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# Exploring Factors Associated with Awareness, Willingness, and HPV Vaccine Uptake among Female Health Sciences University Students in Saudi Arabia

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**Abstract** Background: Human papillomavirus (HPV) is a major contributor to cervical cancer worldwide, posing a significant public health concern. In Saudi Arabia, multiple studies have investigated the levels of awareness and attitudes regarding HPV vaccination; however, gaps in knowledge and willingness to vaccinate persist, particularly among young women. Aim: This study aimed to evaluate the awareness, attitudes, and willingness to receive the HPV vaccine among female university students in Saudi Arabia, with a focus on identifying factors influencing vaccine acceptance. Methods: A cross-sectional study was conducted from March to July 2023 using an Arabic-language electronic questionnaire. The study population comprised female Health Sciences students enrolled at Taibah University in Al Madinah, Saudi Arabia. Data were analyzed using the chi-square test and Pearson's correlation coefficient to identify associations between demographic variables and levels of awareness and attitudes toward HPV vaccination. Results: A total of 946 female students participated in the study. The findings revealed that 63.3% of participants demonstrated satisfactory knowledge regarding HPV and its vaccine, while 61.7% expressed positive attitudes toward HPV vaccination. Despite this, only 32.9% of respondents reported willingness to receive the vaccine. Significant associations were observed between participants' awareness and demographic factors, including age, academic year, and college type ($p < 0.001$). Conclusions: The awareness and attitudes of female university students play a pivotal role in shaping their willingness to receive the HPV vaccine. Enhancing educational efforts on HPV and its vaccine is essential to address misconceptions, improve knowledge, and increase vaccine uptake. This study underscores the importance of integrating targeted health promotion initiatives and nursing interventions to foster positive behavioral changes and improve vaccination rates.

**Keywords** Human Papillomavirus (HPV) Vaccination, Female Health Sciences Students, Awareness, Willingness, Health Promotion, Saudi Arabia

## 1. Summary Statement

### What is Already Known about This Topic

- Human papillomavirus (HPV) is a prevalent sexually transmitted infection that poses a major risk for cervical cancer, which can be mitigated through early screening methods like Pap smears.
- The HPV vaccine is most effective when administered before sexual activity begins, providing a preventive strategy against cervical cancer.

**What This Paper Adds**

- This study provides valuable insights into the awareness, attitudes, and willingness to receive the HPV vaccine among female university students in Al-Madina city, Saudi Arabia, highlighting a gap between knowledge and vaccine acceptance.
- It contributes to understanding the role of demographic factors, such as age, academic year, and college type, in shaping students' awareness of HPV, which can inform the development of more tailored and effective health promotion strategies.

**Implications of This Paper**

- The findings reveal that although many female students exhibited adequate knowledge and positive attitudes toward the HPV vaccine, a significant number were not willing to receive the vaccine or had not been vaccinated, indicating a gap in vaccine acceptance despite awareness.
- Demographic factors, including age, academic year, and college type, were found to have a significant impact on students' awareness of HPV, suggesting the importance of designing targeted educational programs to address specific groups and increase vaccine uptake.

# 2. Introduction

Human papillomavirus (HPV) is one of the most prevalent sexually transmitted infections (STIs) globally and plays a significant role in public health due to its strong association with cervical cancer and other anogenital and oropharyngeal cancers. HPV is primarily transmitted through skin-to-skin contact, especially during sexual activity, and can affect various body parts, including the mouth, throat, rectum, anus, vulva, vagina, penis, and cervix [1, 2]. Given that most sexually active individuals will be infected with HPV at some point in their lives, the risk of contracting the virus is influenced by factors such as the number of sexual partners, unprotected sexual activity, and relationship dynamics. Globally, HPV prevalence among men ranges from 3.4% to 45%, while in women, it ranges from 2% to 44% [3].

In Saudi Arabia, HPV is a major factor in cervical cancer, contributing to over 92% of cervical cancer cases and affecting 31% of the general population, with 80% of women with cytological abnormalities testing positive for the virus [4]. Despite a relatively lower incidence of cervical cancer in Saudi Arabia compared to global statistics, it remains the tenth most common cancer among women aged 15 to 44 years [5]. Unfortunately, a majority of these cases are diagnosed at advanced stages, which complicates treatment options [5]. The persistence of cervical cancer in Saudi Arabia, despite being a preventable condition, can be attributed to multiple factors, including limited awareness, cultural taboos, and insufficient public health initiatives focused on vaccination and screening [4-6].

Culturally, the discussion surrounding sexual health, including the prevention of STIs like HPV, is often sensitive in Saudi Arabia due to conservative values and societal norms [5, 7-9]. Discussions about sexual health and vaccination programs related to STIs are perceived as taboo in some communities, and this cultural sensitivity can influence individuals' willingness to engage in educational campaigns. Such cultural factors are important considerations in the development of health interventions and strategies, as they can affect both the willingness to seek preventive measures and the adoption of health practices like vaccination [7, 8, 10].

HPV is classified into high-risk and low-risk genotypes. High-risk types such as HPV 16 and 18 are responsible for approximately 70% of cervical cancer cases globally, while low-risk types like HPV 6 and 11 cause genital warts [11]. Cervical cancer remains the fourth most common cancer among women globally, with an estimated prevalence of 15.7 per 100,000 [12, 13]. While the majority of HPV infections (approximately 90%) resolve without symptoms within one to two years, a small percentage (about 10%) can lead to serious health complications such as cervical cancer [14, 15].

Recognizing the significance of HPV as a public health concern, the World Health Organization advocates for vaccination as a critical preventive measure, particularly if administered before the onset of sexual activity [12, 13]. In Saudi Arabia, the Saudi Food and Drug Authority approved prophylactic HPV vaccines for girls aged 11 to 26 in 2010, and the vaccine was incorporated into the National Vaccination Schedule. Despite the high efficacy of HPV vaccines, concerns persist, including myths regarding potential side effects like fatigue, headaches, and localized swelling, which are generally minor. Additionally, there have been unfounded concerns about vaccines causing autoimmune diseases or infertility [5, 16].

Despite the availability of HPV vaccines, a significant knowledge gap about HPV and its prevention exists in Saudi Arabia, especially among the general public, healthcare professionals, and students. Female university students, particularly those in health-related fields, represent a crucial demographic for targeted educational interventions. These students have the potential to act as health advocates within their communities, yet studies have shown that many lack adequate knowledge about HPV, its vaccine, and the associated risks of cervical cancer [5, 17]. The limited knowledge of HPV among female university students could stem from societal taboos, lack of discussion about sexual health in educational settings, and insufficient culturally sensitive public health initiatives. Addressing these gaps is essential for improving health literacy and fostering positive attitudes toward preventive measures such as vaccination [10, 18, 19].

This study seeks to assess the awareness, attitudes, and willingness to accept HPV vaccination among female students at Taibah University in Al Madinah city, Saudi Arabia. By examining the relationship between demographic factors, HPV knowledge, and vaccination acceptance, this study aims to identify the key drivers and barriers to vaccine uptake. Given the cultural sensitivities around sexual health in Saudi Arabia, the findings will provide critical insights into how health promotion and education efforts can be better tailored to the specific needs and challenges of this population [1, 5, 7]. The goal is to enhance awareness and increase HPV vaccination rates, ultimately contributing to the prevention of cervical cancer in Saudi Arabia through culturally relevant educational programs and policy interventions.

### 2.1. Significance of the Study

This study is of significant importance for several reasons. First, it provides valuable insights into the level of awareness, attitudes, and acceptance of HPV vaccination among female nursing students, a critical group within the healthcare sector. Nursing students play an essential role in healthcare education and patient care, and their understanding of HPV and its vaccine can directly impact their ability to educate patients and advocate for vaccination in their future nursing practice.

Given the high incidence of cervical cancer globally, particularly in Saudi Arabia, increasing awareness and improving vaccination uptake can significantly reduce the burden of HPV-related cancers. By examining the factors influencing awareness, attitudes, and acceptance, this research can help inform targeted educational interventions and public health strategies to promote HPV vaccination among nursing students and the broader community.

Additionally, this study addresses a gap in the existing literature concerning the understanding of HPV and vaccination within the Saudi healthcare context. The findings will contribute to the development of evidence-based health policies and preventive measures to combat cervical cancer in Saudi Arabia.

### 2.2. Research Purpose and Objectives

The primary aim of this study is to assess the awareness, attitudes, and acceptance of HPV vaccination among female nursing students in Saudi Arabia. This study seeks to explore the level of knowledge, the factors influencing attitudes, and the overall acceptance of the HPV vaccine within this important demographic group. Understanding these aspects can provide insights into how nursing students perceive and accept HPV vaccination, which is critical for improving healthcare education and advocacy within their communities.

The specific objectives of this study are as follows: 1) To assess the socio-demographic characteristics and level of awareness about the HPV vaccine among female nursing students in Saudi Arabia. This includes exploring factors such as age, academic year, family background, and previous exposure to information about HPV; 2) To evaluate the attitudes and acceptability of HPV vaccination among female nursing students. This will involve understanding how these students perceive the vaccine, including their concerns, beliefs, and any cultural or social factors that might influence their willingness to accept the vaccine; 3) To examine the relationship between socio-demographic factors, awareness, attitudes, and acceptance of the HPV vaccine among female nursing students. This objective aims to identify any significant correlations between students' demographic characteristics (e.g., age, educational level) and their awareness, attitudes, and likelihood of accepting the HPV vaccine.

By achieving these objectives, the study will provide comprehensive insights into the factors influencing HPV vaccination among female nursing students and help identify areas for targeted educational interventions.

## 3. Methods

### 3.1. Research Design

This study utilizes a correlational cross-sectional research design, appropriate for examining the relationships between awareness, attitudes, and acceptance of HPV vaccination among female students in health-related programs at a specific point in time. By analyzing these variables, the study aims to identify potential correlations and provide a deeper understanding of the factors influencing HPV vaccination knowledge and acceptance within this population.

### 3.2. Setting and Sample

The target participants for this study were female students enrolled in health-related programs at Taibah University. These programs included medicine, dentistry, nursing, medical rehabilitation, pharmacy, and applied medical sciences. By selecting students from diverse health disciplines, the study aimed to provide a comprehensive understanding of HPV vaccination awareness, attitudes, and acceptance among female students within the university's health colleges.

A convenience sampling method was utilized to select participants for the study. The inclusion criteria were designed to ensure the sample accurately represented the target population. Eligible participants were female students aged 19 years or older, currently enrolled in one of the health colleges, and willing to provide informed consent. Exclusion criteria included male students, those with moderate to severe illnesses, individuals who had previously experienced serious adverse reactions to the

HPV vaccine or its components, students with a history of severe allergic reactions, and those unwilling to participate in the study.

To determine the appropriate sample size, a power analysis was conducted for a correlation test with a power of 95%, an alpha significance level of 0.05, and a moderate effect size of 0.3. Based on these parameters and the number of eligible participants, the calculated sample size was estimated to be 722. The estimated eligible population of female students in the health colleges at Taibah University was 1,147, with an expected response rate of 82.5%. However, to ensure a robust sample size and enhance the reliability of the study's findings, the researcher recruited a total of 946 students who agreed to participate in the study. This approach aimed to strengthen the validity and generalizability of the study's outcomes by accounting for potential non-response and variability within the population.

### 3.3. Data Collection Procedure

Data for this study were collected online using Google Forms, which facilitated easy distribution and accessibility for participants. The survey link was shared with potential participants through email and various social media platforms, including WhatsApp, to maximize outreach and participation among eligible students. This approach ensured the survey was accessible to students across different groups and faculties within the health colleges at Taibah University.

Before completing the questionnaire, participants were provided with detailed information about the study's purpose and a clear explanation of the informed consent process. This ensured that participants fully understood the study's scope, objectives, and their rights as participants, enabling them to make an informed decision about participation. The informed consent section included details about the study's aim, participant confidentiality, and their right to withdraw at any time without penalty. Participants provided their informed consent electronically before proceeding with the survey.

The questionnaire was structured to collect data on participants' demographic information, awareness of HPV and cervical cancer, attitudes toward HPV vaccination, and beliefs about vaccination. Participants were instructed to complete the questionnaire independently, which took approximately 15 minutes. Responses were submitted electronically, and the data were securely collected in an encrypted database.

Data collection took place over a period of several months, from March to July 2023. This extended timeframe allowed for sufficient engagement with eligible students and ensured an adequate response rate for statistical analysis. The online format, combined with the extended collection period, provided flexibility for participants, contributing to the overall success and comprehensiveness of the study.

### 3.4. Ethical Considerations

This study was reviewed and approved by the Institutional Review Board (IRB) at the College of Nursing, Taibah University. The researchers provided all female participants with a clear explanation of the study's objectives, ensuring they fully understood the purpose and scope of the research. Participants were then required to provide written informed consent before data collection commenced. The study adhered to the ethical principles outlined in the Declaration of Helsinki, safeguarding participants' rights, dignity, and well-being throughout the research process.

To protect participants' privacy, all collected data were treated with strict confidentiality and used exclusively for the purposes of this study. The questionnaires did not include any personally identifiable information, and all data were anonymized to ensure participant's privacy. Additionally, participants were informed of their right to withdraw from the study at any time without facing any penalties or negative consequences. These ethical measures were implemented to uphold the integrity of the research and ensure the confidentiality, autonomy, and welfare of all participants.

### 3.5. Data Collection Instrument

The primary data collection instrument used in this study was a self-administered questionnaire, adapted from previous research conducted by Darraj et al. [20] and White et al. [21]. The original version of the questionnaire was carefully modified to align with the specific objectives of this study. A comprehensive literature review was conducted to assess the instrument's relevance and ensure its validity and reliability within the context of the study. To ensure accessibility for all participants, the questionnaire was translated into Arabic, with a standardized translation and back-translation process to maintain accuracy. Consent was also obtained for the use of the modified version of the questionnaire.

The questionnaire was organized into five distinct sections, each designed to gather comprehensive data relevant to the study's objectives:

**Demographics Information:** The first section focused on demographic information, collecting essential details about the participants. This included variables such as age, academic year, faculty type, nationality, and marital status, providing valuable context to understand the sample population and its diversity. A total of five items were included in this section, which helped to characterize the respondents and provide a clearer understanding of the demographic background of the study sample.

**Awareness of HPV:** The second section of the questionnaire assessed participants' awareness of the HPV. It consisted of five items aimed at evaluating general knowledge about HPV. To ensure clarity in responses, a 3-point Likert scale was used, where participants could select

from: 0 = Not sure, 1 = False, and 2 = True. Based on their responses, participants' knowledge was categorized as either satisfactory knowledge (≥60% correct answers) or unsatisfactory knowledge (<60% correct answers), which allowed the researchers to evaluate the level of awareness among the participants.

**Attitudes Toward HPV Vaccination:** The third section examined participants' attitudes toward the HPV vaccine. This section included seven items, each rated on a 3-point Likert scale with the options: 1 = Agreement, 2 = Neutrality, and 3 = Disagreement. Responses were classified into two categories: positive attitudes (≥60% agreement) and negative attitudes (<60% agreement). This section provided insights into how participants felt about the HPV vaccine and their perceptions of its importance, contributing to a broader understanding of factors that might influence vaccine uptake.

**Opinions About HPV Virus:** The fourth section of the questionnaire sought to capture participants' opinions about HPV as a virus. This section consisted of five items designed to explore views and potential misconceptions about HPV. By examining participants' opinions, the researchers were able to identify any misunderstandings or gaps in knowledge related to the virus, which could impact attitudes and vaccine acceptance.

**Acceptance of HPV Vaccination:** The final section focused on assessing participants' acceptance of the HPV vaccination. It consisted of eight items designed to gauge the participants' willingness to accept the HPV vaccine. Similar to the other sections, responses were categorized based on a threshold of 60%, with those agreeing to take the vaccine classified as having acceptance (≥60%) and those disagreeing classified as non-acceptance (<60%). This section was crucial in understanding the factors that influenced participants' decisions about vaccination and provided key insights into the barriers or motivations regarding vaccine uptake.

By organizing the questionnaire into these five sections, the study ensured that it captured detailed, quantifiable data on various factors influencing HPV vaccination awareness, attitudes, and acceptance. The structured format allowed for an in-depth analysis of the demographic variables, knowledge, attitudes, and willingness to accept the HPV vaccine, ensuring that the findings were robust and meaningful for addressing the study's objectives.

### 3.6. Pilot Study

To ensure the validity and reliability of the questionnaire used in this study, a pilot study was conducted with 20 female students. The development of the questionnaire was guided by a comprehensive review of the literature and extensive discussions with a panel of five experts in maternal and newborn health nursing at our institution. Their expertise played a key role in refining the instrument, ensuring its relevance and accuracy for the study's objectives.

The first stage of the validity process involved a review by academic faculty from the University of Taibah. The faculty members assessed the questionnaire for any ambiguity or repetition in the items. Following this, a professional translator translated the questionnaire from Arabic to English, and then it was re-translated back into Arabic to ensure linguistic accuracy and consistency. This translation process helped ensure that the wording and meaning of the questions remained clear and accurate for the target population.

In the second stage, the researcher carefully reviewed each item to ensure that the key topics—such as awareness, attitudes, and acceptability of HPV vaccination, as well as the barriers to its use—were adequately addressed. To further refine the instrument, a pilot study was conducted with 40 female students. This phase was essential to assess the clarity of the questions and estimate the amount of time needed for participants to complete the questionnaire. Based on the pilot study results, the questionnaire's content and format were adjusted as necessary. The data from the pilot study were not included in the final analysis.

Reliability was assessed using a Cronbach's alpha value of 0.74, indicating acceptable internal consistency for the questionnaire. This reliability coefficient ensured that the instrument was suitable for measuring the study's intended outcomes. Overall, the pilot study helped confirm that the questionnaire was both valid and reliable, making it an appropriate tool for the main study.

### 3.7. Statistical Analysis

Data were analyzed using SPSS version 23. The statistical analysis included several key techniques to assess the relationships between variables and identify factors influencing HPV vaccination awareness, attitudes, and acceptance.

**Descriptive Statistics:** Descriptive statistics, including the mean and standard deviation, were used to summarize the demographic data (such as age, academic year, and faculty) and analyze responses to the survey items related to awareness, attitudes, and acceptance of the HPV vaccination. These statistics provided an overview of the study sample's characteristics and their knowledge and attitudes toward HPV vaccination.

**Pearson's Correlation Coefficient:** Pearson's correlation coefficient was used to assess the strength and direction of relationships between continuous variables. This analysis helped determine whether and how variables such as HPV awareness, attitudes, and acceptance were related to each other. The results provided insights into how these factors may influence one another.

**Chi-square Tests:** Chi-square tests were conducted to compare categorical variables and examine the relationships between demographic factors and key variables of interest, specifically focusing on the relationship between HPV vaccination and the personal characteristics of female students.

**Logistic Regression:** Logistic regression was performed to identify the factors influencing the acceptance of HPV vaccination. The analysis examined both unadjusted and adjusted odds ratios (ORs) to determine which demographic and attitudinal factors were most strongly associated with vaccination acceptance. The model's goodness of fit was assessed using the Hosmer-Lemeshow test.

Statistical significance was set at $p < 0.05$ for general comparisons, with a threshold of $p < 0.001$ considered highly significant. These methods ensured a comprehensive understanding of the factors influencing HPV vaccination acceptance and provided robust statistical evidence for the study's conclusions.

# 4. Results

## 4.1. Students' Characteristics Distribution

The study aimed to explore the knowledge, attitudes, and acceptance of the HPV vaccine among university students. A total of 946 students participated in the study, with the majority falling between the ages of 20 and 25 years (71.0%), followed by those aged 19 years or younger (12.2%), and those aged 26 years or older (16.8%). The students were primarily enrolled in the 1-4 university level (72.1%), with a smaller proportion in the 5-6 level (8.5%) and 7-8 level (19.5%).

Regarding the students' faculty backgrounds, most participants were from the Nursing faculty (50.2%), while the remainder were from Medical faculties (46.7%) and other faculties (3.1%). The majority of participants were Saudi Arabian (97.7%), with a smaller proportion being non-Saudi (2.3%). In terms of social status, most students were single (81.9%), and a minority were married (18.1%) (Table 1).

## 4.2. Knowledge and Attitudes Towards HPV

In terms of HPV knowledge, the results revealed that satisfactory knowledge about HPV varied significantly across demographic factors (Table 2). Students aged 26-30 years demonstrated the highest level of satisfactory knowledge (73.3%), while those aged 31 years or older had the lowest level (38.4%). Similarly, students from the 1-4 university level showed better knowledge (65.1%) compared to those in the 7-8 level (53.8%). Students from Medical faculties exhibited a higher level of knowledge (61.3%) compared to their peers in Nursing faculties (66.1%).

When it came to attitudes towards HPV, students aged 26-30 years exhibited the most positive attitudes (59.3%), with students from the Medical faculties showing the most favorable attitudes (58.1%). In contrast, students from other faculties reported the least positive attitudes (48.3%).

Acceptance of the HPV vaccine varied by age group. Students aged 26-30 years had the highest acceptance rate (37.2%), while students aged 31 years or older showed the lowest acceptance rate (11.0%). Nursing faculty students had a slightly lower acceptance rate (26.1%) than their counterparts in Medical faculties (41.4%).

**Table 1.** Students' Characteristics Distribution (N=946)

| Variables | n (%) |
|---|---|
| **Age (years)** | |
| ≤19 years old | 115 (12.2%) |
| 20 to 25 years old | 672 (71.0%) |
| 26 to 30 years old | 86 (9.1%) |
| ≥31 years old | 73 (7.7%) |
| **University level** | |
| 1-4 level | 682 (72.1%) |
| 5-6 level | 80 (8.5%) |
| 7-8 level | 184 (19.5%) |
| **Faculty** | |
| Medical faculties | 442 (46.7%) |
| Nursing | 475 (50.2%) |
| Others | 29 (3.1%) |
| **Nationality** | |
| Saudi Arabian | 924 (97.7%) |
| Non-Saudi Arabian | 22 (2.3%) |
| **Social Status** | |
| Married | 171 (18.1%) |
| Single | 775 (81.9%) |

**Table 2.** Students' Knowledge, Attitudes, and Acceptance of HPV

| Items | Students knowledge about HPV | | Students attitude about HPV | | Students' Acceptance about HPV | |
|---|---|---|---|---|---|---|
| | Satisfactory n (%) | Unsatisfactory (n (%) | Positive n (%) | Negative n (%) | Accepted n (%) | Unaccepted n (%) |
| **Age (years)** | | | | | | |
| ≤19 years old | 61 (53.0%) | 54 (47.0%) | 53 (46.1%) | 62 (53.9%) | 40 (34.8%) | 75 (65.2%) |
| 20 to 25 years old | 447 (66.5%) | 225 (33.5%) | 451 (67.1%) | 221 (32.9%) | 231 (34.4%) | 441 (65.6%) |
| 26 to 30 years old | 63 (73.3%) | 23 (26.7%) | 51 (59.3%) | 35 (40.7%) | 32 (37.2%) | 54 (62.8%) |
| ≥31 years old | 28 (38.4%) | 45 (61.6%) | 29 (39.7%) | 44 (60.3%) | 8 (11.0%) | 65 (89.0%) |
| **University level** | | | | | | |
| 1-4 level | 444 (65.1%) | 238 (34.9%) | 442 (64.8%) | 240 (35.2%) | 245 (35.9%) | 437 (64.1%) |
| 5-6 level | 56 (70.0%) | 24 (30.0%) | 40 (50.0%) | 40 (50.0%) | 28 (35.0%) | 52 (65.0%) |
| 7-8 level | 99 (53.8%) | 85 (46.2%) | 102 (55.4%) | 82 (44.6%) | 38 (20.7%) | 146 (79.3%) |
| **Faculty** | | | | | | |
| Medical faculties | 271 (61.3%) | 171 (38.7%) | 257 (58.1%) | 185 (41.9%) | 183 (41.4%) | 259 (58.6%) |
| Nursing | 314 (66.1%) | 161 (33.9%) | 313 (65.9%) | 162 (34.1%) | 124 (26.1%) | 351 (73.9%) |
| Others | 14 (48.3%) | 15 (51.7%) | 14 (48.3%) | 15 (51.7%) | 4 (13.8%) | 25 (86.2%) |
| **Nationality** | | | | | | |
| Saudi | 586 (63.4%) | 338 (36.6%) | 567 (61.4%) | 357 (38.6%) | 307 (33.2%) | 617 (66.8%) |
| Non-Saudi | 13 (59.1%) | 9 (40.9%) | 17 (77.3%) | 5 (22.7%) | 4 (18.2%) | 18 (81.8%) |
| **Social state** | | | | | | |
| Married | 100 (58.5%) | 71 (41.5%) | 97 (56.7%) | 74 (43.3%) | 53 (31.0%) | 118 (69.0%) |
| Single | 499 (64.4%) | 276 (35.6%) | 487 (62.8%) | 288 (37.2%) | 258 (33.3%) | 517 (66.7%) |

### 4.3. Awareness of HPV Vaccine and Barriers to Uptake

The survey also assessed the participants' awareness and opinions regarding the HPV vaccine (Table 3). Most students (80.5%) were unaware of the vaccine, with only a small portion (16.7%) recognizing it as a preventive measure for HPV infection. Fewer students associated the vaccine with the prevention of sexually transmitted diseases (1.5%) or as a boost to the immune system (0.3%).

Regarding the question of who should receive the HPV vaccine, 78.5% of students did not know, while 15.3% suggested that adolescent females should receive the vaccine. Only a small number (1.2%) believed all women should be vaccinated. When asked why the HPV vaccine was necessary, most students (82.8%) were unsure, while only 12.1% recognized it as a preventive measure for cervical cancer.

The most frequently reported barrier to obtaining the HPV vaccine was a lack of information (14.3%), followed by concerns about side effects (2.9%). A majority of students (81.1%) were unaware of any obstacles to vaccination. Additionally, when asked how to communicate HPV vaccine information to parents, most students (78.8%) did not have a suggestion, though 15.9% thought certified health sources, such as the Ministry of Health, would be the most effective means.

### 4.4. Correlation Between Knowledge, Attitude, and Acceptance of HPV Vaccination

The Pearson correlation analysis revealed significant relationships between the knowledge, attitude, and acceptance scores regarding HPV vaccination among female university students (data are not shown in the tables).

**Knowledge Score and Attitude Score:** A moderate positive correlation was found between the knowledge score and the attitude score ($r = 0.431$, $p < 0.0001$). This indicates that as students' knowledge about HPV vaccination increased, their attitude towards the vaccine became more positive.

**Knowledge Score and Acceptance Score:** A moderate positive correlation was also observed between the knowledge score and the acceptance score ($r = 0.387$, $p < 0.0001$). This suggests that greater knowledge about HPV vaccination was associated with a higher level of acceptance of the vaccine.

**Attitude Score and Acceptance Score:** A stronger positive correlation was identified between the attitude

score and the acceptance score ($r = 0.489$, $p < 0.0001$), indicating that students who held a more positive attitude towards HPV vaccination were more likely to accept the vaccine.

Overall, all correlations between knowledge, attitude, and acceptance of HPV vaccination were statistically significant, with p-values less than 0.05, demonstrating the importance of these factors in influencing female students' views and behaviors towards HPV vaccination.

### 4.5. Sociodemographic Factors and HPV Vaccination

Several sociodemographic factors also influenced vaccination rates (Table 4). Age appeared to have a minor impact on vaccination uptake, with no significant differences between students aged 19 years or younger, 20-25 years, and 26-30 years. However, students aged 31 years or older were less likely to have received the vaccine compared to their younger counterparts.

**Table 3.** Awareness and Opinions of Female University Students Regarding HPV

| Variables | n (%) |
|---|---|
| **Know about the human papilloma vaccine?** | |
| I don't know | 762 (80.5%) |
| Protects someone from being infected with this disease | 158 (16.7%) |
| Vaccination against STD | 14 (1.5%) |
| I heard it's a preventive measure for adulthood | 9 (1.0%) |
| Boosts the immune system | 3 (0.3%) |
| **Who should get the HPV vaccine?** | |
| I don't know | 743 (78.5%) |
| Adolescent females | 145 (15.3%) |
| All women | 11 (1.2%) |
| Both adolescent males and females | 4 (0.4%) |
| At risk individuals | 18 (1.9%) |
| Before marriage | 25 (2.6%) |
| **Reasons for getting the HPV vaccine and why?** | |
| I don't know | 783 (82.8%) |
| To prevent cancer cervix | 114 (12.1%) |
| For prevention, especially when visiting laser clinics | 15 (1.6%) |
| Protection from virus | 34 (3.6%) |
| **Obstacles to obtaining the HPV vaccine** | |
| I don't know | 767 (81.1%) |
| Lack of information about vaccine | 135 (14.3%) |
| Fear from side effects of vaccine | 27 (2.9%) |
| Lack of time to take the vaccine | 17 (1.8%) |
| **Best way to communicate information about the HPV vaccine to parents?** | |
| I don't know | 745 (78.8%) |
| Certified and reliable sources, Ministry of Health | 150 (15.9%) |
| Health education message, lecture, posters | 25 (2.6%) |
| Social media | 26 (2.7%) |

**Table 4.** Relationship between HPV Vaccination and Personal Characteristics of Female Students

| Variables | Yes (n, %) | Not receive vaccine (n %) | $\chi^2$ | p-value |
|---|---|---|---|---|
| **Age** | | | | |
| ≤19 years old | 66 (57.4%) | 49 (42.6%) | | |
| 20 to 25 years old | 376 (56.0%) | 296 (44.0%) | 3.84 | 0.28 |
| 26 to 30 years old | 44 (51.2%) | 42 (48.8%) | | |
| ≥31 years old | 33 (45.2%) | 40 (54.8%) | | |
| **University level** | | | | |
| 1-4 level | 391 (57.3%) | 291 (42.7%) | 6.58 | 0.04* |
| 5-6 level | 36 (45.0%) | 44 (55.0%) | | |
| 7-8 level | 92 (50.0%) | 92 (50.0%) | | |
| **Faculty** | | | | |
| Medical faculties | 237 (53.6%) | 205 (46.4%) | | |
| Nursing | 263 (55.4%) | 212 (44.6%) | 1.65 | 0.44 |
| Others | 19 (65.5%) | 10 (34.5%) | | |
| **Nationality** | | | | |
| Saudi | 502 (54.3%) | 422 (45.7%) | 4.57 | 0.03* |
| Non-Saudi | 17 (77.3%) | 5 (22.7%) | | |
| **Social State** | | | | |
| Married | 98 (57.3%) | 73 (42.7%) | 0.51 | 0.48 |
| Single | 421 (54.3%) | 354 (45.7%) | | |

University level played a significant role in vaccination rates, with students in the 1-4 university levels being more likely to receive the HPV vaccine (57.3%) compared to those in the 5-6 (45.0%) and 7-8 (50.0%) levels. Faculty affiliation also impacted vaccination rates. Students in the Nursing and Medical faculties exhibited similar rates of vaccine uptake (55.4% and 53.6%, respectively), but students from other faculties had a significantly higher vaccination rate (65.5%). Nationality was another factor that influenced vaccination uptake, with non-Saudi students showing a higher vaccination rate (77.3%) compared to their Saudi counterparts (54.3%).

### 4.6. Predictors of HPV Vaccination Uptake

In terms of predicting HPV vaccination uptake, several factors were identified as significant. Logistic regression analysis revealed that satisfactory knowledge about HPV, a positive attitude towards the vaccine, and a higher acceptance of vaccination were the most influential predictors of vaccination uptake (Table 5). Students with satisfactory knowledge about HPV were significantly more likely to have received the vaccine ($\beta = 2.452$, $p = 0.003$), as were those with positive attitudes ($\beta = 2.932$, $p = 0.001$) and greater acceptance ($\beta = 0.919$, $p = 0.036$).

In summary, the findings underscore significant gaps in knowledge about HPV and its vaccine, especially among older students and those in higher university levels. Despite a positive attitude and greater acceptance of the vaccine among some students, a lack of information and uncertainty about who should receive the vaccine emerged as key barriers to uptake. The regression analysis confirmed that students who demonstrated satisfactory knowledge, had positive attitudes, and accepted the HPV vaccine were significantly more likely to have received it. The study also highlights that sociodemographic factors, such as age, university level, faculty, nationality, and social status, play important roles in determining HPV vaccination uptake. These findings suggest that targeted educational interventions could help increase awareness and acceptance of the HPV vaccine, particularly among students who are less knowledgeable and hesitant about the vaccine.

**Table 5.** Logistic Regression Analysis for Predicting Students' HPV Vaccination

| Predictors of vaccination against HPV | ß | P value | 95% C.I for EXP(B) | |
|---|---|---|---|---|
| | | | Lower | Upper |
| Satisfactory Knowledge | 2.452 | **0.003** | 1.870 | 3.214 |
| Positive Attitude | 2.932 | **0.001** | 2.235 | 3.845 |
| Acceptance of vaccination | 0.919 | **0.036** | 0.699 | 1.207 |

# 5. Discussion

This study aimed to assess the knowledge, attitudes, and acceptance of the HPV vaccine among female university students in Saudi Arabia, providing valuable insights into gaps in awareness, vaccine acceptance, and the factors influencing these outcomes. The findings align with several previous studies highlighting the global and regional challenges surrounding HPV education and vaccine uptake.

The majority of students in this study displayed limited awareness of the HPV vaccine, with 80.5% of participants unaware of it and only 16.7% recognizing it as a preventive measure for HPV infection. These results are consistent with earlier research that indicates university students often lack sufficient knowledge of HPV and its vaccine, which is essential for vaccine acceptance [22, 23].

The knowledge gap was especially evident among older students and those in advanced academic levels, emphasizing the importance of implementing educational programs tailored to these groups to enhance their understanding of HPV and the vaccine. Likewise, studies conducted in different regions of Saudi Arabia, such as those by Alshammari et al. [18] and Rashwan et al. [24], have similarly highlighted a substantial lack of awareness about HPV, its association with cervical cancer, and the infection's preventable nature. These findings underscore the need for more comprehensive HPV education, particularly in disciplines such as pharmacy and medical programs, where students are better positioned to communicate vaccine benefits in their future careers [7, 10, 16].

Attitudes toward the HPV vaccine varied across demographic groups. Younger students (aged 20-25 years) and those in lower academic years were more likely to have positive attitudes toward vaccination. This is consistent with other studies showing that younger individuals tend to be more receptive to vaccination, likely due to greater exposure to public health campaigns [25]. Furthermore, students enrolled in medical faculties showed more favorable attitudes compared to their peers in other faculties, suggesting that specialized educational programs, particularly within the medical field, may contribute to more positive perceptions of the HPV vaccine. This trend is consistent with findings from previous studies, which reported that students with more knowledge of HPV were more likely to support vaccination [6, 26].

The acceptance of the HPV vaccine in this study was influenced by multiple factors, including knowledge and attitudes. More than one-third of students indicated a willingness to receive the vaccine, with over half reporting that they had already been vaccinated. This aligns with studies by Ali et al. [22], who found a relatively low rate of vaccine refusal among university students. However, several barriers to vaccination were identified, with the most common being a lack of information. A substantial proportion of participants (82.8%) were unsure of the reasons for the HPV vaccine's necessity, and 78.8% had no suggestions for effectively communicating HPV vaccine information to parents. These results highlight the need for targeted public health campaigns aimed at both students and their families, providing clear and accurate information about the vaccine's role in preventing HPV and related cancers [4, 16, 27].

The study's findings also revealed that satisfactory knowledge, positive attitudes, and greater vaccine acceptance were strong predictors of HPV vaccination uptake. These results support findings from Pearson correlation analyses, which showed a positive relationship between knowledge and vaccine acceptance. Similar studies, including those by D'Errico et al. [28] and Abdelaliem et al. [6], also found that higher awareness of HPV was associated with greater vaccine acceptance. This highlights the critical role that education plays in increasing vaccine uptake, particularly in university settings.

Furthermore, the study identified significant associations between vaccine attitudes and demographic factors such as age, education level, and faculty. Younger students, especially those in lower academic years, were more likely to accept the vaccine, supporting previous research suggesting that early interventions with vaccination education can be particularly effective. In contrast, the study found no significant association between marital status and vaccine acceptance, contrary to studies such as those by Hollins et al. [29] and D'Errico et al. [28], which reported more positive attitudes among married students.

Nationality also played a key role, with non-Saudi students showing higher vaccine acceptance compared to their Saudi counterparts. This discrepancy may be attributed to cultural or socio-economic factors, as non-Saudi students may have greater exposure to global health initiatives and better access to healthcare resources. This is consistent with findings from studies on vaccination rates in neighboring Middle Eastern countries, such as Alsous et al. [30], which showed varying levels of vaccine

acceptance influenced by regional health policies and cultural attitudes.

Lastly, the study's results emphasize the need for public health efforts to focus on improving awareness, addressing misconceptions, and overcoming barriers to vaccine uptake. Targeted interventions, especially among medical and non-Saudi student populations, could enhance the overall effectiveness of HPV vaccination programs. Educational campaigns should aim to dispel myths about the vaccine's safety and efficacy while highlighting its role in cancer prevention. Moreover, more emphasis should be placed on providing information to students' families, as they play a crucial role in influencing vaccine decisions [8, 16, 31].

In conclusion, this study underscores the need for comprehensive, culturally sensitive educational interventions to address knowledge gaps and barriers to HPV vaccination among university students. It emphasizes the importance of improving awareness and attitudes toward HPV and its vaccine, particularly among older students, those at higher academic levels, and students from diverse cultural backgrounds. By targeting these groups and addressing the identified barriers, public health campaigns can play a vital role in increasing HPV vaccination rates and reducing the prevalence of HPV-related cancers in the future.

### 5.1. Research Implications and Recommendations

The findings from this study provide valuable insights into the awareness, attitudes, and acceptance of the HPV vaccine among female university students in Saudi Arabia. These insights underscore critical gaps in knowledge and vaccine uptake, offering opportunities to refine public health strategies aimed at improving vaccination rates [5, 6].

A major implication of this study is the necessity for comprehensive public health campaigns targeting university students [32]. These campaigns should focus on providing accurate, accessible, and culturally sensitive information about HPV and its vaccine. Specifically, educational programs should address the knowledge gaps, particularly among students in the later years of their studies, who exhibit lower levels of awareness [30]. Tailored educational interventions, especially for students in non-medical faculties, could help increase vaccine acceptance and bridge the gap in HPV understanding between medical and non-medical students. Integrating HPV education into university curricula, particularly in health-related disciplines, would also ensure consistent, thorough information about the risks of HPV and the benefits of vaccination [16, 27].

In addition to education, addressing barriers to vaccine uptake is crucial. Many students identified a lack of information as a major obstacle to vaccination. Future efforts should not only enhance awareness but also improve communication with students' families, who often play a significant role in healthcare decisions. Engaging families through educational campaigns and providing information on the importance of the vaccine could create a more supportive environment for students to pursue vaccination [20, 23, 25]. Furthermore, logistical and financial barriers should be addressed by offering free or subsidized vaccines on university campuses to make the process as accessible as possible. Peer-led education initiatives, where students share factual information about HPV and vaccination, could also effectively increase acceptance and foster positive attitudes toward the vaccine [4, 10, 16].

Cultural and socioeconomic factors also play a crucial role in shaping vaccine perceptions. This study found significant differences in vaccine acceptance between Saudi and non-Saudi students, highlighting the influence of cultural factors [31, 33]. Future research should explore how cultural attitudes affect vaccine uptake and how educational materials can be tailored to resonate with diverse cultural groups. Socioeconomic status may also influence access to healthcare services and information. Investigating how these factors impact students' vaccination decisions and exploring strategies to address these barriers would be valuable in shaping more inclusive health campaigns [23, 24].

Longitudinal studies would provide further insights into how knowledge and attitudes evolve over time and whether educational efforts lead to sustained changes in vaccination behavior. By tracking students' vaccination uptake and attitudes throughout their university years, researchers can assess the long-term impact of health campaigns and identify areas for improvement. These studies could also evaluate the effectiveness of specific interventions, such as vaccination drives or workshops, in boosting HPV vaccination rates among university students [10, 16, 30, 33].

Integrating HPV vaccination into routine healthcare services on university campuses could significantly improve vaccine uptake. Training healthcare providers at university health centers to offer the vaccine as part of routine care, alongside counseling about its benefits, would help normalize the vaccination process. Establishing vaccination clinics on campuses could further increase accessibility, ensuring that students have convenient opportunities to get vaccinated [4, 6, 25].

The study also revealed demographic differences in vaccine acceptance based on factors such as age, education level, and faculty. This presents an opportunity for further research to explore these differences in more depth and develop targeted interventions that address the specific needs of various student groups [20, 26, 33]. For example, understanding why younger students are more likely to accept the vaccine could inform strategies to boost uptake among older students. The positive attitudes toward vaccination among medical students suggest that interventions tailored to specific faculties could replicate this success across other disciplines [16, 25, 30].

### 5.2. Study Limitations

This study has several limitations that should be considered. The cross-sectional design, capturing data at a single point in time, limits the ability to establish causal relationships between variables like knowledge and HPV vaccine acceptance. Longitudinal studies would provide more insight into how attitudes and behaviors evolve and the long-term effects of educational interventions. Additionally, self-reported data may be subject to biases such as social desirability or recall bias, potentially affecting the accuracy of findings. Future research could include objective measures like vaccine uptake records to validate self-reported data.

The sample, consisting solely of female university students in Saudi Arabia, may limit the generalizability of the findings to other populations, including male students, those from different cultural backgrounds, or individuals outside of the university setting. The study did not explore the specific reasons for vaccine hesitancy or refusal, which could be better understood through qualitative methods like interviews or focus groups. Moreover, while demographic differences such as age, faculty, and nationality were identified, other potential influences like family or socioeconomic factors were not fully examined. Future research should address these gaps to provide a more comprehensive understanding of vaccine acceptance and its influencing factors.

## 6. Conclusions

This study highlights the significant role of knowledge, attitudes, and awareness in influencing HPV vaccine acceptance among female university students in Saudi Arabia. The findings emphasize the need for targeted educational interventions to address knowledge gaps and improve vaccine attitudes, particularly among students exhibiting vaccine hesitancy. Despite a generally high level of awareness about HPV and the vaccine, misconceptions and cultural factors contributed to lower acceptance rates, indicating the need for more culturally sensitive and accessible health education campaigns.

The study also underscores the importance of policies that enhance vaccine accessibility and promote its benefits to reduce barriers to uptake. It suggests that universities and educational institutions can play a crucial role in improving public health outcomes, particularly in preventing HPV-related cancers. Despite limitations such as its cross-sectional design and reliance on self-reported data, the study contributes valuable insights into HPV vaccine acceptance in Saudi Arabia. Future research should explore the long-term impact of educational interventions, the role of family and cultural influences, and vaccine acceptance in other populations to better inform public health strategies.

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