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Improving HPV Vaccine Uptake Among Girls Aged 9–14 Years in Akwa Ibom State, Nigeria: A Community-Participatory Pre/Post-Intervention Study

Victory Ekpin

victoryekpin98@gmail.com

Institute of Health Research and Development

Christie Akwaowo

Institute of Health Research and Development

Martins Iyekekpolor

Northumbria University

Edidiong Umoh

University of Uyo

Utibeka-Theresa Nde

University of Uyo

Chidinma Ndubuisi

MIVA Open University

Chika Ojumah

Ahmadu Bello University

Uwemedimbuk Ekanem

University of Uyo

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Abstract

Background

Cervical cancer remains a leading cause of cancer-related mortality among women in Nigeria, where Human Papillomavirus (HPV) vaccine uptake has historically been among the lowest in sub-Saharan Africa. Despite the introduction of the HPV vaccine into Nigeria's National Immunisation Programme in 2023, uptake remains suboptimal. This study evaluated the effect of a community-participatory, multi-channel sensitisation intervention on HPV vaccine uptake, awareness, and knowledge among caregivers of girls aged 9–14 years in Akwa Ibom State, Nigeria.

Methods

A pre/post-intervention study was conducted across six communities in three local government areas representing urban, semi-urban, and rural settings. Independent cross-sectional surveys were administered to caregivers of eligible girls before (n = 331, January 2025) and after (n = 355, June 2025) a fourteen-week community sensitisation intervention delivered through five channels: churches, schools, primary healthcare facilities, community sound announcers, and physical materials. All materials were co-designed with community stakeholders. Descriptive statistics, chi-square and Mann-Whitney U tests, and multivariable logistic regression were used for analysis. Statistical significance was set at $p < 0.05$.

Results

HPV vaccine uptake increased from 7.3% (95% CI: 4.5%–10.0%) to 50.4% (95% CI: 45.2%–55.6%), an absolute increase of 43.1 percentage points. HPV vaccine awareness rose from 15.1% to 65.4% ($p < 0.001$). Among HPV-aware respondents, good HPV knowledge increased from 63.9% to 84.3% ($p = 0.019$), though vaccine-specific knowledge remained predominantly poor across both phases (4.0% vs. 6.9%, $p = 0.749$). Willingness to vaccinate among unvaccinated caregivers was high and unchanged (87.0% vs. 87.5%, $p = 0.979$). Routine facility records corroborated survey findings, showing a 276% increase in mean monthly doses administered. HPV vaccine awareness was the strongest independent predictor of uptake in both phases (pre-intervention aOR 9.88, 95% CI: 2.07–47.46; post-intervention aOR 16.59, 95% CI: 6.98–39.46).

Conclusions

A community co-designed, multi-channel sensitisation intervention was associated with a substantial increase in HPV vaccine uptake within six months. Limited awareness rather than vaccine hesitancy was the primary barrier in this setting. Sustaining these gains requires parallel investment in vaccine supply-

chain resilience alongside community sensitisation, and future interventions should prioritise strengthening vaccine-specific knowledge to support informed and durable vaccination uptake.

Trial registration

Pan African Clinical Trials Registry (PACTR), PACTR202609683563072, [07 September, 2026]. Retrospectively registered.

Background

Cervical cancer remains one of the most preventable yet persistently fatal malignancies affecting women worldwide. In 2022, an estimated 660,000 new cases and 350,000 deaths were recorded globally, with the overwhelming majority occurring in low- and middle-income countries.[1] Sub-Saharan Africa, Central America, and Southeast Asia bear a disproportionate burden of disease, reflecting profound inequities in access to Human Papillomavirus (HPV) vaccination, cervical cancer screening, and treatment infrastructure, compounded by socioeconomic and systemic barriers.[1]

In Nigeria, cervical cancer is the second most common cancer among women, with approximately 12,075 new cases diagnosed annually, resulting in 7,968 deaths.[2] Alarmingly, eight in ten women are diagnosed at advanced stages, when curative treatment options are severely limited and survival outcomes are poor.[3] Inadequate treatment infrastructure further contributes to low survival rates, making primary prevention the most viable and cost-effective strategy in the Nigerian context.[3]

The HPV vaccine is among the most efficacious primary prevention tools available. Current WHO-prequalified vaccines target HPV serotypes 16 and 18, which are collectively responsible for approximately 70% of cervical cancer cases globally.[4] When delivered alongside screening programmes such as HPV DNA testing and Papanicolaou (Pap) smear, the vaccine constitutes the cornerstone of cervical cancer prevention. Countries with high vaccination coverage and functional screening infrastructure have recorded dramatic reductions in cervical cancer incidence.[5]

Despite the proven efficacy of the HPV vaccine, uptake in Nigeria has historically been low.[6,7] Until October 2023, the vaccine was not publicly funded, requiring out-of-pocket purchase at prohibitively high costs.[8] The subsequent introduction of the HPV vaccine into Nigeria's National Immunisation Programme, with an initial rollout targeting girls aged 9–14 years across 16 of the 36 states, represented a landmark shift in the country's cervical cancer prevention landscape.[9] Despite improved access, uptake remains suboptimal, and research consistently identifies gaps in awareness and knowledge of HPV, cervical cancer, and the vaccine as critical determinants of caregivers' willingness to vaccinate.[10,11]

A systematic review of interventions to promote HPV vaccination across Africa found that educational interventions were effective in improving vaccine uptake and knowledge in twelve of thirteen evaluated

studies, with post-intervention uptake ranging from 34% to 93.3%.[12] In Nigeria specifically, community-participatory approaches have shown promise in improving health outcomes by harnessing social networks and local leadership structures.[13] Community participation involves establishing partnerships with influential community members and intervention recipients to facilitate entry, acceptance, and sustained engagement.[14] Crucially, materials and messages co-designed with community stakeholders have been shown to improve community resonance, engagement, and health outcomes compared to externally imposed approaches.[15]

Akwa Ibom State was one of the 16 states included in the initial HPV vaccine rollout and presents a unique context for intervention: it carries the highest HIV prevalence rate in Nigeria (5.5% against a national average of 1.4%),[16] and women living with HIV face a sixfold higher risk of developing cervical cancer.[17] Despite this epidemiological vulnerability, the state lacks published data on HPV vaccine uptake and community-level determinants of vaccination in the post-rollout period.

This study reports the findings of a community-participatory pre/post-intervention study designed to improve HPV vaccine uptake among girls aged 9–14 years in three local government areas of Akwa Ibom State, Nigeria. The findings are expected to generate actionable evidence for policymakers and programme designers seeking to scale context-appropriate, community-driven cervical cancer prevention efforts.

Methods

Study Setting

The study was conducted in Akwa Ibom State, located in the south-south geopolitical zone of Nigeria and forming part of the Niger Delta region. The state has an estimated population of approximately 7.2 million, distributed across 31 local government areas (LGAs) in three senatorial districts.[18] One LGA was randomly selected from each of the three senatorial districts to achieve geographic coverage: Uyo (Akwa Ibom North-East), Ikot Ekpene (Akwa Ibom North-West), and Okobo (Akwa Ibom South), representing urban, semi-urban, and rural community types respectively. The pre-intervention survey was conducted from 6 to 10 January 2025, and the post-intervention survey from 9 to 13 June 2025, with the community awareness intervention implemented over the intervening six-month period.

Study Design

A pre/post-intervention study design was employed, reported in accordance with the Transparent Reporting of Evaluations with Non-randomised Designs (TREND) statement.[19] The study was conducted in three sequential phases: (1) a pre-intervention cross-sectional survey; (2) co-design and implementation of a community awareness intervention; and (3) a post-intervention cross-sectional

survey and evaluation. Because the two surveys sampled different participants from the same communities, the design involves independent samples rather than matched pre/post observations.

Study Population and Eligibility Criteria

The study population comprised parents and caregivers of female children aged 9–14 years residing in the selected communities at the time of each survey. Eligibility required that respondents: (i) were the primary caregiver of at least one girl aged 9–14 years currently residing in the household; (ii) had resided in the community for at least six months prior to the survey; (iii) were aged 18 years or older; and (iv) were willing and able to provide written informed consent. Respondents were excluded if they were unable to communicate in English or in any of the three principal local languages (Ibibio, Annang, Oron), even with interpreter assistance.

Sample Size and Sampling

The minimum sample size was estimated at 174 per survey phase, based on a prior HPV vaccine uptake prevalence of 13% in Southeast Nigeria,[20] a precision of 0.05, and a 95% confidence interval. This was inflated by 20% for non-response, giving a target of 209 per phase. A multi-stage sampling technique was applied: one LGA was randomly selected per senatorial district; two communities were selected per LGA by simple random sampling; and consecutive eligible households were enrolled within each community.

Intervention: community co-design and sensitisation

Community Stakeholder Workshops

Following completion of the pre-intervention survey, community stakeholder workshops were convened at the community level rather than the LGA level, as originally planned. This modification was made in response to the geographic and social distinctiveness of the six study communities, which made LGA-level aggregation logistically impractical. A total of six first-round workshops were held, each with a minimum of ten participants. Attendees typically included the village head or his representative, the men's leader, women's leader, and youth leader, a primary healthcare (PHC) worker, a teacher, one to two adolescent girls, and in several communities, a religious leader.

Each workshop served two functions. First, findings from the pre-intervention survey were presented to community stakeholders, including data on awareness levels, knowledge gaps, and respondents' stated preferences for how health messages should be communicated. This evidence directly informed the co-design process. Second, stakeholders engaged in structured discussion to identify contextually appropriate communication channels, messages, and materials. Participants identified religious organisations, schools, community sound announcers, primary healthcare settings, and strategic

placement of physical materials as the most appropriate channels. Community members also provided guidance on the design, content, and language of sensitisation materials, including fliers and banners, which were developed in the principal local language (Ibibio). Stakeholders were engaged at every stage of sensitisation planning during this phase.

Following development of the sensitisation messaging, materials, and implementation plan, a second round of community workshops was conducted for validation purposes. Stakeholders in each community reviewed the draft materials and implementation strategy, made corrections, and gave final approval before rollout. The entire co-design and validation phase, spanning initial workshops, iterative material development, and validation, was completed over three weeks.

Sensitisation Activities

The sensitisation phase was implemented over 14 weeks across all six study communities simultaneously, using five concurrent channels. All sensitisation activities involving direct community engagement were led by trained medical doctors, ensuring consistency and clinical credibility in the delivery of health messages. Prior to implementation, formal permissions were obtained from all relevant gatekeepers, including village chiefs, religious leaders, school authorities, and the Primary Health Care Development Agency. All five channels were deployed uniformly across each community.

Religious organisations

Letters were sent to all churches in each community requesting that the sensitisation message be read to their congregations every Sunday throughout the 14-week period. In addition, the five largest churches per community, as identified by community stakeholders, were visited directly by the research team for in-person sensitisation sessions led by trained medical doctors, with the team rotating across communities throughout the period. Fliers were distributed to church members during these visits.

School outreaches

Weekday outreaches were conducted in secondary schools across each community. Given that most communities had one to two major secondary schools, all secondary schools within each community were visited. Outreaches were led by trained medical doctors and targeted both teachers and senior secondary school students. Teachers were educated on HPV and the vaccine, and senior secondary school students were specifically targeted on the basis that they were of sufficient age and comprehension to engage with the content and serve as information conduits within their households. Fliers were distributed to both teachers and students during each school visit.

Community announcements

Community announcers, known locally as “town criers” were engaged to broadcast sensitisation messages twice weekly across each community throughout the 14-week period, ensuring broad,

repeated, and geographically extensive reach.

Primary healthcare worker engagement

A one-on-one structured session was conducted by trained medical doctors with the healthcare workers manning each community PHC facility. Given that most facilities were staffed by one to two nurses or Community Health Officers (CHOs), individual sessions were more appropriate than group training. These sessions equipped PHC workers with the knowledge and communication skills to counsel patients and caregivers attending health services about HPV and the vaccine throughout the sensitisation period. Fliers were provided for distribution at each PHC facility.

Physical materials

Two large banners were erected at high-footfall locations in each community, as identified by community stakeholders, and remained in place throughout the 14-week sensitisation period. Fliers were distributed across all three active delivery settings, churches, schools, and PHC facilities, providing a consistent take-home resource reinforcing the core messages delivered through each channel.

Data Collection

Quantitative data were collected using a structured, interviewer-administered questionnaire adapted from validated tools used in comparable settings.[21–23] The questionnaire was developed by the researchers and can be assessed in *supplement 1*. The questionnaire covered five domains: sociodemographic characteristics; awareness and knowledge of HPV, cervical cancer, and the HPV vaccine; vaccine uptake status, willingness to vaccinate, and barriers to vaccination; community perceptions and communication preferences; and general vaccination attitudes, assessed using a five-point Likert scale. The post-intervention survey included an additional domain assessing respondents' engagement with and perceptions of the community awareness campaign. The questionnaire was pre-tested with 30 participants in Oron LGA and minor revisions were made to improve item clarity and flow.

The questionnaire was administered in English and in the three principal local languages (Ibibio, Annang, and Oron), depending on the respondent's preference, to ensure comprehension across literacy levels. Six trained research assistants conducted data collection across the study communities. Research assistants received structured pre-survey training covering the study objectives, questionnaire administration procedures, participant rights, and data protection protocols. During fieldwork, supervisors reviewed all completed questionnaires daily for completeness and internal consistency, and data entry was conducted under close oversight.

In addition to survey data, routine immunisation records were obtained from PHC facilities within the selected communities to provide an independent corroboration of self-reported HPV vaccine uptake during the post-intervention phase.

Variable Operationalisation

The primary outcome was HPV vaccine uptake, defined as receipt of at least one dose of the HPV vaccine by the caregiver's daughter or ward, coded as a binary variable (vaccinated vs. not vaccinated).

Knowledge was assessed using two composite scores, restricted to respondents who reported awareness of the relevant entity. HPV knowledge was computed from items on the nature of HPV infection, transmission, symptoms, associated illnesses, risk factors, and prevention (maximum score: 37). Vaccine knowledge covered vaccine purpose, safety, target group, dosing, and screening after vaccination (maximum score: 11). Scores were expressed as percentages of the maximum. Following the Modified Bloom's cut-off approach,[24] respondents were classified as having Good knowledge (≥ 60%) or Poor knowledge (< 60%). For the vaccine knowledge scale, the 60% threshold was applied at the nearest integer above 6.6 (i.e., a score of ≥ 7). Likert-scale items measuring vaccination attitudes (1 = Strongly Disagree to 5 = Strongly Agree) were analysed with higher scores on hesitancy items reflecting less favourable attitudes.

Data Analysis

All analyses were conducted in Python (version 3.11; pandas, scipy, statsmodels) with cross-validation in SPSS version 27. Statistical significance was set at $p < 0.05$. Categorical variables are presented as frequencies and proportions; continuous variables as mean (SD) or median (IQR) based on Shapiro-Wilk testing. Pre-to-post comparisons used Pearson Chi-square or Fisher's exact test for proportions, and Mann-Whitney U test for continuous scores. Bivariate analysis of predictors of uptake was conducted within each survey phase separately. Multivariable binary logistic regression was run separately for each phase, using a liberal inclusion threshold of $p < 0.25$ in bivariate analysis plus theoretically justified variables. Adjusted odds ratios (aOR) are presented with 95% CIs; model fit was assessed using McFadden Pseudo-R^2 and AIC. Post-intervention campaign evaluation was analysed descriptively, with Chi-square used to examine the association between campaign participation and uptake.

Ethical Considerations

Ethical clearance was obtained from the Health Research Ethics Committee of the University of Uyo Teaching Hospital (UUTH/AD/S/96/VOLXXI/1001). All activities complied with the Declaration of Helsinki. Informed consent was obtained from all participants prior to enrolment. Participants were verbally informed of the study objectives, procedures, potential risks and benefits, and their right to withdraw at any time without consequence. For participants who were unable to read, informed consent was obtained by having the consent information read aloud to them by a trained member of the research team. Participants were given the opportunity to ask questions and, after confirming their understanding and willingness to participate, provided consent themselves before proceeding to the questionnaire. Consent was documented electronically through a dedicated consent field on the digital data collection platform, which participants completed before accessing the survey questions.

Data were anonymised through the use of unique identification codes, and all records were stored in password-protected digital systems accessible only to the research team. Participation was entirely voluntary and no financial inducements were offered; modest reimbursement for transport was provided to community stakeholders attending the co-design and validation workshops only, and did not constitute undue influence.

Declaration of Use of Artificial Intelligence

Artificial intelligence tools, including Claude (developed by Anthropic; Sonnet 4.6) and ChatGPT (developed by OpenAI; GPT-5.5), were used to assist with language editing, manuscript organization, and improvement of the grammar and tone of the manuscript. All AI-generated outputs were critically reviewed, verified, and edited by the principal investigator (VE), who takes full responsibility for the accuracy, integrity, and originality of the work. AI tools were not used to generate references, fabricate or modify data, perform statistical analyses, or make interpretive judgements.

Results

1. Sociodemographic Characteristics of Participants

A total of 341 eligible caregivers were approached in the pre-intervention survey, of whom 331 consented and participated, yielding a response rate of 97.1%. In the post-intervention survey, 359 caregivers were approached, of whom 355 participated, a response rate of 98.9%. Across both phases, 686 caregivers participated in the study.

The sociodemographic profiles were broadly comparable across phases. The mean age was 40.5 years (SD 10.3) pre-intervention and 40.0 years (SD 10.1) post-intervention, with the majority falling within the 30–44-year age group. Females constituted approximately three-quarters of respondents in both phases (74.3% and 76.3%), and mothers were the most frequently represented caregivers (56.2% and 62.8%). Secondary education was the most common educational attainment for both mothers and fathers. The majority of respondents were unemployed or informally employed, and all participants identified as Christian. Each LGA contributed approximately one-third of the sample in both phases. Full sociodemographic details are presented in Table 1.

Table 1
Sociodemographic characteristics of participants by survey phase

Characteristic	Pre-intervention (n = 331)	Post-intervention (n = 355)
Age, years — mean (SD)	40.5 (10.3)	40.0 (10.1)
Age category, n (%)		
<30 years	43 (13.0)	45 (12.7)
30–44 years	178 (53.8)	215 (60.6)
45–59 years	94 (28.4)	72 (20.3)
≥60 years	16 (4.8)	23 (6.5)
Gender, n (%)		
Female	246 (74.3)	271 (76.3)
Male	85 (25.7)	84 (23.7)
Relationship to child, n (%)		
Father	66 (19.9)	76 (21.4)
Mother	186 (56.2)	223 (62.8)
Guardian	79 (23.9)	56 (15.8)
Mother/female caregiver education, n (%)		
No formal education	29 (8.8)	23 (6.5)
Primary	73 (22.1)	90 (25.4)
Secondary	178 (53.8)	194 (54.6)
Tertiary	42 (12.7)	37 (10.4)
Other	9 (2.7)	11 (3.1)
Father/male caregiver education, n (%)		
No formal education	20 (6.0)	11 (3.1)
Primary	58 (17.5)	67 (18.9)
Secondary	140 (42.3)	174 (49.0)
Tertiary	35 (10.6)	30 (8.5)
Other	78 (23.6)	73 (20.6)
Respondent occupation, n (%)		

Characteristic	Pre-intervention (n = 331)	Post-intervention (n = 355)
Unemployed	46 (13.9)	31 (8.7)
Formal sector employed	24 (7.3)	19 (5.4)
Informal sector employed	20 (6.0)	27 (7.6)
Self-employed	241 (72.8)	278 (78.3)
Household income, NGN/month — median (IQR)	35,000 (20,000–60,000)	50,000 (25,000–70,000)
LGA of residence, n (%)		
Uyo	112 (33.8)	119 (33.5)
Ikot Ekpene	106 (32.0)	113 (31.8)
Okobo	113 (34.1)	123 (34.6)
Tribe/Ethnicity, n (%)		
Ibibio	112 (33.8)	119 (33.5)
Annang	101 (30.5)	107 (30.1)
Oron	113 (34.1)	121 (34.1)
Igbo	5 (1.5)	8 (2.3)
Religion	Christianity: 100%	Christianity: 100%

SD = standard deviation; IQR = interquartile range; LGA = Local Government Area; NGN = Nigerian Naira.

2. Awareness of HPV, Cervical Cancer, and the HPV Vaccine

Awareness of HPV, cervical cancer, and the HPV vaccine increased significantly between survey phases (Fig. 1). Awareness of HPV rose from 10.9% (36) pre-intervention to 28.7% (102) post-intervention (χ^2=32.884, $p < 0.001$). Cervical cancer awareness increased from 33.5% (111) to 47.0% (167) (χ^2=12.412, $p < 0.001$). The most pronounced change was observed in HPV vaccine awareness, which more than quadrupled from 15.1% (50) to 65.4% (232) (χ^2=176.563, $p < 0.001$).

Among those aware of the HPV vaccine, health workers remained the predominant source of information in both phases (64.0% and 63.8% respectively). Family/friends, religious leaders, and community meetings expanded considerably as information sources post-intervention, rising from 6.0% to 38.8%, 10.0% to 37.9%, and 2.0% to 17.2% respectively, while Radio/TV declined from 42.0% to 22.0%.

3. Knowledge of HPV and the HPV Vaccine

HPV knowledge was assessed among participants who reported awareness of HPV which were 36 pre-intervention and 102 post-intervention respondents; vaccine knowledge among 50 and 232 respectively.

Mean HPV knowledge score improved significantly from 24.86 (SD 3.50) to 27.00 (SD 3.75; Mann-Whitney U = 1249.5, p = 0.004), with good knowledge increasing from 63.9% to 84.3% (χ^2=5.514, p = 0.019). For vaccine knowledge, the mean score improved from 4.14 (SD 1.44) to 4.69 (SD 1.20; Mann-Whitney U = 4486.0, p = 0.010), but the proportion with good knowledge remained low and did not differ significantly between phases (4.0% vs. 6.9%; χ^2=0.195, p = 0.659). Figure 2 shows the full score distributions.

4. Self-Reported HPV Vaccine Uptake

HPV vaccine uptake increased across all strata (Fig. 3; Table 2). Overall uptake rose from 7.3% (24/331; 95% CI: 4.5%–10.0%) pre-intervention to 50.4% (179/355; 95% CI: 45.2%–55.6%) post-intervention (χ^2=151.163, p < 0.001), an absolute increase of 43.1 percentage points. Significant increases were observed in all three LGAs, with Uyo recording the largest proportional increase (2.7% to 57.1%). Among vaccine-aware respondents, uptake doubled from 36.0% to 72.0% (χ^2=22.035, p < 0.001). School-based delivery accounted for 95.8% of pre-intervention vaccinations; post-intervention, schools remained predominant (59.8%) but health facilities (31.3%) and churches (6.7%) emerged as additional delivery points.

Table 2
HPV vaccine uptake by phase, LGA, and awareness status

Uptake Variable	Pre-intervention	Post-intervention	p-value
Overall uptake, n (%)	24/331 (7.3)	179/355 (50.4)	< 0.001
95% Confidence Interval	4.5%–10.0%	45.2%–55.6%	
Uptake by LGA			
Uyo	3/112 (2.7)	68/119 (57.1)	< 0.001
Ikot Ekpene	14/106 (13.2)	50/113 (44.2)	< 0.001
Okobo	7/113 (6.2)	61/123 (49.6)	< 0.001
Uptake among vaccine-aware, n (%)	18/50 (36.0)	167/232 (72.0)	< 0.001
95% Confidence Interval	22.7%–49.3%	66.2%–77.8%	
Where vaccine received (among vaccinated)	n = 24	n = 179	
School	23 (95.8)	107 (59.8)	
Health facility	1 (4.2)	56 (31.3)	
Church	0 (0.0)	12 (6.7)	
Outreach	0 (0.0)	4 (2.2)	

95% CI = 95% confidence interval; LGA = Local Government Area. p-values from Pearson Chi-square test.

4b. HPV Vaccine Uptake - Routine PHC Facility Records

Routine immunisation records from the six PHC facilities serving the study communities independently corroborated the self-reported uptake findings. Across all facilities, a mean of 28.5 HPV vaccine doses was administered per month during the eight months preceding the intervention (June 2024–January 2025), rising to a mean of 107.2 doses per month during the four-month intervention period (February–May 2025), a 276% increase in monthly throughput (Fig. 4). The increase was most pronounced in Ikot Ekpene and Okobo, where pre-intervention delivery had been negligible.

5. Willingness to Vaccinate and Barriers to Vaccination

Among unvaccinated respondents, willingness to vaccinate was high and stable across phases 267 (87.0%) pre-intervention and 154 (87.5%) post-intervention, with no statistically significant difference (χ^2=0.001, p = 0.979). The predominant barrier pre-intervention was lack of awareness (93.8% of unvaccinated respondents), which declined to 80.1% post-intervention. Vaccine unavailability when sought emerged as a more prominent barrier post-intervention (10.2% vs. 1.3%). Other barriers remained infrequent in both phases. Figure 5 presents barriers ranked by frequency.

6. Factors Associated with HPV Vaccine Uptake — Bivariate Analysis

Pre-intervention

In the pre-intervention phase, awareness of HPV ($p < 0.001$), cervical cancer ($p < 0.001$), and the HPV vaccine ($p < 0.001$) were significantly associated with uptake. Among vaccine-aware respondents, 36.0% were vaccinated compared to 2.1% of those unaware. Mother's education ($p = 0.026$), occupation ($p = 0.002$), LGA ($p = 0.010$), and household income (vaccinated median ₦70,000 vs. unvaccinated ₦30,000; $p < 0.001$) were also significant. Results are presented in Table 3.

Table 3
Bivariate analysis of factors associated with HPV vaccine uptake — pre-intervention survey (n = 331)

Variable	Vaccinated n (%)	Not Vaccinated n (%)	p-value
Age category			
<30 years	1 (2.3%)	42 (97.7%)	0.479
30–44 years	16 (9.0%)	162 (91.0%)	
45–59 years	6 (6.4%)	88 (93.6%)	
≥60 years	1 (6.2%)	15 (93.8%)	
Gender			
Female	19 (7.7%)	227 (92.3%)	0.748
Male	5 (5.9%)	80 (94.1%)	
Relationship to child			
Father	4 (6.1%)	62 (93.9%)	0.112
Mother	18 (9.7%)	168 (90.3%)	
Guardian	2 (2.5%)	77 (97.5%)	
Mother's education			
No formal education	0 (0.0%)	29 (100.0%)	0.026*
Primary	2 (2.7%)	71 (97.3%)	
Secondary	15 (8.4%)	163 (91.6%)	
Tertiary	7 (16.7%)	35 (83.3%)	
Other	0 (0.0%)	9 (100.0%)	
Father's education			
No formal education	0 (0.0%)	20 (100.0%)	0.096
Primary	3 (5.2%)	55 (94.8%)	
Secondary	15 (10.7%)	125 (89.3%)	
Tertiary	4 (11.4%)	31 (88.6%)	
Other	2 (2.6%)	76 (97.4%)	
Occupation			

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Chi-square or Fisher's exact test for categorical variables; Mann-Whitney U for income. p-values shown on the first row of each variable group.

Variable	Vaccinated n (%)	Not Vaccinated n (%)	p-value
Unemployed	2 (4.3%)	44 (95.7%)	0.002**
Formal sector employed	4 (16.7%)	20 (83.3%)	
Informal sector employed	5 (25.0%)	15 (75.0%)	
Self-employed	13 (5.4%)	228 (94.6%)	
LGA of residence			
Uyo	3 (2.7%)	109 (97.3%)	0.010**
Ikot Ekpene	14 (13.2%)	92 (86.8%)	
Okobo	7 (6.2%)	106 (93.8%)	
Awareness of HPV			
No	13 (4.4%)	282 (95.6%)	< 0.001***
Yes	11 (30.6%)	25 (69.4%)	
Awareness of cervical cancer			
No	4 (1.8%)	216 (98.2%)	< 0.001***
Yes	20 (18.0%)	91 (82.0%)	
Awareness of HPV vaccine			
No	6 (2.1%)	275 (97.9%)	< 0.001***
Yes	18 (36.0%)	32 (64.0%)	
Household income, NGN/month — median (IQR)	₦70,000 (45,000–80,000)	₦30,000 (20,000–55,000)	< 0.001***

Note. * p < 0.05; ** p < 0.01; *** p < 0.001. Chi-square or Fisher's exact test for categorical variables; Mann-Whitney U for income. p-values shown on the first row of each variable group.

Post-intervention

Post-intervention, awareness of HPV, cervical cancer, and the HPV vaccine remained strongly associated with uptake (all p < 0.001). Among vaccine-aware respondents, 72.0% were vaccinated compared to 9.8% of those unaware. Age (p = 0.009), relationship to child (p = 0.002), father's education (p < 0.001), and household income (p < 0.001) were significant; occupation was not. Results are in Table 4.

Table 4

Bivariate analysis of factors associated with HPV vaccine uptake — post-intervention survey (n = 355)

Variable	Vaccinated n (%)	Not Vaccinated n (%)	p-value
Age category			
<30 years	28 (62.2%)	17 (37.8%)	0.009**
30–44 years	114 (53.0%)	101 (47.0%)	
45–59 years	32 (44.4%)	40 (55.6%)	
≥60 years	5 (21.7%)	18 (78.3%)	
Gender			
Female	135 (49.8%)	136 (50.2%)	0.775
Male	44 (52.4%)	40 (47.6%)	
Relationship to child			
Father	41 (53.9%)	35 (46.1%)	0.002**
Mother	122 (54.7%)	101 (45.3%)	
Guardian	16 (28.6%)	40 (71.4%)	
Mother's education			
No formal education	9 (39.1%)	14 (60.9%)	0.123
Primary	48 (53.3%)	42 (46.7%)	
Secondary	98 (50.5%)	96 (49.5%)	
Tertiary	22 (59.5%)	15 (40.5%)	
Other	2 (18.2%)	9 (81.8%)	
Father's education			
No formal education	7 (63.6%)	4 (36.4%)	< 0.001***
Primary	39 (58.2%)	28 (41.8%)	
Secondary	101 (58.0%)	73 (42.0%)	
Tertiary	17 (56.7%)	13 (43.3%)	
Other	15 (20.5%)	58 (79.5%)	
Occupation			

Note. * p < 0.05; ** p < 0.01; *** p < 0.001. Chi-square or Fisher's exact test for categorical variables; Mann-Whitney U for income. p-values shown on the first row of each variable group.

Variable	Vaccinated n (%)	Not Vaccinated n (%)	p-value
Unemployed	14 (45.2%)	17 (54.8%)	0.743
Formal sector employed	10 (52.6%)	9 (47.4%)	
Informal sector employed	16 (59.3%)	11 (40.7%)	
Self-employed	139 (50.0%)	139 (50.0%)	
LGA of residence			
Uyo	68 (57.1%)	51 (42.9%)	0.142
Ikot Ekpene	50 (44.2%)	63 (55.8%)	
Okobo	61 (49.6%)	62 (50.4%)	
Awareness of HPV			
No	90 (35.6%)	163 (64.4%)	< 0.001***
Yes	89 (87.3%)	13 (12.7%)	
Awareness of cervical cancer			
No	46 (24.5%)	142 (75.5%)	< 0.001***
Yes	133 (79.6%)	34 (20.4%)	
Awareness of HPV vaccine			
No	12 (9.8%)	111 (90.2%)	< 0.001***
Yes	167 (72.0%)	65 (28.0%)	
Household income, NGN/month — median (IQR)	₦50,000 (32,500–80,000)	₦37,500 (20,000–61,250)	< 0.001***

Note. * p < 0.05; ** p < 0.01; *** p < 0.001. Chi-square or Fisher's exact test for categorical variables; Mann-Whitney U for income. p-values shown on the first row of each variable group.

7. Multivariable Logistic Regression — Predictors of HPV Vaccine Uptake

Pre-intervention

In the pre-intervention model (n = 331, events = 24), awareness of the HPV vaccine was the only significant independent predictor of uptake (aOR = 9.884, 95% CI: 2.058–47.460, p = 0.004). Mother's education was excluded due to complete separation. No other variable reached significance. The model demonstrated acceptable fit (McFadden Pseudo-R^2=0.394, AIC = 136.25). Results are in Table 5.

Table 5
Multivariable logistic regression — predictors of HPV vaccine uptake, pre-intervention survey (n = 331, events = 24)

Variable	aOR	95% CI	p-value
Awareness of HPV vaccine	9.884**	2.058–47.460	0.004
Awareness of HPV	1.844	0.467–7.279	0.383
Awareness of cervical cancer	2.094	0.442–9.923	0.352
Age 30–44 yrs (ref: <30)	4.643	0.447–48.230	0.199
Age 45–59 yrs (ref: <30)	2.971	0.227–38.942	0.407
Age ≥ 60 yrs (ref: <30)	9.684	0.322–291.127	0.191
Father edu: Primary (ref: NFE/Other)	5.781	0.591–56.561	0.132
Father edu: Secondary (ref: NFE/Other)	6.319	0.988–40.397	0.052
Father edu: Tertiary (ref: NFE/Other)	2.763	0.307–24.850	0.365
Occupation: Formal sector (ref: Unemployed)	3.559	0.310–40.843	0.308
Occupation: Informal sector (ref: Unemployed)	5.275	0.492–56.503	0.169
Occupation: Self-employed (ref: Unemployed)	1.148	0.170–7.770	0.888
LGA: Ikot Ekpene (ref: Uyo)	3.351	0.730–15.368	0.120
LGA: Okobo (ref: Uyo)	2.587	0.483–13.857	0.267
Household income (per ₦10,000)	1.018	0.968–1.071	0.485
McFadden Pseudo-R^2: 0.394 | AIC: 136.25			

aOR = adjusted odds ratio; CI = confidence interval. Mother's education excluded due to complete separation. * p < 0.05; ** p < 0.01.

Post-intervention

In the post-intervention model, HPV vaccine awareness was the strongest predictor (aOR = 16.590, 95% CI: 6.975–39.457, p < 0.001), followed by HPV awareness (aOR = 3.962, p = 0.003) and cervical cancer awareness (aOR = 2.819, p = 0.007). Father's primary (aOR = 5.777, p = 0.001) and secondary education (aOR = 4.710, p < 0.001) were independently associated with higher odds of uptake. Mother's secondary (aOR = 0.289, p = 0.037) and tertiary education (aOR = 0.155, p = 0.030) were associated with lower odds relative to no formal education. Respondents in Ikot Ekpene had lower odds than those in Uyo (aOR = 0.373, p = 0.022). Occupation, age, gender, and household income were not significant. The model demonstrated good fit (McFadden Pseudo-R^2=0.434, AIC = 316.46). Results are in Table 6.

Table 6
Multivariable logistic regression — predictors of HPV vaccine uptake, post-intervention survey (n = 355, events = 179)

Variable	aOR	95% CI	p-value
Awareness of HPV vaccine	16.590***	6.975–39.457	< 0.001
Awareness of HPV	3.962**	1.624–9.666	0.003
Awareness of cervical cancer	2.819**	1.336–5.945	0.007
Mother edu: Primary (ref: NFE/Other)	0.333	0.100–1.117	0.075
Mother edu: Secondary (ref: NFE/Other)	0.289*	0.090–0.930	0.037
Mother edu: Tertiary (ref: NFE/Other)	0.155*	0.029–0.837	0.030
Father edu: Primary (ref: NFE/Other)	5.777**	2.015–16.561	0.001
Father edu: Secondary (ref: NFE/Other)	4.710***	1.986–11.171	< 0.001
Father edu: Tertiary (ref: NFE/Other)	2.456	0.620–9.732	0.201
Occupation: Formal sector (ref: Unemployed)	0.288	0.039–2.129	0.223
Occupation: Informal sector (ref: Unemployed)	0.577	0.101–3.288	0.536
Occupation: Self-employed (ref: Unemployed)	0.657	0.186–2.314	0.513
LGA: Ikot Ekpene (ref: Uyo)	0.373*	0.161–0.866	0.022
LGA: Okobo (ref: Uyo)	0.452	0.194–1.056	0.067
Age 30–44 yrs (ref: <30)	1.007	0.382–2.656	0.989
Age 45–59 yrs (ref: <30)	0.707	0.227–2.204	0.550
Age ≥ 60 yrs (ref: <30)	0.470	0.094–2.344	0.357
Household income (per ₦10,000)	1.007	0.907–1.119	0.891
McFadden Pseudo-R^2: 0.434 | AIC: 316.46			

aOR = adjusted odds ratio; CI = confidence interval. * p < 0.05; ** p < 0.01; *** p < 0.001.

8. Post-Intervention Campaign Evaluation

Among 355 post-intervention respondents, 215 (60.6%) reported awareness of campaign activities and 170 (47.9%) participated directly. Among participants, the village crier announcement was the most frequently cited channel (64.1%), followed by church lectures (46.5%) and school campaigns (32.9%). Of all post-intervention respondents, 167 (47.0%) reported that the messages influenced their perception of the vaccine, and 162 (45.6%) reported that the messages influenced their vaccination decision.

Campaign participants had higher uptake (55.9%) than non-participants (45.4%), though this difference did not reach statistical significance (χ^2=3.482, p = 0.062). Full findings are in Table 7.

Table 7
Post-intervention campaign evaluation findings (n = 355)

Campaign Evaluation Indicator	**Post-intervention (n = 355)**		
Aware of campaign activities	215 (60.6%)		
Participated in awareness activities	170 (47.9%)		
Found messages easy to understand	163 (45.9%)		
Messages influenced perception of HPV vaccine	167 (47.0%)		
Messages influenced decision to vaccinate	162 (45.6%)		
Channel of information (among participants, n = 170)			
Village crier announcement	109 (64.1%)		
Church lecture	79 (46.5%)		
School campaign	56 (32.9%)		
Health centre	42 (24.7%)		
Letter reading in church	23 (13.5%)		
Posters and banners	1 (0.6%)		
Campaign participation and vaccine uptake		χ^2	p-value
Participated: vaccinated	95/170 (55.9%)	3.482	0.062
Did not participate: vaccinated	84/185 (45.4%)		

9. Motivators for Vaccination and Vaccine Concerns

Among unvaccinated respondents, assurance of vaccine safety was the most consistently cited motivator across both phases (60.9% pre-intervention; 58.0% post-intervention). Information from health professionals increased markedly as a motivator from 33.6% to 59.7%, while government recommendation declined from 21.8% to 9.1%. Among respondents aware of the HPV vaccine, side effects were the most commonly cited concern in both phases, declining from 20.0% to 12.1%. Other concerns, including effectiveness, cost, and cultural/religious beliefs, were reported by fewer than 3% of vaccine-aware respondents in either phase. Figure 6 presents motivators ranked by post-intervention frequency.

Discussion

This study evaluated the effect of a community-participatory, multi-channel sensitisation intervention on HPV vaccine uptake among girls aged 9–14 years in three local government areas of Akwa Ibom State, Nigeria. The principal finding showed that overall uptake increased from 7.3% pre-intervention to 50.4% post-intervention, representing an absolute increase of 43.1 percentage points within a six-month period. Importantly, routine immunisation records from the six participating primary healthcare facilities demonstrated a concurrent increase in HPV vaccine delivery, with average monthly doses administered increasing by 276% during the intervention period.

The pre-intervention baseline is consistent with the lowest end of the distribution reported in a 2024 systematic review and meta-analysis of HPV vaccine uptake among adolescent schoolgirls in sub-Saharan Africa, which estimated a pooled prevalence of 28.53% (95% CI: 5.25–51.81) and recorded Nigeria's country-level estimate as the lowest in the region at 3.77%.[25] The post-intervention figure, however, places the study communities well above the regional pooled average and centrally within the post-intervention uptake range of 34%–93.3% reported in a systematic review of African HPV promotion interventions.[12]

Across both survey phases, awareness of the HPV vaccine was the strongest independent predictor of uptake, and its adjusted odds ratio nearly doubled between models (aOR 9.88 to 16.59). Yet among vaccine-aware caregivers, uptake remained at only 36% before the intervention, rising to 72% afterwards, confirming that awareness alone was insufficient. Two features of the intervention design likely account for the additional effect. First, messages were delivered almost entirely through trusted community sources including church leaders, schoolteachers, and primary healthcare workers, rather than through impersonal media. Trusted-messenger delivery is among the most consistently reported facilitators of vaccine confidence in the literature,[26] and a cluster-randomised trial in neighbouring Cross River State demonstrated that engaging traditional and religious leaders increased the likelihood of full childhood vaccination by 39%.[27] Second, fourteen weeks of multi-channel exposure, across church, school, health facility, town crier, and printed materials, provided the kind of repeated, consistent contact that behaviour-change theory identifies as necessary for shifting socially embedded health decisions.[28,29] Notably, post-intervention HPV awareness and cervical cancer awareness emerged as significant independent predictors alongside vaccine-specific awareness, suggesting the campaign built broader health literacy around the disease itself, a pattern consistent with communication-strategy reviews finding that combined disease-and-vaccine messaging outperforms vaccine-only approaches.[30]

Before the intervention, the principal barrier to HPV vaccination in this setting appeared to be limited awareness rather than reluctance to vaccinate. Among caregivers whose daughters had not been vaccinated, willingness to accept the vaccine was already high (87%) and remained essentially unchanged after the intervention (87.5%, $p = 0.979$). Together with the marked increase in vaccine uptake, this suggests that the campaign primarily addressed information and access gaps rather than changing underlying attitudes towards vaccination. This pattern may not apply across all settings.

Studies from northern Nigeria, Kenya, and Uganda have documented substantial attitudinal resistance driven by concerns about infertility, population control, and vaccine safety,[31–33] while broader reviews across sub-Saharan Africa identify religious beliefs, gender dynamics, and sociocultural norms as important barriers to HPV vaccine uptake.[34] The comparatively high baseline willingness observed in this study may therefore reflect the local context, including established trust in community institutions and the absence of widespread vaccine misinformation during the study period.

The increase in vaccine uptake should also be interpreted alongside changes in caregiver knowledge. Although overall HPV knowledge improved substantially among respondents who had heard of HPV, vaccine-specific knowledge remained low in both surveys. This suggests that caregivers may have been willing to vaccinate their daughters without fully understanding the vaccine itself, relying instead on trusted recommendations from community leaders, health workers, and teachers. While this may be sufficient to promote early uptake, future interventions should place greater emphasis on strengthening vaccine-specific knowledge to support informed decision-making and sustain confidence over time.

The pattern of reported barriers provides further insight into how the intervention may have influenced uptake. Lack of awareness remained the most frequently reported barrier after the intervention, although it declined considerably, while reports of vaccine unavailability increased from 1.3% to 10.2%. This shift suggests that as awareness and demand increased, vaccine availability became a more visible constraint. This interpretation is further supported by routine facility records, which showed a marked increase in the number of HPV vaccine doses administered during the intervention period. Similar implementation challenges have been reported during HPV vaccine introduction in Kwara State and Ghana, where increasing community demand highlighted weaknesses in vaccine supply and service readiness.[35,36] These findings reinforce the need to align community sensitisation with reliable vaccine availability to ensure that increased demand can be translated into vaccination.

The associations observed for parental education also deserve cautious interpretation. Higher paternal education was associated with greater vaccine uptake, whereas higher maternal education was associated with lower uptake after adjustment. Although the reasons for this pattern cannot be determined from the present study, one possible explanation is that fathers continue to play a major role in household health decisions in this setting, making their acceptance of vaccination particularly influential. This interpretation is supported by evidence from southwest Nigeria linking fathers' attitudes to HPV vaccination decisions.[37] The inverse association with maternal education may reflect greater exposure to conflicting information through digital media among more educated caregivers,[38] although this remains speculative and should be explored using qualitative or mixed-methods research.

Post-intervention uptake also differed significantly between the two study locations, with lower uptake in semi-urban Ikot Ekpene than in urban Uyo. Similar sub-national variation has been reported across sub-Saharan Africa and is often attributed to differences in local health systems, community engagement, and service delivery rather than differences in vaccine attitudes alone.[25] This finding suggests that

implementation strategies may need to be adapted to local contexts rather than applied uniformly across communities.

Several limitations should be considered when interpreting these findings. First, the pre-intervention regression model included relatively few vaccination events, resulting in fewer events per variable than is generally recommended for stable multivariable estimates.[39] These findings should therefore be interpreted cautiously. Second, because the study used independent pre- and post-intervention cross-sectional surveys, the observed increase in uptake cannot be attributed solely to the intervention, particularly given the concurrent national HPV vaccine rollout at the time.[40]

In conclusion, this study suggests that limited awareness, rather than unwillingness to vaccinate, was the principal barrier to HPV vaccine uptake in the study communities. A community co-designed, multi-channel sensitisation campaign delivered through trusted local institutions was associated with a substantial increase in vaccine uptake within a relatively short period. Sustaining these gains will require moving beyond awareness generation alone. HPV vaccination programmes should integrate community engagement with reliable vaccine supply, strengthen vaccine-specific education to support informed decision-making, and tailor implementation strategies to local community contexts rather than adopting a one-size-fits-all approach. Future programme evaluations should incorporate longitudinal follow-up and qualitative research to better understand how caregivers make vaccination decisions, identify barriers to completion of the vaccine schedule, and determine which components of community-based interventions contribute most to sustained improvements in uptake.

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from the Health Research Ethics Committee of the University of Uyo Teaching Hospital (UUTH/AD/S/96/VOLXXI/1001). All activities complied with the Declaration of Helsinki. Informed consent was obtained from all participants prior to enrolment. Participants were verbally informed of the study objectives, procedures, potential risks and benefits, and their right to withdraw at any time without consequence. For participants who were unable to read, the consent information was read aloud to them by a trained member of the research team, after which they provided consent themselves before proceeding to the questionnaire. Consent was documented electronically through a dedicated consent field on the digital data collection platform, which participants completed before accessing the survey questions.

Consent for publication

Not applicable. This manuscript does not contain data from any individual person.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

VE conceived and designed the study, led data collection and the community sensitisation intervention, conducted the quantitative data analysis, and drafted the manuscript. CA contributed to the conceptualisation of the study, supported the data analysis, and critically reviewed successive versions of the manuscript. MI contributed to the conceptualisation of the study, supported data collection, and critically reviewed successive versions of the manuscript. EU led the data collection and coordination of the community sensitisation intervention on the ground. UTN contributed to the implementation of the intervention and data collection and reviewed successive versions of the manuscript. CN contributed to manuscript writing and reviewed the manuscript. CO contributed to the data analysis and critically reviewed the manuscript. UE supervised the study from conceptualisation through to final manuscript preparation. All authors read and approved the final manuscript.

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Data Availability

The dataset supporting the conclusions of this article is available in the Zenodo repository under the title "Dataset for: Improving HPV Vaccine Uptake Among Girls Aged 9–14 Years in Akwa Ibom State, Nigeria: A Community-Participatory Pre/Post-Intervention Study." The dataset includes a data dictionary describing all variables, coding schemes, and notes on derived variables. [https://doi.org/10.5281/zenodo.21830368]

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Figures

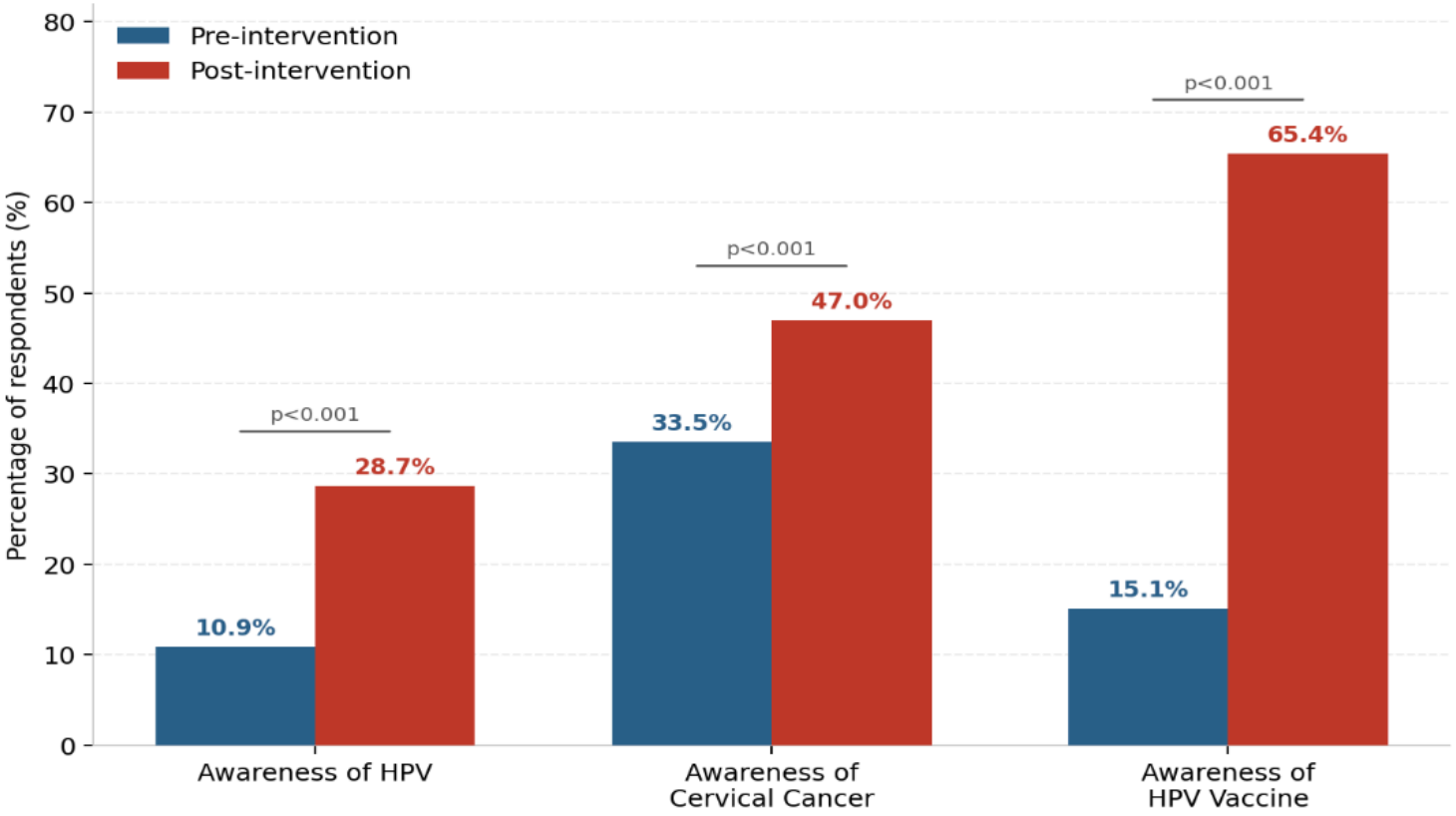


Figure 1

Awareness of HPV, cervical cancer, and the HPV vaccine by survey phase (n=331 pre-intervention; n=355 post-intervention). p-values from Pearson Chi-square test.

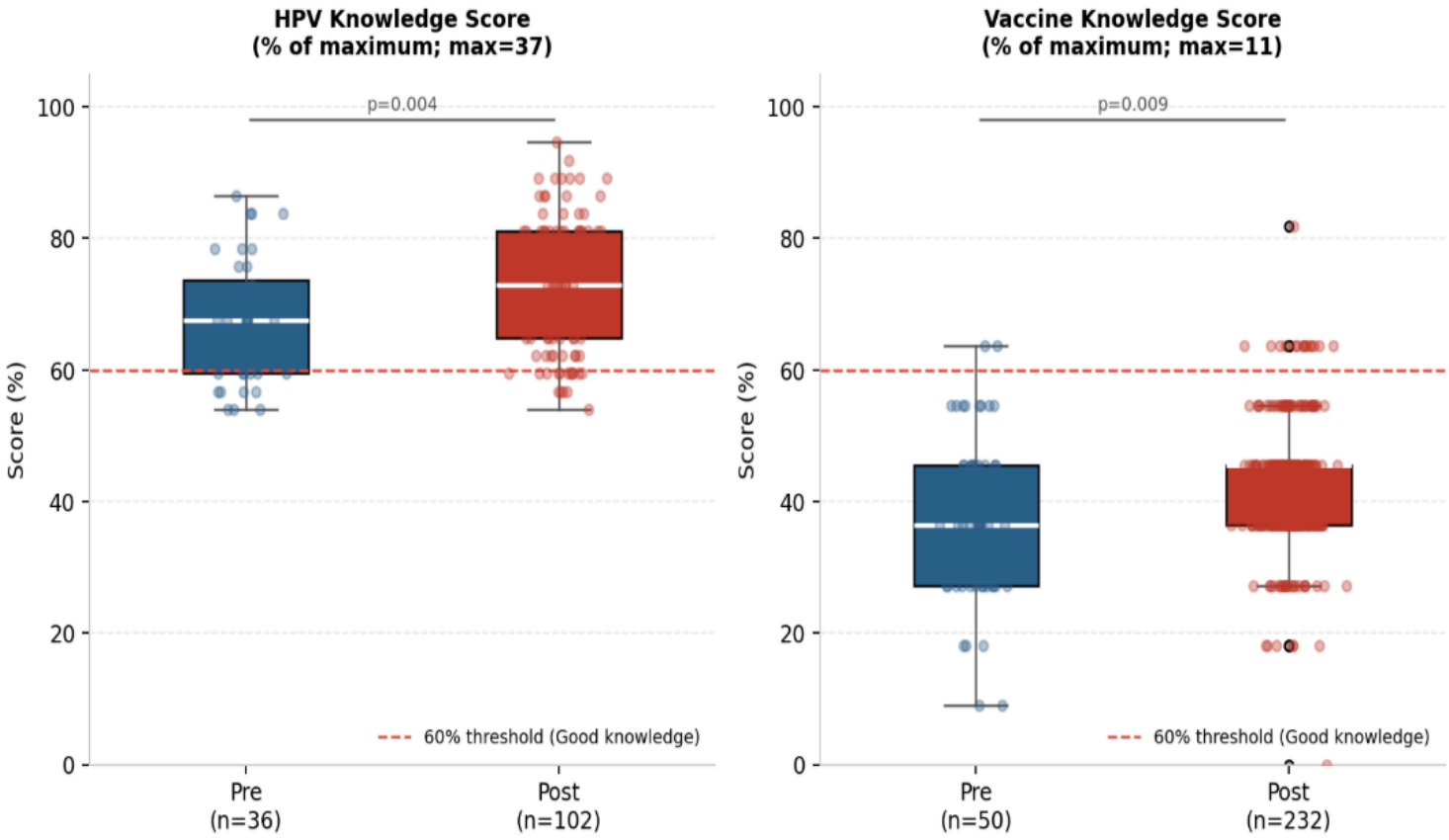


Figure 2

Distribution of HPV and vaccine knowledge scores (as percentage of maximum) among aware respondents, by survey phase. Jittered data points show individual observations overlaid on the boxplot. p-values from Mann-Whitney U test.

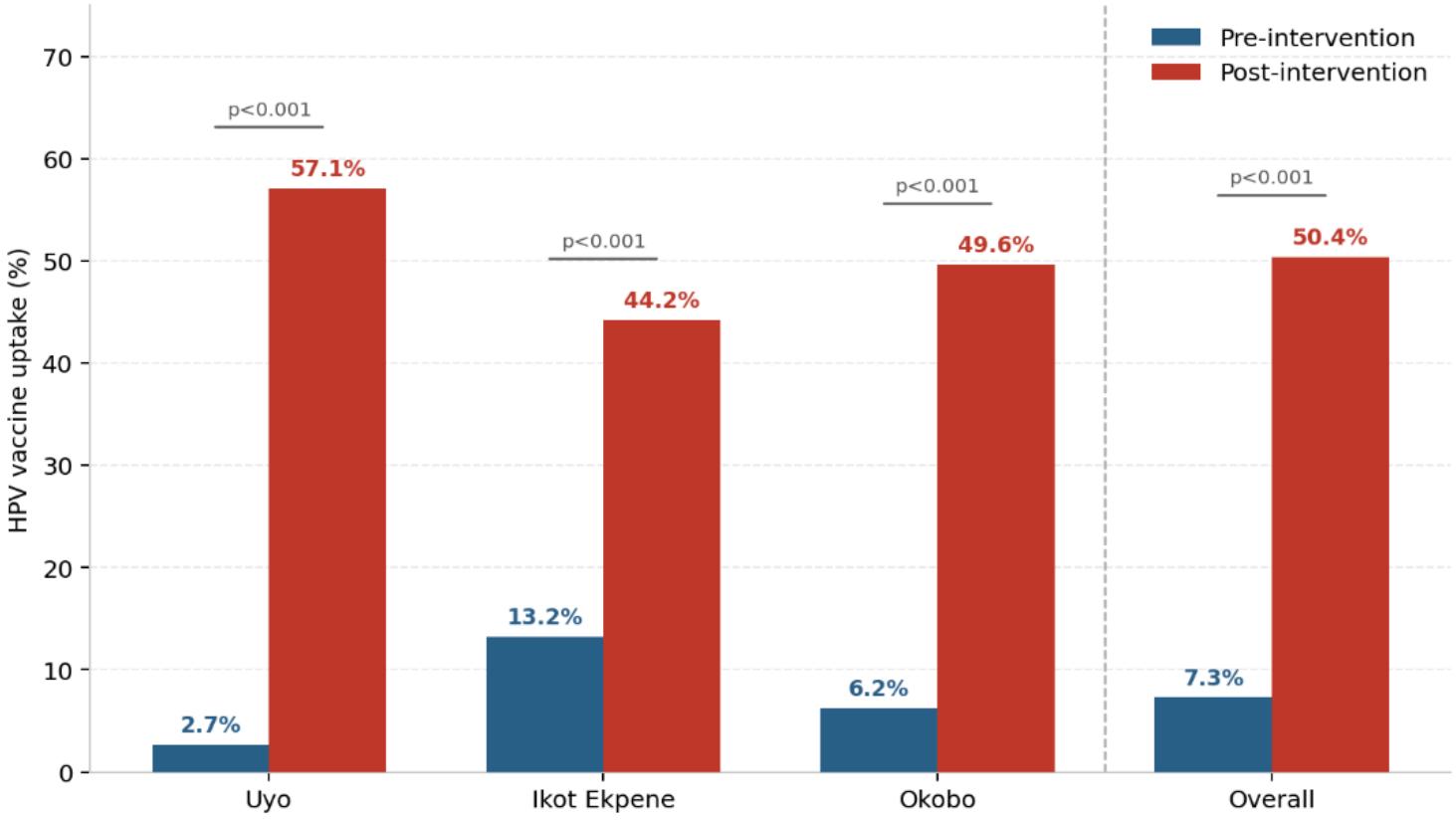


Figure 3

Self-reported HPV vaccine uptake by LGA and by survey phase. All comparisons p<0.001 (Pearson Chi-square test).

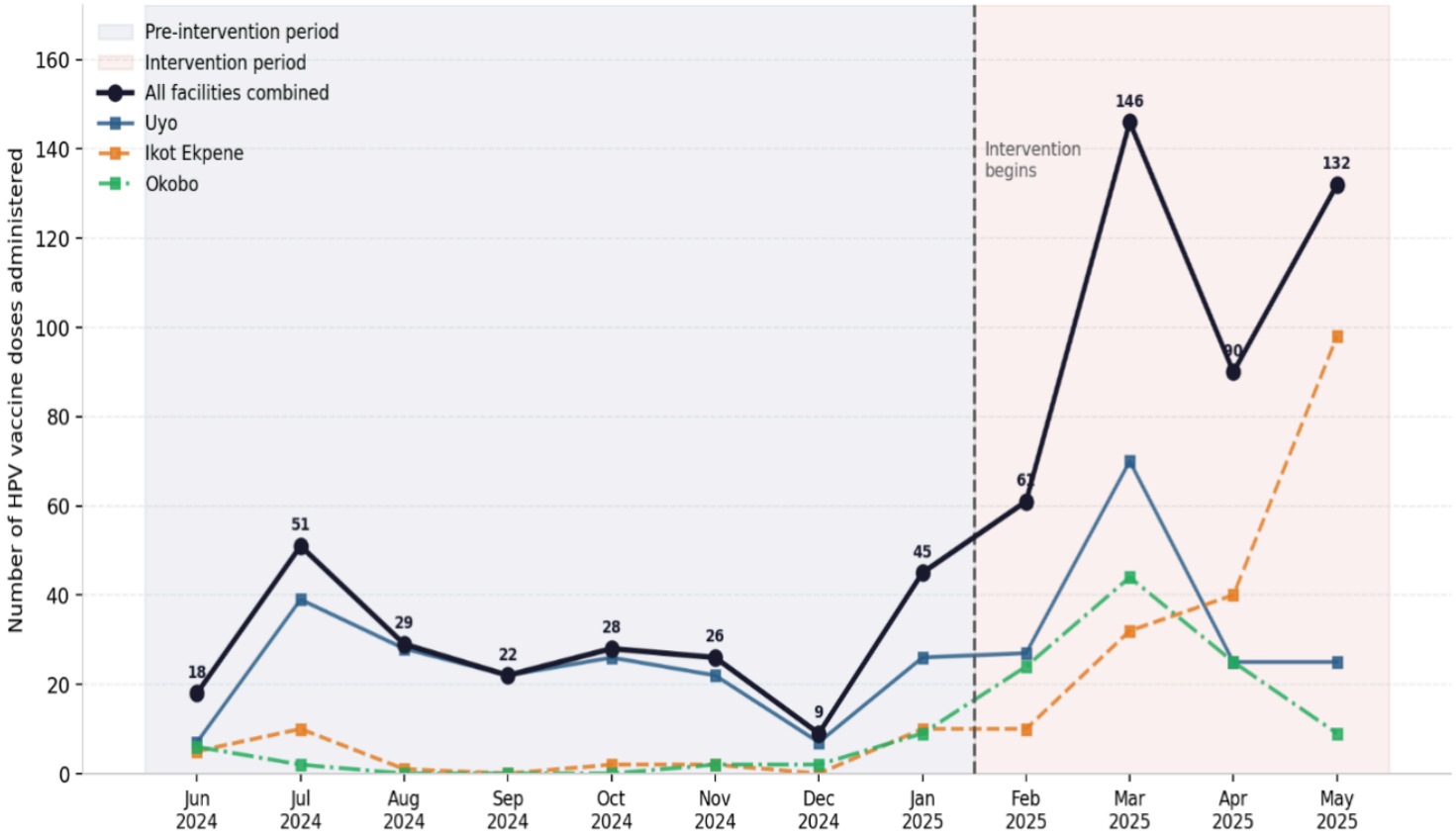


Figure 4

Monthly HPV vaccine doses administered across all six PHC facilities, June 2024–May 2025. The dashed vertical line marks the start of the intervention period (February 2025).

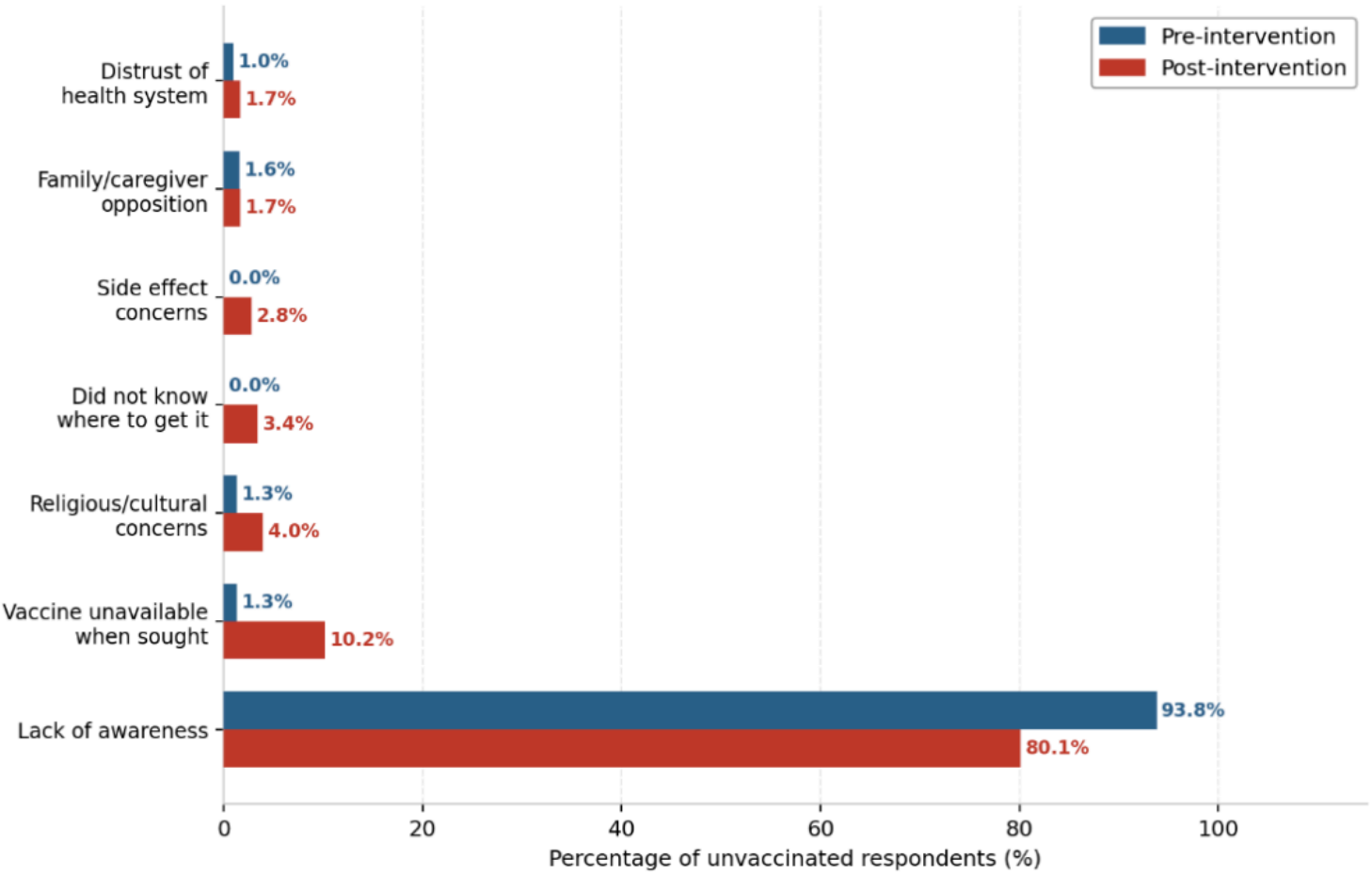


Figure 5

Barriers to HPV vaccination among unvaccinated respondents, by survey phase. Denominators are unvaccinated respondents per phase (pre-intervention n=307; post-intervention n=176).

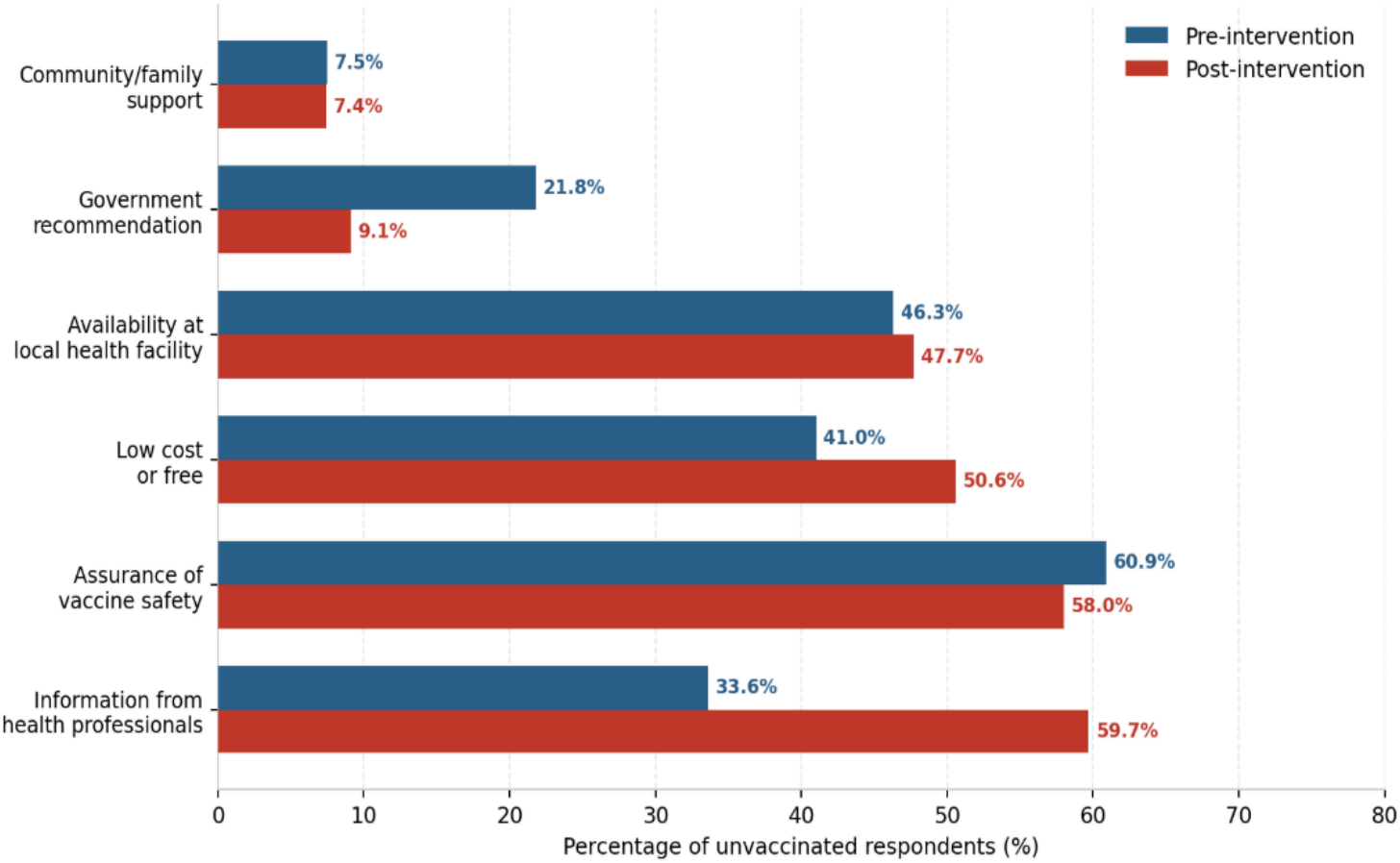


Figure 6

Motivators for HPV vaccination among unvaccinated respondents, by survey phase. Denominators are unvaccinated respondents per phase (pre-intervention n=307; post-intervention n=176). Respondents could select multiple motivators.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- HPVVaccineStudyQuestionnaire.docx