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ORIGINAL RESEARCH

Factors Associated with Pre- and Post-Educational Intervention Knowledge Levels of HPV and Cervical Cancer Among the Male and Female University Students, Northwest Ethiopia

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Background: Human papillomavirus (HPV) infections are sexually transmitted and most frequently associated with cervical cancer in women, but they are also a public health concern in men. There is rising evidence that HPV's role in other cancers, such as anal, vulva, vaginal, penis, head, and neck cancers. The present study aimed to understand the factors associated with HPV and cervical cancer knowledge levels of university students before and after an educational intervention.

Methods: An Institutional-based cross-sectional study was conducted from October to November 2018. A total of 638 study participants were selected using a simple random multistage sampling technique. A pretested questionnaire was used, consolidated the data, and analyzed with SPSS version 23. Bivariate and multivariate logistic regression analyses were performed to identify which variables were associated with the knowledge levels.

Results: Six hundred thirty-eight study participants with a 100% response rate, and the mean age was 21.07 years (±SD, 1.96). Initial awareness of various broad categories was 4.09, and after the intervention, it increased to 23.4, with an average increase of 19.31 at 99% CI, $p \leq 0.001$ significance level. Before the educational intervention, students with <21 years of age [6.16, 95% CI: (2.21–17.18)] and ≤2.5 CGPA [3.44, 95% CI: (1.51–7.81)] were less knowledgeable over other counterparts. After educational intervention, the year of study was significantly associated with increased knowledge of overall and different broad categories of cervical cancer and HPV. Year of study, 1st-year students [AOR: 0.27, 95% CI: (0.14–0.51)] over third years and above are less knowledgeable. First-year students and CGPA ≤2.5 were less improved awareness over others.

Conclusion: The educational intervention improved more than fourfold increase knowledge on cervical cancer and HPV, and the year of study was a key factor associated with overall improvement. This study suggests that educational intervention effectively strengthens our understanding of the spread of HPV and cervical cancer disease burden.

Keywords: Amhara, cancer, pre and posttest

Introduction

The human papillomavirus (HPV) infection is the most commonly sexually transmitted[1,2] and coupled with an increased risk of cancer.[3,4] HPV infection occurs soon after sexual debut, and about 80–90% of HPV infections are transitory and clear by early life.[5] If HPV persists, it can lead to a range of benign and malignant lesions in both sexes,[6] including genital warts,[7] oropharyngeal, anal, penile,[8,9]

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cervix, vulva, and vaginal cancers.[10,11] 70–80% of sexually active women will become infected with HPV at some point in their lives.[8,12] Young women in their 20s have the highest prevalence of HPV infections,[12,13] although men are at continual risk of contracting new infections throughout their lives.[14]

Cervical cancer is the sixth most commonly occurring cancer in women, accounting for 1.7% of all cancers.[15] Cervical cancer has claimed the lives of over 90% of people in low- and middle-income nations.[16] Cervical cancer is the second most common cancer in Ethiopian women aged 15 to 44 years old. According to ET (2019), HPV infections lead to 26.4% of cervical cancer, while 1.2% of anogenital cancer.[17] It is projected that 6294 women are diagnosed with cervical cancer each year, with 4884 dying of the disease.

There is insufficient evidence regarding young people's knowledge and understanding of cervical cancer, risk factors, screening, and HPV vaccine in the developing world.[18] Despite its high incidence, HPV awareness is often low in most nations, including young adults.[19]

In underdeveloped countries, the sources of information through which people learn about cervical cancer remain restricted. Cervical cancer and HPV awareness and knowledge are persistently poor in developing countries.[18] In Africa, unsafe sexual behavior and a lack of understanding of health issues are prevalent among youth aged 15 to 24.[20] Men should indeed play a critical role in lowering the burden of cervical cancer.[16] Men can also help reduce the burden of cervical cancer by safeguarding their partners from HPV infections, inspiring them to get screened, and empowering them to protect themselves.[21,22] WHO has made recommendations and urged men to be integrated into cervical cancer prevention efforts in the middle- and low-income countries.[23] Men's roles in prevention are direct and indirect, including avoiding cancer-causing chemicals, quitting smoking, restricting sexual partners, and safe coitus.[24] Men's involvement in cervical cancer prevention is critical, and men's health behavior and attitudes are expected to be influenced by their disease awareness.[25]

Men have limited awareness of cervical cancer and are unconcerned about cervical cancer prevention.[26] There is little research on male awareness of cervical cancer in women and why men are excluded from prevention initiatives worldwide.[25] However, little is known about male participation in cervical cancer screening and treatment.[16] However, there is little study on men's awareness of cervical cancer.[25] Only a few research looked at HPV-related knowledge in young male and female adults, and the results were mixed.[27] According to several studies, most men are unaware of cervical cancer, and some men believe they are not accountable for cervical cancer in women.[22,28] Men's lack of knowledge about cervical cancer is risky because women are typically passive to males.[29] Cervical cancer and human papillomavirus (HPV) awareness and knowledge are extremely low in Ethiopia.[30] Health education initiatives are crucial for enhancing women's knowledge and perspectives regarding cervical cancer, screening, and self-efficacy.[31] Additionally, studies indicate that educational intervention has increased HPV knowledge.[32]

Furthermore, no study has been conducted in Ethiopia to assess men's knowledge levels and educational interventions' effectiveness among university students. This study aimed to explore educational intervention and the overall knowledge levels changes on HPV and cervical cancer awareness in male and female students from two campuses of the University of Gondar (UoG).

Methods

Study Design, Area, Source, and Study Participants

Institutional-based cross-sectional pre- and post-test comparative studies were conducted to understand the factors associated with HPV and cervical cancer awareness levels among male and female students from Tewodros and Maraki campuses of UoG.

Inclusion and Exclusion Criteria

All students enrolled in the regular programs aged 18 to 30 were included in the study.

Students enrolled in extension programs and aged below 18 and above 30 were excluded from the study.

Sample Size and Questionnaire

Sample Size Determination

The sample size was determined using the online tool of UCSF,[33,] to calculate the sample size required for before and after study, a two-tailed, 5% precision, 80% power, and effect size=0.5 and SD_{Δ}=4.5, the sample size for the study was 638. G*Power ver3.1.9.7, for the McNemer test,[34] a two-tailed, 1.5 effect size, α 0.05, 80% power, and 33% (based on pilot study) of the population changes due to the intervention, 604 participants needed to detect

the effect and a finite population formula[35] to determine the number of males and females required. The assumption was that 50% of the university students had sufficient knowledge of cervical cancer, 95% confidence interval, and 4% reliability. The sample size was determined as follows:

$$n = (Z\alpha 1/2)^2 \times pq/d^2$$

Where: n=the desired sample size

p=0.5 (expected minimum variability) and so, q=0.5

Zα1/2=critical value at 95% confidence level of certainty is=(1.96)

$=[(1.96)^2\ (0.5)(0.5)]/(0.04)^2=600.25=601$,

Adding 5% non-response rate=31

The final sample size was N=601+31=632

(Applying finite population, N=11500 male (N=6900) female (N=4600) students enrolled into different programs at University of Gondar.)

The sample number of females:

$=N_T xA/N$; $=4600\times631/11{,}500=252$

The sample number of males:

$=6900\times630/11{,}500=378$

The final sample size for the study was 638.

Questionnaire Development

The questionnaire was designed and developed based on study objectives, literature review (CDC, WHO), and pilot study. An initial pilot study was carried out at the college level, UoG, before the study was conducted in October–November 2018. The study was carried out using questionnaires consisting of six sections, including 53 items, both open- and close-ended questions in English and Amharic languages. The questionnaire was initially written in English and translated to Amharic and back to English to keep the questions' consistent. Most students prefer to use the questionnaire in Amharic. The questionnaire was coded and had the same items and provided two different time intervals, before and after the interventions.

Study Variables

Socio-Demographic Variables

Age, sex, religion, year of study, the branch of study, CGPA, place of residence, father's and mother's educational qualifications and occupation, family size, family income.

Dependent Variables

Cervical cancer symptoms, risk factors, HPV, screening, vaccine.

Educational Intervention

The educational intervention was one time for a brief one-hour audio-visual-based presentation on cervical cancer symptoms, risk factors, HPV epidemiology, screening, and vaccination highlighting the STD nature of HPV transmission to the students, followed by 10-minute open discussion. Then, the post-test questionnaire was provided to the study participants to answer.

Sampling and Data Collection Procedure

The study was conducted on 638 undergraduate and post-graduate male (60%) and female (40%) students aged between 18 and 30 years. The study's aims and scope were posted on different official noticeboards and asked for voluntary participation. The study participants were chosen to use a simple random sampling technique and were enrolled using a multistage sampling technique. Information sheets and written informed consent were distributed randomly with a fixed number of questionnaires at a given time and venue. The sampling was repeated in different locations of the two campuses until the desired sample size, and ratio of male to female was achieved. Data were collected using a pretested questionnaire. Data collectors were trained laboratory technical staff to employ questionnaires on the selected study participants and collected the data.

Statistical Analysis

In the sample population, all variables of interest were summarized using descriptive statistics. For continuous variable age, means and standard deviations were generated. Knowledge levels of respondents regarding symptoms, risk factors, HPV and its relationship with cervical cancer, screening, and vaccination were measured using a 38-item instrument. A score of 1 was allotted for a good/correct answer and 0 for a wrong answer or "Do not know." The maximum possible score was 38. The total score was divided into those scored above 19 or more were categorized as having good ("sufficient") knowledge; the others were categorized as poor knowledge.

Proportions were compared by using the McNemar Chi^2 test to determine the changes between pre- and post-intervention knowledge levels at 99% CI, $p\leq0.001$

significance. The impact of socio-demographic characteristics on knowledge levels of cervical cancer was investigated using binary logistic regression. Finally, explanatory variables with a p-value less than 0.2 in the bivariate analysis were included in multivariate regression analyses to investigate factors that predict the correlation between baseline cervical cancer knowledge scores and changes in scores after the educational intervention. The odds ratio and 95% CI interval were used to assess the association's existence and strength. All tests of significance were two-tailed at a 5% level. The reference category was the most common category of an independent variable (IV).

Ethical Considerations

Ethical clearance was obtained from the Institute of Biotechnology (EC No.: IoB/28/12/2018), University of Gondar, Gondar, Ethiopia. Enrolled students of eligible ages volunteered to participate, and a signed written consent form was included in the study. The study's purpose and importance were explained to the participants before obtaining written informed consent, and the confidentiality of their identities was ensured. Data collectors were given one day of training on purpose, the study's scope, and the study's ethical aspects, such as maintaining the research's confidentiality. The data from the questionnaire were processed anonymously by assigning random codes. During data collection, the confidentiality of the information was protected by omitting names or I.D. numbers from the questionnaire.

Results

Socio-Demographic Characteristics of the Study Participants

A total of 638 student participants attended pre- and post-intervention, with a 100% response rate. Of the total respondents, 384 (60.18%) were male (Table 1). The study participants ranged from 18 to 30 with a mean age of 21.07 (±SD, 1.96) years. More than 50% of study participants were from the Amhara region. The majority of the study's participants were Orthodox Christians (77.1%), undergraduates (95%), and never married. Nearly 50% (332) of participants' CGPA was <2.5. More than 30% of the study participants' father's educational levels (215) and mother's educational levels (212) were up to the primary level. Forty-two percent of students

Table 1 Socio-Demographics of Male and Female University Students, N=638

Variables	N	%
Gender		
Male	384	60.2
Female	254	39.8
Age range		
<21 years	276	43.3
21 and 22 years	271	42.5
≥23 years	91	14.3
Area		
Rural	319	50.0
Urban	319	50.0
Region		
Addis Ababa	84	13.2
Amhara	335	52.5
Oromia	123	19.3
Other	96	15.0
Level of education		
Under-graduation (UG)	607	95.1
Post-graduation (PG)	31	4.9
Year of study		
First year of UG	98	15.4
Second year of UG	377	59.1
Third year of UG	83	13.0
Fourth year of UG and above	80	12.5
Stream of study		
Biological sciences	271	42.5
Other sciences	161	25.2
Humanities	206	32.3
CGPA		
<2.5	332	52.0
2.5–3.0	225	35.3
>3.0	81	12.7
Marital status		
Unmarried	608	95.3
Married	30	4.7
Religion		
Orthodox	492	77.1
Protestants	83	13.0
Muslims	63	9.9
Father's education level		
Illiterates	220	34.5
Primary	215	33.7
Secondary	106	16.6
Higher	97	15.2

(*Continued*)

Table 1 (Continued).

Variables	N	%
Mother's education level		
Illiterates	283	44.4
Primary	212	33.2
Secondary	80	12.5
Higher	63	9.9
Father's occupation		
Employed	177	27.7
Business	151	23.7
Other occupation	270	42.3
No employment	40	6.3
Mother's occupation		
Employed	97	15.2
Business	95	14.9
Other occupation	97	15.2
Homemaker	349	54.7
Family size		
≤5	334	52.4
≥6	304	47.6
Family income (ETB)		
<5,000	519	81.3
5,000–10,000	84	13.2
>10,000	35	5.5

Notes: The mean age of the study respondents is 21.07 years (±SD. 1.96).
Abbreviation: ETB: Ethiopian Birr.

belonged to biological sciences. More than 90% of the respondent's fathers had some occupation, while 54.7% of the participants were homemakers. Most of the participants' 519 (81.3%) family income were <5000 birr.

Knowledge Levels of Study Participants About HPV and Cervical Cancer and McNemar's Test of the Significance of Knowledge Levels Before and After Intervention

Responses to questions on selected domains before and after educational intervention are presented in Table 2. McNemar test determined a statistically significant difference in the proportion of HPV and cervical cancer awareness pre- and post-intervention at 99% CI, P≤0.001 significance level.

Knowledge About the Symptoms of Cervical Cancer

Nine questions were asked about the symptoms (Table 2). Before, 174 (27.3%) students, and after the educational intervention, 581 (91.1%) reported that they had heard about cervical cancer. Vaginal bleeding after menopause could be a sign of cervical cancer? Before the intervention, only 47 (7.4%) students and 410 (64.3%) responded correctly after the educational intervention. However, more than sixty percent of the respondents, 392 (61.4%), did not know any symptoms associated with cervical cancer before the intervention. After the intervention, 3.4% of study respondents could not correctly respond to any cervical cancer symptoms.

Knowledge About Cervical Cancer's Risk Factors

To study participants, nine questions were asked to assess knowledge about cervical cancer risk factors (Table 2). About 336 (57.4%) of study respondents had no idea about risk factors associated with the disease before the educational intervention, and only 36 (5.6%) students could not identify any of the risk factors even after the intervention. Before the intervention, 57 (8.9%) students responded that high parity could be a risk factor, and after the intervention, 283 (44.4%) could feel high parity could be a risk factor, and the least correctly responded question under the risk factor domain.

Knowledge About the HPV and Its Relationship with Cervical Cancer

Nine different questions like the causative organism, mode of transmission of HPV, and different diseases in males and females were asked to understand the knowledge levels before and after the educational intervention. Before the intervention, 81 (12.7%) of study respondents were aware of the STI nature of HPV, and 448 (70.2%) students responded correctly after intervention (Table 2). Before the intervention, only 23 (3.6%) and 27 (4.4%) were aware of anal and genital cancers before the intervention, respectively. On the other hand, HPV can cause anal cancers was the least correctly answered before (9.5%) and even after (20.8%) educational intervention. About 501 (78.5%) of study respondents had no idea about HPV and its association with the diseases before the educational intervention, and only 56 (8.8%) students could not know about HPV after the intervention.

Knowledge About the Screening of Cervical Cancer

There were four different questions asked about cervical cancer screening methods and their importance. Before the educational intervention, only 13.8% of total respondents were aware of screening, and 74.9% could respond correctly

Table 2 Awareness About Cervical Cancer and McNemar Test Before and After Educational Intervention at P≤0.001 Significance Level, N=638

Categories Inquired	Pre-Intervention Correct Responses		Post-Intervention Correct Response		Difference %	Chi^2 value p≤ 0.001
	N	%	N	%		
Symptoms						
What is uterine cervical cancer?	174	27.3	581	91.1	63.8	401
Is cervical cancer a preventable disease?	54	8.5	338	53.0	44.5	253
Is a persistent unpleasant vaginal discharge could be a sign of c. cancer?	102	16.0	459	71.9	55.9	322
Is menorrhagia a symptom of cervical cancer?	76	11.9	470	73.7	61.8	374
Is vaginal bleeding between periods could be a sign of cervical cancer?	53	8.3	403	63.2	54.9	322
Is vaginal bleeding after menopause could be a sign of cervical cancer?	47	7.4	410	64.3	56.9	353
Persistent pelvic pain could be a sign of cervical cancer?	63	9.9	395	61.9	52.0	311
Discomfort or pain during sex could be a sign of cervical cancer?	95	14.9	415	65.0	50.1	287
Vaginal bleeding during or after sex could be a sign of cervical cancer?	82	12.9	441	69.1	56.2	327
Risk factors						
Is poor hygiene a risk factor for cervical cancer?	142	22.3	434	68.0	45.7	237
Multiple sex partners is a risk factor for cervical cancer?	164	25.7	508	79.6	53.9	298
Coitus at an early age is a risk factor for cervical cancer?	131	20.5	464	72.7	52.2	303
No knowledge of cervical cancer is a risk factor?	160	25.1	449	70.4	45.3	246
Swelling of the cervix is a risk factor for cervical cancer?	103	16.1	385	60.3	44.2	248
Consuming contraceptive pills could be a risk factor for cervical cancer?	80	12.5	394	61.8	49.3	286
Could unprotected intercourse be a risk factor for cervical cancer?	148	23.2	505	79.2	56.0	325
Is high parity a risk factor for cervical cancer?	57	8.9	283	44.4	35.5	186
Could smoking be a risk factor for cervical cancer?	108	16.9	460	72.1	55.2	320
Human Papilloma Virus (HPV)						
What is the causative organism of cervical cancer?	86	13.5	455	71.3	57.8	329
HPV can infect women	123	19.3	474	74.3	55.0	307
HPV infections can cause cervical cancer	101	15.8	495	77.6	61.8	344
HPV is a sexually transmitted infection	81	12.7	448	70.2	57.5	321
HPV infections are usually obvious and usually resolve their own	37	5.8	275	43.1	37.3	206
Can HPV infect men?	27	4.2	250	39.2	35.0	194
Can HPV infections cause genital warts?	68	10.7	369	57.8	47.1	259
Can HPV infections cause oral/pharyngeal cancers?	53	8.3	324	50.8	42.5	235
Can HPV infections cause genital cancers in males?	28	4.4	265	41.5	37.1	208
HPV infections can cause anal cancers?	23	3.6	248	38.9	35.3	196
Screening						
Have you heard of screening for cervical cancer?	88	13.8	478	74.9	61.1	348
Ever heard of the Pap smear test?	109	17.1	526	82.4	65.3	397
Why is the Pap smear test used?	56	8.8	331	51.9	43.1	249
Can Pap smear tests pick up cell changes that may go on to become c.c.?	47	7.4	383	60.0	52.6	310
Vaccination						
Have you heard of a vaccine for cervical cancer?	64	10.0	434	68.0	58.0	342
HPV vaccine exists that protects against cervical cancer	45	7.1	426	66.8	59.7	367
A vaccine for HPV is available to men	19	3.0	222	34.8	31.8	184
To which age group should HPV vaccines be given?	25	3.9	99	15.5	11.6	50
Can HPV vaccines be given to boys?	39	6.1	326	51.1	45.0	256
Which is the most appropriate stage for HPV vaccination?	57	8.9	293	45.9	37.0	210

after the intervention (Table 2). About 465 (72.9%) of study respondents had no idea about screening before the educational intervention, and only 57 (8.9%) students could not answer after the intervention. Only 7.4% of respondents identified that the Pap smear test could pick up cell changes before and increased to 60% after the intervention.

Awareness Regarding HPV Vaccination

There were six different questions: availability of HPV vaccine for both girls and boys, vaccination age. Before the educational intervention, 10% of the participants heard about the HPV vaccine, and only 3% were aware of the vaccine available for males (Table 2). Five hundred and seven (79.5%) and 77 (12.1%) were unaware of any question on HPV vaccine before and after educational intervention, respectively.

Study Participants' Awareness of Broad Categories of Cervical Cancer

McNemar test showed a change in the mean level of awareness on various broad categories of cervical cancer and HPV before and after intervention statistically significant at 99% CI, p≤0.001 (Table 3). After the intervention, there was more than five-fold increase in overall awareness of cervical cancer.

Factors Associated with Cervical Cancer Knowledge Among Study Participants

Factors Associated with Pre-Intervention Cervical Cancer Knowledge Among Study Participants

The multivariate analysis showed that seven independent variables were significantly associated with base-level knowledge about different domains of cervical cancer: gender, year of study, age, parent's educational level, CGPA, and family income (Table 4). However, no factor was statistically significant in the overall knowledge of cervical cancer. Base-level knowledge on symptoms, females nearly three times [AOR:2.57, 95% CI: (1.37–4.82)], third year and above [AOR:3.13, 95% CI: (1.3–7.43)], and family income 5000 and above [AOR:3.25, 95% CI: (1.04–10.16)] were more knowledgeable over other counterparts. Similarly, baseline awareness on cervical cancer risk factors, females [AOR:2.09, 95% CI: (1.37–3.19)], family income 5000 and above [AOR:4.33, 95% CI: (2.08–9.01)] were more knowledgeable over others and study participants mother's education level: primary and below [AOR:2.43, 95% CI: (1.24–4.76)] were less knowledgeable over others. Knowledge level about HPV, age <21 years six times less knowledgeable [AOR:6.16, 95% CI: (2.21–17.18)] over higher age groups, and CGPA <2.5 were three times less knowledgeable [AOR:3.44, 95% CI: (1.515–7.81)] over higher CGPA. Similarly, the study participant's father's education level, primary and below, was nearly five times less [AOR:4.89, 95% CI: (1.79–13.37)] knowledgeable over higher education on screening. Vaccination knowledge and family income <5000 were nine times less informed [AOR:9.63, 95% CI: (2.2–42.13)] over higher income groups.

Factors Associated with Post-Intervention Cervical Cancer and HPV Knowledge Among Study Participants

The multivariate analysis showed that post-intervention overall knowledge and different domains of cervical cancer were under the influence of the year of study (Table 5). Overall cervical cancer knowledge was strongly associated with the year of study, area, and CGPA. Students from rural [AOR:1.75, 95% CI: (1.25–2.43)] over urban, year of study 1st-year students [AOR:0.27, 95% CI: (0.14–0.51)] over third years and above, CGPA2.5–3.0 [AOR:2.16, 95% CI: (1.13–4.13)] over higher were less knowledgeable. Knowledge on symptoms, age <21 years [AOR:0.5, 95% CI: (0.26–0.97)] over ≥23 years, year of study 1st-year students [AOR:0.34, 95% CI: (0.12–0.94)] over a third-year

Table 3 Mean Level of Awareness on Various Broad Categories of Cervical Cancer and McNemar Test Score at P≤0.001 Significance Level, N=638

Category	Pre-Intervention	Post-Intervention	Difference	Chi^2 value*
Symptoms	1.17	6.13	4.96	433
Risk factors	1.71	6.08	4.37	364
HPV	0.39	5.65	5.26	224
Screening	0.47	2.70	2.23	354
Vaccination	0.35	2.84	2.49	219
Overall knowledge about cervical cancer	4.09	23.4	19.31	335

Note: *p≤0.001.

Table 4 Bi-Variable and Multi-Variable Logistic Regression Analysis of Potential Factors Associated with Cervical Cancer Knowledge Before Education Intervention, N=638

Variable	Category Domain	Knowledge		COR (95% CI)	AOR (95% CI)
		Sufficient	Not Sufficient		
Gender	**Symptoms**				
	Male	20	364	0.38(0.20–0.72)[b]	2.57(1.37–4.82)[a]
	Female	33	221	Reference	Reference
Year of study					
	1st year UG	7	91	0.21(0.08–0.55)[b]	4.65(1.8–11.97)[a]
	2nd year UG	15	362	0.12(0.05–0.25)[a]	8.23(3.9–17.3)[a]
	3rd year UG	10	73	0.31(0.13–0.75)[b]	3.13(1.3–7.43)[b]
	4th year UG and above	21	59	Reference	Reference
Family income	**(ETB)**				
	<5,000	35	484	0.20(0.07–0.52)[a]	4.95(1.9–12.87)[a]
	5,000–10,000	10	74	0.30(0.90–0.95)[c]	3.25(1.04–10.16)[c]
	>10,000	8	27	Reference	Reference
Gender	**Risk factors**				
	Male	52	332	0.47(0.31–0.72)[a]	2.09(1.37–3.19)[a]
	Female	62	192	Reference	Reference
Family income	**(ETB)**				
	<5,000	75	444	0.23(0.11–0.48)[a]	4.3(2.08–9.01)[a]
	5,000–10,000	25	59	0.54(0.23–1.27)[ns]	1.82(0.78–4.22)[ns]
	>10,000	14	21	Reference	Reference
Mother's education level					
	Illiterates	40	243	0.43(0.22–0.83)[b]	2.31(1.2–4.47)[b]
	Primary	31	181	0.41(0.21–0.80)[b]	2.43(1.24–4.76)[b]
	Secondary	20	60	0.61(0.28–1.29)[ns]	1.64(0.77–3.47)[ns]
	Higher	23	40	Reference	Reference
Age range	**HPV**				
	<21 years	6	270	0.16(0.05–0.45)[a]	6.16(2.21–17.18)[a]
	21 and 22 years	25	246	0.79(0.36–1.73)[ns]	1.26(0.57–2.75)[ns]
	≥23 years	12	79	Reference	Reference
CGPA					
	<2.5	16	316	0.29(0.12–0.66)[a]	3.44(1.51–7.81)[a]
	2.5–3.0	15	210	0.42(0.18–0.97)[c]	2.35(1.02–5.39)[ns]
	>3.0	12	69	Reference	Reference
Father's education	**Screening**				
	Illiterates	9	211	0.3(0.12–0.74)[b]	5.75(1.97–16.8)[a]
	Primary	8	207	0.27(0.10–0.69)[a]	4.89(1.79–13.37)[a]
	Secondary	3	103	0.20(0.56–0.75)[c]	4.58(1.24–16.96)[c]
	Higher	12	85	Reference	Reference
Family income(ETB)	**Vaccination**				
	<5,000	5	514	0.10(0.24–0.45)[a]	9.63(2.2–42.13)[a]
	5,000–10,000	1	83	0.12(0.01–1.28)[ns]	7.78(0.78–77.58)[ns]
	>10,000	3	32	Reference	Reference

Notes: [a]Significant at p ≤0.001; [b]significant at p ≤ 0.01; [c]significant at p ≤ 0.05.
Abbreviation: ns, not significant.

Table 5 Bi-Variable and Multi-Variable Logistic Regression Analysis of Potential Factors Associated with Cervical Cancer Knowledge After Educational Intervention, N=638

Variable	Category Domain	Knowledge		COR (95% CI)	AOR (95% CI)
		Sufficient	Not Sufficient		
Area	**Overall knowledge**				
	Rural	148	171	0.57(0.41–0.79)[a]	1.75(1.25–2.43)[a]
	Urban	198	121	Reference	Reference
Year of study					
	First year of UG	71	27	3.68(1.94–6.99)[a]	0.27(0.14–0.51)[a]
	Second year of UG	172	205	0.94(0.49–1.78)[ns]	1.06(0.56–2.02)[ns]
	Third year of UG	69	14	5.26(2.24–12.31)[a]	0.19(0.08–0.44)[a]
	Fourth year of UG and above	34	46	Reference	Reference
CGPA					
	<2.5	172	160	0.59(0.35–1.01)[ns]	1.67(0.98–2.84)[ns]
	2.5–3.0	123	102	0.46(0.24–0.88)[c]	2.16(1.13–4.13)[c]
	>3.0	51	30	Reference	Reference
Age range	**Symptoms**				
	<21 years	222	54	1.96(1.02–3.76)[c]	0.5(0.26–0.97)[c]
	21 and 22 years	211	60	1.67(0.91–3.07)[ns]	0.59(0.32–1.09)[ns]
	≥23 years	63	28	Reference	Reference
Year of study					
	First year of UG	90	8	2.86(1.06–7.73)[c]	0.34(0.12–0.94)[c]
	Second year of UG	269	108	0.72(0.394–1.35)[ns]	1.37(0.74–2.54)[ns]
	Third year of UG	77	6	4.21(1.55–11.45)[a]	0.23(0.87–0.64)[a]
	Fourth year of UG and above	60	20	Reference	Reference
Mother's occupation					
	Employed	70	27	0.45(0.22–0.93)[c]	2.23(1.08–4.59)[c]
	Business	74	21	0.58(0.27–1.23)[ns]	1.81(0.85–3.84)[ns]
	Other occupation	81	16	0.64(0.35–1.18)[ns]	1.56(0.85–2.87)[ns]
	Homemaker	271	78	Reference	Reference
Year of study	**Risk factors**				
	First year of UG	89	9	4.12(1.77–9.56)[a]	0.25(0.10–0.58)[a]
	Second year of UG	279	98	1.1(0.64–1.9)[ns]	0.87(0.5–1.48)[ns]
	Third year of UG	76	7	4.69(1.87–11.77)[a]	0.22(0.09–0.56)[a]
	Fourth year of UG and above	57	23	Reference	Reference
Level of education	**HPV**				
	Under-graduation (UG)	275	332	0.34(0.13–0.88)[c]	2.92(1.13–7.56)[c]
	Post-graduation (PG)	19	12	Reference	Reference
Year of study					
	First year of UG	51	47	2.28(1.11–4.67)[c]	0.43(0.21–0.89)[c]
	Second year of UG	157	220	1.47(0.69–3.16)[ns]	0.67(0.31–1.44)[ns]
	Third year of UG	51	32	3.3(1.38–7.9)[b]	0.3(0.12–0.72)[b]
	Fourth year of UG and above	35	45	Reference	Reference

(*Continued*)

Table 5 (Continued).

Variable	Category Domain	Knowledge		COR (95% CI)	AOR (95% CI)
		Sufficient	Not Sufficient		
CGPA					
	<2.5	142	190	0.53(0.32–0.88)[c]	1.88(1.13–3.12)[c]
	2.5–3.0	104	121	0.58(0.31–1.08)[ns]	1.72(0.91–3.22)[ns]
	>3.0	48	33	Reference	Reference
Area	**Screening**				
	Rural	179	140	0.59(0.42–0.82)[a]	1.68(1.2–2.36)[a]
	Urban	223	96	Reference	Reference
Level of education					
	Under-graduation (UG)	380	227	0.24(0.09–0.63)[a]	4.16(1.56–11.04)[a]
	Post-graduation (PG)	22	9	Reference	Reference
Year of study					
	First year of UG	75	23	5.2(2.49–11.21)[a]	0.18(0.08–0.4)[a]
	Second year of UG	221	156	2.46(1.32–4.58)[a]	0.4(0.21–0.75)[a]
	Third year of UG	66	17	6.42(2.9–14.22)[a]	0.15(0.07–0.34)[a]
	Fourth year of UG and above	40	40	Reference	Reference
Year of study	**Vaccination**				
	First year of UG	42	56	0.79(0.41–1.54)[ns]	0.88(0.48–1.62)[ns]
	Second year of UG	113	264	0.4(0.2–0.8)[b]	1.55(0.94–2.56)[ns]
	Third year of UG	49	34	1.32(0.59–2.91)[ns]	0.46(0.24–0.86)[c]
	Fourth year of UG and above	32	48	Reference	Reference

Notes: [a]Significant at p ≤0.001; [b]significant at p ≤ 0.01; [c]significant at p ≤ 0.05.
Abbreviation: ns, not significant.

and higher, mother's occupation employed [AOR:2.23, 95% CI: (1.08–4.59)] over homemaker were less knowledgeable.

On risk factors, 1st year students [AOR:0.25, 95% CI: (0.10–0.58)] were less aware over second years and above. Similarly, knowledge of HPV was associated with level of education, year of study and CGPA. Undergraduates [AOR:2.92, 95% CI: (1.13–7.56)] over postgraduates,1st year students [AOR:0.43, 95% CI: (0.21–0.89)], CGPA<2.5 [AOR:1.88, 95% CI: (1.13–3.12)] were less knowledgeable over other counterparts. Knowledge on cervical cancer screening, rural [AOR:1.68, 95% CI: (1.2–2.36)], undergraduates [AOR:4.16, 95% CI: (1.56–11.04)], 2nd year students [AOR:0.4, 95% CI: (0.21–0.75)] were less knowledgeable over others. Knowledge on vaccination, 3rd year students [AOR:0.46, 95% CI: (0.24–0.86)] less knowledgeable over 4th year and above.

Discussion

The current study found that study participants lacked information about cervical cancer and the several domains examined. This finding is consistent with a comparable study conducted in Texas among medical and non-medical students.[36]

Several studies revealed that a brief educational intervention could improve college students' overall understanding of cervical cancer and HPV, and similar findings have been reported in several intervention studies.[32,36,37] In our study, adopting a theory-based educational intervention resulted in a fivefold increase in general knowledge about cervical cancer, symptoms, risk factors, HPV, screening, and vaccination, consistent with prior Jamaican studies.[37] The majority of respondents lack awareness of the risk factors and symptoms of cervical cancer, HPV, and its vaccines. This corresponds to other research undertaken in Ghana.[38] The discrepancy could result from information being disseminated via various mass media and the availability of screening programs in Ghana.[38] After an intervention, despite considerable increases of 8.5% to 53% in the number of participants who believed cervical cancer was preventable, 47% still

believed cervical cancer was not preventable. This observation is consistent with the research findings conducted in Jamaica.[37]

Before the educational intervention, 27.3% of students ever heard about cervical cancer. It is high compared to a study in Nigeria, 22.6%;[39] however, it is very low compared to a study in Eastern Ethiopia that reported 50%.[40] This difference could be different in study settings and the age of the study participants. Only 12.9% had base-level knowledge about vaginal bleeding after coitus could be a sign of cervical cancer, which is low compared to a study in India, 27%,[41] very low compared to different studies reported.[38,40] The baseline knowledge levels on vaginal bleeding between periods and foul-smelling vaginal discharge as a symptom of cervical cancer were lower than studies reported.[38,41] After menopause, vaginal bleeding may be an indication of cervical cancer. Before the intervention, only 7.4% of students correctly responded; after the intervention, 64.3% of students correctly responded. This score is extremely low compared to a study conducted in Jamaica on women before and after intervention (50.3% vs 94.1%).[37] This could be a difference in respondents' gender and age.

Before the intervention, only 42.6% of research participants were aware of risk factors, which is low compared to a study conducted in Ghana, which found that 63.8% of participants were aware of cervical cancer risk factors.[38] At the base level, 57.4% of study respondents did not know any risk factors. This score is lower than a study done in Eastern Ethiopia, 24.2%.[40] At the base level, 25.7% of study participants knew that multiple sex partners could be a risk factor, which is higher than a study of 6%.[41] This difference in awareness could be due to awareness of HIV education received as a part of the curriculum.

Before the intervention, 8.9% of students responded that high parity could be a risk factor, and it can be compared with a 12% awareness reported in a study.[41] After the intervention, 44.4% of students indicated that high parity could be a risk factor; however, this score is extremely low compared to research conducted in Ghana,[38] owing to the country's cultural differences, and high parity is very common.

Before the intervention, students from biological sciences and in their fourth or higher year of study scored higher on knowledge levels than students majoring in non-biological sciences, a finding that corroborated studies done in New York and Mexico.[32,42] Baseline knowledge levels were lower for the humanities stream than for the science stream, while the former show a larger gain in scores following the intervention; this can be compared with a study conducted in Texas after the intervention, non-physicians' knowledge levels improved at par with physicians.[36]

Only 16.9% of research participants identified smoking as a risk factor, and first-year undergraduate students' level of awareness was poor over others, a finding consistent with a study conducted in Brazil.[43]

In the present study, before the intervention, females had a better awareness of cervical cancer symptoms and risk factors than males. This observation is comparable to studies done in New York,[32] Texas,[36] Ghana,[38] Mexico,[42] and India,[44] but there was little difference between male and female students on HPV-related questions and vaccination, consistent with another study.[32] It reflected a trend in public education on sexually transmitted illnesses.

Only 13.5% of study participants were aware that HPV is the causative organism for cervical cancer and that HPV can infect males (4.5%), which is extremely low compared to a study conducted in the USA (58.2% and 55.2%, respectively).[45] This study demonstrated that brief educational interventions focusing on HPV successfully increase HPV knowledge, similar to a study conducted with New York adolescents.[32] After the intervention, knowledge about HPV was 5.6 times more than before (0.39), and a similar increase was made in a study conducted in Vietnam.[46] Brief educational interventions focused on HPV may thus be helpful for primary prevention of all sexually transmitted illnesses, cervical cancer, and other HPV-related diseases.

Before the educational intervention, 12.7% of study respondents were aware of the STD nature of HPV infections, but most women and men lacked basic knowledge that HPV infection is sexually transmitted. This observation is consistent with a study conducted in Berlin,[27] but is lower than in the USA (90%).[47] The degree of information on HPV was higher for fourth-year students and above, PG students, and students with a higher CGPA and a similar discovery was made in a study in Mexico, where fourth-year health science students had a higher level of knowledge.[42]

Before the intervention, most participants in our study had never heard of cervical cancer screening and were unaware of the purpose of a Pap test, which contradicts the findings of a Jamaican study.[37] Before the educational intervention, only 13.8% of total respondents were aware of screening, comparable with a study in Nigeria, 17.9%,[39]

however very lower than a study conducted in Eretria Medical students, 46%.[48] The huge difference could be a difference in study participants. Before the intervention, 7.4% of study participants knew that the Pap smear test should be done as a screening test to detect cervical cancer early, and less than (27%) a study conducted in India.[41] The current study's findings are consistent with those of earlier intervention studies.[37] Knowledge levels on screening were improved over base level and this finding. This observation may be that participants received adequate details about the screening during the education sessions.

Before the educational intervention, 10% of participants had heard of vaccines, only 3% were aware of male-specific vaccines, and 79.5% were unaware of HPV vaccines, comparable with a study conducted in Vietnam, which reported low levels of knowledge about HPV vaccination.[46] Awareness and sufficient knowledge on screening and vaccination coupled with effective participation in screening and HPV vaccination, and such observation was reported in multiple studies, including a study conducted in Ghana.[38]

Following education, there was a rise in positive attitudes for receiving and recommending screening and vaccination. Both males and females showed a favorable attitude about obtaining or advocating HPV screening and vaccination after understanding that vaccines can protect against HPV. A similar observation was reported for the vaccine in a study conducted in India,[44] Nigeria,[49] and Jamaican investigations.[37] Our findings suggest indicating that a theory-based educational intervention can help improve cervical cancer knowledge. Educational interventions can potentially eliminate barriers and elicit positive cervical cancer screening behavior, and these findings may aid future attempts to enhance cancer screening rates in similar low-resource settings. Mean knowledge scores increased dramatically from 4 to 23 following the presentation, regardless of gender, branch, age, and similar observation in a study conducted in Texas observation.[36] The overall knowledge of study participants was 54.23% after the intervention, compared with a study in Ethiopia, 55.7%.[40]

In our study, young adults in their first year had a lower rate of knowledge acquisition following intervention than other age groups, and comparable findings of a study in Berlin, where students of class 11 or below were the least improvement on overall knowledge on HPV.[27] All groups had poor baseline knowledge, with older participants scoring higher. A similar observation was made in another study in Texas.[36] We observed a strong correlation between increasing age and increased HPV knowledge among study participants, analogous to a study conducted in India.[44]

On risk factors, first-year students [AOR:0.25, 95% CI: (0.10–0.58)] were less aware than second- and third-year students, which is consistent with a study in Brazil that found medical students up to their third year have lower knowledge levels [PR:0.6, 95% CI: (0.6: 0.7)] than fourth- and higher-year students.[43] Franceschi et al reported similar findings in their investigation.[50]

Factor on risk variables, first-year students [AOR:0.25, 95% CI: (0.10–0.58)] were less conscientious than second- and third-year students. Education level was consistently connected with an increased understanding of cervical cancer.[50] Third-year and above were knowledgeable before and after intervention [AOR:3.13, 95% CI: (1.3–7.43)], and a similar association between educational background (p=0.000) and knowledge level of the respondents reported in a community study in Ghana.[51] A similar association was reported in a study conducted in Eretria.[48]

Study participants' mother's education level: primary and below [AOR:2.43, 95% CI: (1.24–4.76)] were less knowledgeable than others, and a similar association was reported in a study having an educational level above 12th (AOR: 12.11, 95% CI 4.57–32.09) were more knowledgeable.[40] Knowledge level about HPV, age <21 years six times less knowledgeable [AOR:6.16, 95% CI: (2.21–17.18)] over higher age groups, and a similar association was reported in a study.[48] After educational intervention, students from rural [AOR:1.68, 95% CI: (1.25–2.36)] were less knowledgeable over urban, and similar associations were reported (AOR=2.5, 95% CI: 1.1–5.7) in a study in Addis Ababa, Ethiopia,[52] and Malaysia (OR: 1.96, 95% CI: 1.11–3.46).[53] The factor associated with an increase in screening knowledge of the study participants was undergraduates [AOR:2.92, 95% CI: (1.13–7.56)] less improved over postgraduates, and a similar association was reported in a study.[48]

The factor associated with the increase in screening knowledge of the study participants was higher the year of study [AOR:0.15, 95% CI: (0.07–0.34)] are more knowledgeable and similar observation [OR=2.8, 95% CI: 1.1–7.8] reported in an Addis Ababa study in Ethiopia.[52] 3rd-year students [AOR:0.46, 95% CI: (0.24–0.86)] less knowledgeable on HPV vaccination over 4th year and above. Furthermore, a similar observation was reported in a study [OR: 1.19, 95% CI: 1.09–1.29].[53]

Limitation of the Study

This study may contain bias due to time and financial constraints. Due to the cross-sectional nature of the study, causal correlations are difficult to establish. Additionally, because the study included only students present on the sampling days, students with a high absence rate would be less likely to be included. The study's participation was entirely voluntary. As a result, most participants may have indicated a higher level of interest in the subject. Finally, some participants may have had difficulty comprehending the questions because of their disparate educational backgrounds, contributing to possible bias. The students at UoG may not indicate students from other Ethiopian universities, as most students were from the Amhara region and were predominantly Orthodox Christians.

Strengths of the Study

To our knowledge, ours is the first study to understand the efficacy of an educational presentation on cervical cancer, HPV knowledge, and vaccination among Ethiopian male and female university students.

In Ethiopia, research on male awareness of cervical cancer and HPV has been limited to healthcare personnel, and to our knowledge, this is the first study that focuses on male university students. A phased educational intervention enabled this instructional tool to reach a sizable number of students and assess their knowledge before and after the lecture. While we saw a significant increase in general knowledge among study participants immediately following the intervention, we do not know how well the information was retained over time. As one of the first studies to examine the effect of educational intervention on cervical cancer and HPV knowledge, and given the paucity of research on HPV knowledge in male and female students of Ethiopian universities, this study provides critical information for clinicians, educators, and policymakers. This study is expected to provide critical information on HPV health education and the importance of including males to grasp Ethiopia's disease burden fully.

Our findings suggest that more inputs are needed to educate the general public, particularly women, about cervical cancer symptoms because early detection of symptoms can prompt medical treatment, leading to a better prognosis and lower death rates. It is critical to guarantee that cervical cancer screening facilities are available in all health centers and the required immunization implementation is reachable. In theory, increasing positive attitudes toward cervical cancer screening and HPV vaccines and behavioral changes would significantly impact cervical cancer prevention in Ethiopia. This educational intervention improves women's knowledge and encourages men to reduce illness burden in low-resource settings in countries like Ethiopia.

Conclusion

Before the intervention, awareness was associated with gender and age, and after the intervention, more than four folds increased knowledge on cervical cancer and HPV, and the year of study was the key factor associated with overall improvement. This study suggests that educational intervention effectively strengthens our understanding of the risk factors for spreading HPV and cervical cancer disease. The present study illustrates the need for extra educational interventions to better inform students with disparate educational backgrounds. Finally, planned lectures on cervical cancer and HPV might help university students learn more about these topics. Future research into the effectiveness of this form of educational intervention on cervical cancer screening and HPV vaccine uptake will shed more light on its efficacy.

Data Sharing Statement

The datasets used to support the findings of this study are available on reasonable request. All relevant data are within the manuscript.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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