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# The effect of peer education on high school students' knowledge levels regarding Human Papillomavirus (HPV) infection and vaccination

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## ABSTRACT

**Purpose:** This study aimed to explore the impact of the peer education model on adolescents' knowledge levels regarding Human Papillomavirus (HPV) infection and HPV vaccination.

**Design and methods:** The study was conducted quasi-experimentally in a pretest-posttest single-group design. The study sample consisted of 913 students enrolled in 9th, 10th, and 11th grades. The data of the study were collected between April and May 2023. Data were collected using the Demographic Information Form and the Human Papillomavirus Knowledge Scale (HPV-KS).

**Results:** It was determined that 8.8 % of the students had previously received information about HPV, of which 50 % had received this information through the media, and only 0.3 % of them had received the HPV vaccine. Before peer education, the mean HPV-KS score among students was  $1.14 \pm 3.54$ , while after peer education, the mean score increased to  $23.78 \pm 8.32$ , and this difference was found to be statistically significant ( $p < 0.005$ ). Thus, it has been observed that the peer education model effectively enhances the knowledge level regarding HPV and the HPV vaccine among high school students.

**Conclusions:** The use of this model will help young people take healthy steps regarding risky sexual health. Moreover, it is recommended that nurses utilize the peer education model to promote healthy lifestyle behaviors and enhance knowledge on various health-related topics among adolescents, who constitute a significant at-risk group.

**Practice implications:** It is recommended that nurses utilize the peer education model to promote healthy lifestyle behaviors and enhance knowledge on various health-related topics among adolescents, who constitute a significant at-risk group.

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## Introduction

Human Papillomavirus (HPV) is a DNA virus from the family Papillomaviridae, with over 200 identified types, and it is the most common viral infection worldwide, affecting the reproductive system. The immune system often clears this infection, but sometimes, certain types of HPV can persist as a result of anomalies occurring in infected cells, leading to a persistent infection. HPV can infect the skin and mucous membranes in different anatomical regions, such as the anogenital area and the oral cavity. Besides causing anal, vulvar, vaginal, penile, and oropharyngeal cancers, it is associated with 90 % of cervical cancers and precancerous cervical lesions (WHO, 2024). The global prevalence of HPV infection is reported to be approximately 12 %, with regional

variations (Bruni et al., 2020). Almost entirely attributable to HPV, cervical cancer is the fourth most common cancer among women worldwide, with 604,127 new cases reported globally, according to the GLOBOCAN 2020 report, and accounts for 5.2 % of the total cancer burden (Sung et al., 2021). Comprehensive cervical cancer control includes primary prevention (education, vaccination against HPV), secondary prevention (screening and treatment of precancerous lesions), tertiary prevention (diagnosis and treatment of invasive cervical cancer), and palliative care.

HPV vaccines, the most effective method of combating HPV, have the potential to significantly reduce the incidence of HPV-associated precancerous lesions and work best when administered before exposure to HPV. In addition, they effectively protect against certain types of HPV that can cause genital warts (Brotherton & Bloem, 2018). In this context, the World Health Organization (WHO) recommends vaccination for girls aged 9 to 14 who have not yet started sexual activity, and ideally for boys as well (WHO, 2024). Over the past 15 years, more than 80 countries have initiated national HPV vaccination programs,

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with the United States, Australia, Canada, and the United Kingdom among the first countries to include the HPV vaccine in their national immunization programs. While most countries target adolescent girls in their programs, some countries also have programs for adolescent boys (Lee et al., 2018). HPV vaccination is not yet included in Turkey's immunization program. It is available for a fee and is optional (Aydoğdu & Özsoy, 2018). Related to this, HPV vaccination rates vary between 55 % and 31 % in different countries (Natipagon-Shah et al., 2021; Nguyen-Huu et al., 2020), whereas in Turkey, this rate is approximately 2 % (Dönmez et al., 2019).

Adolescents often exhibit low levels of knowledge regarding HPV (Çetin et al., 2014; Yalaki et al., 2016; Zhang et al., 2020), potentially leading to the adoption of risky sexual behaviors. Given the pivotal role of early adolescence in fostering behavior change, this developmental stage is deemed the most opportune time for educating individuals about HPV and HPV vaccination. Peers within this age demographic wield significant influence over behavior modification and are thus leveraged as an educational tool. The term 'peer education model' encompasses a range of definitions and serves as an approach, a channel of communication, a method, a philosophy, and a strategy. Peer education is a planned educational model conducted among groups with similar status, aiming for changes in knowledge, behaviors, and attitudes (Stakic et al., 2003). Global and national studies show that peer education is more effective than routine education models (Bulut & Ortaylı, 2004; Yıldırım & Apan, 2001). In this context, peer education aims to utilize peer influence for positive behavior changes. During peer education, it is emphasized that knowledge transfer is easier among young people with similar social roles (Yıldırım & Apan, 2001). Studies conducted on university students have found that peer education is an effective method in reducing risky sexual behaviors (Bulduk, 2009; Kırmızıtoprak & Şimşek, 2011), increasing knowledge about family planning and reproductive health (Aşçı et al., 2016), and reducing substance dependence among high school students (Akkuş et al., 2016). When the literature is reviewed, it is observed that there is a low level of knowledge about HPV and HPV vaccination during the adolescent period (Akkuş et al., 2016; López et al., 2020; Yalaki et al., 2016) and educational interventions are inadequate.

HPV is a significant concern for adolescents due to their engagement in risky behaviors. Studies on this topic typically focus on individuals aged 18 and older, with limited research conducted specifically on the adolescent group. It is also noteworthy that the majority of research in this area tends to focus solely on adolescents' knowledge levels regarding HPV. It is noteworthy that studies examining the effects of peer education interventions on adolescents' knowledge about HPV and the HPV vaccine are limited (Castellanos et al., 2018; Ferrara et al., 2012; Sadoh et al., 2018). Therefore, it is believed that the findings from this research will fill a critical gap in the literature. This study was designed based on the hypothesis that peer education would effectively increase HPV knowledge levels in the adolescent group. Accordingly, the primary aim of this research is to investigate the impact of peer education—a well-recognized approach for raising awareness and promoting positive behavioral changes among adolescents—on their knowledge of HPV and the HPV vaccine.

## Methods

### Study design

This study was conducted in a quasi-experimental pretest-posttest single-group design to determine the effect of the "Peer Education Model" on adolescents' knowledge about HPV.

### Participants

The population of the study consisted of 4084 9th, 10th, and 11th-grade students enrolled in science high schools, Anatolian high schools,

Anatolian religious high schools, and vocational high schools in a city center. 12th graders were not included in the study, considering that they would graduate and would not be able to participate in the follow-up process. G\*Power 3.1.9.4 program was used to determine the sample size. Since there was no reference study in the literature, the sample size was calculated by using a *t*-test from the test family and Means: The difference between two dependent means (matched pairs) from the statistical test. Accordingly, the effect size was 0.11, the type 1 margin of error was 0.05 (95 %), the power was 0.95, and the sample size was found to be at least 896. Considering the loss of data, the sample number was determined to be 938 students. However, since 25 students were excluded from the study due to missing data in the questionnaires, the study was finalized with a total of  $n = 913$  students. By stratifying according to the types of high schools, one high school from Science High School ( $n = 245$ , 26.8 %), Anatolian High School ( $n = 307$ , 33.6 %), and Anatolian Imam Hatip High School ( $n = 84$ , 9.2 %) and two high schools from Vocational and Technical Anatolian High School (VTAHS) ( $n = 277$ , 30.4 %) were included in the study.

### Data collection

The data of the study were collected between April and May 2023. The students were informed about the research, and their parents were asked for their consent forms by sending them a Parent/Guardian Consent Form. Before the training, the "Demographic Information Form" and "HPV-KS" prepared by the researcher were in line with the literature information and were filled out by the students. It took approximately 20 min for the students to fill in the pre-test question form. One month after the implementation of the intervention, the students were asked to fill in the questionnaire form and scale again, and the measurements were repeated.

### Content and implementation of the intervention

#### 1. Selection and training of peer educators

Peer educators were identified with the "Who is this? Test". It is a sociometric group technique, included in the group of observational techniques, that reveals how individuals in a group perceive both themselves and each other. Due to its inclusion in sociometric methods, the "Who is this? Test" is reported to be valid and reliable, and it is recognized as a strong determinant of future social behavior. In the test, 10–30 expressions are created to describe the students in the group in some aspects, taking into account the general situation of the group, its characteristics, its developmental period, and the purpose of the practitioner. Descriptive expressions are not standardized, and each practitioner can create a "Who is this?" list with a suitable number and statements according to their own goals. In this technique, students identify their peers who fit behavioral descriptions such as being the most liked, always wanting to help everyone, having many friends, getting along well with others, being pleasant and kind, being trustworthy, and being respected for their words. After the list is applied to all students, a table is prepared to evaluate the results (Yıldırım, 2002). In this study, the test was prepared by researchers through discussion, tailored to the purpose of the study and the group.

The following methods were followed in the selection of peer educators (Fig. 1):

- First, the "Who is this? Test" was administered to 11th-grade students from the five schools included in the study.
- The students who scored the highest points in the "Who is this?" Test were selected, and face-to-face individual interviews were conducted to explain the purpose and content of the study. Written consent was obtained from the families of the peer educator students who agreed to participate in the study.

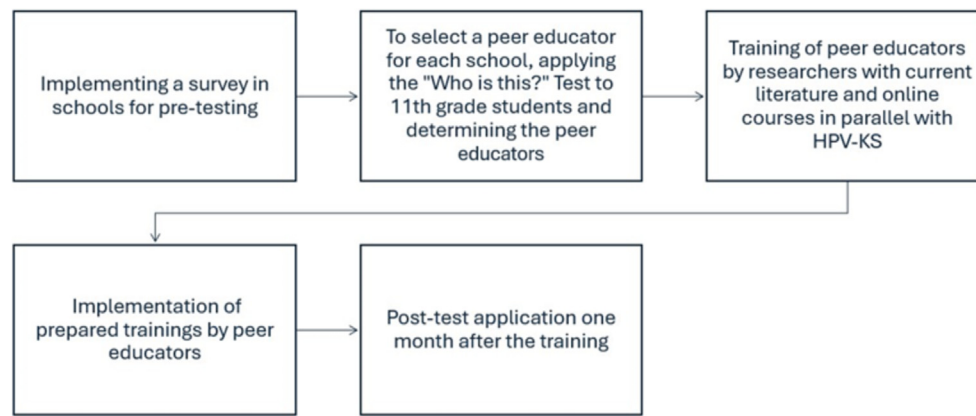


Fig. 1. Flow diagram of the study implementation.

- The training sessions for the students were delivered to the peer educators by the researchers via an online platform in three sessions, each lasting approximately 60 min. At the end of each session, any parts of the subject that were not understood were discussed.
- At the end of the training, the researchers asked the peer educators questions to assess their understanding of the material. Any areas of misunderstanding were addressed by repeating key points to reinforce their knowledge.

The content of the training given to peer educators consisted of the following topics prepared under the guidance of WHO: HPV definition, incidence, problems caused by it, symptoms, transmission routes, risk factors, prevention methods, HPV treatment, and HPV vaccines (WHO, 2024).

## 2. Implementation of the training by peers.

The interventions were implemented in the classrooms or conference halls where the students were studying by projecting the educational material on the smart board. Peer educators provided training to the students under the supervision of the researchers. The training lasted for one lesson hour, and the researchers answered the students' questions after the training.

## Data collection tools

The data were collected using the Demographic Information Form and the Human Papillomavirus Knowledge Scale (HPV-KS).

**Demographic Information Form:** This form is aimed at gathering information about the students' age, gender, grade level, family type, perceived economic status, perceived academic achievement, and family history of cancer.

**Human Papilloma Virus Information Scale (HPV-KS):** The Human Papillomavirus Knowledge Scale (HPV-KS) was developed by Waller and colleagues in 2013 to measure individuals' levels of knowledge about HPV, HPV vaccines, and screening tests. The scale investigates whether individuals have previously heard of HPV, HPV vaccines, and HPV screening tests, as well as their level of knowledge about these topics. The HPV-KS consists of a total of 35 items, including three sub-dimensions of 29 items and an independent sub-dimension of six items (Waller et al., 2013). The Turkish validity and reliability study of the scale was conducted by Demir (2019). As a result of the language and scope validity, the final version of the 33-item scale was determined, and its Cronbach's alpha value was calculated as 0.96. The total score obtained from the HPV-KS ranges from 0 to 33, and a higher score indicates a higher level of knowledge about HPV, HPV screening tests, and HPV vaccines. The validity and reliability study of the scale was conducted with adults (18–65 years old), but in the

recommendations section of the study, it was suggested that the scale could be used in adolescents in the 15–18 age group (Demir, 2019).

## Data analysis

The data were analyzed using the SPSS 26.0 program with appropriate statistical tests. The normality of continuous variables was tested using the Kolmogorov-Smirnov test. It was observed that the data followed a normal distribution ( $p = 0.521$ ). In the comparison of categorical variables in dependent groups, the McNemar test was used. The  $t$ -test was used for comparing binary variables to examine the differences between dependent and independent variables, while the One-way ANOVA test was applied for comparisons involving more than two variables. To determine which group caused the difference in comparisons of more than two variables, the Post-Hoc Bonferroni test was employed (Cleophas et al., 2011). In group comparisons, the pre-test HPV-KS scores were used, considering that the intervention might affect the scores. The Paired Samples test was conducted to analyze whether there was a significant difference between the pre- and post-training mean scores, with the significance level set at  $p < 0.05$ .

## Ethical consideration

This study was prepared following the Declaration of Helsinki. Approval from the ethics committee of a university (E-54674167-050.01.04-159,472), permission from the Provincial Directorate of National Education, and written permission from parents were obtained. Approval was obtained for the use of the scale and its applicability to high school students, the age group of our study.

## Results

In our study, which included 913 students, Cronbach's alpha value of the scale was calculated as 0.93. The mean age of the participants in the 14–18 age range was found to be  $15.7 \pm 0.99$ . Among the participants, 52.5 % were female, 33.6 % attended Anatolian high schools, and 42.6 % were 11th-grade students. The majority of students rated their academic performance (62.2 %) and family income (61.7 %) as middle. While 82.9 % of the students live with their families, 82.5 % come from nuclear families. The proportion of students who do not work is 94.2 %, while 46.9 % have mothers who work and 89.6 % have fathers who work. The majority of students' mothers (53.1 %) and fathers (69 %) have received high school education or higher. Nine percent of students smoke, 26.2 % have a family history of cancer (first-degree relatives), and 1 % have a family history of cervical cancer. It was determined that 78.6 % of the students had completed their childhood vaccinations, and only 0.3 % had received the HPV vaccine ( $n = 3$ ).

When asked about the reasons for not receiving the HPV vaccine, the most common response was “I have not heard about it” (75.4%). The percentage of students considering getting the HPV vaccine is 16.6%, while 54.2% of students are unsure about getting vaccinated. It was found that 8.8% of the students had previously received information about HPV and the HPV vaccine, and 50% of them obtained this information through the media (Table 1).

In evaluating the differences between independent variables and the mean HPV-KS scores, the pre-test mean scores were used, considering that the intervention might affect the scores. According to the test results, students who were female, non-smokers, and had working mothers had higher HPV-KS scores. When knowledge test scores were compared according to the type of high school attended, statistically significant differences in HPV knowledge were found between students attending science high schools and those attending other high schools.

**Table 1**  
Distribution of students according to their descriptive characteristics.

Descriptive Characteristics of Students	Number	%
<b>Age</b>	14	105 11.5
	15	287 31.4
	16	297 32.5
	17*	224 24.5
<b>Mean age (X ±SD)</b>	<b>15.7 ± 0.99</b>	
<b>Gender</b>	Female	479 52.5
	Male	434 47.5
<b>High school types</b>	Science High School	245 26.8
	Anatolian High School	307 33.6
	Religious High School	84 9.2
	VTAHS1	148 16.2
	VTAHS2	129 14.2
<b>Grade</b>	9th	261 28.6
	10th	263 28.8
	11th	389 42.6
	<b>Perceived academic success</b>	Good
Middle		568 62.2
Bad		60 6.6
<b>Perceived family income</b>	Good	322 35.3
	Middle	563 61.7
	Bad	28 3.1
<b>Where she/he lives</b>	With family	757 82.9
	In dormitory	150 16.4
	With relatives	6 0.7
<b>Family type</b>	Nuclear family	753 82.5
	Extended family	108 11.8
	Dispersed Family	52 5.7
	Working	53 5.8
<b>Working status</b>	Not working	860 94.2
	Working	818 89.6
<b>Father's working status</b>	Working	818 89.6
	Not working**	95 10.4
<b>Family history of cancer</b>	Yes	239 26.2
	No	445 48.7
	I do not know	229 25.1
<b>Childhood Vaccines</b>	Fully vaccinated	718 78.6
	I do not know	195 21.4
<b>Status of obtaining information about HPV and its vaccine</b>	Yes	80 8.8
	No	833 91.2
<b>Way to obtain information about HPV and its vaccine (n = 80)</b>	Family	16 20.0
	Media	40 50.0
	Health	9 11.2
	Professionals	
	Friends	15 18.8
<b>Total</b>	<b>913</b>	<b>100</b>

X = Mean, SD = Standard deviation, VTAHS: Vocational and Technical Anatolian High School.

\* 14 students in the 18-year-old group are included in the 17-year-old group.

\*\* 8 students whose fathers passed away are included in the group of students whose fathers are not working.

Further analysis revealed that this difference was driven by students attending science high schools (Bonferroni test). When comparing the education levels of students' mothers and fathers with their HPV-KS scores, a statistically significant difference was found ( $p < 0.05$ ); having a mother and father with a high school education or above was associated with increased HPV knowledge levels. When comparing the presence of a history of cervical cancer in the family, it was found that having a history of cervical cancer created a statistically significant difference; this group had higher HPV-KS scores (Table 2).

When evaluating the relationship between some variables related to HPV and HPV-KS scores, it is observed that individuals who have received the HPV vaccine and those who have previously obtained information about the HPV vaccine tend to have higher scale scores. Comparison of HPV-KS scores based on students' intentions regarding receiving the HPV vaccine revealed a statistically significant difference between those considering vaccination, those not considering it, and those uncertain; further analysis indicated that those considering vaccination were the group that contributed to this difference (Bonferroni test). Examination of the reasons for not getting the HPV vaccine revealed that the cost of the vaccine created a statistically significant difference compared to other groups, and this group demonstrated a higher level of HPV knowledge (Table 3).

Table 4 presents a comparison of students' intentions to get the HPV vaccine before and after peer education. It was found that the number of students willing to get vaccinated increased from 152 before the training to 739 after the training. The comparison of vaccination intentions before and after the education was evaluated using the chi-square test, and a statistically significant difference was observed.

Table 5 illustrates the total scores of students on the HPV-KS and its subscales before and after the training. A statistically significant difference was observed between the knowledge test scores and scale subscale scores of students before and after the training ( $p < 0.001$ ). Following the training, there was an increase in all subscale scores among the students.

## Discussion

Awareness regarding HPV and the HPV vaccine remains low across all regions within adolescence. This can be attributed to several factors, including the reliance on parents as decision-makers, a lack of access to accurate information, and prevailing negative social perceptions (Çetin et al., 2014; Yalaki et al., 2016). Peer education, based on the strength of social interaction and similar roles among individuals, effectively promotes and develops healthy behaviors (Stakic et al., 2003). Therefore, this study aims to investigate the effect of peer education on adolescents' knowledge of HPV infection and HPV.

The mean HPV-KS score of high school students prior to peer education was found to be  $1.14 \pm 3.54$ , indicating that their knowledge levels are quite low. In another study, it was found that adolescent girls and their mothers have limited knowledge and opinions about the HPV vaccine, and participants expressed a desire to learn more about it (Yurtsev, 2011). Studies conducted in China and Nigeria also indicate that high school students have a low level of knowledge (12.6%–23%) about HPV and the HPV vaccine (Fagbule et al., 2020; Zhang et al., 2020). A systematic review including 70 studies conducted in European countries reports that nearly half of adolescents are not knowledgeable about HPV and the HPV vaccine (López et al., 2020). Research findings in the literature indicate that while there is variation in HPV and HPV vaccine knowledge levels among adolescents across countries, it is particularly low in developing countries (Kutz et al., 2023; Perlman et al., 2014). Although knowledge level is crucial in developing positive health behaviors, studies on this subject, including our own research results, indicate that adolescents' knowledge of HPV and the HPV vaccine is at a low level. This finding highlights the importance of providing adequate information on HPV and sexual health at an early age. In line with this, studies have

**Table 2**  
Distribution of Pre-Test HPV-KS Mean Scores Based on Students' Demographic Characteristics.

Variables	N	X	SD	t-test		
				t-value	df	p-value
<b>Gender</b>						
Female	479	1.32	3.81	1.606	912	0.003
Male	434	0.94	3.20			
<b>Mother's working status</b>						
Working	428	1.42	4.00	2.293	912	0.022
Not working	485	0.89	3.05			
<b>Smoking status</b>						
Yes	82	1.08	2.33	2.795	912	0.005
No	831	1.76	2.77			

Variables	N	X	SS	ANOVA test					
				Sources	SD	df	MS	F	p-value
<b>High school type</b>									
Science High School*	245	2.08	4.36	<b>B.G.</b>	386.604	4	96.651	7.946	0.000
Anatolian High School	307	1.05	3.55	<b>W.G.</b>	11,044.312	908	12.163		
Imam Hatip High School	84	1.20	3.83	<b>Total</b>	11,430.916	912			
VTAHS1	148	0.56	2.51						
VTAHS2	129	0.19	1.58						
<b>Mother's educational status</b>									
Literate	39	0.33	2.08	<b>B.G.</b>	116.922	2	58.461	4.702	0.009
Primary education	390	0.82	2.96	<b>W.G.</b>	11,313.994	910	12.433		
High school and above*	484	1.46	4.00	<b>Total</b>	11,430.916	912			
<b>Father's educational status</b>									
Literate	11	0.00	0.00	<b>B.G.</b>	174.176	2	87.088	7.040	0.001
Primary education	272	0.51	2.33	<b>W.G.</b>	11,256.740	910	12.370		
High school and above*	630	1.43	3.94	<b>Total</b>	11,430.916	912			
<b>Cervical cancer history in the family</b>									
Yes*	9	3.44	5.76	<b>B.G.</b>	149.033	2	44.517	3.960	0.041
No	539	1.14	3.59	<b>W.G.</b>	11,381.883	910	12.508		
I do not know	365	1.08	3.38	<b>Total</b>	11,430.916	912			
<b>Total</b>	913	1.14	3.54						

X = Mean, SD = Standard deviation, t: Independent-samples t-test, df: Degrees of Freedom, Sources: Sources of Variance, B.G.: Between Groups, W.G.: Within Group, SS: Sum of Squares, MS: Mean of Squares, VTAHS: Vocational and Technical Anatolian High School.

\* As a result of post hoc analysis (Bonferroni), it was determined that this was the group that created significance.

**Table 3**  
Distribution of Pre-Test HPV-KS Mean Scores Based on Students' HPV-Related Characteristics.

Variables	N	X	SD	t-test		
				t-value	df	p-value
<b>HPV vaccination status</b>						
Yes	3	6.33	10.96	3.057	912	0.002
No	910	1.12	3.49			
<b>Status of getting information about the HPV vaccine</b>						
Yes	833	7.45	6.23	-9.842	912	0.000
No	80	0.53	2.42			

Variables	N	X	SD	ANOVA test					
				Sources	SD	df	MS	F	p-value
<b>HPV vaccination intention (n = 910)</b>									
Yes*	152	2.92	5.51	<b>B.G.</b>	591.900	2	295.950	25.522	0.000
No	263	0.65	2.78	<b>W.G.</b>	10,517.313	907	11.596		
I am not sure	495	0.82	2.81	<b>Total</b>	11,109.21	909			
<b>Total</b>	910	1.12	3.49						
<b>Reasons for not getting the HPV vaccination</b>									
I did not hear	688	0.48	2.22	<b>B.G.</b>	1376.518	6	229.420	21.286	0.000
Vaccine is expensive*	25	4.92	6.55	<b>W.G.</b>	9732.695	903	10.778		
Not knowing the side effects of the vaccine	120	2.67	4.98	<b>Total</b>	11,109.213	909			
Family not allowing it	34	4.47	5.70						
Do not think it is harmful	35	1.85	5.23						
Fear of injection	5	3.60	8.04						
Anti-vaccination	3	3.66	6.35						
<b>Total</b>	910	1.12	3.49						

X = Mean, SD = Standard deviation, t: Independent samples t-test, df: Degrees of Freedom, Sources: Sources of Variance, B.G.: Between Groups, W.G.: Within Group, SS: Sum of Squares, MS: Mean of Squares.

\* As a result of post hoc analysis (Bonferroni), it was determined that this was the group that created significance.

**Table 4**  
Comparison of Students' Intentions to Get the HPV Vaccine Before and After the Training.

Status	Pre-Education		Post-Education		Chi-Square Test Value	p-value
	n	%	n	%		
<b>Considering Vaccination</b>	152	%16.7	739	%81.2	X <sup>2</sup> = 331.322	p = 0.000
<b>Not Considering Vaccination</b>	263	%28.9	27	%3.0		
<b>Not Sure</b>	495	%54.4	144	%15.8		
<b>TOTAL</b>	910					

shown that the peer education model is particularly effective in reducing risky behaviors and increasing knowledge levels (Akkuş et al., 2016; Aşçı et al., 2016; Bulduk, 2009). In this study, adolescents' knowledge levels about HPV infection and HPV vaccination were low before peer education, but after peer education, their knowledge levels increased ( $p < 0.05$ ). Studies involving young people have demonstrated that peer education is an effective approach in decreasing risky sexual behaviors (Bulduk, 2009), enhancing knowledge on family planning and reproductive health (Aşçı et al., 2016), and mitigating substance dependency (Akkuş et al., 2016).

Adolescents' involvement in risky sexual behaviors and their limited knowledge about HPV underscore the importance of targeting the adolescent period for educational interventions. This period presents a critical opportunity for instilling accurate attitudes and promoting behavior change from an early age. A study conducted in Nigeria among adolescents aged 9–17 years found that peer education was effective in improving their knowledge and awareness about HPV and cervical cancer (Sadoh et al., 2018). Another study showed that peer education intervention increases students' knowledge about the HPV vaccine and makes it easier for them to accept the vaccine (Castellanos et al., 2018). In addition, Ferrara et al. (2012) found that peer education significantly changed adolescents' knowledge, attitudes, and behaviors related to HPV, providing significant support in a positive direction (Ferrara et al., 2012). Our findings in this regard are consistent with previous studies on the subject in the literature and support the findings of those studies.

Additionally, our study shows that the intention to get vaccinated increased after the intervention. The percentage of participants considering vaccination rose from 16% ( $n = 152$ ) before the intervention to 81% ( $n = 739$ ) afterward. Although we were unable to observe changes in actual vaccination behavior due to the short duration of our educational program, the increase in vaccination intent following the intervention is a significant finding. In a study conducted among high school students, it was found that only 12.2% of the students considered getting the HPV vaccine (Yalaki et al., 2016). A study conducted in China found that the percentage of adolescents willing to get vaccinated was 67% before HPV education, and this rate increased to approximately 92% after the education. In a study conducted in

**Table 5**  
Comparison of students' HPV-KS score averages before and after training.

Scale Sub-Dimensions	Before training X ± SD	After training X ± SD	t-test		
			t	sd.	p-value
HPV Subsize	0.78 ± 2.38	12.68 ± 3.35	−86.933	912	0.000
HPV Test Subdimension	0.11 ± 0.47	3.71 ± 2.17	−48.793	912	0.000
HPV Vaccine Lower Size	0.13 ± 0.56	3.46 ± 1.63	−58.381	912	0.000
Independent Sub Dimension	0.10 ± 0.50	3.90 ± 1.95	−56.337	912	0.000
<b>Scale Total Score</b>	1.14 ± 3.54	23.78 ± 8.32	−74.937	912	0.000

X = Mean, SD = Standard deviation, t = Paired-samples t-test.

Italy, the intention to get vaccinated in the intervention group increased from 42% to 60% before and after peer education (Ferrara et al., 2012). Compared to these studies, the intention to get vaccinated in our country appears to be very low. A review of the literature shows that adolescents who gain knowledge about HPV and its vaccine tend to develop a positive intention toward vaccination. Our study also supports and confirms this result, showing that educational interventions on HPV can increase the intention to get the HPV vaccine.

#### Strengths and limitations

Considering that the knowledge level of HPV and the HPV vaccine is lower in developing and underdeveloped countries, our study is expected to make a significant contribution to the literature by addressing an important issue. Additionally, another strength of the study is that the sample was selected using a stratified sampling method from each type of high school and grade level, ensuring an adequate sample size. However, the study also has some limitations. This study was conducted in a city that is the crossroads of four of the seven geographical regions of Turkey, so the results of the study cannot be generalized to the whole country. Approval from the Ethics Committee and the Provincial Directorate of National Education for the study could not be obtained until March for the academic year ending in June. The research dates had to be arranged according to the students' vacations, such as exam weeks, vacations and public holidays. Although it was found that the students did not have enough information about the vaccines administered to them, it was accepted that they answered the socio-demographic questionnaire correctly. Additionally, the study design is limited in determining the independent effect of peer education compared to randomized controlled trials.

#### Implications to practice

Peer education programs about HPV and HPV vaccine for adolescent group will be effective in reducing risky sexual behaviors and increasing the prevalence of the vaccine. At the same time, it will be beneficial in reducing the types of cancer caused by HPV and in terms of cost-effectiveness. Therefore, it is recommended that nurses frequently use the peer education model to teach healthy lifestyle behaviors and increase the level of knowledge on health-related issues in adolescents, who constitute an important risk group.

#### Conclusion

This study determined that the peer education program was effective in increasing the level of knowledge about HPV infection and HPV vaccine in adolescents. Based on this result, peer education programs about HPV and HPV vaccine for this age group will be effective in reducing risky sexual behaviors and increasing the prevalence of the vaccine. At the same time, it will be beneficial in reducing the types of cancer caused by HPV and in terms of cost-effectiveness. Therefore, it is recommended that nurses frequently use the peer education model to teach healthy lifestyle behaviors and increase the level of knowledge on health-related issues in adolescents, who constitute an important risk group. Based on our research results, there is a need for more studies that demonstrate the effect of peer education on this subject. Additionally, randomized controlled trials (RCTs) are needed to evaluate the impact of peer education on behavioral changes related to the HPV vaccine. Pediatric and school health nurses are groups that should take a proactive role in protecting and promoting adolescents' health. Although parents have a strong influence on their children's lifestyle, they may not always be able to protect them from risky behaviors. Therefore, everyone involved in a child's education must collaborate to foster positive behaviors and attitudes toward a healthy lifestyle.

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## CRedit authorship contribution statement

**Elif Erbay:** Writing – original draft, Visualization, Project administration, Methodology, Data curation, Conceptualization. **Sultan Kayan:** Writing – original draft, Software, Project administration, Formal analysis, Data curation, Conceptualization. **Asiye Kartal:** Writing – review & editing, Supervision, Software, Project administration, Formal analysis, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## References

- Akkuş, D., Eker, F., Karaca, A., Kapisız, Ö., & Açıkgöz, F. (2016). High school youth peer education program an effective model to prevent substance abuse happen? *Journal of Psychiatric Nursing*, 7(1), 34–44. <https://doi.org/10.5505/phd.2016.59489>.
- Aşçı, Ö., Gökdemir, F., & Çiçekoğlu, E. (2016). Hemşirelik öğrencilerine akran eğitimciler ile verilen üreme sağlığı eğitiminin etkinliği. *Sağlık Bilimleri ve Meslekleri Dergisi*, 3(3), 173–183. <https://doi.org/10.17681/hsp.56193>.
- Aydoğdu, S. G. M., & Özsoy, Ü. (2018). Serviks kanseri ve HPV. *Androloji Bülteni*, 20, 25–29. <https://doi.org/10.24898/tandro.2018.62533>.
- Brotherton, J. M. L., & Bloem, P. N. (2018). Population-based HPV vaccination programmes are safe and effective: 2017 update and the impetus for achieving better global coverage. *Best Practice & Research. Clinical Obstetrics & Gynaecology*, 47, 42–58. <https://doi.org/10.1016/j.bpobgyn.2017.08.010>.
- Bruni, L., Diaz, M., Castellsagué, X., Ferrer, E., Bosch, F. X., & de Sanjosé, S. (2020). Cervical human papillomavirus prevalence in 5 continents: meta-analysis of 1 million women with normal cytological findings. *The Journal of Infectious Diseases*, 202, 1789–1799. <https://doi.org/10.1086/657321>.
- Bulduk, S. (2009). *Gençlerde okula dayalı akran eğitimi girişimlerinin HIV/AIDS risk davranışlarını azaltma üzerine etkisi. Doktora Tezi. İstanbul Üniversitesi Sağlık Bilimleri Enstitüsü Halk Sağlığı Hemşireliği Anabilim Dalı, Halk Sağlığı Hemşireliği Programı, İstanbul.*
- Bulut, A., & Ortaylı, N. (2004). Bir Araştırmanın Düşündürdükleri: Cinsel Sağlık Ama Nasıl? *STED*, 1, 60–63.
- Castellanos, M., Odaimi, T., Demissie, S., Lee, A., & Farberov, M. (2018). A new peer-to-peer educational model to increase knowledge and acceptability of HPV vaccination. *Journal of Adolescent Health*, 62(2), S105–S106. <https://doi.org/10.1016/j.jadohealth.2017.11.214>.
- Çetin, O., Verit, F. F., Keskin, S., Zebitay, A. G., Derogöz, A., Usta, T., & Yücel, O. (2014). Ergen kızların human papilloma virüsü ve aşısı hakkındaki bilgi düzeyleri. *Türk Ped Arş*, 49, 142–147. <https://doi.org/10.5152/tpa.2014.1545>.
- Cleophas, T. J., Zwinderman, A. H., Cleophas, T. J., & Zwinderman, A. H. (2011). Bonferroni t-test. *Statistical analysis of clinical data on a pocket calculator: Statistics on a pocket calculator* (pp. 41–42).
- Demir, F. (2019). *Human Papilloma Virüsü (HPV) Bilgi Ölçeği'nin Türkçe Geçerlik ve Güvenirliliği. Yayınlanmamış Yüksek Lisans Tezi. Sağlık Bilimleri Üniversitesi, Gülhane Sağlık Bilimleri Enstitüsü, Halk Sağlığı Hemşireliği Anabilim Dalı, Ankara.*
- Dönmez, S., Öztürk, R., Kisa, S., Karaoz Weller, B., & Zeyneloğlu, S. (2019). Knowledge and perception of female nursing students about human papillomavirus (HPV), cervical cancer, and attitudes toward HPV vaccination. *Journal of American College Health*, 67(5), 410–417. <https://doi.org/10.1080/07448481.2018.1484364>.
- Fagbule, O. F., Kanmodi, K. K., Aliemeke, E. O., Ogunniyi, K. E., Ogbeide, M., Victor, S. O., ... Kanmodi, P. A. (2020). Knowledge of HPV and HPV vaccine among senior secondary school students in Nigeria: Implications on cancer prevention strategies, the CHANCE study. *Population Medicine*, 2, 1–10. <https://doi.org/10.18332/popmed/127237>.
- Ferrara, M., Langiano, E., & De Vito, E. (2012). A school based community randomized trial of the effect of peer health education on primary prevention knowledge, attitude and behaviours towards HPV among adolescents. *Italian Journal of Public Health*, 9(1), 20–32.
- Kırmızıtoprak, E., & Şimşek, Z. (2011). Cinsel yolla bulaşan hastalıklar ve güvenli cinsel yaşam konusunda gençlerin bilgi ve davranışlarına akran eğitiminin etkisi. *TAF Preventive Medicine Bulletin*, 10(4), 463–472.
- Kutz, J. M., Rausche, P., Gheit, T., Puradiredja, D. I., & Fusco, D. (2023). Barriers and facilitators of HPV vaccination in sub-Saharan Africa: A systematic review. *BMC Public Health*, 23, 974. <https://doi.org/10.1186/s12889-023-15842-1>.
- Lee, V. Y., Booy, R., Skinner, R., & Edwards, K. M. (2018). The effect of exercise on vaccine-related pain, anxiety and fear during HPV vaccinations in adolescents. *Vaccine*, 36, 3254–3259. <https://doi.org/10.1016/j.vaccine.2018.04.069>.
- López, N., Garcés-Sánchez, M., Panizo, M. B., de la Cueva, I. S., Artés, M. T., Ramos, B., & Cotarelo, M. (2020). HPV knowledge and vaccine acceptance among European adolescents and their parents: A systematic literature review. *Public Health Reviews*, 41(1), 1–24. <https://doi.org/10.1186/s40985-020-00126-5>.
- Natipagon-Shah, B., Lee, E., & Lee, S. Y. (2021). Knowledge, beliefs, and practices among US college students concerning papillomavirus vaccination. *Journal of Community Health*, 46, 380–388. <https://doi.org/10.1007/s10900-020-00922-9>.
- Nguyen-Huu, N. H., Thilly, N., Derrough, T., Sdona, E., Claudot, F., Pulcini, C., ... HPV Policy Working Group (2020). Human papillomavirus vaccination coverage, policies, and practical implementation across Europe. *Vaccine*, 38(6), 1315–1331. <https://doi.org/10.1016/j.vaccine.2019.11.081>.
- Perlman, S., Wamai, R. G., Bain, P. A., Welty, T., Welty, E., & Ogembo, J. G. (2014). Knowledge and awareness of HPV vaccine and acceptability to vaccinate in sub-Saharan Africa: A systematic review. *PLoS One*, 9(3), Article e90912. <https://doi.org/10.1371/journal.pone.0090912>.
- Sadoh, A. E., Okonkwo, C., Nwaneri, D. U., Ogboghodo, B. C., Eregiea, C., Oviawe, O., & Famuyiwa, O. (2018). Effect of peer education on knowledge of human papilloma virus and cervical cancer among female adolescent students in Benin City, Nigeria. *Annals of Global Health*, 84(1), 1218. <https://doi.org/10.29024/aogh.24>.
- Stakic, S., Zielony, R., Bodiroza, A., & Kimzeke, G. (2003). Peer education within a frame of theories and models of behaviour change. *Entre Nous: The European Magazine for Sexual and Reproductive Health*, 56, 4–6.
- Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2021). Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer J Clin*, 71(3), 209–249. <https://doi.org/10.3322/caac.21660>.
- Waller, J., Ostini, R., Marlow, L., McCaffery, K., & Zimet, G. (2013). Validation of a measure of knowledge about human papillomavirus (HPV) using item response theory and classical test theory. *Preventive Medicine*, 56(1), 35–40. <https://doi.org/10.1016/j.ypmed.2012.10.028>.
- WHO (2024). Human papillomavirus (HPV) and cervical cancer. Retrieved from: <https://www.who.int/news-room/fact-sheets/detail/human-papilloma-virus-and-cancer> (Updated: 5 March 2024) 29.03.2024.
- Yalaki, Z., Tasar, M. A., Saç, R.Ü., Göçmen, S., Karadağlı, S., Akbas, N., & Dallar, Y. B. (2016). The levels of knowledge of high school students about human papilloma virus infection/Lisede okuyan öğrencilerin insan papilloma virüs enfeksiyonu hakkındaki bilgi düzeyleri. *Çocuk Enfeksiyon Dergisi*, 10(3), 86. <https://doi.org/10.5152/ced.2016.2330>.
- Yıldırım, İ. (2002). Bireyi Tanıma Teknikleri. In: G. Can (Ed.), *Psikolojik Danışma ve Rehberlik* (pp. 121–168), (second press). Ankara: Pegem Yayıncılık
- Yıldırım, R. C., & Apan, T. (2001). Kırkkale Üniversitesi Tıp Fakültesi Öğrencilerinin HIV/AIDS Konusunda Bilgi Düzeyleri. *HIV/AIDS Tıp Dergisi*, 4, 17–22.
- Yurtsev, E. (2011). *Ergen kızlar ve annelerinin HPV aşısına ilişkin bilgi ve görüşleri. Yüksek lisans tezi. Adnan Menderes Üniversitesi, Sağlık Bilimleri Enstitüsü, Aydın.*
- Zhang, X., Liu, C. R., Wang, Z. Z., Ren, Z. F., Feng, X. X., Ma, W., ... Li, J. (2020). Effect of a school-based educational intervention on HPV and HPV vaccine knowledge and willingness to be vaccinated among Chinese adolescents: A multi-center intervention follow-up study. *Vaccine*, 38(20), 3665–3670. <https://doi.org/10.1016/j.vaccine.2020.03.032>.