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REPRODUCTIVE, FEMALE AND CHILD HEALTH

# Attitudes and knowledge about HPV vaccination among Ghanaian women with cervical cancer

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**Abstract**

**Objective:** To explore knowledge about the human papillomavirus (HPV), HPV vaccination, barriers to vaccination and acceptance of the HPV vaccine in the highest-risk and most-impacted population in Ghana.

**Methods:** A survey was administered to 100 women with histologically confirmed cervical cancer at a teaching hospital in Ghana.

**Results:** Participants had a mean age of 59 (±14.3) years, 65.0% had a parity of five or higher and 89.0% had a monthly income less than 500 Ghana cedis ($63 USD). Seventy-nine percent of participants had a diagnosis of stage III or greater cervical cancer. Only 8.0% had heard of HPV and 4.0% knew that HPV caused cervical cancer. Fifty-five percent had not heard of vaccines, in general; of the remainder, the majority endorsed that vaccines, in general, were effective (89.0%) and safe (95.0%). No participants had received the HPV vaccine. After a brief education session, 94% believed the HPV vaccine was effective and 65.0% were categorised as having 'high vaccine acceptance' after responding 'definitely yes' to recommending the HPV vaccine to female relatives, male relatives and the community. There were no significant differences in demographic variables or cervical cancer disease characteristics between the 'high vaccine acceptance' and 'some vaccine hesitancy' groups.

**Conclusion:** Although women with cervical cancer in Ghana have low awareness of HPV and HPV vaccination, they demonstrate high vaccine acceptability and low hesitancy.

KEYWORDS

cervical cancer, HPV vaccine, human papillomavirus vaccine, sub-Saharan Africa, vaccine hesitancy, vaccine knowledge

## INTRODUCTION

Cervical cancer causes significant morbidity and mortality and the burden of disease disproportionately affects women in low-resource settings.[1,2] If diagnosed early, cervical cancer can be treated surgically with conization or hysterectomy, with curative intent.[3] However, late-stage cervical cancer, defined as the International Federation of Gynecology and Obstetrics (FIGO) stage II or higher, is typically inoperative and is associated with very poor outcomes. Five-year survival rates for cervical cancer range from 95% for stage I disease to 15% for stage IV.[4] Due in part to limited routine screening for pre-cancerous cervical changes, late-stage diagnosis and poor clinical outcomes are common in low- and middle-income (LMIC) countries.[5] According to the World Health Organization, cervical cancer is one of the leading causes of cancer-related death in women in Ghana. In 2020, the cervical cancer

age-standardised mortality rate was 17.8 per 100 000 in Ghana compared to 2.5 per 100 000 in high-income countries, and the age-standardised incidence rate was 27.4 per 100 000 compared to 13.3 per 100 000 worldwide.[6]

The majority of cases of cervical cancer are caused by persistent human papillomavirus (HPV) infection, with HPV 16 and 18 having been identified as the most carcinogenic strains.[7] Cervical cancer has the potential to be preventable with routine screening as well as by the administration of the HPV vaccine.[7,8] In countries where vaccine programmes were introduced and uptake was greater than 50%, a significant reduction in HPV-related disease was seen. A systematic review and meta-analysis of studies from 14 high-income countries in 2019 showed that HPV 16 and 18 infections in women aged 20–24 decreased by 66% between the pre- and postvaccination periods. Reductions were also seen in HPV-related disease, with the diagnosis of cervical dysplasia decreasing by 31% in women aged 20–24.[9] These outcomes indicate that cervical cancer has the potential to be a rare disease with adequate screening and preventative measures.

Despite the huge potential for the HPV vaccine to prevent cervical cancer, rates of vaccination are very low, particularly in LMICs like Ghana.[10] The HPV vaccine was more widely introduced in Ghana in 2013 with support from a campaign through the Global Alliance for Vaccines and Immunisations (GAVI). However, efforts to continue vaccination at the national level have been limited and data on vaccination rates since the initial launch is unavailable.[11,12] Healthcare infrastructure for HPV vaccination is sparse, with only a few public and private health facilities providing access to the HPV vaccine.[11,12] Additional barriers to cervical cancer prevention and HPV vaccination in LMICs include lack of knowledge and awareness of the disease, cost of preventative care and cultural factors such as lack of spousal support and misconceptions about gynaecologic healthcare.[13–17]

Given the high burden of HPV-related disease in LMICs including Ghana, understanding drivers of low vaccine uptake is particularly important. This study focused on the highest-risk and most-impacted population in Ghana—women with cervical cancer—to explore their knowledge about HPV and the HPV vaccine, barriers to vaccination and acceptance of the HPV vaccine. Findings can be used to inform HPV vaccine programmes targeted at these high-risk populations of women.

## MATERIALS AND METHODS

A survey was administered to adult women with a histopathologic diagnosis of cervical cancer receiving clinical management at a tertiary care teaching hospital in Ghana that houses a Gynecologic Oncology fellowship training programme and provides sub-specialised medical and surgical management of gynaecologic malignancies. The Gynecologic Oncology Unit manages approximately 250 women with new cervical cancer diagnoses annually. The standard approach to the diagnosis of cervical cancer at the study sites includes a history and physical exam, a biopsy of concerning cervical lesions and a histopathologic microscopic examination of biopsied tissue to confirm cervical cancer.

Inclusion criteria were women with a histopathologic diagnosis of cervical cancer, receiving medical care at the hospital's Gynecologic Oncology clinic, age 18 years or older and fluency in spoken English or Twi. Recruitment and data collection were carried out from November 2020 to October 2021 and occurred at patients' second Gynecologic Oncology clinic visit, at which time they had already been diagnosed with histologically confirmed cervical cancer and were presenting for a follow-up visit to discuss treatment options.

The survey was designed based on items adapted from prior studies[13,14] and included 17 questions regarding general attitudes toward vaccines, awareness of HPV and the HPV vaccine and acceptability of HPV vaccination (see Supporting Information: Appendix 1). Survey development was informed by the local expertise of Ghanaian gynaecologic oncology collaborators and pilot tested in Ghanaian women similar to the study population. Response types were a combination of multiple choice and the Likert scale. Demographic information was collected on age, location of residence, parity, marital status, occupation, education level and monthly income. Clinical information was extracted from participants' medical records, including cervical cancer stage and histopathology diagnosis. Surveys were verbally administered by a research assistant in English or Twi, the two main languages spoken in Kumasi. Written informed consent was obtained from all participants. Depending on the participant's literacy level, the consent was either read and completed by the participant herself, or verbally administered by a research assistant and signed using a thumbprint. IRB approval was granted by the teaching hospital's institutional review board.

Demographic variables and variables describing knowledge, attitudes and experiences with HPV and the HPV vaccine were summarised using descriptive statistics. Apart from age, which was analysed as a continuous variable using mean and standard deviation, all other variables were analysed categorically and described using frequencies and proportions. Participants' ages at the time of data collection were adjusted to calculate their age in 2013, when GAVI more broadly introduced the HPV vaccine in Ghana for individuals ages <26 years[11,12] and their age in 2018, when the Food and Drug Administration (FDA) expanded recommended administration of the HPV vaccine to ages 27–45 years.[18] A 'high vaccine acceptance' group was created, defined as participants who responded 'definitely yes' to recommending the HPV vaccine to each of three key groups: female relatives, male relatives and the community. All other participants were considered to have some vaccine hesitance and were, therefore, categorised as having 'some vaccine hesitancy'. A series of bivariate analyses were conducted using $t$ tests, $\chi^2$ and Fischer's exact where appropriate to compare demographic variables across the 'high vaccine acceptance' versus 'some vaccine hesitancy' groups. Survey

responses were entered in REDCap (Research Electronic Data Capture),[19] a secure electronic tool for data organization and then downloaded into SAS, version 9.4 (SAS Institute Inc.) for statistical analysis.

TABLE 1 Demographic characteristics of study participants ($n = 100$).

| Variable | $n$ (%, 95% CI) or mean ± SD |
|---|---|
| Age (years) | 59.5 ± 14.3 |
| Parity | |
| Zero | 1 (1.0, 0.0–3.0) |
| 1–4 | 34 (34.0, 24.7–43.3) |
| 5 or more | 65 (65.0, 55.7–74.4) |
| Marital status | |
| Married | 33 (33.0, 23.8–42.2) |
| Not married | 67 (67.0, 57.8–76.2) |
| Occupation | |
| Not working | 54 (54.0, 44.2–63.8) |
| Farmer | 18 (18.0, 10.5–25.5) |
| Trader | 24 (24.0, 15.6–32.4) |
| Professional work | 1 (1.0, 0.0–3.0) |
| Other | 3 (3.0, 0.0–6.3) |
| Highest education completed | |
| None | 48 (50.0, 40.0–60.0) |
| Primary | 32 (33.3, 23.9–42.8) |
| Secondary | 16 (16.7, 9.2–24.1) |
| Monthly income | |
| <500 cedis[a] | 89 (89.0, 82.9–95.1) |
| ≥500 cedis[a] | 11 (11.0, 4.9–17.1) |
| Cervical cancer stage | |
| I | 1 (1.0, 0.0–3.0) |
| II | 20 (20.0, 12.2–27.8) |
| III | 71 (71.0, 62.1–79.9) |
| IV | 7 (7.0, 2.0–12.0) |
| Unknown | 1 (1.0, 0.0–3.0) |
| Cervical cancer histopathology | |
| Squamous cell carcinoma | 87 (88.8, 82.5–95.0) |
| Adenocarcinoma | 7 (7.1, 2.0–12.2) |
| Unknown/other | 4 (4.1, 0.2–8.0) |
| Current status of cervical cancer | |
| New diagnosis, no treatment yet | 95 (97.9, 95.1–100.0) |
| Completed radiation therapy, now with recurrence | 2 (2.1, 0.0–4.9) |

Abbreviations: CI, confidence interval; SD, standard deviation.
[a]500 cedis = $63 USD.

## RESULTS

Of 102 eligible women, 100 agreed to participate and completed the survey, with a completion rate of 98.0%. Participants had a mean age of 59 (±14.3) years (Table 1). Most were not married ($n = 67/100$, 67.0%), did not work ($n = 54/100$, 54.0%), had no formal education ($n = 48/96$, 50.0%) and had a monthly income less than 500 Ghana cedis ($63 USD) ($n = 89/100$, 89.0%). The majority had a diagnosis of stage III cervical cancer ($n = 71/100$, 71.0%); only 1.0% ($n = 1/100$) had a diagnosis of stage I cervical cancer, which is conducive to surgical management. Most participants had the histologic subtype of squamous cell carcinoma ($n = 87/100$, 87.0%) and 97.9% ($n = 95/97$) were presenting to care after a new diagnosis of cervical cancer without prior treatment.

Regarding knowledge about HPV, only 8.0% ($n = 8/100$) had awareness of HPV (Table 2). Of the eight participants who had awareness of HPV, 62.5% ($n = 5/8$) correctly reported that HPV was spread by sexual contact and 50.0% ($n = 4/8$) knew HPV could cause cervical cancer.

General vaccine knowledge and awareness was also limited, as 63.0% ($n = 63/100$) reported that they had never received a vaccine in the past (Table 3). Of participants who did not receive all recommended vaccines, the most common reasons included having never heard of vaccines

TABLE 2 Knowledge about HPV, mode of transmission and related cancers.

| Variable | $n$ (%, 95% CI) |
|---|---|
| Heard of HPV ($n = 100$) | 92 (92.0, 86.7–97.3) |
| No | 8 (8.0, 2.7–13.3) |
| Yes | |
| Perceived mode of HPV transmission ($n = 8$) | 3 (37.5, 4.0–71.1) |
| Don't know | 0 (0.0, 0.0–0.0) |
| Skin-to-skin contact | 0 (0.0, 0.0–0.0) |
| Coughing and sneezing | 5 (62.5, 29.0–96.1) |
| Sexual contact | 0 (0.0, 0.0–0.0) |
| Mosquito bites | 2 (25.0, 0.0–55.0) |
| Other | |
| Knowledge of types of HPV-related cancers ($n = 8$) | 3 (37.5, 4.0–71.1) |
| Don't know | 4 (50.0, 15.4–84.7) |
| Cancer of the cervix | 0 (0.0, 0.0–0.0) |
| Cancer of the throat | 1 (12.5, 0.0–35.4) |
| Cancer of the stomach | 1 (12.5, 0.0–35.4) |
| Cancer of the penis | 0 (0.0, 0.0–0.0) |
| Other | 92 (92.0, 86.7–97.3) |

Abbreviations: CI, confidence interval; HPV, human papillomavirus.

TABLE 3 General vaccine uptake, knowledge and attitudes.

| Variable | *n* (%, 95% CI) |
|---|---|
| Previously received any vaccine (*n* = 100) | |
| Received all recommended vaccines | 2 (2.0, 0.0–4.7) |
| Received some recommended vaccines | 35 (35.0, 25.7–44.4) |
| Never received a vaccine | 63 (63.0, 53.5–72.5) |
| Reasons for not receiving all vaccines (*n* = 98) | |
| Have never heard of/don't know about vaccines | 60 (61.2, 51.6–70.9) |
| Unsure where to get a vaccine | 22 (22.4, 14.2–30.7) |
| Vaccines are too expensive | 4 (4.1, 0.2–8.0) |
| Vaccines are unsafe | 1 (1.0, 0.0–3.0) |
| Vaccines do not prevent diseases | 0 (0.0, 0.0–0.0) |
| Other | 2 (2.0, 0.0–4.8) |
| Frequency that community members receive routine vaccines (*n* = 98) | |
| Always | 1 (1.0, 0.0–3.0) |
| Often | 5 (5.1, 0.8–9.5) |
| Sometimes | 39 (39.8, 30.1–49.5) |
| Never | 53 (54.1, 44.2–64.0) |
| Perceived efficacy of vaccines (in general) (*n* = 45) | |
| Very effective | 40 (88.9, 79.7–98.1) |
| Somewhat effective | 5 (11.1, 1.9–20.3) |
| Minimally effective | 0 (0.0, 0.0–0.0) |
| Not effective at all | 0 (0.0, 0.0–0.0) |
| Perceived safety of vaccines (in general) (*n* = 43) | |
| Very safe | 41 (95.3, 89.1–100.0) |
| Somewhat safe | 1 (2.3, 0.0–6.8) |
| Somewhat harmful | 1 (2.3, 0.0–6.8) |
| Very harmful | 0 (0.0, 0.0–0.0) |

Abbreviation: CI, confidence interval.

(*n* = 60/98, 61.2%) and not knowing where to get vaccines (*n* = 22/98, 22.4%). Of participants who had some vaccine awareness, 88.9% (*n* = 40/45) endorsed that vaccines, in general, were very effective and 95.3% (*n* = 41/43) endorsed that they were very safe.

In considering the HPV vaccine specifically, 5.0% (*n* = 5/100) of participants had heard of the HPV vaccine (Figure 1); of those, the most common sources of information were the media (*n* = 3/5, 60.0%) and healthcare workers (*n* = 2/5, 40.0%). No participants reported receiving any portions of the HPV vaccine series (Table 4). Based on an age-adjusted calculation, 6.0% (*n* = 6/100) of participants would have been age 26 or younger and eligible for the GAVI-sponsored HPV vaccine in 2013, and 16.0% (*n* = 16/100) would have been age 45 or younger and eligible for the HPV vaccine as of 2018. Among the 16 eligible participants, lack of awareness of the vaccine (*n* = 14/16, 87.5%) was the most common reason for not receiving it. After receiving brief basic education about the HPV vaccine from the research assistant, 93.9% (*n* = 92/98) believed the HPV vaccine definitely or probably would have prevented their current diagnosis of cervical cancer.

Based on their knowledge of the HPV vaccine and personal experience with cervical cancer, participants said they would definitely or probably recommend the HPV vaccine to their female children or grandchildren (*n* = 97/100, 97.0%), their male children or grandchildren (*n* = 97/100, 97.0%) and members in their community (*n* = 83/100, 83.0%) (Figure 2A). Sixty-five percent (*n* = 65/100) of participants were categorised as having 'high vaccine acceptance' after responding 'definitely yes' to recommending the HPV vaccine to all three groups: female relatives, male relatives and the community (Figure 2B). There were no significant differences in demographic variables or cervical cancer disease characteristics between the 'high vaccine acceptance' and 'some vaccine hesitancy' groups.

## DISCUSSION

In the present study, we found that knowledge about HPV and HPV vaccination was low among Ghanaian women with cervical cancer, with only 8.0% having heard of HPV

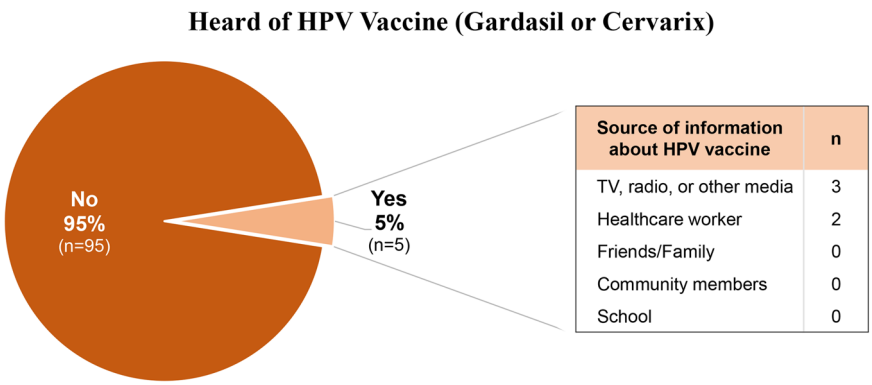


FIGURE 1 Participant awareness and source of information about the HPV vaccine. HPV, human papillomavirus.

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TABLE 4 HPV vaccine uptake, barriers and perceived efficacy.

| Variable | *n* (%, 95% CI) |
|---|---|
| Received HPV vaccine ($n = 99$)[a] | |
| Yes | 0 (0.0, 0.0–0.0) |
| No | 99 (100.0, 100.0–100.0) |
| Reasons for not receiving vaccine ($n = 95$)[a] | |
| Not eligible based on age | 84 (84.0) |
| Did not know about vaccine | 12 (12.0) |
| Did not know where to get vaccine | 0 (0.0) |
| Did not think vaccine was needed | 0 (0.0) |
| Vaccine unavailable | 0 (0.0) |
| Told not to get vaccine | 0 (0.0) |
| Could not pay for vaccine | 0 (0.0) |
| No transportation to healthcare facility | 0 (0.0) |
| Did not think vaccine was safe | 0 (0.0) |
| Did not think vaccine would prevent cervical cancer | 0 (0.0) |
| Believe that HPV vaccine would have prevented current diagnosis of cervical cancer ($n = 98$)[a] | |
| Definitely yes | 80 (81.6, 74.0–89.3) |
| Probably yes | 12 (12.2, 5.8–18.7) |
| Unsure | 6 (6.1, 1.4–10.9) |
| Probably not | 0 (0.0, 0.0–0.0) |
| Definitely not | 0 (0.0, 0.0–0.0) |

Abbreviations: CI, confidence interval; HPV, human papillomavirus.

[a]*n* does not equal 100 due to missing data.

and 5.0% being aware of the HPV vaccine. There was also low uptake of both the HPV vaccine and vaccines in general. Women with cervical cancer believed in the efficacy of the vaccine, as 93.9% believed that it would have prevented their diagnosis of cervical cancer. Most had a high level of vaccine acceptability, with 97.0% willing to recommend the vaccine to their family members and 83.0% willing to recommend it to their community.

Our findings that women with cervical cancer have limited knowledge of HPV and the HPV vaccine are consistent with those previously seen in other LMICs. A systematic review of 14 studies from 10 sub-Saharan African countries showed that an average of 26% of the populations surveyed were aware of HPV (range 0%–36%, seven studies) and an average of 15% were aware of the vaccine (range 0%–40%, six studies).[15] Despite the growing body of evidence on cervical cancer prevention over the past 10–15 years, rates of awareness of HPV and the HPV vaccine in LMICs have not increased over this period. This indicates that dissemination of knowledge continues to be slow to reach low-resource settings. It also suggests that LMICs, including Ghana, should continue to be a strong focus for increasing awareness of and education around HPV and the HPV vaccine.

When comparing our high-risk cohort to similar studies of healthy populations, knowledge of HPV and the HPV vaccine was lower. For instance, our cohort had lower awareness of the HPV vaccine than healthy populations in India,[16] Cambodia,[17] and urban areas of Bangladesh[20] (26%, 35% and 21%, respectively). Even within Ghana itself, surveys of women and men in urban cities reported knowledge of HPV as high as 50% and awareness of the HPV vaccine as high as 40%.[13,14] Respondents in these populations primarily obtained their information about cervical cancer from the media, lived in urban settings, attended secondary school or above and had higher income and employment rates.[13,14,20] This suggests that barriers to HPV knowledge and vaccine awareness may stem from differences in socioeconomic status and the resulting access to education, media and healthcare.

No women in our study received the HPV vaccine, which was an expected finding given their diagnosis of cervical cancer, as well as their age at diagnosis. Even for age-eligible women, multiple barriers to HPV vaccination and cervical cancer prevention exist. A lack of knowledge and awareness as well as misconceptions about HPV and the HPV vaccine are primary barriers. Additional barriers to vaccination include cultural and societal factors, including a lack of spousal support for screening, a cultural focus on sick care over preventative care, misconceptions about pelvic exams and low perceived cervical cancer risk.[21,22] These misconceptions may be perpetuated by many women's reliance on family members and close relatives rather than medical professionals for healthcare advice.[13] From a health systems perspective, barriers related to healthcare provider attitudes also exist. A recent survey of healthcare providers in Ghana demonstrated vaccine hesitancy. Factors that influenced healthcare providers' attitudes toward the HPV vaccine included lack of knowledge about the vaccine schedule, safety and efficacy; limited time for preventative care; and misinformation about the target population (for instance, some providers thought that a negative HPV prescreen test was required before HPV vaccination).[11] Finally, cost is a prohibitive barrier for many. One dose of Cervarix (bivalent HPV vaccine) costs 250 Ghana cedis (total 750 cedis or $150 USD, for three doses) and insurance coverage is unavailable.[11,23] The majority of women in our study made less than 500 cedis ($63 USD) per month, which would preclude them from affording the vaccine.

Despite low knowledge and awareness of HPV and the HPV vaccine, as well as the many barriers to care, we found that women with cervical cancer in Ghana were readily accepting of the vaccine after a brief education session. Our finding that 93.9% of participants believed the HPV vaccine would have prevented their current diagnosis of cervical cancer suggests they believed in the efficacy of the vaccine.

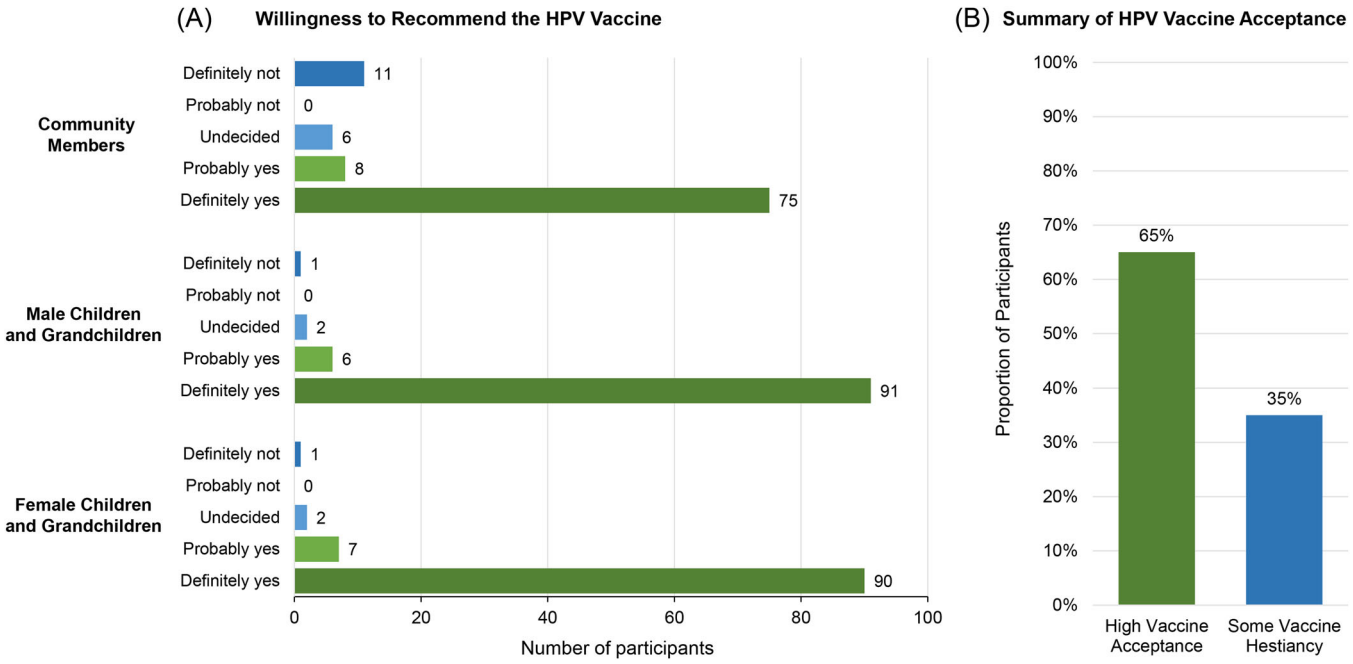


FIGURE 2 Participant acceptance of the HPV vaccine after a brief educational session. (A) Number of participants who recommend the HPV vaccine to three key groups: (1) female relatives, (2) male relatives, (3) community members. (B) Summary of participants' vaccine acceptance. 'High vaccine acceptance' was defined as participants who responded 'definitely yes' to recommending the HPV vaccine to all three key groups. All other participants were considered to have 'some vaccine hesitancy'. There were no significant differences in demographic variables or cervical cancer disease characteristics between groups. HPV, human papillomavirus.

Vaccine acceptability was high and hesitancy low, with 97% willing to recommend the vaccine to their male and female children/grandchildren and 83% willing to recommend it to community members. These findings are consistent with those seen across multiple studies in numerous LMICs, including Tanzania (93%),[24] Mali (100%),[25] Bangladesh (urban population: 94%, rural population: 99%),[20] and Kenya (95% would vaccinate daughters).[26] These findings highlight a unique opportunity for women with cervical cancer to serve as educators and champions for HPV vaccination in their communities. By combining their personal experience with cervical cancer with improved knowledge of HPV, these women could serve as trusted sources for health information and could influence communities to seek vaccination. Future educational campaigns in Ghana should consider the involvement of these women to share their personal stories, give a face to cervical cancer and potentially serve as liaisons between community members and the healthcare system.

This study adds to the literature by exploring perspectives on HPV and vaccination among women in Ghana who already have a diagnosis of cervical cancer. By focusing on women with cervical cancer, we illustrate the knowledge and attitudes of the highest-risk population with regard to HPV-related disease and provide insight into a potential new group of advocates for cervical cancer prevention. An additional strength of this study was the high response rate, with 98% of participants completing the survey. The teaching hospital sees approximately 250 women with new cervical cancer diagnoses each year; we, therefore, were able to capture almost half of those women in this study. While the HPV vaccine is not currently widely available in Ghana, the high burden of disease from cervical cancer highlights that increasing HPV vaccine access should be a public health priority. As nongovernmental organisations (NGOs) and the Ghanaian health system consider allocating limited resources toward increasing HPV vaccine access, understanding acceptability and barriers to acceptance is essential.

The study has several important limitations. First, it was conducted in a single county and at a single study site, which may limit generalisability to other LMICs. However, the teaching hospital serves a diverse population throughout central Ghana as evidenced by the range of age, education level and place of residence of our participants, and is one of only two hospitals in Ghana with a Gynecologic Oncology fellowship training programme. Second, we only surveyed women who presented for care. This inherently excludes some of the highest-risk women, such as those without access to transportation, without sufficient funds for healthcare, without permission from family members or with other barriers to care. Third, a validated survey was not used due to the absence of an applicable validated survey tool. Fourth, conclusions from this study are based on participants' recall of prior vaccination education and status. Many vaccines are given in childhood; therefore, recall bias may be present. Responses may also have been impacted by

the stress of the gynaecologic clinic visit, the recent diagnosis of cervical cancer and negative emotions about learning about a preventative vaccine. Finally, given the timing of this study in relation to the timing of the age-expanded HPV guidelines, the majority of participants were historically ineligible for the HPV vaccine based on their age. Additional research, done in the next decade, will be beneficial for updating these results in a more vaccine-eligible population.

In conclusion, while women with cervical cancer in Ghana have limited knowledge of HPV and low awareness of the HPV vaccine, most demonstrate high vaccine acceptability and low hesitancy. LMICs, including Ghana, should therefore be a strong focus for increasing awareness of and access to the HPV vaccine. Partnering with women with cervical cancer to develop peer education campaigns could help accelerate vaccine uptake.

## AUTHOR CONTRIBUTIONS

The study was conceptualised by Sarah G. Bell and Emma R. Lawrence. IRB approval and protocol design was done by Adu Appiah-Kubi, Sarah G. Bell, Thomas Konney, Augustine Tawiah and Emma R. Lawrence. Survey questions were developed by Katherine R. Zurales and reviewed by all authors. Data collection was carried out by Adu Appiah-Kubi with data organization by Katherine R. Zurales and Emma R. Lawrence. Data analysis was done by Emily K. Kobernik. The manuscript was drafted by Katherine R. Zurales with contributions and approval by all authors.

## ACKNOWLEDGEMENTS

None.

## CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## ETHICS STATEMENT

Written informed consent was obtained from all participants and IRB approval was granted by the KATH Institutional Review Board (KATH IRB/AP/112/20).

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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