria expands its national HPV vaccination campaigns in order to ensure fair uptake. Crucially, this study also emphasizes the necessity of audience segmentation in health messaging design, acknowledging that gender, age, and education not only impact awareness but also engagement habits across platforms.

The above findings suggest that socio-demographics, information sources, and engagement preferences play interconnected roles in determining HPV vaccine awareness. By harnessing digital platforms in culturally appropriate ways, health educators and policymakers may address long-standing knowledge gaps and encourage participation in life-saving immunization programs.

Conclusion

Parents' HPV-related engagement was shaped by sociodemographic factors such as age, gender, education, and parental role. The WhatsApp intervention shifted primary sources of vaccine information, with notable increases in social media and school health programs. The sharp decline in parents reporting no access to information highlights the campaign's role in improving equity. Engagement data further showed stronger interest in clinical and expert-driven content compared to myth-busting or procedural posts, showing the need to tailor health messages to demographic profiles and content preferences.

Limitations

This study demonstrates the efficacy of WhatsApp-based interventions for improving HPV vaccine awareness, but the one-group pretest/post-test design has inherent constraints. The absence of a control group limits causal inference, as changes observed may have been influenced by factors beyond the intervention itself. These external influences may have reinforced or overlapped with the intervention, making it difficult to isolate its unique effect. In addition, the design is more vulnerable to threats such as maturation and history bias, where participants' knowledge or attitudes may evolve naturally over time, regardless of the intervention.

The study's focus on urban public schools also reduces generalizability. Urban participants typically have better internet connectivity, higher smartphone penetration, and greater digital literacy, which may have facilitated engagement. In contrast, rural populations may face barriers such as limited access to smartphones, weaker connectivity, and lower digital literacy, potentially reducing the effectiveness of WhatsApp-based interventions.

Despite these limitations, the significant pre–post changes observed strongly suggest that the intervention contributed meaningfully to improved awareness. Future research should employ more rigorous designs, such as randomized controlled trials, to strengthen causal conclusions and account for external influences. Studies should also explore rural and underserved contexts to assess scalability, inclusiveness, and equity of digital health strategies, ensuring that interventions are adaptable across diverse settings.

Recommendations

Future HPV vaccine awareness efforts should use mobile messaging apps like WhatsApp to provide parents with timely, interesting, and demographically relevant content, according to the study's findings. Fathers, elderly caregivers, and those with less education should be given priority in health education initiatives because they demonstrate lower baseline awareness and involvement. In order to include digital outreach with current school health initiatives and guarantee constant and reinforced messaging, public health organizations and educational institutions should fortify their partnerships. To improve cultural relevance, programming should also be co-designed with communities; this includes using personal narratives, expert voices, and interactive features to keep viewers interested. Strategies should also address gaps in digital literacy and, where necessary, use low-tech alternatives in order to optimize impact. Lastly, it is important to leverage real-time engagement data to continuously improve communication strategies and deepen parent involvement in adolescent vaccine uptake.

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Print ISSN: 3043-4742 Online ISSN: 3043-4750

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Consent for Publication

All authors have read and approved the final manuscript. The participants in the study were informed about the nature and purpose of the research, and written consent for participation and publication of their data was obtained from all participants. Additionally, consent was obtained from the parents or legal guardians of minor participants.

Competing interests

The authors declare no competing interests.

Funding

This study did not receive external funding. All research activities were self-supported by the authors.

Authors' contributions

F. C. Uzoma led the study, overseeing the research design, data collection, result analysis, and manuscript preparation, while also acting as the corresponding author. Dr. U. W. Dozie provided essential supervision, reviewing the design and offering critical insights during data collection. I. L. Okoro, N. V. Nwanna and O. Egboluche were instrumental in training participants and facilitating the WhatsApp-based campaign. I. C. Basil contributed significantly by performing the statistical analysis and interpreting the results. Prof. S. N. O. Ibe reviewed the manuscript, offering critical feedback and ensuring academic rigor. Dr. C. C. Iwuala and Dr. C. O. Akanazu provided invaluable guidance and support throughout the research process. This collaborative effort ensured a thorough and impactful study on HPV awareness and acceptance.

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Print ISSN: 3043-4742 Online ISSN: 3043-4750

Ethical Approval and consent to participate

The study was conducted in accordance with the guidelines of the Declaration of Helsinki and received approval from the Health Research Ethics Committee of Federal University Teaching Hospital, Owerri (FUTHO), Imo State, Nigeria. This approval was under the chairmanship of Dr. I.I. Ike, MBBS, FMCPAED, and was granted on 24th November 2023. Informed and written consent was obtained from all participants involved in the study.

Data Availability

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request. All data supporting the findings of this study are included in the manuscript. Additional data, such as raw data files and detailed methodologies, are available upon request from the corresponding author, Felicia Chukwuebuka, Uzoma at uzomafeliciac94@gmail.com

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