*Article*

# HPV Vaccine Knowledge and Hesitancy among Health College Students at a Saudi University

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**Abstract:** Human papillomavirus (HPV) infection is a widespread sexually transmitted infection linked to various types of cancers. Although vaccination against HPV is available, global HPV vaccination rates remain low. This study aimed to evaluate the awareness and knowledge of the HPV vaccine and to identify predictors associated with vaccine hesitancy among health college students in Saudi Arabia. A cross-sectional survey was distributed to students enrolled in health colleges. The association of vaccine hesitancy with sociodemographic characteristics was examined using logistic regression analysis. The study found that approximately half of the students (49.9%) were aware of the HPV vaccine. Students from the College of Medicine showed the highest level of knowledge. Only a small proportion (5.2%) reported receiving the vaccine. The overall HPV vaccine hesitancy was 59.1% (43.9% for women and 75.9% for men). The most common reasons for vaccine hesitancy was not knowing enough about it. Men were twice as likely as women to believe that they did not need the HPV vaccine. The odds for HPV vaccine hesitancy were greater among men and younger age group compared to women and older age group. In conclusion, the study underscores the importance of awareness campaigns on HPV vaccination, targeting primarily male students.

**Keywords:** HPV vaccine; Vaccine awareness; Vaccine hesitancy

## 1. Introduction

Human papillomavirus (HPV) infection is the most common sexually transmitted infection associated with various types of cancers, including cervical, anal, penile, vaginal, vulvar and oropharyngeal cancers [1]. Almost 100% of cervical cancer cases are caused by HPV infection [2,3]. In Saudi Arabia, cervical cancer ranks as the 8$^{th}$ most common cancer and the 9$^{th}$ leading cause of cancer deaths [4]. A 10-year retrospective study conducted in Saudi Arabia in 2021 showed that 54.2% of cervical cancer cases tested positive for HPV [5]. In 2018, the World Health Organization (WHO) launched a global strategy to eliminate cervical cancer by 2030. With one of its pillars being to ensure that 90% of girls are fully vaccinated with the HPV vaccine by the age of 15 [6].

In 2006, the United States Food and Drug Administration (FDA) approved the first HPV vaccine to protect against HPV infection and related diseases such as genital warts and cervical cancer [7,8]. Since then, several countries have incorporated the HPV vaccine into their national immunization programs [9]. In Saudi Arabia, the vaccine is recommended for girls aged 11 or 12 and can be administrated as early as 9 years old [10]. The vaccine is most effective when given before exposure to the virus [11]. Multiple studies

 doi:10.20944/preprints202306.0346.v1



have demonstrated the high effectiveness of HPV vaccine in preventing HPV infections and significantly reducing the incidence of HPV-related cancers, as well as associated morbidity and mortality [12–14].

Unfortunately, global HPV vaccination coverage and uptake remain low, which hinders the public health impact of the vaccine [15,16]. In Saudi Arabia, several surveys have reported low HPV vaccination uptake. One study found that in 2020, only 2% of Saudi females received the HPV vaccine [17]. Another recent study conducted in the Eastern Province to assess awareness and knowledge of the HPV vaccine among females and males found that only 4% of the participants had received the HPV vaccination [18]. Additionally, a study conducted in Riyadh showed that a high percentage (89%) of Saudi parents had not received the HPV vaccine [19]. Interestingly, a low HPV vaccine uptake (8.7%) was also reported among medical students [20].

Various social, cultural, and economic factors are associated with the observed slow global uptake of the HPV vaccine [21,22]. Vaccine hesitancy has been identified as the main factor contributing to suboptimal vaccine uptake and coverage rates worldwide. The Strategic Advisory Group of Experts (SAGE) on immunization, a group established by the WHO, defines hesitancy as a "*delay in acceptance or refusal of vaccination despite the availability of vaccination services*" [23]. In 2019, the WHO listed vaccine hesitancy as one of the top ten threats to global health [24]. Vaccine hesitancy is a complex phenomenon influenced by factors such as concerns about vaccine safety, misconceptions and cultural and religious beliefs [23]. If not adequately addressed, HPV vaccine hesitancy can have a negative impact on current efforts to control HPV infection, leading to an increased burden of HPV infection and its associated diseases.

Several local studies have provided insight into the knowledge and awareness of HPV infection and vaccination [18,20,25–29]**.** However, there is a limited number of studies that examine the prevalence and determinants of HPV vaccine hesitancy. Understanding vaccine hesitancy is crucial for identifying the factors that influence public attitudes, beliefs, and behaviors regarding the HPV vaccine. This understanding is essential for developing appropriate interventions to achieve high vaccine coverage. Therefore, this study aimed to assess the awareness and knowledge of the HPV vaccine and identify the key determinants of HPV vaccine hesitancy among health college students in Saudi Arabia.

## 2. Materials and Methods

### *2.1. Study Design and Setting*

The present study is a cross-sectional survey targeting students enrolled in health colleges at King Saud University (KSU), Riyadh, Saudi Arabia. Data were collected in December 2022 from both male and female campuses of the following health colleges: College of Medicine, College of Dentistry, College of Pharmacy, College of Applied Medical Sciences, and College of Nursing.

A self -administered 17-item questionnaire was adapted from Farsi et al. [30] and the questions related to HPV vaccine knowledge were formulated and validated by Waller et al [31]. The first part included six questions about sociodemographic characteristics (gender, age, marital status, cumulative grade point average (GPA), smoking status and history of Sexually Transmitted Infections (STIs)) This was followed by a question asking whether or not they had heard of the HPV vaccine. If the participants' answered yes, they were directed to the second part which consisted of seven "True/False/I Don't Know" questions measuring HPV vaccine knowledge. The last part focused on participants' vaccine acceptability, starting with a question about whether they had received the HPV vaccine. If they had not received it, they were asked about their willingness to receive it and the reasons behind their hesitancy.

### *2.2. Data Collection*

 doi:10.20944/preprints202306.0346.v1



The sample size was calculated as 403 using (https://www.qualtrics.com/blog/calculating-sample-size/), with a 95% confidence level and a 5% error rate. Data collectors were recruited from the five health colleges at KSU to distribute the survey link to their classmates. Inclusion criteria were being a male or female undergraduate student at any health college at KSU. Students in the foundation year, internship students and postgraduate students were excluded. The study purpose was clearly explained to the participants, and they were asked to voluntarily fill out the survey after their providing consent.

### *2.3. Ethical Consideration*

This study was approved by the Institutional Review Board of KSU, Riyadh, Saudi Arabia (Ref. No. 22/0843/IRB). All responses were kept anonymous and confidential.

### *2.4. Statistical Analysis*

We calculated frequencies and percentages for categorical variables, while means and standard deviations were measured for continuous variables. We estimated the percentage of awareness and vaccine hesitancy as well as its reasons. For each of the knowledge items, we calculated mean and standard deviation. We compared knowledge scores across gender using independent student t-test. We also compared the knowledge scores across colleges using ANOVA test for which we reported the F-statistics. We estimated the odds for vaccine hesitancy by gender, college, age group, GPA, smoking status, awareness about HPV vaccine using logistic regression analysis, for which we reported the adjusted odds ratios (AOR) and 95% confidence intervals (CI). The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 26 (Armonk, NY, USA) for IBM.

## 3. Results

### *3.1. Student Characteristics*

The highest proportion of students were sampled from the College of Applied Medical Sciences (42.2%). Furthermore, there was unequal sampling of men and women across the colleges, with only 6 men sampled from the College of Nursing, while only 7 women were sampled from the College of Pharmacy (Table 1). The vast majority of the students were single and reported no history of sexually transmitted infection (STI) (Table 1).

### *3.2. Awareness about the HPV Vaccine*

Overall, only 201 students reported ever hearing about the HPV vaccine (49.9%), with 57.1% for women, and 41.9% for men. Among these, the highest proportion of awareness was among students from the College of Medicine (81.2%), while the lowest was among students from the College of Applied Medical Sciences (24.1%) (Figure 1). When comparing awareness between men and women, it was consistently higher among women compared to men. Furthermore, this gender discrepancy was statistically significant among students from the College of Applied Medical Sciences ($X^2$=29.0, df=1, p-value < 0.0001), and those from the College of Dentistry ($X^2$=11.6, df=1, p-value=0.001).

### *3.3. Knowledge about HPV Vaccine*

Students who reported hearing about the vaccine were assessed on their vaccine knowledge. Detailed responses by gender and college are presented in table 2. Overall, the mean percentage of correct responses was 57.8 (SD=24.8). This mean percentage was highest among students from the College of Medicine, both for women (mean=75.9; SD=22.6) and men (mean=65.8; SD=22.0). Furthermore, the mean percentage of correct responses significantly differed by college among the women's group (F=7.5; df=4; p-value < 0.0001), as well as the men's group (F=4.9; df=4; p-value=0.002).

### *3.4. HPV Vaccine Hesitancy and Its Reasons*

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Overall, only 21 students (5.2%) reported receiving the HPV vaccine; with 6.6% among women and 3.7% among men. When asked about their willingness to receive the vaccine, a total of 165 students (40.9%), including 56.1% of women and 24.1% of men expressed their willingness. Thus, the overall HPV vaccine hesitancy in this study was 59.1% with rates of 43.9% for women and 75.9% for men ($X^2$=42.7; df=1; p-value <0.0001). The highest proportion of HPV vaccine hesitancy was among students from the College of Applied Medical Sciences (70.6%) (Figure 2). Furthermore, vaccine hesitancy was significantly higher among men compared to women. Among men, the highest proportion of vaccine hesitancy was observed in the College of Dentistry (90.9%), while among women, it was in the College of Applied Medical Sciences (59.8%).

When asked about the reasons for not being willing to receive the HPV vaccine, the most common reason was not knowing enough about the vaccine (39.7%). Moreover, a significantly greater proportion of men (47.1%) believed thought they did not need the HPV vaccine compared to women (22.4%) (Figure 3).

### *3.4. Predictors of HPV Vaccine Hesitancy*

The odds for of HPV vaccine hesitancy among men was around six-fold that among women (AOR=6.2; 95% CI=3.44, 11.16). Although not statistically significant, compared to the students from the College of Aapplied Mmedical Ssciences, the odds for of vaccine hesitancy were slightly higheras greater among students from the Ccolleges of Ddentistry (AOR=1.2; 95% CI=0.50, 3.14), and Nnursing (AOR=1.2; 0.59, 2.49). Compared to students between 18 and 20 years of age, the odds offor vaccine hesitancy wereas 60% lower among those ageds 21 to 23 years of age (AOR=0.4; 95% CI=0.20, 0.65). Furthermore, awareness about the HPV vaccine was associated with a 50% reduction in the odds for of vaccine hesitancy (AOR=0.5; 95% CI=0.28, 0.83) (Table 3).

Table 1. Descriptive characteristics of students participating in the survey (N=403)

| **Student characteristics** | **College** | | | | |
|---|---|---|---|---|---|
| | **Applied Medical Sciences N=170** | **Dentistry N=37** | **Pharmacy N=57** | **Medicine N=85** | **Nursing N=50** |
| | Count (%) | Count (%) | Count (%) | Count (%) | Count (%) |
| Gender* | | | | | |
| *Woman* | 87 (51.2%) | 26 (70.3%) | 7 (12.3%) | 44 (51.8%) | 48 (88.9%) |
| *Man* | 83 (48.8%) | 11 (29.7%) | 50 (87.7%) | 41 (48.2%) | 6 (11.1%) |
| Age group* | | | | | |
| *18-20 years* | 122 (71.8%) | 2 (5.4%) | 11 (19.3%) | 12 (14.1%) | 27 (50%) |
| *21-23 years* | 42 (24.7%) | 27 (73.0%) | 43 (75.4%) | 67 (78.8%) | 25 (46.3%) |
| *24 years or older* | 6 (3.5%) | 8 (21.6%) | 3 (5.3%) | 6 (7.1%) | 2 (3.7%) |
| Marital status | | | | | |
| *Single* | 168 (98.8%) | 36 (97.3%) | 57 (100%) | 84 (98.8%) | 50 (92.6%) |
| *Married* | 2 (1.2%) | 1 (2.7%) | 0 | 0 | 3 (5.6%) |
| *Divorced* | 0 | 0 | 0 | 1 (1.2%) | 1 (1.9%) |
| GPA* | | | | | |
| *Lower than 4* | 81 (47.6%) | 1 (2.7%) | 10 (17.5%) | 11 (12.9%) | 10 (18.5%) |
| *4 or above* | 89 (52.4%) | 36 (97.3%) | 47 (82.5%) | 74 (87.1%) | 44 (81.5%) |
| Smoking status | | | | | |
| *Smoker* | 24 (14.1%) | 6 (16.2%) | 7 (12.3%) | 12 (14.1%) | 6 (11.1%) |

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| | | | | | |
|---|---|---|---|---|---|
| *Non-smoker* | 146 (85.9%) | 31 (83.8%) | 50 (87.7%) | 73 (85.9%) | 48 (88.9%) |
| History of STI | | | | | |
| *Yes* | 5 (2.9%) | 0 | 0 | 3 (3.5%) | 2 (3.7%) |
| *No* | 165 (97.1%) | 37 (100%) | 57 (100%) | 82 (96.5%) | 52 (96.3%) |

Notes: STI=Sexually Transmitted Infection.*chi-square test was significant at 0.05 (p-value <0.001).

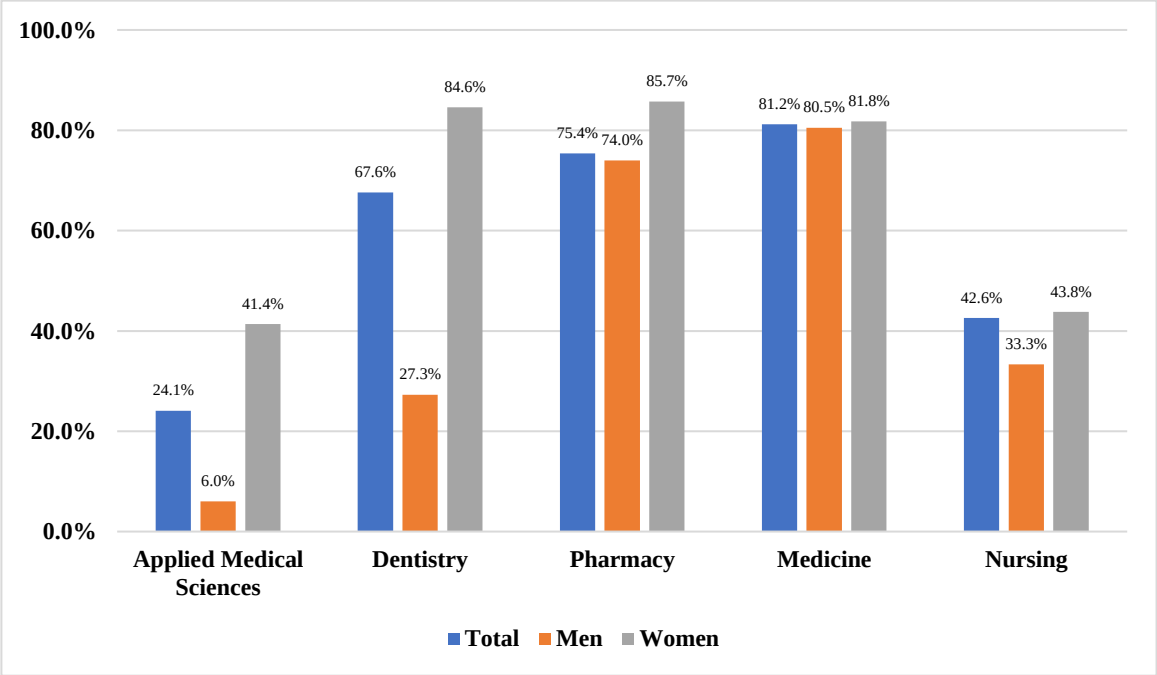


Figure 1. Distribution of students awareness of HPV vaccine, by gender and college

Notes: There was a significant difference in the awareness of men and women regarding the HPV vaccine in the Colleges of Applied Medical Science ($X^2$=29.0, df=1, p-value < 0.0001), and Dentistry ($X^2$=11.6, df=1, p-value=0.001).

Table 2. Assessment of knowledge about HPV vaccine among those who have heard of the vaccine, by gender and college (N=201)

| **Statements** | **Applied Medical Sciences N=41** | | **Dentistry N=25** | | **Pharmacy N=43** | | **Medicine N=69** | | **Nursing N=23** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Women Count(%)** | **Men Count(%)** | **Women Count(%)** | **Men Count(%)** | **Women Count(%)** | **Men Count(%)** | **Women Count(%)** | **Men Count(%)** | **Women Count(%)** | **Men Count(%)** |
| HPV vaccine requires three doses | | | | | | | | | | |
| *True* | 9 (25.0%) | 0 | 6 (27.3%) | 1 (33.3%) | 5 (83.3%) | 12 (32.4%) | 24 (66.7%) | 13 (39.4%) | 13 (61.9%) | 1 (50%) |
| *False* | 3 (13.9%) | 1 (20.0%) | 5 (22.7%) | 1 (33.3%) | 1 (16.7%) | 4 (10.8%) | 4 (11.1%) | 2 (6.1%) | 0 | 0 |
| *Don't know* | 22 (61.1%) | 4 (80.0%) | 11 (50.0%) | 1 (33.3%) | 0 | 21 (58.8%) | 8 (22.2%) | 18 (54.5%) | 8 (38.1%) | 1 (50.0%) |
| HPV vaccine offers protection against all STIs | | | | | | | | | | |

 doi:10.20944/preprints202306.0346.v1



| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *True* | 12 (33.3%) | 1 (20.0%) | 1 (4.5%) | 0 | 0 | 6 (16.2%) | 4 (11.1%) | 2 (6.1%) | 10 (47.6%) | 1 (50.0%) |
| *False* | 10 (27.8%) | 3 (60.0%) | 17 (77.3%) | 1 (33.3%) | 6 (100%) | 22 (59.5%) | 29 (80.6%) | 30 (90.9%) | 9 (42.9%) | 0 |
| *Don't know* | 14 (38.9%) | 1 (20.0%) | 4 (18.2%) | 2 (66.7%) | 0 | 9 (24.3%) | 3 (8.3%) | 1 (3.0%) | 2 (9.5%) | 1 (50.0%) |
| HPV vaccine is most effective if given to people who have never had sex | | | | | | | | | | |
| *True* | 17 (47.2%) | 3 (60.0%) | 7 (31.8%) | 1 (33.3%) | 3 (50.0%) | 10 (27.0%) | 31 (86.1%) | 19 (57.6%) | 12 (57.1%) | 0 |
| *False* | 4 (11.1%) | 0 | 4 (18.2%) | 1 (33.3%) | 1 (16.7%) | 9 (24.3%) | 2 (5.6%) | 3 (9.1%) | 2 (9.5%) | 2 (100%) |
| *Don't know* | 15 (41.7%) | 2 (40.0%) | 11 (50.0%) | 1 (33.3%) | 2 (33.3%) | 18 (48.6%) | 3 (8.3%) | 11 (33.3%) | 7 (33.3%) | 0 |
| A person who has HPV vaccine cannot develop cervical cancer | | | | | | | | | | |
| *True* | 6 (16.7%) | 7 (17.1%) | 7 (31.8%) | 0 | 1 (16.7%) | 9 (24.3%) | 5 (13.9%) | 1 (3.0%) | 7 (33.3%) | 1 (50.0%) |
| *False* | 8 (22.2%) | 9 (22.0%) | 9 (40.9%) | 2 (66.7%) | 4 (66.7%) | 16 (43.2%) | 25 (69.4%) | 26 (78.8%) | 8 (38.1%) | 0 |
| *Don't know* | 22 (61.1%) | 25 (61.0%) | 6 (27.3%) | 1 (33.3%) | 1 (16.7%) | 12 (32.4%) | 6 (16.7%) | 6 (18.2%) | 6 (28.6%) | 1 (50.0%) |
| HPV vaccine offers protection against most cervical cancers | | | | | | | | | | |
| *True* | 17 (47.2%) | 3 (60.0%) | 13 (59.1%) | 1 (33.3%) | 3 (50.0%) | 14 (37.8%) | 26 (72.2%) | 23 (69.7%) | 14 (66.7%) | 2 (100%) |
| *False* | 3 (8.3%) | 0 | 1 (4.5%) | 2 (66.7%) | 1 (16.7%) | 7 (18.9%) | 2 (5.6%) | 6 (18.2%) | 1 (4.8%) | 0 |
| *Don't know* | 16 (44.4%) | 2 (40.0%) | 8 (36.4%) | 0 | 2 (33.3%) | 16 (43.2%) | 8 (22.2%) | 4 (12.1%) | 6 (28.6%) | 0 |
| One of the HPV vaccines offers protection against genital warts | | | | | | | | | | |
| *True* | 14 (38.9%) | 1 (20.0%) | 12 (54.5%) | 1 (33.3%) | 5 (83.3%) | 20 (46.5%) | 27 (75.0%) | 17 (51.55) | 9 (42.9%) | 2 (100%) |
| *False* | 3 (8.3%) | 0 | 2 (9.1%) | 0 | 1 (16.7%) | 5 (11.6%) | 1 (2.8%) | 1 (3.0%) | 2 (9.5%) | 0 |
| *Don't know* | 19 (52.8%) | 4 (80.0%) | 8 (36.4%) | 2 (66.7%) | 0 | 18 (41.9%) | 8 (22.2%) | 15 (45.5%) | 10 (47.6%) | 0 |
| Girls who have had HPV vaccine do not need to get regular pap smears when they are older | | | | | | | | | | |
| *True* | 1 (2.8%) | 0 | 2 (9.1%) | 0 | 0 | 5 (13.5%) | 1 (2.8%) | 1 (3.0%) | 7 (33.3%) | 1 (50.0%) |
| *False* | 17 (47.2%) | 1 (20.0%) | 14 (63.6%) | 0 | 4 (66.7%) | 11 (29.7%) | 24 (66.7%) | 24 (72.7%) | 10 (34.9%) | 0 |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Don't know* | 18 (50.0%) | 4 (80.0%) | 6 (27.3%) | 3 (100%) | 2 (33.3%) | 21 (56.8%) | 11 (30.6%) | 8 (24.2%) | 4 (19.0%) | 1 (50.0%) |
| ***Mean % of correct response (SD)*** | 46.9 (23.9) | 42.8 (23.6) | 55.7 (20.1) | 33.3 (21.8) | 71.4 (31.3) | 46.1 (20.4) | 75.9 (22.6) | 65.8 (22.0) | 53.6 (21.2) | 35.7 (10.1) |

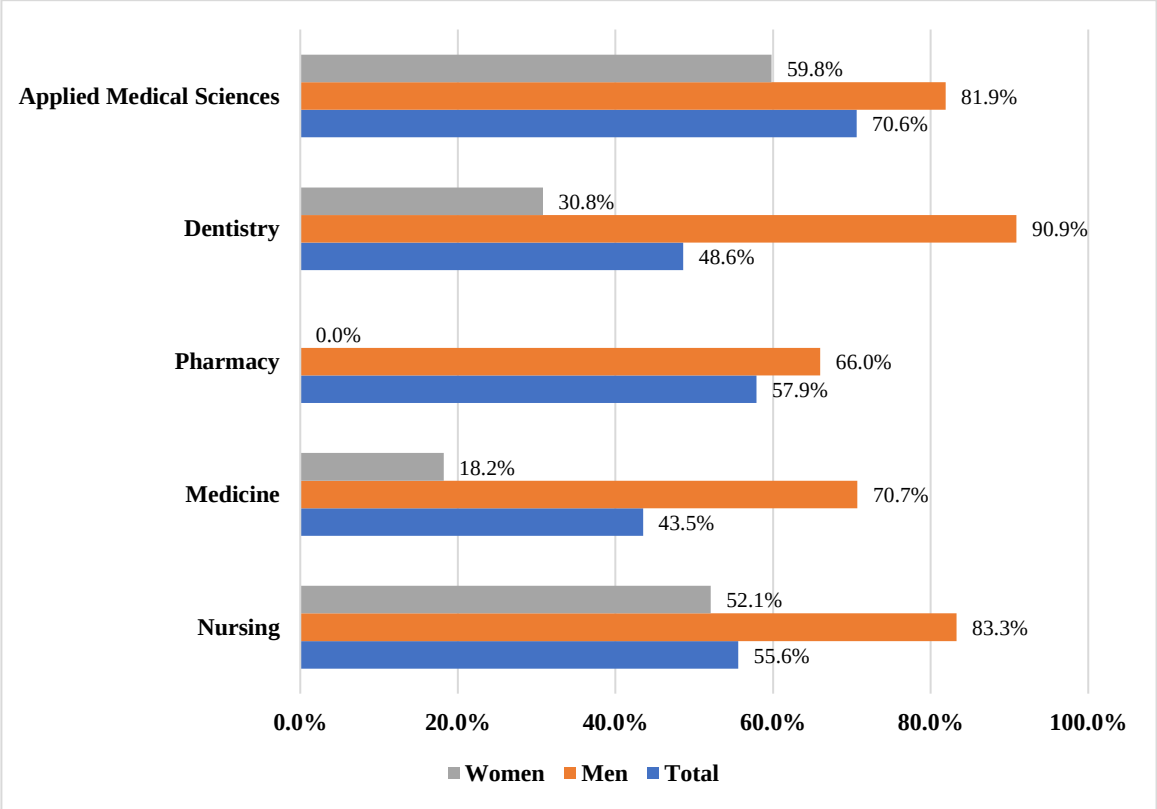


**Figure 2.** HPV vaccine hesitancy by gender and college.

Notes: Significant differences in vaccine hesitancy were observed between men and women within the same college (p-values < 0.01), except for the College of Nursing ($X^2$=2.1; df=1; p-value=0.21). When comparing vaccine hesitancy across colleges within the same gender, significant differences were found in the women's group ($X^2$=29.3; df=4; p-value <0.0001), but not in the men's group ($X^2$=6.5; df=4; p-value=0.16).

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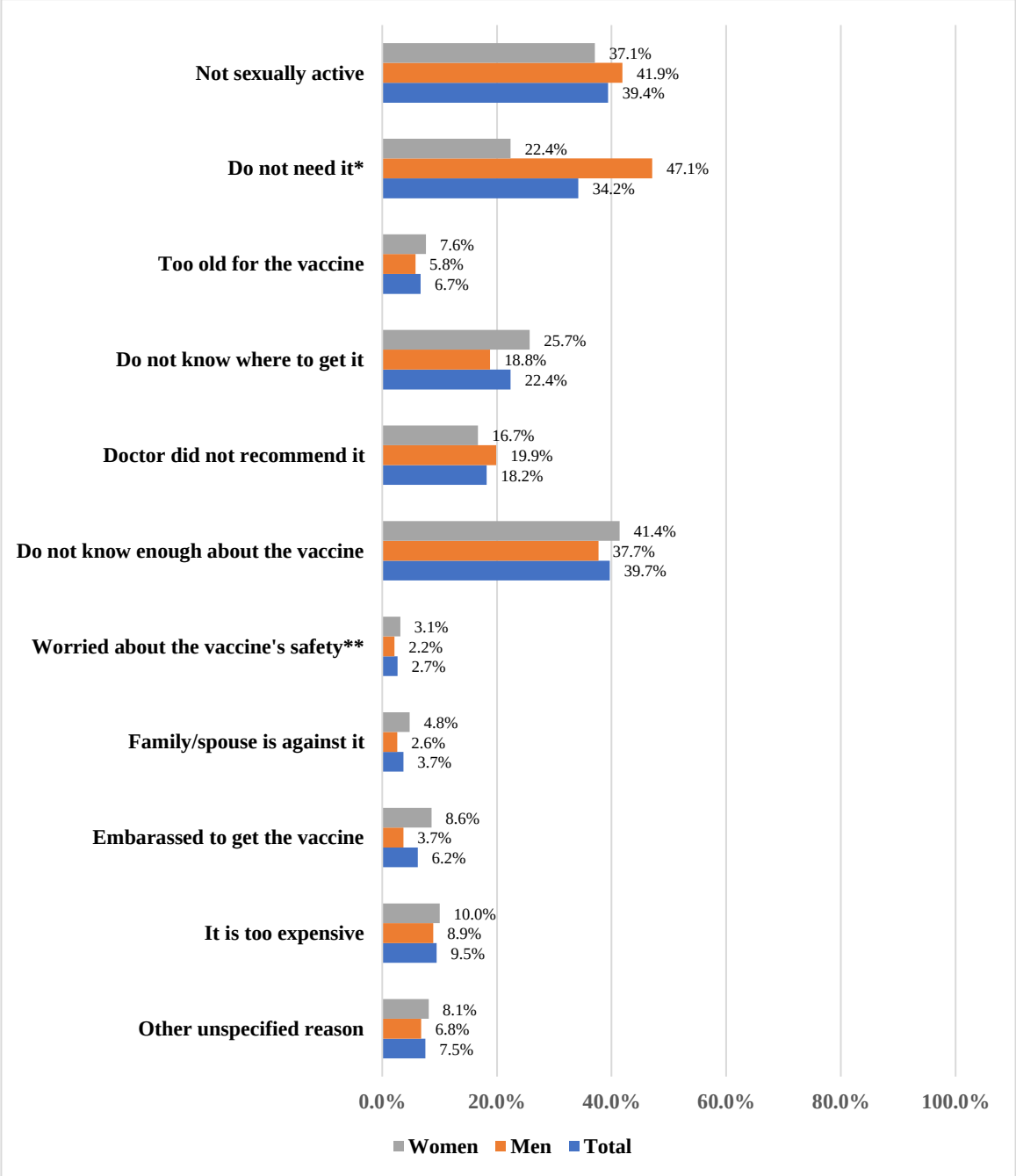


**Figure 3.** Reasons for hesitancy towards HPV vaccine by gender.

* $X^2$=27.2; df=1; p-value < 0.0001
**$X^2$=5.1; df=1; p-value=0.024

**Table 3.** Assessing the odds for vaccine hesitancy by student characteristics (N=403).

| Student characteristics | Vaccine Hesitancy | |
|---|---|---|
| | AOR | 95% CI |
| Gender | | |
| *Woman* | Ref | |
| *Man* | **6.2** | **3.44, 11.16** |
| | | |
| College | | |
| *Applied medical sciences* | Ref | |

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| | | |
|---|---|---|
| *Dentistry* | 1.2 | 0.50, 3.14 |
| *Pharmacy* | 0.5 | 0.24, 1.28 |
| *Medicine* | 0.6 | 0.32, 1.35 |
| *Nursing* | 1.2 | 0.59, 2.49 |
| Age group | | |
| *18-20 years* | Ref | |
| *21-23 years* | **0.4** | **0.20, 0.65** |
| *24 years or older* | 0.4 | 0.15, 1.17 |
| GPA | | |
| *Lower than 4* | Ref | |
| *4 or above* | 0.9 | 0.51, 1.67 |
| Smoking status | | |
| *Smoker* | 0.7 | 0.35, 1.44 |
| *Non-smoker* | Ref | |
| Awareness about HPV vaccine | | |
| *Yes* | **0.5** | **0.28, 0.83** |
| *No* | Ref | |

Notes: AOR=adjusted odds ratio. CI=confidence interval.

## 4. Discussion

This study aimed to examine the current level of HPV vaccine awareness and hesitancy among health college students in the central region of Saudi Arabia. The findings of this study identified trends that point towards an insufficient understanding and acceptance of the HPV vaccine among the students.

Regarding the awareness of the HPV vaccine, approximately half of the students (49.9%) reported having heard of it. On this note, other studies conducted among Saudi college students reported HPV vaccine awareness rates ranging from 30.8% to 42% [18,20,26]. When comparing awareness levels across health colleges, students from the College of Applied Medical Sciences exhibited the lowest level of awareness. Additionally, female students demonstrated higher awareness of the HPV vaccine compared to male students in all colleges. This observation aligns with previous global [32–34] and national studies [35,36] that have reported a gender disparity favoring females in HPV vaccine awareness. Notably, this gender discrepancy was particularly evident among students from the College of Applied Medical Sciences and the College of Dentistry. It is important to acknowledge that there was an imbalance in the sampling of men and women from the different colleges, and this imbalance should be considered when interpreting the results of this study.

Knowledge assessment of participants who were familiar with the HPV vaccine revealed that female students at all colleges exhibited higher levels of knowledge compared to male students. This finding is consistent with previous studies conducted both nationally [35] and internationally [37]. Furthermore, significant differences in knowledge were observed among students attending different colleges when both genders were combined. The College of Medicine displayed the highest mean percentage of correct responses from both male and female students. Similar trends of medical students demonstrating greater knowledge about the HPV vaccine have been reported in recent studies conducted on Saudi students [38,39]. Therefore, students from the College of Medicine may be receiving more comprehensive education about HPV vaccination than students from other health

 doi:10.20944/preprints202306.0346.v1



colleges. This warrants the need for enhancing HPV vaccine education at all health colleges to ensure that students are consistently well-informed.

Our study uncovered low HPV vaccination uptake among health college students at KSU. With only 5.2% of participants indicating that they had received the HPV vaccine, primarily among are females. This rate aligns with a similar study conducted by Bencherit et al. on Algerian college students, which reported a vaccination rate of 5.8% [40]. Among all colleges, 59.1% of students expressed hesitancy towards the HPV vaccine, with male students consistently exhibiting higher level of vaccine hesitancy compared to females. Interestingly, a recent study on medical students in China showed contrasting results, with female students displaying a higher hesitancy rate than male students [41]. Additionally, a study conducted on female university students in Kuwait reported a much lower vaccine hesitancy rate (~20%) compared to our findings [42]. When comparing hesitancy rates among male student from different colleges, no significant variation in vaccine acceptance was observed. However, among female students differences in hesitancy were apparent between colleges, with women from the College of Applied Medical Sciences exhibiting the highest level of hesitation. This suggests that factors other than gender may influence vaccine acceptance among students in this particular college.

We also identified various reasons for HPV vaccination hesitancy among participants. The most common reasons cited by both male and female participants were being sexually inactive (39.4%) and lacking sufficient knowledge about the vaccine (39.7%). Additionally, approximately 22.4% of participants (both men and women) mentioned not knowing where to access the HPV vaccine. A gender-based comparison of vaccine hesitancy reasons revealed that men (47.1%) were twice as likely as women (22.4%) to believe that they did not need the HPV vaccine, indicating a potential lack of awareness among men regarding the risks associated with not receiving the vaccine. On the other hand, women were significantly more concerned about the safety of the HPV vaccine compared to men. These reasons for vaccine hesitancy align with those reported in previous studies. For example, Zhou et al.'s study on college students in China identified factors such as lack of convenience (not knowing where to get the vaccine, distant vaccination sites, and lack of reliable information) concerns about vaccine safety as deterrents to seeking HPV vaccination [41]. Studies conducted in the USA and Kuwait also revealed concerns about vaccine safety as a contributing factor to vaccine hesitancy among college students [42,43]. The survey conducted by Bencherit et al. among Algerian students demonstrated that approximately 30% of students believed they did not need the HPV vaccine [40].

Several factors were identified as potential predictors of HPV vaccine hesitancy in our study. Male gender increased the odds of vaccine hesitancy by six-fold. In addition to gender, age was also found to be a predictor of vaccine acceptance. Students between the ages of 22 and 23 had lower odds of vaccine hesitancy compared to those in the 18–20-year age group, suggesting that older individuals may be more willing to receive the HPV vaccine. The association of older age with an increased likelihood of HPV vaccine acceptance has been previously reported in studies by Alhusayn et al. on Saudi parents' attitudes towards the vaccine [19] and by Alsanafi et al. among college students in a Kuwaiti university[42]. Furthermore, our analysis revealed that awareness of the HPV vaccine was associated with 50% reduction in the odds of vaccine hesitancy, indicating that educating students about the HPV vaccine may be an effective strategy for promoting vaccine uptake.

This study has some limitations that should be acknowledged. The absence of data on HPV infection status among students introduces a confounding factor that may affect the results of the study. A second concern is the unequal sampling across participating colleges, which raises the possibility of selection bias. Thirdly, the current study involves students from one academic institution in Saudi Arabia's central region. For a more comprehensive understanding of HPV vaccine awareness and hesitancy among Saudi students, similar studies should be conducted at other universities in multiple Saudi Arabian regions.

In conclusion, the findings of this study highlight the importance of awareness campaigns on HPV vaccination, particularly targeting male students and those enrolled in colleges with low levels of HPV vaccine awareness and knowledge. Additionally, exploring the impact of increasing vaccination locations and disseminating information about the safety and effectiveness of the HPV vaccine may contribute to higher vaccination rates among college students.

**Author Contributions:** Conceptualization, E.A., D.D. and L.A.; methodology, E.A. and H.H.A.; software, R.D.; validation, E.A. and H.H.A.; formal analysis, R.D.; investigation, E.A.; resources, E.A. and L.A. data curation, H.H.A.; writing—original draft preparation, D.D., R.D., S.A. and E.A.; writing—review and editing, L.F.; visualization, R.D.; supervision, E.A.; project administration, E.A.; funding acquisition, E.A. All authors have read and agreed to the published version of the manuscript." Please turn to the CRediT taxonomy for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

**Funding:** This research was financially supported by The Deputyship for Research and Innovation, Ministry of Education in Saudi Arabia for funding this research work though the project no. IFKSUOR3-113-1.

**Institutional Review Board Statement:** The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of King Saud University (Ref. No. 22/0843/IRB).

**Informed Consent Statement:** Participation in the online questionnaire-based survey implied consent for the study.

**Data Availability Statement:** The data that support the findings of this study are available on request from the corresponding author E.A.

**Acknowledgments:** The authors extend their appreciation to the Deputyship for Research and Innovation, "Ministry of Education" in Saudi Arabia for funding this research (IFKSUOR3-113-1).

**Conflicts of Interest:** The authors declare no conflict of interest.

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