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Willingness to take human papillomavirus vaccine and its associated factors among school adolescent girls: A case of school-based dose one human papillomavirus vaccine campaign in Dire Dawa, Ethiopia

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Abstract

Objective: This study aimed to evaluate the willingness of human papillomavirus vaccine and its associated factors in Dire Dawa in 2022. Ethiopia is undergoing human papillomavirus vaccine implementation in the country with the support of the Global Alliance for Vaccines and Immunization. However, there is a scarcity of data on problems encountered and the receiver's acceptance of the vaccine.

Methods: An institution-based cross-sectional study was conducted among 634 female adolescents from 1 April to 1 May 2022. A simple random sampling technique was used to select study participants. Pretested structured self-administered questionnaires were used to collect data. Data were entered into EPI-data 3.1 and exported to Statistical Package for the Social Sciences version 23.00 software for analysis. Descriptive analysis was conducted to summarize data with text, tables, and figures. A binary logistic regression model was fitted to identify factors associated with the willingness of the human papillomavirus vaccine. Adjusted odds ratios with 95% confidence intervals and *p*-values less than 0.05 were used to determine the association between independent and dependent variables. Hosmer and Lemeshow test was used to determine model fitness.

Results: The magnitude of human papillomavirus vaccine willingness among adolescent girls was 56% with 95% CI (52.1%–59.9%). Discussion on sexual and reproductive health issues (AOR = 7.67, 95% CI: 3.82, 15.42), adolescent girls who were received permission from their family to take human papillomavirus vaccine (AOR = 4.49, 95% CI: 2.40, 8.43), adolescent girls who had good knowledge on human papillomavirus vaccine (AOR = 5.78, 95% CI: 3.18, 10.15), and adolescent girls who had favorable attitude toward human papillomavirus vaccine (AOR = 3.06, 95% CI: 1.73, 5.43) were positively associated with willingness to take human papillomavirus vaccine.

Conclusion: Knowledge about cervical cancer and the human papillomavirus vaccine as well as willingness to take the human papillomavirus vaccine was low. Factors such as maternal education, adolescents' discussion on sexual and reproductive health issues, parent approval of human papillomavirus vaccine, and knowledge and attitude toward human papillomavirus vaccine were significantly associated with willingness to take the human papillomavirus vaccine. Therefore, public health education regarding cervical cancer and human papillomavirus vaccination is still needed and has to be targeted at not only respondents but also their families.

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Introduction

Cervical cancer is the fourth most common cancer affecting women worldwide. The main reason for the high incidence in developing countries, however, is the lack of screening and treatment for pre-invasive cervical abnormalities, which can develop into invasive cancer if left untreated. Genital human papillomavirus (HPV) infection is the main etiological factor of pre-invasive and invasive cervical cancer. In low- and middle-income countries, screening, diagnosis, and treatment have been challenging to implement for various reasons such as low penetration of services in rural communities that need it most and overreliance on highly skilled health staff. As a direct consequence, cervical cancer mortality rates remain high.[1,2]

An estimated 604,000 new cases in 2020 and an estimated 342,000 deaths from cervical cancer in 2020, and approximately 90% of these cases and deaths take place in LMICs.[3,4] About 570,000 women worldwide are affected with cervical cancer, which results in an estimated 311,000 fatalities per year. More than 85% of these deaths take place in less developed nations.[5,6] Many of the disease's victims are young, illiterate women who reside in some of the poorest countries worldwide, where access to pre-screening and treatment is limited; moreover, patients seek medical attention after complications have developed at an advanced stage, and the majority of them do not have access to prevention services or program.[5,7] Annually, there are 4884 deaths and 6294 new cases in Ethiopia. Incidence and mortality rates according to age were 21.5 and 16 per 100,000 females in 2020, respectively.[8] Although cervical cancer prevention is still the top priority for HPV vaccination, there are still impediments to its use globally.

The acceptability of the HPV vaccine among adolescents was found to be hampered by a number of factors (reasons). Studies showed that barriers at various levels, including the community (social group values and norms, media coverage of the HPV vaccine), the organization (allocated resources, information provision, consent process, immunization setting, and environment), the policy (HPV vaccine program), and the organization (information provision). In addition, poor knowledge of cervical cancer, HPV infection, and the HPV vaccine, a negative attitude toward the vaccine, a poor perception of the susceptibility and severity of cervical cancer, and low socioeconomic status have a significant impact on vaccine uptake.[9,10]

Adolescents' resistance to the HPV vaccine has also been linked to parental circumstances. In addition, parents could worry that vaccinations might encourage sexuality and lead to an increase in risky sexual behavior.[11] Aside from believing that vaccination is unnecessary because of their children's low risk of illness and their own moral and religious beliefs, some parents are also concerned about the effectiveness and safety of the vaccines.[12] Furthermore, many parents who reject HPV vaccination for their kids do so out of worry for morality and efficacy.

However, HPV infection can be avoided to reduce the risk of cervical cancer.[13] The HPV vaccination, which protects against the most prevalent strains of high-risk and low-risk HPV infection, can help reach this goal since it is a highly effective and cost-efficient preventative method.[14] To reach the 2030 Sustainable Development Goal eradication target of 90%, over half of the WHO member, countries have implemented HPV vaccination programs.[15] After up to 8 years of follow-up following the vaccine, studies showed a reduction in HPV 16 and 18 infections among females aged 13–19 years of up to 83%.[16] The global strategy to hasten cervical cancer's elimination as a public health issue was approved by the World Health Assembly. A nation meeting the requirement of fewer than four instances of cervical cancer per 100,000 women per year is considered to have eliminated cervical cancer. To attain this goal by the end of the 21st century, the WHO has established the following goals: 90% of girls fully immunized against HPV by the age of 15; 70% of women screened with a high-performance test by 35; again by 45; and 90% of women with invasive cancer handled by 2030.[17]

A national HPV vaccination campaign was started in Ethiopia in December 2018 using a school-based strategy to target all eligible girls in both private and public institutions. The vaccine is administered to out-of-school females in any health facility across all 11 regions and both city administrations of the nation.[18] The best intervention for cervical cancer prevention can be HPV vaccination of girls aged 9–13 years. However, acceptance of HPV vaccination is low in many countries. It is important to identify the willingness to take the HPV vaccine and the associated factors, to develop a strategy to improve the vaccine uptake not only in Ethiopia and other African countries. Because of this, the current study is very relevant to the readers of the journal. This topic is also very important to the Ministry of Health of Ethiopia, as the funding of the study can improve the preventive strategy of cervical cancer through the HPV vaccination in the country. As a result, this study evaluated the desire of adolescent school girls in the Dire Dawa City Administration, Ethiopia, to receive an HPV vaccination and its associated factors.

Methods

Study period and design

Dire Dawa is one of the two chartered cities in Ethiopia (the other being the capital, Addis Ababa). Dire Dawa lies in the eastern part of Ethiopia, which is 515 km away from Addis Ababa. It has nine town kebeles and 38 rural kebeles and it has no Woreda and Zonal structure. It has a population of 466,000, of which 48.9% are males and 51.9% are females. Regarding residence, 58% reside in urban and 42% are from rural. The City Administration has two governmental hospitals, 4 private hospitals, 15 health centers, and 17 privet clinics. Dire Dawa town also has 15 public and 9 private primary schools and an estimated 20,036 students are following their education currently. Among this, 9750 are females and 10,286 are males. An institutional-based cross-sectional study was conducted from 1 April to 1 May 2022.

Population

The source population was all adolescent girls who attended primary schools in Dire Dawa City, while the study population was all selected adolescent girls in Dire Dawa City. All female adolescent girls aged 10–19 years in the selected primary schools in Dire Dawa City administration were included in the study, and adolescents who resided in the city for less than 6 months and were absent from school during the data collection period, those girls who did not agree to participate in the study, and those girls whose families, guardians, or relatives were deprived of their participation through the consent form were excluded from the study.

Sample size determination and sampling procedure

Sample size was calculated based on a single proportion formula, considering the following assumptions: proportion of acceptance of 50% since there is no study in Ethiopia similar to this study population, 95% CI, degree of precision 5%, design effect 1.5, and non-response rate 10%. Therefore, the calculated sample size was 634.

There were 15 public primary schools and 9 private schools with grades 7 and 8 in Dire Dawa City during this data collection period. Among these schools, seven schools from public and four private primary schools were selected using the lottery method. Then sections from each primary school were selected by lottery method based on the number of sections. Next, the calculated sample size was assigned to those selected sections from each primary school using a probability proportional to size method, with the number of adolescent female students used as a measure of size. Finally, simple random sampling was used to select the required number of adolescent female students in each section of the selected primary schools. If selected participants were not present at the time of data collection, at least three revisits were made to interview the girls.

Dependent variable

Willingness to take HPV vaccine one.

Independent variables

- *Sociodemographic variables*: age, religion, grade level, marital status, parents' educational status, parents' occupation, and adolescent live with.
- *Reproductive health-related factors*: family history of cervical cancer, fear of HPV future infection, parent–adolescent discussion on sexual and reproductive health (SRH), and parental approval for HPV vaccine uptake.
- Information received regarding the HPV vaccine
- Knowledge of HPV infection and cervical cancer
- Knowledge of HPV vaccine
- Attitude toward HPV vaccine
- Type of school

Measurement and definition

Knowledge of HPV vaccine: adolescents' level of knowledge was measured based on correct responses using 11 HPV vaccine knowledge questions.

Each correct and incorrect response scores one and zero points, respectively. Using the mean knowledge score as a cutoff, women's knowledge was divided into two: *good knowledge* (scored above or equal to the mean score) and poor *knowledge* (scored less than the mean score of knowledge questions).[19]

Attitude on HPV vaccine: adolescents' attitude was measured based on nine attitude-related items. Those adolescents who answered a mean score and above from attitude-related questions were considered as favorable attitudes, whereas those participants who scored below a mean score from attitude-related items.[20]

Willingness to take the HPV vaccine: Adolescents' willingness to take the HPV vaccine was measured based on eight willingness-related items. Those participants who answered a mean score and above from willingness-related questions were considered as high willingness to take the HPV vaccine, whereas those participants who scored below a mean score from willingness-related items were considered as low willingness to take the HPV vaccine.[19]

Data collection tools and procedures

The data were collected using pretested and structured self-administered questionnaires after reviewing previous literature.[19–21] The questionnaire was first developed in English and translated to local languages (Amharic, AF Somali, and Affan Oromo), then back to English to keep its consistency.

The training was given to data collectors and supervisors for 2 days on data collection procedures, content of the questionnaire, interview techniques, and confidentiality of the information obtained from the respondents. Before the first day of data collection, families or guardians were sent informed consent forms to sign then, self-administered interviews outside of the classroom at school to guarantee that they were answered freely and honestly. Four masters of public health (MPH) specialists supervised 10 health extension workers, who collected data. The data were collected on sociodemographic variables (age, school grade, religion, maternal education status, maternal occupation, and family marital status) and knowledge-related characteristics (information about cervical cancer, information about HPV, cervical cancer is caused by HPV, information about the HPV vaccine, and attitude toward HPV vaccine).

Data quality control

Data quality was ensured during collection, entry, and analysis. Before conducting the main study, training was given to supervisors and data collectors. A pretest was carried out on 63 (10%) of the sample size outside of the current data collection area and the necessary modifications were made. The principal investigator and supervisors were conducting day-to-day on-site supervision during the whole period of data collection. At the end of each day, the questionnaires were reviewed and checked for completeness and accuracy by the supervisor and investigator and corrective discussion was undertaken by all the research team members. Two data clerks were recruited for the data entry process.

Data processing and analysis

Data were cleaned, coded, and entered using Epi-Data version 4.2 and then exported to SPSS 20 for analysis. Descriptive analysis was conducted to summarize the data and the final result of the study was interpreted in the form of text, figures, and tables. Binary logistic regression analysis was executed by computing an odds ratio with a 95% confidence interval to see the crude association between each independent and dependent variable. Model fitness was checked using Hosmer and Lemeshow's goodness of fit.[22] So, Hosmer–Lemeshow's goodness of fit test showed that the model was fitted to the data (p-value = 0.328).

Finally, all independent variables associated with the dependent variable with $p \leqslant 0.25$ were entered into multivariable logistic regression for further analysis, and then significant association was identified based on $p < 0.05$ and adjusted odds ratio (AOR) with 95% CI.

Results

Sociodemographic characteristics

Among the total of 634 adolescents, 623 participated with a response rate of 98.3%. The mean age of the participants was 15.28 (SD ± 0.98). In all, 530 adolescents (85.4%) were from urban residents. Regarding maternal education, 286 (45.9%) had education status at college and above. The majority of adolescents, 478 (78.5%), were living with both their mother and father (Table 1).

Reproductive health-related factors

Regarding discussion with parents on SRH, 290 (46.5%) of adolescents were discussing with their parents on SRH. In all, 14 (2.2%) of adolescents reported that their family had a history of cervical cancer. In all, 230 (36.9%) adolescents feared HPV and 373 (59.9%) were taking the HPV vaccine. In all, 294 (47.2%) of adolescents received parental permission to take the HPV vaccine (Table 2).

Knowledge of HPV infection and cervical cancer

About 354 (56.8%) of adolescent girls heard about HPV infection. Nearly half (354; 51.7%) of adolescent girls reported that HPV types 16 and 18 are the main causes of cervical cancer. In total, 257 (41.3%) adolescent girls said that HPV mainly causes cervical cancer. The overall knowledge regarding HPV infection and cervical cancer was 276 (44.3%) (Table 3).

Knowledge of HPV vaccine

More than half (381; 61.2%) of the adolescent girls heard about the HPV vaccine and 361 (57.9%) of adolescent girls reported that the HPV vaccine can prevent HPV. Health professionals (33.8%) were the main source of information regarding the HPV vaccine, followed by schools (20.7%) and social media (15.4%). The overall knowledge regarding the HPV vaccine was 298 (47.8%) adolescents who had good knowledge about the HPV vaccine (Table 4).

Attitude toward cervical cancer and HPV vaccine

In all, 257 (41.3%) adolescents strongly agree that one sexual partner can reduce HPV infection and 249 (40.0%) agree that adolescent education on SRH is important in the prevention of HPV infection. In all, 219 (35.2%) adolescents agree that HPV infection can cause death. The overall favorable attitude toward cervical cancer and HPV vaccine was 251 (40.3%).

Utilization of and willingness to take the HPV vaccine

More than half (343; 55.1%) of the adolescent girls utilized the HPV vaccine during the campaign and the main reasons for not taking the HPV vaccine were fear of needles and the HPV vaccine causing infertility (Figure 1). The overall willingness to take the HPV vaccine among adolescents was 349 (56%) with 95% CI (52.1%–59.9%). In total, 409 (65.7%) adolescents recommended their friends to take the HPV

Table 1. Sociodemographic characteristics of adolescent girls and their families among school adolescent girls in Dire Dawa town, Eastern Ethiopia, 2022 ($n = 623$).

Variables	Frequency	Percent
Adolescent age		
14–16	531	85.2
17–18	92	14.8
Adolescent grade level		
Grade 7	210	33.7
Grade 8	413	66.3
Residence		
Urban	532	85.4
Rural	91	14.6
Maternal education		
No formal education	77	12.4
Primary school	87	14.0
Secondary school	129	20.7
Collage and above	286	45.9
Father education		
No formal education	66	10.6
Primary school	83	13.3
Secondary school	89	14.3
Collage and above	304	48.8
Adolescent live with		
Live with both mother and father	489	78.5
Live with one of the parents or neither	134	21.5

Table 2. Reproductive health-related characteristics of adolescent girls among school adolescent girls in Dire Dawa town, Eastern Ethiopia, 2022 ($n = 623$).

Variables	Frequency	Percent
Discussions with parents on SRH		
Yes	290	46.5
No	333	53.5
Family history of cervical cancer		
Yes	14	2.2
No	609	97.8
Family history of sexually transmitted infection		
Yes	24	3.9
No	599	96.1
Fear of HPV		
Yes	230	36.9
No	393	63.1
Take HPV vaccine		
Yes	343	55.1
No	280	44.9
Family permits to take the HPV vaccine		
Yes	294	47.2
No	329	52.8
Tradition/taboo on HPV vaccine		
Yes	231	37.1
No	692	62.9
Type of tradition/taboo on HPV vaccine		
Infertility	156	67.5
Health problem	43	18.6
Death	23	9.9
Other	9	3.9

vaccine and 392 (62.9%) adolescents volunteered to take the HPV vaccine in the future. Regarding family volunteerism on the HPV vaccine, 344 (55.2%) adolescents reported that their family volunteered to get their child HPV vaccine.

Factors associated with willingness to take the HPV vaccine

Variables such as mother education, adolescents' discussion on SRH, school type, and knowledge and attitude toward the HPV vaccine were significantly associated with willingness to take the HPV vaccine among adolescent girls. Those adolescent girls with their mother having college and above were four times (AOR = 4.54, 95% CI: 1.62, 12.67) more likely in willingness to take the HPV vaccine as compared to their counterparts. Those adolescent girls discussing with their family on SRH were seven times (AOR = 7.67, 95% CI: 3.82, 15.42) more likely in willingness to take the HPV vaccine as compared to those adolescent girls who did not discuss it with their family SRH. Adolescent girls who received permission from their family were four times (AOR = 4.49, 95% CI: 2.40, 8.43) more likely to willingness to take the HPV vaccine as compared to their counterparts. Adolescent girls who had good knowledge about the HPV vaccine were five times (AOR = 5.78, 95% CI: 3.18, 10.15) more likely in willingness to take the HPV vaccine as compared to adolescent girls with poor knowledge. Those adolescent girls who had a favorable attitude were three times (AOR = 3.06, 95% CI: 1.73, 5.43) more likely in willing to take the HPV vaccine as compared to their counterparts (Table 5).

Discussion

This study aimed to determine the magnitude of the willingness of HPV vaccine one and its associated factors among adolescent girls in Dire Dawa City. The magnitude of HPV vaccine willingness to take in this study was 56% with 95% CI (52.1%–59.9%). This finding was lower than the WHO recommendation or target for resource-limited countries in 2030, which is 90%. This might be because supply challenges, lack of access to healthcare education among female students, and inadequate parent–adolescent communication on SRH including the HPV vaccine.[23] Since in many nations with limited resources, women's access to healthcare and education is a barrier that makes it more challenging to improve the health of adolescents, notably through acceptance of the HPV vaccine.

This finding was consistent with studies conducted in the United States (52%)[24] and China (54%).[25] But this finding was higher than studies conducted in Hong Kong, China

Table 3. Knowledge on HPV infection and cervical cancer among school adolescent girls in Dire Dawa town, Eastern Ethiopia, 2022 ($n = 623$).

Variables	Frequency (%)
Hear about HPV infection	
Yes	354 (56.8%)
No	269 (43.2%)
HPV types 16 and 18 are the main causes of cervical cancer	
Yes	322 (51.7%)
No	88 (14.1%)
I am not sure	213 (34.2%)
Multiple sex increases HPV infection	
Yes	266 (42.7%)
No	78 (12.5%)
I am not sure	279 (44.8%)
Early sexual initiation increases HPV infection	
Yes	313 (50.2)
No	59 (9.5%)
I am not sure	251 (40.3%)
Smoking can aggravate HPV infection	
Yes	276 (44.3%)
No	49 (7.9%)
I am not sure	298 (47.8%)
Sexual intercourse is the main mode of transmission for HPV infection	
Yes	266 (42.7%)
No	39 (6.3%)
I am not sure	318 (51.0%)
Cervical cancer is mainly caused by the HPV virus	
Yes	257 (41.3%)
No	39 (6.3%)
I am not sure	327 (52.5%)
HPV can be transmitted without any symptom	
Yes	275 (44.1%)
No	55 (8.8%)
I am not sure	293 (47.0%)
HPV vaccine can prevent HPV virus	
Yes	361 (57.9%)
No	108 (17.3%)
I am not sure	154 (24.7%)

Table 4. Knowledge on HPV vaccine among school adolescent girls in Dire Dawa town, Eastern Ethiopia, 2022 ($n = 623$).

Variables	Frequency (%)
Hear about the HPV vaccine	
Yes	381 (61.2%)
No	242 (38.8%)
HPV vaccine can prevent human papillomavirus	
Yes	361 (57.9%)
No	108 (17.3%)
I am not sure	154 (24.7%)
HPV vaccine is started 9–14 years	
Yes	313 (50.2%)
No	50 (8.0%)
I am not sure	260 (41.7%)
HPV vaccination is recommended two times	
Yes	254(40.8%
No	40(6.4%)
I am not sure	329 (52.8%)
HPV vaccination is recommended before sexual initiation	
Yes	255(40.9%)
No	30 (4.9%)
I am not sure	338 (54.3%)
HPV vaccine is given to females only	
Yes	305 (49.0%)
No	20 (3.2%)
I am not sure	298 (47.8%)
HPV vaccine is an effective vaccine	
Yes	296 (47.5%)
No	10 (1.6%)
I am not sure	317 (50.9%)

(36.5%),[26] Netherlands (39%),[27] Turkey (11.2%),[28] Ambo,[20] and Arbaminch.[29] However, the result of this study was lower than studies from China (66.9%),[30] India (74.4%),[31] and Debre Tabor.[19]

This might be due to the difference in the definition of the acceptance of HPV vaccination, study subjects involved, socioeconomic status, health information access, and tools used to measure the acceptance of HPV vaccination. The acceptance of the HPV vaccination in this study was only half, which might be due to poor health information access, less encouragement of girls to participate in school seminars and health-related school clubs, and sociocultural influence on the female gender. The other differences might also be due to differences in the study period, study design, maternal sociodemographic characteristics such as access to information, educational status, cross-cultural differences in immunization, and health service utilization characteristics.

This study revealed that maternal education was one of the predictors of willingness to take the HPV vaccine, which was similar to previous studies, conducted in Arbaminch,[29] Debretabor,[19] Germany,[32] and Denmark.[33] Since educated mothers are an information source by openly discussing their daughters' health issues, including the HPV vaccination, the severity of cervical cancer, and the importance of immunization. However, because minorities are the main demographic for whom the HPV vaccine is intended, children under the age of 18 are unable to choose for themselves and are instead predominantly influenced by their parents. Especially the culturally sensitive societies like Ethiopia, mothers are the consultants and caretakers of their daughters, such that if women are educated, it is believed that families are saved from any literacy-associated catastrophe so that parents' level of education may influence whether they decide to allow their daughters to receive vaccinations, which may affect the acceptance rate of their daughters.

Parent–adolescent discussion on SRH issues leads to increased awareness of reproductive health matters, reduces

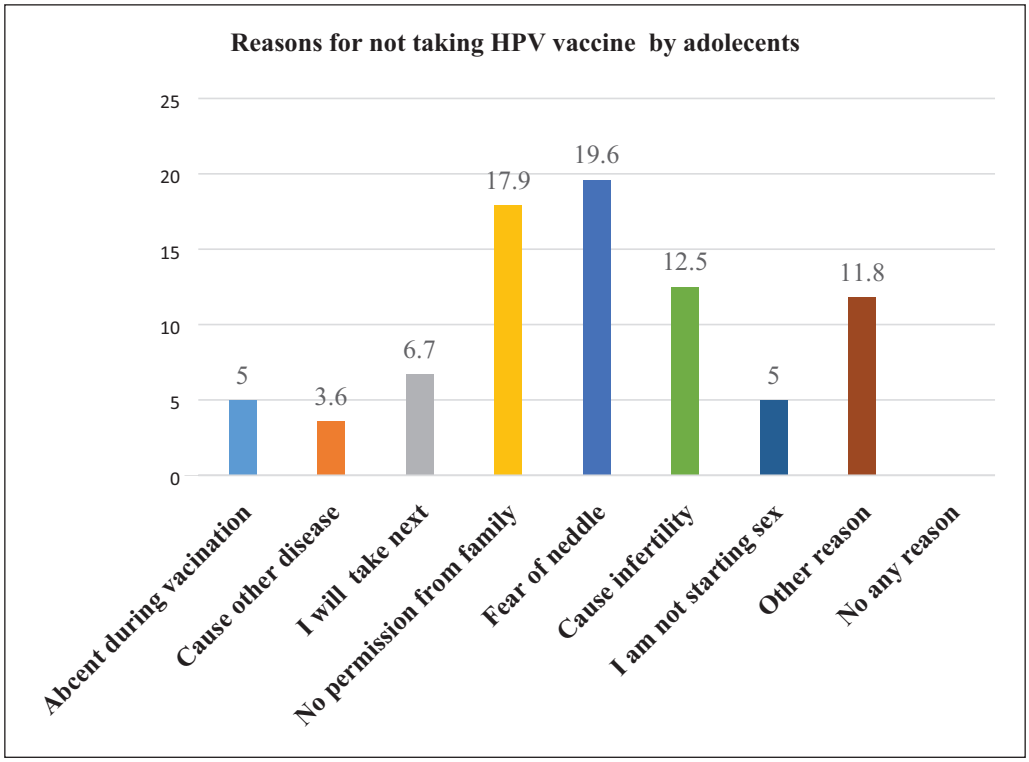

Figure 1. Reasons for not taking HPV vaccine I among school adolescent girls in Dire Dawa City Administration, Eastern Ethiopia, 2022 ($n = 280$).

risky behaviors among adolescents, and contributes to negative SRH outcomes. This study showed that adolescent girls discussing with their family on SRH had a positive effect on the acceptance of the HPV vaccine. The study was supported by a study conducted in Uganda.[34] The reason for this might be the health threats for adolescents today are predominantly behavioral rather than biomedical and more of today's adolescents are involved in health behavior with the potential for serious consequences. In most cultures, parents and family members are an influential source of knowledge, beliefs, attitudes, and values for children and young people. Open parent–adolescent discussion on SRH issues often leads to increased awareness of reproductive health matters, reduces risky behaviors among adolescents, and is the basis for reducing bad reproductive health outcomes.[35] Therefore, adolescent–parent open discussion on SRH will help adolescents' HPV vaccine acceptability rate.

Allowing minor adolescents with a decisional capacity to consent to HPV vaccination advances important healthcare- and public health-related ethical principles. The finding of this study discovered that parental approval was one of the predictors for the willingness of HPV uptake, which is similar to studies, conducted in Nigeria[36] and Uganda.[34] This might be due to parents who perceived risks of HPV infection, perceived vaccine benefits, and vaccine safety were associated with the acceptability of HPV vaccination for themselves and their children, and perceptions that their children were at greater risk of getting cancer indicated more desire to permit their children to get the HPV vaccine. Parents wanting to protect their children from cervical cancer and other HPV-related diseases because of the perceived benefits of HPV vaccination had a strong relationship with the intention of vaccinating themselves and their children. On the other hand, parents who were not sure about HPV vaccine efficacy and were afraid of any side effects, which might be harmful to their children, were less likely to accept the vaccine.[37] Therefore, parents who approve or give permission for their children to take the HPV vaccine can increase the acceptability of the vaccine by adolescents.

The success of the newly recommended HPV vaccination will be determined by adolescents' knowledge and attitude toward the vaccine. According to the findings of this survey, knowledge and attitude toward the HPV vaccine was significantly associated with willingness to HPV uptake. Adolescent girls who had good knowledge of the HPV vaccine were four times more likely to be willing to take the HPV vaccine. This was mainly due to adolescents with good knowledge about HPV and its vaccine knowing very well about the bad consequences of HPV and the greatest benefit of the vaccine. This finding was consistent with studies done in Malaysia,[38] India,[31] Turkey,[28] Ambo,[20] and Arbaminch.[29] The reason might be that adolescent girls understand the benefits of vaccinations. Students who provide evidence of the HPV vaccine's benefits may be accepted and given the vaccine. On

Table 5. Multivariable analysis for willingness of HPV vaccine among school adolescent girls in Dire Dawa town, Eastern Ethiopia, 2022 ($n = 623$).

Variable	Willingness of HPV.V		COR, 95% CI	AOR, 95% CI	*p*-Value
	Willing	Not willing			
Residence					
Urban	313 (50.2%)	219 (35.2%)	2.18 (1.39, 3.44)	1.13 (0.36, 3.51)	0.83
Rural	36 (5.8%)	55 (8.8)	1	1	
Mother education					
Collage and above	190 (32.8%)	96 (16.6%)	3.88 (2.28, 6.61)	4.54 (1.62, 12.67)*	0.04*
Secondary school (9–12)	70 (12.1%)	59(10.2%)	2.33 (1.29,4.20)	4.06 (1.55, 10.59)*	0.04*
Primary school (1–8)	41 (7.1%)	46 (7.9%)	1.75 (0.93, 3.29)	1.43 (0.11, 1.84)	0.21
No formal education	26 (4.5%)	51 (8.8%)	1	1	
Father education					
Collage and above	209 (38.6%)	95 (17.5%)	4.71 (2.66, 8.35)	0.75 (0.26, 2.17)	0.60
Secondary school (9–12)	45 (8.3%)	44 (8.5%)	2.19 (1.13, 4.26)	0.48 (0.15, 1.48)	0.12
Primary school (1–8)	29 (5.4%)	54 (10.0%)	1.15 (0.58, 2.29)	0.47 (0.16, 1.44)	0.11
No formal education	21 (3.9%)	45 (8.3%)	1	1	
Adolescent lives with					
Live with both parents	289 (46.4%)	200 (32.1%)	1.78 (1.21,2.62)	1.74 (0.96, 3.17)	0.068
Live with one of them or neither	60 (9.6%)	74 (11.9%)	1	1	
Type of school					
Private school	69 (11.1%)	43 (6.9%)	1.32 (0.87, 2.01)	1.21 (0.69, 2.31)	0.43
Public school	280 (44.9%)	231 (37.1%)	1	1	
Discussion with their family on SRH					
Yes	237 (38.0%)	53 (8.5%)	7.67 (3.82,15.42)	6.27 (3.15, 12.48)*	<0.001**
No	112 (8.0%)	22 (35.5%)	1	1	
Family history of cervical cancer					
Yes	11 (1.8%)	4 (0.6%)	2.19 (0.69, 6.97)	0.81 (0.13, 5.12)	0.82
No	338 (54.3%)	270 (43.3%)	1	1	
Received permission from the family to take the HPV vaccine					
Yes	246 (39.5%)	49 (7.9%)	10.97 (7.46, 16.12)	4.49 (2.40, 8.43)	0.005
No	103 (16.5%)	225 (36.1%)	1	1	
Knowledge of cervical cancer					
Good	209 (33.5%)	67 (10.8%)	4.61 (3.25, 6.54)	0.92 (0.46, 1.83)	0.82
Poor	140 (22.5%)	207 (33.2%)	1	1	
Knowledge of HPV.V					
Good	259 (41.6%)	42 (6.7%)	15.89 (10.58, 23.8%)	5.78 (3.18, 10.15)	<0.001**
Poor	90 (14.4%)	232 (37.2%)			
Attitude toward HPV.V					
Favorable	187 (30.0%)	64 (10.3%)	3.99 (2.67, 5.37)	3.06 (1.73, 5.43)	<0.001**
Unfavorable	162 (26.0%)	210 (33.7%)	1	1	

AOR: adjusted odds ratio; COR: crude odds ratio.
*p-value < 0.05, **p-value < 0.01, ***p-value < 0.001.

the other hand, adolescent girls who have awareness about "who, where, and when" one should be vaccinated and self-estimated sufficiency of information about vaccination or satisfaction with information on vaccination as well as clear evidence on side effects of the vaccine can increase the acceptance and uptake of HPV vaccine.[39]

The likelihood of willingness to take HPV vaccination was about three times higher for adolescent girls with a favorable attitude than for those with unfavorable. This finding was consistent with studies done in Debretabor,[19] Arbaminch,[29] Germany,[32] and Turkey.[28] A positive attitude toward the HPV vaccine enables adolescent girls to motivate them to accept and use the vaccine.

Bias may have affected the result of our study. Social desirability bias in which adolescents answered questions in a manner that would be viewed favorably by others may have resulted in over-reporting of good attitudes and perceptions as well as intended uptake of vaccines. Moreover,

causal inferences cannot be drawn from this study due to the nature of the study design.

Conclusion

Knowledge about cervical cancer and the HPV vaccine as well as willingness to take HPV vaccine was low in the study area. Factors such as mother education, adolescents' discussion on SRH, fear of HPV parent approval of HPV vaccine, and knowledge and attitude toward HPV vaccine were significantly associated with willingness to take HPV vaccine among adolescent girls. Program managers need to facilitate community-based education regarding parent–adolescent discussion on SRH is recommended. Health professionals and health extension workers should also identify the acceptance barriers that exist in health education regarding the HPV vaccine, demystify taboos in the population, and contribute toward complete vaccine coverage. Generally, health information dissemination campaigns should include parents as their attitude and knowledge toward HPV vaccination may hinder their decision to accept vaccination for their daughters.

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Author contributions

Nigus Kassie: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Software; Writing—original draft; Writing—review and editing. Alekaw Sema: Conceptualization; Investigation; Methodology; Writing—review and editing. Bezabih Amsalu: Conceptualization; Investigation; Software; Writing—review and editing. Yitagesu Sintayehu: Conceptualization; Formal analysis; Funding acquisition; Methodology; Software; Writing—review and editing. Alemwork Abie: Conceptualization; Formal analysis; Methodology; Software; Writing—review and editing. Betlhem Mengist: Conceptualization; Formal analysis; Methodology; Writing—original draft; Writing—review and editing. Shegaye Yibabie: Conceptualization; Formal analysis; Investigation; Methodology; Writing—review and editing. Enyew Talie: Conceptualization; Project administration; Supervision; Writing—review and editing. All contributed significantly and gave the final approval for the paper to be published; agreed to be accountable for all impacts of the work.

Availability of data and materials

The participant's de-identified data used for the current study will be available upon submitting a reasonable request from the corresponding author (niguskassie19@gmail.com) in either SPSS or Stata format and as per the permission obtained from senior project principals.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics approval and consent to participate

Ethical clearance for this study was obtained from the Institutional Review Board (IRB) of Dire Dawa University with a protocol number of (DDU-ERC-2022-023) and the supporting letter was obtained from the Dire Dawa town education bureau for each primary school. After that, the school director/management granted permission to each class representative. After the informed consent forms were sent to sign, written informed consent was obtained from all families or guardians of the primary school students. Adolescents' whose families/guardians refused to sign were provided full autonomy not to participate in the study. Then assent was also obtained from adolescent girls. Finally, to ensure confidentiality, the names of respondents were replaced by code numbers.

Trial registration

Not applicable.

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Supplemental material

Supplemental material for this article is available online.

References

1. Arbyn M, Weiderpass E, Bruni L, et al. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. *Lancet Glob Health* 2020; 8: e191–e203.
2. Worldhealthorganization(WHO).Globalstrategytoacceleratethe elimination of cervical cancer as a public health problem, https://www.who.int/publications-detail-redirect/9789240014107 (2021, accessed 31 December).
3. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 2021; 71: 209–249.
4. Stelzle D, Tanaka LF, Lee KK, et al. Estimates of the global burden of cervical cancer associated with HIV. *Lancet Glob Health* 2020; 9(2): e161–e169.
5. Draft W. Global strategy towards eliminating cervical cancer as a public health problem. Geneva, Switzerland: WHO, 2019.

6. Arbyn M, Weiderpass E, Bruni L, et al. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. *Lancet Glob Health* 2020; 8(2): e191–e203.
7. World Health Organization. Global strategy to accelerate the elimination of cervical cancer as a public health problem, https://www.google.com.et/books/edition/Global_strategy_to_accelerate_the_elimin/ (2020, accessed 31 December).
8. Bruni L, Albero G, Serrano B, et al. ICO/IARC information centre on HPV and cancer (HPV information centre). Human papillomavirus and related diseases in the world Summary Report, https://hpvcentre.net/statistics/reports/XWX.pdf (2013, accessed 14 March).
9. Finocchario-Kessler S, Wexler C, Maloba M, et al. Cervical cancer prevention and treatment research in Africa: a systematic review from a public health perspective. *BMC Womens Health* 2016; 16(1): 1–25.
10. Black E and Richmond R. Prevention of cervical cancer in Sub-Saharan Africa: the advantages and challenges of HPV vaccination. *Vaccines* 2018; 6(3): 61.
11. Nabirye J, Okwi LA, Nuwematsiko R, et al. Health system factors influencing uptake of Human Papilloma Virus (HPV) vaccine among adolescent girls 9–15 years in Mbale District, Uganda. *BMC Public Health* 2020; 20: 171.
12. Abou El-Ola MJ, Rajab MA, Abdallah DI, et al. Low rate of human papillomavirus vaccination among schoolgirls in Lebanon: barriers to vaccination with a focus on mothers' knowledge about available vaccines. *Therap Clin Risk Manag* 2018; 14: 617.
13. Songthap A, Pitisuttithum P, Kaewkungwal J, et al. Knowledge, attitudes, and acceptability of a human papilloma virus vaccine among students, parents and teachers in Thailand. *Southeast Asian J Trop Med Public Health* 2012; 43(2): 340–353.
14. Sopian MM, Shaaban J, Yusoff SS, et al. Knowledge, decision-making and acceptance of human papilloma virus vaccination among parents of primary school students in Kota Bharu, Kelantan, Malaysia. *Asian Pac J Cancer Prev* 2018; 19(6): 1509.
15. Cheng L, Wang Y and Du J. Human papillomavirus vaccines: an updated review. *Vaccines* 2020; 8(3): 391.
16. Gable J, Eder J, Noonan K, et al. *Increasing HPV vaccination rates among adolescents: challenges and opportunities*. Philadelphia, PA: The Children's Hospital of Philadelphia, https://m.hexmagaeg.com/www.policylab/sites/default/files/pdf/publications/INCREASING_HPV_VACCINATION_RATES_AMONG_ADOLESCENTS_0.pdf (2015, accessed 31 July).
17. Bruni L, Saura-Lázaro A, Montoliu A, et al. HPV vaccination introduction worldwide and WHO and UNICEF estimates of national HPV immunization coverage 2010–2019. *Prev Med* 2021; 144: 106399.
18. Drolet M, Bénard É, Pérez N, et al. Population-level impact and herd effects following the introduction of human papillomavirus vaccination programs: updated systematic review and meta-analysis. *Lancet* 2019; 394(10197): 497–509.
19. Mihretie GN, Liyeh TM, Ayele AD, et al. Female adolescents' knowledge and acceptability of human papillomavirus vaccine in Debre Tabor Town, Ethiopia: a crosssectional study. *BMJ Open* 2023; 13: e061813.
20. Beyen MW, Bulto GA, Chaka EE, et al. Human papillomavirus vaccination uptake and its associated factors among adolescent school girls in Ambo town, Oromia region, Ethiopia, 2020. *PLoS One* 2022; 17(7): e0271237.
21. Loke AY, Chan ACO and Wong YT. Facilitators and barriers to the acceptance of human papillomavirus (HPV) vaccination among adolescent girls: a comparison between mothers and their adolescent daughters in Hong Kong. *BMC Res Notes* 2017; 10(1): 390.
22. Hosmer DW, Lemeshow S and Klar J. Goodness-of-fit testing for the logistic regression model when the estimated probabilities are small. *Biom J* 1988; 30(8): 911–924.
23. Federal Democratic Republic of Ethiopia Ministry of Health (FMOH). Improving the performance of the health system: a foundation for universal health coverage, https://www.prb.org/wp-content/uploads/2018/05/National-Adolescent-and-Youth-Health-Strategy-2016-2020.Ethiopia.pdf (2016, accessed 12 December).
24. Blumenthal J, Frey MK, Worley MJ Jr, et al. Adolescent understanding and acceptance of the HPV vaccination in an underserved population in New York City. *J Oncol* 2021; 2012: 904034.
25. You D, Han L, Li L, et al. Human papillomavirus (HPV) vaccine uptake and the willingness to receive the HPV vaccination among female college students in China: a multicenter study. *Vaccines (Basel)* 2020; 8: 31.
26. Xue L, Hu W, Zhang H, et al. Awareness of and willingness to be vaccinated by human papillomavirus vaccine among junior middle school students in Jinan, China. *Hum Vaccin Immunother* 2018; 14(2): 404–411.
27. Rondy M, van Lier A, van de Kassteele J, et al. Determinants for HPV vaccine uptake in the Netherlands: a multilevel study. *Vaccine* 2010; 28(9): 2070–2075.
28. Ozyer S, Uzunlar O, Ozler S, et al. Awareness of Turkish female adolescents and young women about HPV and their attitudes towards HPV vaccination. *Asian Pac J Cancer Prev* 2013; 14(8): 4877–4881.
29. Ukumo EY, Weldehawariat FG, Dessalegn SA, et al. Acceptance of human papillomavirus vaccination and associated factors among girls in Arba Minch Town, Southern Ethiopia, 2020. *Infect Dis Obstet Gynecol* 2022; 2022: 7303801.
30. Loke AY, Chan ACO and Wong YT. Facilitators and barriers to the acceptance of human papillomavirus (HPV) vaccination among adolescent girls: a comparison between mothers and their adolescent daughters in Hong Kong. *BMC Res Notes* 2017; 10(1): 390.
31. Ramavath KK and Olyai R. Knowledge and awareness of HPV infection and vaccination among urban adolescents in India: a cross-sectional study. *J Obstet Gynecol India* 2013; 63(6): 399–404.
32. Schülein S, Taylor KJ, König J, et al. Factors influencing uptake of HPV vaccination among girls in Germany. *BMC Public Health* 2016; 16: 995.
33. Slåttelid Schreiber SM, Juul KE, Dehlendorff C, et al. Socioeconomic predictors of human papillomavirus vaccination among girls in the Danish childhood immunization program. *J Adolesc Health* 2015; 56(4): 402–407.
34. Turiho AK, Muhwezi WW, Okello ES, et al. Human papillomavirus (HPV) vaccination and adolescent girls' knowledge

and sexuality in Western Uganda: a comparative cross-sectional study. *PLoS One* 2015; 10(9): 1–12.
35. Kristina SA, Lienaningrum AS and Wulandari GP. Beliefs and acceptance of human papillomavirus (HPV) vaccine among parents in urban community in Yogyakarta. *Int J Pharm Res* 2020; 12: 662–667.
36. Ndikom CM and Oboh PI. Perception, acceptance and uptake of human papillomavirus vaccine among female adolescents in selected secondary schools in Ibadan, Nigeria, 2017. *Afr J Biomed Res* 2017; 20; 237–244.
37. Young B, Bedford L, Kendrick D, et al. Factors influencing the decision to attend screening for cancer in the UK: a meta-ethnography of qualitative research. *J Public Health* 2018; 40(2): 315–339.
38. Rajiah K, Maharajan MK, Chin NS, et al. Awareness and acceptance of human papillomavirus vaccination among health sciences students in Malaysia. *Virusdisease* 2015; 26(4): 297–303.
39. Costa AS, Gomes JM, Germani ACCG, et al. Knowledge gaps and acquisition about HPV and its vaccine among Brazilian medical students. *PLoS One* 2020; 15(3): e0230058.