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Evaluation of female university students' knowledge, attitudes, and practices toward human papillomavirus infection and vaccination. Multicenter cross-sectional study

Biset Asrade Mekonnen^{1*}, Yeniewa Kerie Anagaw², Bilen Asfaw Kassahun² and Minichil Chanie Worku²

Abstract

Introduction Having good knowledge and a favorable attitude toward human papillomavirus (HPV) and HPV vaccinations is the cornerstone for increasing the use of HPV vaccinations and preventing cervical cancer. The objective of this study was to evaluate the level of knowledge, attitudes, and practices regarding HPV and HPV vaccinations, as well as to identify associated factors among female undergraduate health science students at both the University of Gondar (UoG) and Bahir Dar University (BDU), Amhara, Ethiopia.

Methods Institutional-based multicenter descriptive cross-sectional study was conducted from June 1, 2023, to July 30, 2023. A multistage sampling technique was used to select 633 female undergraduate health science students, and data were collected using a structured, self-administered questionnaire. The data were coded, entered in Epi-data, and exported to SPSS for analysis. Variables with a P-value < 0.25 in the bivariate analysis were inserted in a multivariate logistic regression model, and those with a P-value of < 0.05 in the multivariate binary logistic regression were considered statistically significant factors for knowledge, attitude, and practice regarding HPV and vaccine against it.

Results The study included 600 participants with a mean age of 20.8 ± 0.75 years. Using Bloom's cutoff points for the KAP study, among the participants, 436 (72.7%) had good knowledge about HPV, whereas 315 (52.5%) had good knowledge about HPV vaccinations. More than half of the participants, 359 (59.8%) heard about HPV vaccinations in Ethiopia. More than half of the participants, 342 (57%) had favorable attitudes toward HPV vaccinations. Only 261 (43.5%) participants believed the HPV vaccine was safe and effective. All participants had never been tested for HPV, and 471 (78.5%) refused to have their samples for regular HPV testing. The factors like ages between 21 and 23 years (AOR, 2.12, 95% CI: 1.22–3.09) and favorable attitudes toward HPV vaccinations (AOR: 1.88; 95% CI: 1.15–3.41) were associated with the participant's knowledge about HPV vaccinations. Having good knowledge about the virus (AOR: 1.92; 95% CI: 1.11–5.88) and its vaccine (AOR: 1.60; 95% CI: 1.07–2.47) were factors associated with the attitude of the

*Correspondence:

Biset Asrade Mekonnen
biset2006me@gmail.com

Full list of author information is available at the end of the article



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participants about HPV vaccinations. Additionally, HPV vaccination practice was significantly associated with the attitude of the participants toward HPV vaccinations (AOR: 1.85; 95%CI: 1.15–3.45), knowledge about HPV (AOR: 1.18; 95%CI: 0.55–5.50), and HPV vaccinations (AOR: 1.85; 95%CI: 1.08–2.44).

Conclusion This study revealed that half of the students had good knowledge and a favorable attitude toward HPV vaccinations, but there was poor HPV vaccination practice. There is still a need for continued health education, training, and counseling services for students to strengthen HPV vaccination practices, improve students' attitudes and knowledge about the benefits of vaccination, and improve counseling abilities against HPV-induced cancer.

Keywords Knowledge, Attitude, Practice, Human papillomavirus, Infection, Vaccine, Ethiopia

Introduction

Human papillomavirus (HPV) is a viral infectious disease (IDs) commonly associated with Sexually Transmitted Diseases (STDs) and is a major cause of the global disease burden. It is a common human infection that can cause cervical cancer, other anogenital cancers, genital warts, and recurrent respiratory papillomatosis [1–4].

HPV infection is most common in young and sexually active individuals. It is so prevalent that approximately 75–80% of sexually active individuals become infected in their lifetime [4]. There are more than 100 HPV genotypes. Of these, at least 13 genotypes cause cervical, genital, and pharyngeal cancers. Non-oncogenic HPV types 6 and 11 are responsible for 90% of genital warts, whereas HPV types 16 and 18 are responsible for 70% of cervical malignancies, and most HPV infections are asymptomatic or subclinical, contributing to the rapid transmission and spread of the virus [4, 5].

Persistent infection with high HPV risk has been established as the primary cause of cervical cancer, which is the second most frequent type of cancer among women in Ethiopia, with an incidence rate of approximately 13.0 per 100,000 women per year [6, 7]. However, anogenital cancers other than cervix are limited in women, but there is an increase in the anus, vulva, and vagina cases, with incidence rates of 0.27, 0.73, and 0.39, respectively, in women, whereas the incidence rates of prostate, anus, and penis cases in men are 4.73, 0.25, and 0.06, respectively [7].

HPV vaccinations have a great potential to prevent HPV-related infections in millions of women and men worldwide. It can prevent more than 90% of cervical cancers [6]. The World Health Organization (WHO) recommends that girls aged 9–14 years be the primary target group for HPV vaccination, with females aged 15 years and older serving as the secondary target population [8]. HPV vaccinations are recommended for everyone up to the age of 26 [9].

Ethiopia also launched the HPV vaccine for the first time with the provision of the Global Alliance for Vaccine and Immunization (GAVI) in 2018. Currently, two doses of the HPV vaccine are administered to females aged 9–14 years at 6-month intervals through a school-based

approach [6]. However, the immunization program will not be accepted in Ethiopia because certain members of the community still oppose it for different reasons. Social influence, knowledge and attitude about cervical cancer, HPV, and its vaccine, acceptability of the vaccine, or willingness of an individual to be vaccinated, child age, perceived access to the vaccine, religious background, and perceptions about disease severity can result in vaccine refusal. As a result, the adolescent girls expressed their reluctance to vaccinate. These barriers have been the barriers to successful HPV vaccination programs in Ethiopia [3, 6, 9].

There are limited studies evaluating the knowledge, attitudes, and practices of university students regarding HPV infection and HPV vaccinations in Ethiopia. Therefore, this study aimed to evaluate the level of knowledge, attitudes, and practices of female undergraduate health science students toward HPV infection and HPV vaccinations and to identify associated factors at the University of Gondar (UoG) and Bahir Dar University (BDU). The findings of this study will help identify students' knowledge, attitudes, and practices about HPV infection and HPV vaccinations to develop strategies to enhance students' knowledge, attitudes, and practices. Improving students' knowledge, attitudes, and practices about HPV vaccinations, thus contributing to reducing the incidence of HPV-induced cancer among young adults in the community.

Materials and methods

Study area, design, and period

An institutional-based multicenter cross-sectional study was conducted to evaluate the knowledge, attitudes, and practices of female undergraduate health science students at both UoG and BDU, Amhara, Ethiopia, from June 1, 2023, to July 30, 2023. UOG is located in Gondar city, the capital of the Central Gondar Administrative Zone, which is 747 km from Addis Ababa in the northwest direction. BDU is located in Bahir Dar city, northwest Ethiopia, which is the capital of the Amhara National Regional State (ANRS). This city is located on the southern shore of Lake Tana, a tributary of the Blue

Nile. The city is located approximately 565 km north to northwest of Addis Ababa.

Source and study population

The source population was all female undergraduate health science students enrolled at both UoG and BDU for the 2023/2024 academic year, while the study population was those who fulfilled the inclusion criteria at both Universities during the data collection period.

Eligibility criteria

Female undergraduate health science students who attended classes during the data collection period and agreed to participate in the survey were included. Graduate students were excluded from this study.

Independent variables

Sociodemographic characteristics of female health science students (age, religion, residence, department, undergraduate year).

Dependent variables

Knowledge, attitudes, and practices of female health science students toward HPV and HPV vaccinations.

Sample size determination and sampling techniques

The single population proportion formula was used to calculate the sample size based on the assumption that a Proportion (P) of 50% yields a maximum sample size. Furthermore, 1.5% design effect, α value of 0.05, $Z_{\alpha/2}=1.96$, and margin of error (d)=5% were used. This gives a sample size of 576. Assuming a 10% non-response rate, the final sample size is 633.

A multistage sampling technique was used to select participants. First, out of the 10 departments, four departments (pharmacy, nursing, midwifery, and medical laboratory) were selected randomly. The sample size was distributed proportionally to the two universities, selected departments, and each batch. Finally, the sample was selected from the list of students in all departments and batches using simple random sampling techniques.

$$\begin{aligned} n &= \frac{z^2 * p * (1 - p) * design\ effect}{w^2} \\ &= \frac{(1.96)^2 * 0.5 * (1 - 0.5) * 1.5}{(0.05)^2} \\ &= 576 \Rightarrow n = 633 \end{aligned}$$

Data collection tool and procedures

Closed and open-ended self-administered questionnaires were developed in English and comprised four extensive areas: sociodemographic characteristics, knowledge about HPV infection and HPV vaccinations,

attitudes, and practices toward HPV vaccinations. Data were collected by experienced pharmacists after providing training. The researchers closely supervised the data collection process and cross-checked the completeness of the questionnaires. The questionnaire used to collect data in the current study is presented in the Supplementary Information (**Supplementary Material 1**).

Outcome measurement

Knowledge about HPV infection and HPV vaccination was measured using seven and eight items, respectively. Every correct response received a “score of 1” while every incorrect response received a “score of 0.” The total points to be scored for knowledge about HPV and its vaccine were 7 and 8, respectively, and the minimum was 0. Using Bloom’s cutoff points for the KAP study, a score of 50–100% of correct responses indicated good knowledge and poor knowledge for participants with a score less than 50% of correct.

The attitude toward HPV vaccinations was measured using 15 items. These items were assessed using a five-point Likert scale ranging from 1 “strongly disagree” to 5 “strongly agree.” The highest score was expected to be 75, and the lowest score was 15 for each participant. Those who scored above 50% had a positive attitude, and those who scored below 50% had a negative attitude toward HPV vaccinations.

HPV vaccinations were measured using three items. Each correct response was given a score of 1, and each incorrect response was scored 0. The highest and lowest scores were 3 and 0, respectively. Those who scored above 50% had good HPV vaccination practices, whereas those who scored below 50% had poor HPV vaccination practices.

Data quality assurance

The WHO guidelines were followed when adopting and validating the data collection format. Prior to data collection, informed consent was obtained, and the data collectors were trained on the goals and significance of the study. A pretest was conducted using 5% of the randomly selected samples to ensure data collection feasibility, language clarity, and response accuracy. The internal consistency and validity of the tools were also evaluated using Cronbach’s α , which was 0.84. This proved that the survey was credible and legitimate [10]. The Cronbach’s alpha value of 0.73 indicates an acceptable level of internal consistency. To ensure the completeness and consistency of the collected data, the researchers carried out on-site checks and reviews of all completed questionnaires.

Data processing and analysis

After coding, the data were entered into Epi-Data version 3.1 and then exported to SPSS version 25 for further

Table 1 Sociodemographic characteristics of female health science students at UoG and BDU, Ethiopia, 2023 (n = 600)

| Variables | Categories | Frequency | Percentage |
|--------------------|--------------------|-------------|------------|
| Age | 19–20 | 152 | 25.3 |
| | 21–23 | 448 | 74.7 |
| | Mean ± SD | 20.8 ± 0.75 | |
| Religion | Orthodox | 482 | 80.3 |
| | Muslim | 37 | 6.2 |
| | Catholic | 21 | 3.5 |
| | Protestant | 60 | 10.0 |
| Residence | Urban | 202 | 33.7 |
| | Rural | 398 | 66.3 |
| Department | Pharmacy | 120 | 20.0 |
| | Nursing | 190 | 31.7 |
| | Midwifery | 160 | 26.7 |
| | Medical laboratory | 130 | 21.6 |
| Undergraduate year | Year 1 | 180 | 30.0 |
| | Year 2 | 140 | 23.3 |
| | Year 3 | 140 | 23.3 |
| | Year 4 | 100 | 16.7 |
| | Year 5 | 40 | 6.7 |
| | Total | 600 | 100 |

analysis. Descriptive statistics were used to present mean scores and frequencies of sociodemographic profiles. The Variance Inflation Factor (VIF) was used to determine whether co-linearity existed between independent factors before performing multivariate binary logistic regression analysis. Chi-square statistics were used to check the adequacy of cells for binary logistic regression. Independent predictors of outcome and strength of association between dependent and independent variables were identified using binary logistic regression analysis, and P-values < 0.25 were entered into multiple regression analysis. A two-tailed test with P-values < 0.05 at a 95% confidence interval (CI) and Adjusted odds ratio (AOR) with 95% CI were considered significant predictors. Finally, tables and charts were used for descriptive analysis.

Results

Sociodemographic characteristics of the participants

Of the 633 participants, 600 were included in this study, with a response rate of 94.8%. The mean age of the participants was 20.8 ± 0.75 (19–23) years. Of the study participants, 448 (74.7%) were aged 21–23 years. Most study participants, 482 (80.3%) were Orthodox religious followers (Table 1).

Sources of HPV infection and vaccine information

All participants heard about HPV infections. However, 359 (59.8%) participants heard about the HPV vaccine (Table 2). The most common source of information about HPV infection and HPV vaccines was health

Table 2 Knowledge of HPV and its vaccination among female health science students at UoG and BDU, Ethiopia, 2023 (n = 600)

| Items in the Knowledge Questions | Category | Frequency | Percentage |
|--|-----------------|-----------|------------|
| Ever heard about HPV? | Yes | 600 | 100 |
| | No | 0 | 0 |
| Know the transmission of HPV infection | Yes | 504 | 84.0 |
| | No | 96 | 16.0 |
| Know the signs and symptoms of cervical cancer | Yes | 180 | 30.0 |
| | No | 420 | 70.0 |
| Know the risk factors for HPV | Yes | 498 | 83.0 |
| | No | 102 | 17.0 |
| Know about HPV-associated diseases | Yes | 461 | 76.8 |
| | No | 139 | 23.2 |
| Know the method of prevention of HPV infection | Yes | 560 | 93.3 |
| | No | 40 | 6.7 |
| Can HPV infection be treated? | Yes | 330 | 55.0 |
| | No | 270 | 45.0 |
| Ever heard about HPV vaccines in Ethiopia? | Yes | 359 | 59.8 |
| | No | 241 | 40.2 |
| Know the recipient of the HPV vaccine | Yes | 507 | 84.5 |
| | No | 93 | 15.5 |
| Can the HPV vaccine cause infertility? | Yes | 100 | 16.7 |
| | No | 500 | 83.3 |
| Does the HPV vaccine prevent cervical cancer? | Yes | 459 | 76.5 |
| | No | 141 | 23.5 |
| Is the HPV vaccine used to prevent genital warts? | Yes | 273 | 45.5 |
| | No | 327 | 54.5 |
| What age range is recommended for vaccination against HPV infection? | 10–14 years | 178 | 29.7 |
| | I don't know | 422 | 70.3 |
| How many doses are recommended for an HPV vaccine? | Two doses | 138 | 23.0 |
| | I don't know | 462 | 77.0 |
| Did you know the schedule for HPV vaccination? | 6 months–1 year | 152 | 25.3 |
| | I don't know | 448 | 74.7 |
| | | | |

professionals, 180 (30.0%), followed by mass media (radio, television, and newspaper), 158 (26.3%) (Fig. 1).

Knowledge about HPV infection and vaccination

Overall, 436 (72.7%) of the participants had good knowledge about HPV infection, whereas 315 (52.5%) had good knowledge about HPV vaccination (Fig. 2). Among the participants, 504 (84.0%) and 560 (93.3%) knew the transmission and prevention methods of HPV infection, respectively, whereas 420 (70.0%) did not know the signs and symptoms of cervical cancer. More than half of the participants, 359 (59.8%), heard about HPV vaccination in Ethiopia; however, more than two-thirds of the participants, 422 (70.3%), 462 (77.0%), and 448 (74.7%) did not know the recommended age range, dose, and schedule for HPV vaccination, respectively (Table 2).

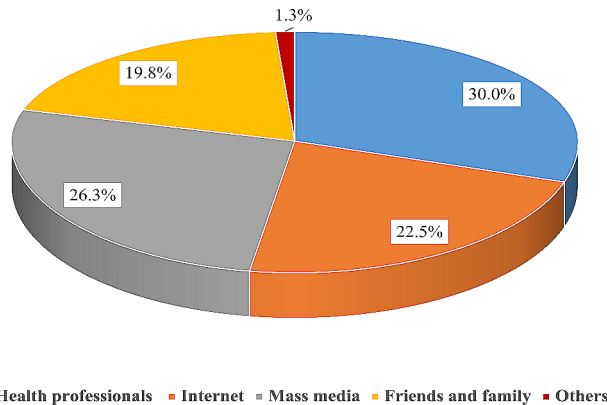


Fig. 1 Source of HPV and HPV vaccine information for female health science students at UoG and BDU, Ethiopia, 2023 (n=600)

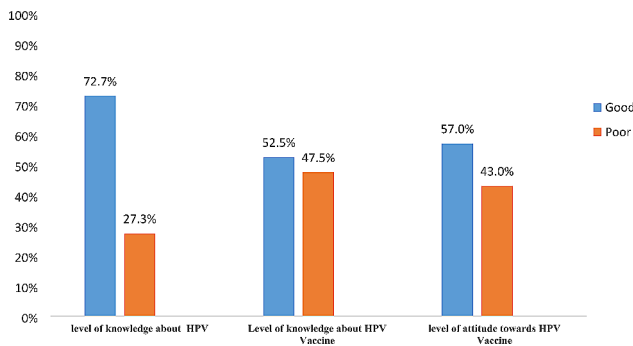


Fig. 2 Level of knowledge and attitude toward HPV and its vaccine among female health science students at UoG and BDU, Ethiopia, 2023 (n=600)

Attitude toward the HPV vaccine

More than half of the study participants, 342 (57%) had favorable attitudes toward HPV vaccine (Fig. 2). Most study participants, 547 (91.2%) agreed or strongly agreed that the HPV vaccine is effective in preventing cervical cancer. However, more than two-thirds of the study participants, 483 (80.5%), disagreed or strongly disagreed that they would not take the vaccine because they did not believe they were at risk of getting HPV infection, while 266 (44.3%) believed that the vaccine’s side effects were reasonable and would not prevent them from receiving the vaccine. More than half of the study participants, 338 (56.3%) agreed that the HPV vaccine may not have a long-term negative effect and 261 (43.5%) agreed that the vaccine is safe. Most participants agreed that the vaccine is more useful for women than men (Table 3).

HPV vaccination practices

All study participants had never been tested for HPV, and more than two-thirds of the study participants, 471 (78.5%), were unwilling to undergo routine HPV testing by collecting samples by themselves (Table 4).

Table 3 Attitude toward HPV vaccination among female health science students at UoG and BDU, Ethiopia, 2023 (n=600)

| Items in the Attitude Questions | SD | Disagree | Neutral | Agree | SA |
|--|------------|------------|------------|------------|------------|
| HPV vaccine is effective in preventing cervical cancer | 0 | 0 | 53(8.8) | 284 (47.3) | 263 (43.8) |
| I will take the vaccine because I feel at risk of getting an HPV infection | 66 (11.0) | 417 (69.5) | 94 (15.7) | 23 (3.8) | 0 |
| A person who has only one sexual partner can be protected from HPV infection | 12 (2.0) | 86 (14.3) | 185 (30.8) | 317 (52.8) | 0 |
| It is not necessary to get human papillomavirus vaccination | 123 (20.5) | 183 (30.5) | 111 (18.5) | 183 (30.5) | 0 |
| I believe that the vaccine’s side effects are reasonable and will not prevent me from receiving the vaccine. | 18 (3.0) | 185 (30.8) | 131 (21.8) | 266 (44.3) | 0 |
| I feel that it is better to be vaccinated before becoming sexually active | 0 | 24 (4.0) | 264 (44.0) | 278 (46.3) | 34 (5.7) |
| More information on HPV and its vaccine will be required before I take the vaccine | 0 | 0 | 90 (15.0) | 331 (55.2) | 179 (29.8) |
| The human papillomavirus vaccine may have a long negative effect | 171 (28.5) | 167 (27.8) | 237 (39.5) | 25 (4.2) | 0 |
| I feel that only sexually active ladies should get the vaccine | 16 (2.7) | 360 (60.0) | 110 (18.3) | 114 (19.0) | 0 |
| Do you think your family is allowed to vaccinate? | 0 | 37 (6.2) | 235 (39.2) | 300 (50.0) | 28 (4.7) |
| Education on the HPV vaccine should be implemented at College | 0 | 25 (4.2) | 77 (12.8) | 327 (54.5) | 171 (28.5) |
| HPV vaccination should be included in the National Program on Immunization | 0 | 13 (2.2) | 247 (41.2) | 340 (56.7) | 0 |
| The vaccine is safe | 0 | 41 (6.8) | 298 (49.7) | 134 (22.3) | 127 (21.2) |
| The vaccine is useful for men | 0 | 102 (17.0) | 223 (37.2) | 275 (45.8) | 0 |
| The vaccine is useful for women | 0 | 0 | 76 (12.7) | 269 (44.8) | 255 (42.5) |

SD: Strongly Disagree, SA: Strongly Agree

Table 4 HPV vaccination practices among female health science students at UoG and BDU, Ethiopia, 2023 (n = 600)

| Items of Practice Questions | Category | Frequency | Percentage |
|--|----------|-----------|------------|
| Have you ever been tested for HPV? | Yes | 0 | 0 |
| | No | 600 | 100 |
| I am willing to undergo routine HPV testing if I can collect my samples | Yes | 129 | 21.5 |
| | No | 471 | 78.5 |
| I am willing to undergo routine HPV testing even if I am not allowed to collect my samples | Yes | 204 | 34.0 |
| | No | 396 | 66.0 |

Table 5 Factors associated with female health science students' knowledge about HPV vaccinations at UoG and BDU, Ethiopia, 2023 (n = 600)

| Factors | Category | COR (95% CI) | AOR (95% CI) | P value |
|----------------------------------|----------------------|-------------------|--------------|---------|
| Age | 19–20 | 1 | 2.12 | 0.04 |
| | 21–23 | 2.24 (1.34–3.14)* | (1.22–3.09)* | |
| Residence | Rural | 1 | 2.08 | 0.06 |
| | Urban | 2.28 (1.47–3.41)* | (1.34–2.82) | |
| HPV knowledge | Poor knowledge | 1 | 1.12 | 0.07 |
| | Good knowledge | 2.93 (1.54–5.63)* | (1.13–8.34) | |
| Attitude toward HPV vaccinations | Unfavorable Attitude | 1 | 1.88 | 0.03 |
| | Favorable Attitude | 1.67 (1.08–3.18) | (1.15–3.41)* | |

*Statistically significant at $p < 0.05$ with COR and AOR

Table 6 Factors associated with the attitude of female health science students toward HPV vaccinations at UoG and BDU, Ethiopia, 2023 (n = 600)

| Factors | Category | COR (95% CI) | AOR (95% CI) | P value |
|----------------------------------|----------------|-------------------|------------------|---------|
| Age | 19–20 | 1 | 1.62 | 0.07 |
| | 21–23 | 1.44 (1.01–2.03)* | (1.13–2.41) | |
| Residence | Rural | 1 | 1.53 | 0.09 |
| | Urban | 1.54 (1.1–2.2)* | (1.0–2.1) | |
| HPV knowledge | Poor knowledge | 1 | 1.92 | 0.02 |
| | Good knowledge | 3.21 (1.88–5.21) | (1.11–5.88)* | |
| Knowledge about HPV vaccinations | Poor knowledge | 1 | 1.60(1.07–2.47)* | 0.03 |
| | Good knowledge | 1.83 (1.14–2.53)* | | |

*Statistically significant at $p < 0.05$ with COR and AOR

Factors associated with participants' HPV vaccination knowledge

The age, residence, and attitude of female undergraduate health science students were associated with their knowledge of HPV vaccinations in binary logistic regression, with a p-value of < 0.25 . However, after multiple logistic regression analysis, age (AOR, 2.12, 95%, CI=1.22–3.09)

Table 7 Factors associated with the practice of female health science students regarding HPV vaccinations at UoG and BDU, Ethiopia, 2023 (n = 600)

| Factors | Category | COR (95% CI) | AOR (95% CI) | P value |
|----------------------------------|----------------------|-------------------|------------------|---------|
| Age | 19–20 | 1 | 1.63 | 0.06 |
| | 21–23 | 1.74 (1.23–3.09)* | (1.01–3.15) | |
| Residence | Rural | 1 | 2.51 | 0.40 |
| | Urban | 2.86 (1.41–4.45)* | (1.28–4.92) | |
| HPV knowledge | Poor knowledge | 1 | 1.18(0.55–5.50)* | 0.02 |
| | Good knowledge | 1.05(0.79–1.56) | | |
| Knowledge about HPV vaccinations | Poor knowledge | 1 | 1.85 | 0.03 |
| | Good knowledge | 1.54(1.21–1.96) | (1.08–2.44)* | |
| Attitude toward HPV vaccinations | Unfavorable attitude | 1 | 1.85(1.15–3.45)* | 0.04 |
| | Favorable attitude | 1.22(1.05–2.33) | | |

*Statistically significant at $p < 0.05$ with COR and AOR

and attitude (AOR:1.88; 95%, CI: 1.15–3.41) had a statistically significant association with their knowledge about HPV vaccination at p-value < 0.05 (Table 5).

Factors associated with participants' attitudes toward HPV vaccinations

In the multivariate logistic regression, the study participant's knowledge about HPV (AOR: 1.90; 95%, CI: 1.11–5.88) and HPV vaccinations (AOR: 1.60; 95%CI: 1.07–2.47) were significantly associated with their attitudes (Table 6).

Factors associated with participants' HPV vaccination practice

This study found that female undergraduate health science students' knowledge about HPV (AOR: 1.18; 95%CI: 0.55–5.50), the HPV vaccine (AOR:1.85; 95%CI: 1.08–2.44), and attitudes toward HPV vaccinations (AOR: 1.85; 95%CI:1.15–3.45) were significantly associated with their HPV vaccination practices (Table 7).

Discussion

Having good knowledge and a favorable attitude toward HPV and HPV vaccinations are the cornerstones for increasing the use of HPV vaccinations and preventing cervical cancer. This study revealed that the proportion of female undergraduate health sciences students' knowledge about HPV and HPV vaccinations was 72.7% and 52.5%, respectively, indicating that the participants' knowledge of HPV vaccinations was greater than their knowledge of HPV vaccinations. This finding was supported by studies conducted at different locations; Malaysia (50.8%) [11] and Jimma (52.7%) [12]. Moreover,

the finding was relatively greater than other studies; Uganda (47.7%) [13], Indonesia (44.4%) [14], India (44%) [15], Nigeria (31.2%) [16], Ambo, Ethiopia (24.9%) [17], and South Africa (14.75%) [18], but lower than studies conducted in Romania (85.8%) [19], Ibadan (84%) [20], Thailand (60%) [21], Malaysia (60.9%) [22], Italy (56.3%) [23], UK (54.8%) [24], and other Ethiopian towns like Debre Tabor (59.2%) [25], Bahir Dar (58.1%) [26], Ambo (88.6%) [27], and Arba Minch (71.7%) [28]. This variation may be due to differences in the study setting, study population, study period, and source of information.

All participants heard about HPV infection; however, only 59.8% had heard about HPV vaccinations. This percentage was lower than studies in Debre Tabor, Ethiopia (68.9%) [25] and Italy (80.4%) [27]. In this study, students obtained information about HPV and its vaccine mainly from health professionals (30.0%), followed by mass media (radio, television, and newspaper) (26.3%) and the internet (25.5%). The findings were supported by studies conducted in Malaysia, Ibadan, Thailand, Nigeria, Morocco, and in Addis Ababa, Ethiopia [11, 16, 20, 21, 29, 30]. This indicates that health professionals can play an important role in providing adequate information regarding HPV and its vaccine to female undergraduate health sciences students. There was a minimal role for friends and family (19.8%) as sources of knowledge in this study. On the other hand, in the study conducted in Debre Tabor, Ethiopia [25], Indonesia [14], Nigeria [16], Turkey [31], and Hong Kong [32], the main sources of information for the students were the mass media (radio, television, and newspaper) and the Internet. The possible reasons for this difference could be differences in the study subjects, study locations, and study periods.

In this study, 83.0% of female undergraduate health science students were aware of HPV infection risk factors. The results were similar to those of studies conducted in India (85%) [33], but greater than the study conducted in Uganda (40%) [13]. Approximately 93.3% of the students were aware of cervical cancer prevention methods, which was supported by a study conducted in Addis Ababa, Ethiopia (93.5%) [30], and India (92.5%) [34]. This finding is larger than that of a study conducted in Nigeria (8%) [16], but less than that of a study conducted in Albania (100%) [35].

Approximately 57% of the female undergraduate health science students had a favorable attitude toward HPV vaccinations, whereas the remaining 43% had an unfavorable attitude toward HPV vaccinations, which is consistent with the findings of other studies conducted in Adama, Ethiopia (55.6%) [36], but greater than those studies in Albania (45.9%) [35] and in Jimma, Ethiopia (44.4%) [37]. More than two-thirds of the study participants (80.5%) disagreed or strongly disagreed that they would not take the vaccine because they did not believe

they were at risk of HPV infection, while 33.8% believed that the vaccine's side effects were reasonable and would not prevent them from receiving the vaccine. More than half of the study participants (56.3%) agreed that HPV vaccinations may not have a long-term negative effect, and most students agreed that the vaccinations were more useful to women than men (Table 3).

All female undergraduate health science students had never tested for HPV, and more than two-thirds of the students, 471(78.5%), did not have the willingness to undergo routine HPV testing by collecting samples themselves, which was supported by other studies conducted in Spain (71.5%) [38], Hong Kong (7%) [32], Nigeria (6%) [16], Uganda (19%) [13], and in Addis Ababa, Ethiopia (6.5%) [30]. The main reasons for not being screened were the absence of symptoms; being healthy, lack of awareness, fear of the procedure, and dislike of pelvic examination. The aforementioned reasons follow studies in Nigeria, Uganda, and Adama in Ethiopia [13, 16, 36].

After multiple logistic regression analysis, students who were aged between 21 and 23 were 2 (AOR, 2.12, 95%, CI=1.22–3.09) times more knowledgeable about HPV vaccinations than students in 19–20 years because, as the age of the students increased, the chance of getting a source of information and hearing about HPV vaccinations increased. The likelihood of being knowledgeable about HPV vaccinations was 1.88 (AOR: 1.88; 95%, CI: 1.15–3.41) times more in students with a favorable attitude than in students with an unfavorable attitude. The participants' knowledge of HPV and HPV vaccinations was significantly associated with their attitudes. Students who had good knowledge about HPV had a 1.92 (AOR: 1.92; 95%, CI: 1.11–5.88) times more positive attitude, whereas students with good knowledge about HPV vaccinations had a 1.6 (AOR: 1.60; 95%CI: 1.07– 2.47) times more positive attitude toward HPV vaccinations. This finding is consistent with other studies conducted in Ambo, Ethiopia [17]. The findings of this study are greater than those of other studies conducted in the Ethiopian towns; of Jimma, Arba Minch, and Bahir Dar [12, 26, 28]. This can be explained by the fact that individual barriers to HPV vaccination, such as fear of needle injection, side effects, and poor accessibility of information, can negatively affect attitudes toward HPV vaccination.

The study also identified factors associated with HPV vaccinations, female undergraduate health science students' knowledge about HPV, HPV vaccinations, and their attitudes were significantly associated with HPV vaccination practice. Students who had good knowledge about HPV had 1.18 (AOR: 1.18; 95%CI: 0.55–5.50) times more HPV vaccination practice than students who had poor knowledge, whereas those who had good knowledge on HPV vaccination had 1.85 (AOR: 1.85; 95%CI: 1.08– 2.44) times more HPV vaccination practice than those

who had poor knowledge on HPV vaccination. Additionally, students who had a favorable attitude had 1.85 times more HPV vaccination practice than those who had an unfavorable attitude (AOR: 1.85; 95%CI: 1.15–3.45).

Strengths and limitations of the study

The results were more representative because of a large sample size and primary sources were used. The main limitation of this study is that it does not involve male students as study participants and relies mainly on a quantitative approach, not a qualitative approach.

Conclusion

This study revealed that half of the students had good knowledge and a favorable attitude toward HPV vaccinations, but they had poor HPV vaccination practices. The age and attitude of the students were associated with their knowledge. Having good knowledge about HPV and its vaccines was significantly associated with an attitude toward HPV vaccinations. HPV vaccination practice was significantly associated with knowledge and attitude toward HPV infection and its vaccines. To strengthen HPV vaccination practices, improve student attitudes and knowledge about the benefits of vaccination, and improve counseling abilities against HPV-induced cancer, health sectors and universities should provide health education, training, and counseling services to their students. Further research is required with large-scale study participants on this issue.

Supplementary information

The online version contains supplementary material available at <https://doi.org/10.1186/s12905-024-03279-6>.

Supplementary Material 1

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Author contributions

BAM and MCW were responsible for writing the research proposal, data collection supervision, data entry, analysis, and interpretation. YKA and BAK were responsible for data curation, validation, review, and editing. BAM was also responsible for manuscript writing, revision, and submission approval. All authors have read and approved the final manuscript.

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Data availability

All data are included within the article.

Declarations

Ethics approval and consent to participate

A letter of ethical approval was obtained from the Research and Ethical Review Committee, School of Pharmacy, University of Gondar (SOP/247/2023). The participants were informed about the purpose of the study, and they provided verbal consent. The data collection was initiated after obtaining permission and provisions following relevant guidelines. The obtained data from the participants were strictly confidential.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Department of Pharmacy, College of Medicine and Health Sciences, Bahir Dar University, P.O. Box 79, Bahir Dar, Ethiopia

²Department of Pharmaceutical Chemistry, School of Pharmacy, University of Gondar, P.O. Box 196, Gondar, Ethiopia

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