ISSN 3007-3170(O)
ISSN :3007-3162(P)
January-March 2025
Social Sciences & Humanity Research Review

Understanding Gender Gaps In Hpv Knowledge And Vaccine Acceptability Among University Students In Islamabad: Examining Gender-Based Disparities

Sadaf Akhtar Wazir[1], Samina Naeem Khalid[2], Junaid Mahmood[3], Mir Aqeel Tariq[4]

[1]MBBS(FUMC),MPhil(KMU),MSPH(HSA)
[2]Professor and HOD (MNCH) HSA
[3]MBBS (KMU)
[4](BSPH) HSA

ARTICLE INFO

Keywords: Human Papillomavirus (HPV),HPV Vaccine, Cervical Cancer,Vaccine Awareness, Sexually Transmitted Infections (STIs), HPV Transmission, Barriers to Vaccination, HPV Knowledge.

Corresponding Author:
Sadaf Akhtar Wazir,
MBBS(FUMC), MPhil(KMU), MSPH(HSA)

ABSTRACT

Human Papilloma Virus (HPV) is a highly contagious sexually transmitted infection linked to various cancers, including cervical, penile, and oropharyngeal cancers. Although effective vaccines like Gardasil and Cervarix exist, their awareness and use in Pakistan remain low due to cultural stigma, limited education, and access issues. This study explores knowledge, attitudes, and perceptions toward HPV and its vaccine among university students in Islamabad, aiming to guide future awareness strategies.

A cross-sectional quantitative study was conducted at Health Services Academy Islamabad using stratified random sampling. A total of 300 students (60% BS, 30% MSPH, 10% PhD) participated. Data was collected via a structured questionnaire ,out of 300 students, 70.7% had heard of HPV, with 71% recognizing sexual transmission. However, only 10–16% identified other transmission routes. Female MSPH students showed the highest awareness of HPV-related cervical cancer. Treatment knowledge was low among BS students. Vaccine awareness was moderate, with barriers including religious beliefs (20%) and cultural misconceptions (17%).Despite moderate HPV awareness, significant gaps remain. Educational interventions are essential to address misconceptions and improve vaccine uptake.

INTRODUCTION

Human Papilloma Virus are small particles about 60 nanometers in diameter. HPV genome encodes two structural proteins (L1 and L2) and a number of early proteins (E1-E7). The L1 structural protein self assembles into virus like particles, forming basis of Current HPV vaccine (Kirnbauer et al., 1993). The name human papilloma

virus is used for the papillomaviruses (PVs) found in humans. The classification of PVs is based on the analysis of differences and similarities in the viral DNA sequence. Broadly Human papilloma virus is divided into 'low Risk Human Papilloma Virus' which causes benign skin lesions like skin warts etc. Examples of low-risk Human papilloma virus include HPV6, 11, 40, 44, 54, 61, 62, 74, 81, 84, 89 etc. The second group is 'High Risk Human Papilloma Virus' which causes cancers like cervical cancers, penile cancers, and other muco-cutaneous cancers. Examples of high-risk human papilloma virus are HPV 16,18,56 (Mlynarczyk-Bonikowska & Rudnicka, 2024).

Human papilloma virus is associated with cancers of different parts of human body like cancers of cervix, penis, vulva, vagina, anus, oropharynx and conjunctival cancers (Forman et al., 2012). Cervical cancer is a preventable form of cancer and is responsible for high mortality and morbidity among women of reproductive age. Highest prevalence of cervical HPV occur in women in sub-Saharan Africa (24%), followed by Latin America and Caribbean (16%), South-East Asia (14%) and eastern Europe (14%), (World Health Organization, 2024).

Globally, it is estimated that 620,000 new cancer cases in women and 70 000 new cancer cases in men were caused by HPV in 2019 (Bruni et al., 2010). Cervical cancer is the fourth leading cause of cancer and cancer deaths in women in 2022, with some 660 000 new cases and around 350 000 deaths worldwide. Cervical cancers account for over 90% of HPV-related cancers in women (Ferlay et al., 2024).

Male population is also affected by infection by Human papilloma virus. A study conducted in 2023 shows that one in three men over age of 15 are infected by at least one genital HPV type and one in five are affected by High-risk human papilloma virus. A systemic review and meta- analysis investigated the prevalence of Human papilloma virus infection in general male population based on various studies conducted between 1995 -2022. The global prevalence was 31 % for any type of HPV and 21 %For high risk HPV. These estimates signify the importance of including and engaging men in control of Human papilloma virus infection and related diseases and reduce HPV related burden of disease in both male and female population, as male can be silent carrier of this deadly virus (WHO update.2023).

Vaccines are considered to be one of greatest health care success stories of 20th century, which resulted in massive reduction in mortality and morbidity from variety of infectious agents. The discovery of fact that Human papilloma virus is associated with development of various benign and malignant conditions is considered to be one of the most significant event in global health care .After the discovery of fact that HPV is associated with many type of cancers scientists started to found cure of them.(Akhatova et al., 2022). In 1919 scientists discovered first HPV vaccine that mimicked body immune response to Human papilloma virus. In 2006 HPV vaccine called Gardasil was approved by US food and drug administration authority for young girls. Dr. Harald Zur Hausen won the Nobel Prize on his groundbreaking discovery that certain strains of HPV (namely HPV 16 and 18) could eventually cause cervical cancer, which led to the development of the HPV vaccine. In 2009, Gardasil was approved for boys too by the US food and drug administration company. (St. Jude Children's Research Hospital, 2025).

Currently two types of vaccines one quadrivalent and other bivalent have been introduced for use in over 100 countries since 2006 (Markowitz et al ,2014; Burney & Zafar,2023). Considering the world public health burden of cervical cancer caused by HPV ,World health assembly (WHA.73.2) adopted the Global strategy to accelerate

the elimination of cervical cancer as a public health problem with the following targets(WHO update,2023).

1.90% of girls fully vaccinated with HPV vaccine by age 15;

2.70% of women are screened with a high-performance test by 35, and again by 45 years of age; and

3.90% of women identified with cervical disease receive treatment (90% of women with pre-cancer treated; 90% of women with invasive cancer managed).

The current vaccine coverage rate globally has increased from 20 to 27 % from 2022 to 2023.This is strongly associated with introduction of HPV vaccine by Gavi in Gavi-supported countries like Bangladesh, Nigeria etc. HPV vaccine coverage is below 90% target as set by WHO to combat cervical cancer. Only 56% of adolescent girls in high income countries and 23 % in low- and middle-income countries have full dose HPV vaccine. UNICEF 's digital platform for young people did a poll of over 400000 users and showed that 75% users were unsure or unaware of what is HPV. All users were later given information about Human papilloma virus and its vaccine.52% respondents elucidated that they want to get vaccinated, but 34% said that lack of availability is hindering them and 41 % said its financial constrains that make it difficult for them to get vaccinated (UNICEF, 2024).

Several factors have been identified which are major culprits towards low HPV coverage rates in middle income countries and low-income countries. The foremost important factors in this aspect is social, economic, cultural and moral factors of societies. (Duncan et al., 2021). To begin with cost associated with delivery of of HPV vaccine is major hurdle. Top three challenges as indicated by healthcare professionals are, inadequate transportation of staff and supplies, insufficient funding, and lack of professional team to accomplish immunization .To solve this problem Gavi, the Vaccine Alliance, has suggested a model that urges vaccine manufacturers to implement a tiered pricing policy, where countries with low income are charged less than countries with high for same product (Schuind et al., 2024).

Another barrier is cultural norms and rumors about HPV and its vaccine. In many cultures, it is a sin to talk about sexually transmitted diseases .Youth is less sensitized about sexually transmitted disease like Human papilloma virus .There are many taboos associated with HPV vaccine too like they cause increase mortality and morbidity among those girls who are vaccinated ,HPV vaccine is related to un-fertility in girls etc (Chowdhury et al., 2022). Securing political will and adequate finances are interrelated for success of HPV vaccine coverage. If political will to eliminate Human papilloma virus is high in specific society more importance and budget will be allocated to HPV vaccine resulting in high vaccine coverage (Ebrahimi et al., 2023).

WHO recommends that HPV vaccination should be incorporated in national immunization schedules for reaching preliminary target of individuals of girls 9 - 14 and secondary target of individuals of women over15year of age (World Health Organization, 2017). In 2020, 56 low middle-income countries initiated national HPV vaccine schedules which were approved by Gavi (Ebrahimi et al., 2023).

Since Pakistan stands somewhere between middle income countries to low income countries the statistics of HPV and STD is not much different from rest of countries. The annual incidence of Human papilloma virus related diseases is 23.1%. The highest prevalence rate for HPV was observed for cervical cancer about 80%, oral cancers about 40% (Minhas, Sajjad, Mushtaq Chaudhry, & Rehman, 2022). Penile cancer associated with HPV is also on rise in Pakistan. Vaginal and vulvar cancer

incidence in Pakistan is quite low but 80-90 percent of these cancers are also attributed to Human papilloma virus (Ferlay et al., 2020).

HPV vaccine coverage rate in Pakistan is quite low as low as 2% in 2023.This is slightly higher from 2022 which was 1% (UNICEF, 2023). Major barriers identified is same as identified world wide which are lack of awareness about Huan papilloma virus and its vaccine, financial constrain, lack of availability, cultural barriers etc. Some studies have been conducted in Pakistan to know the exact barriers that leads to HPV vaccine coverage rates in Pakistan. One such study conducted in 2024 about human papilloma virus vaccine acceptance and knowledge in Pakistan showed that 297 out of 313(65%) participants have heard somewhere about Human papilloma virus,256 (50%) participants documented that they knew about HPV as cause of various cancers.320 participants were willing to get vaccinated but due to high cost and unavailability of vaccine they were not able to get vaccinated (Shamsi et al., 2024).

A similar study conducted among Pakistani university students in Karachi showed that main source of their information about HPV is from curriculum (38%). About 21 % claimed that their health care providers gave them information about HPV and its vaccine.36% of participants had no prior knowledge of HPV vaccine.56% participants were willing to get HPV vaccine and 23 % gave variety of reasons for their unwillingness. Major barriers identified in this study were being sexually inactive, no prior knowledge about HPV vaccine, religious barriers and some participants were worried about cost of vaccine (Ghayas et al., 2018).

This study aims to explore these disparities in Islamabad's university population, providing evidence to inform policies and programs that encourage equitable awareness and proactive engagement in HPV prevention efforts. Gender disparities in perception and awareness of Human papilloma virus and its vaccine is an essential public health challenge specially in low to middle income countries like Pakistan. Female students exhibit a higher level of awareness because of more exposure to reproductive health information, misconceptions, cultural stigma, and financial barriers persist, limiting their understanding and vaccine uptake. Male students, however, demonstrate significantly lower awareness, often perceiving HPV as a female-specific issue, which further reduces their engagement in preventive efforts. These disparities are exacerbated by a lack of comprehensive health education, limited access to reliable information, and sociocultural taboos surrounding discussions of sexual health. This study will try to address these disparities in detail in selected population.

In Pakistan, cervical cancer ranks as the third most common cancer among women of all ages and the second most frequent among those aged 15 to 44 years. Annually, approximately 5,008 new cases of cervical cancer are diagnosed in the country, leading to about 3,197 deaths. Despite the substantial burden of HPV-related diseases, awareness and understanding of HPV and its vaccine remain limited in Pakistan. The lack of a nationwide HPV vaccination program exacerbates this issue, leaving a large segment of the population vulnerable to HPV infections and their consequences. University students represent a critical demographic for public health interventions, as they are at an age where sexual activity often begins, increasing the risk of HPV transmission. Assessing their awareness and perceptions of HPV and its vaccine is essential for developing targeted educational programs. Moreover, understanding gender-based disparities in knowledge and attitudes can inform strategies to address specific misconceptions and barriers faced by male and female students.

METHODS

The study used quantitative approach to inquire level of knowledge and basic difference in perception and awareness in both genders of university students about HPV and its vaccine. Study wiould follow a structured sequential approach to ensure comprehensive evaluation of quantitative component properly.

Step 1: Questionnaire formulation

As a first step towards methodology, a detailed questionnaire was formulated after thorough literature review consisting of four sections , including demographic information, knowledge about Human papilloma virus infection, knowledge about HPV vaccine and attitude towards HPV vaccination.

Step 2: Quantitative analysis

For quantitative analysis SPSS software was used in which demographic characteristics, knowledge of HPV and HPV vaccine, access to knowledge attitude to vaccination will be expressed as percentages.

This study was conducted among university students of Health Services Academy Islamabad. A structured questionnaire was used to access the knowledge of HPV and its vaccine, with a focus on gender differences.

This institution was selected because it's a public health institution and ready to offer services for research. Both bachelor and master's students are present in this university with gender as well as geographical variation therefore comparison of both gender diversity and ethnicity variation regarding Human papilloma virus and its vaccine can be made.The study took 6 months to be completed.

Stratified Random Sampling for 300 Students was done and for this following procedure was followed.

Step 1: Define the Strata

Since the study aimed to assess awareness among different academic levels, the population was divided into three strata:

BS Students

MSPH Students

PhD Students

Step 2: Determine Sample Allocation

The total sample size is 300 students, and the proportion of students in each stratum should reflect their actual representation in the university population.

BS Students: 60% (180 students)

MSPH Students: 30% (90 students)

PhD Students: 10% (30 students)

Step 3: Select Participants Randomly

In order to select participants randomly, a list of all the courses at undergraduate, post graduate and PhD was obtained. A total of 18 courses at undergraduate level are taught in HAS. As calculated above total of 180 students are to be selected from BS courses, so 10 students per course were selected with gender equality. Similarly, at master's level 90 students were selected with gender equality. At PhD level 30 students with gender equality were selected. Next a list of students from each academic program was obtained and a unique number to each student within their respective stratum was given. Random number generator was used to select participants from each list.

For sample size calculation Cochran Formula or sample size determination formula for proportions was employed

$N=Z^{2.} p. (1-p)/d^2$

N= Required sample size
Z= Z score corresponding to confidence interval which is ideally taken as 95%
p= proportion of population with the characteristic of interest i.e. prevalence of HPV =23% which is equal to 0.23(Minhas, Sajjad, Mushtaq Chaudhry, & Rehman, 2022)
d=Margin of error 5%.
N=272.

Following inclusion criteria was used;

1. University students aged 18-45 years.
2. Currently enrolled in Health services Academy.
3. Male and female students to assess gender disparities.
4. Students who provide informed consent to participate in study.
5. Ability to understand and respond in the language of study.

Similarly following exclusion criteria was used;

1.Students who have already participated in an HPV awareness or vaccination study.
2.Individuals with a medical background who specialize in infectious diseases, as they may have prior knowledge that could skew results.
3.Those unwilling to participate or unable to provide informed consent.
4.International students who may not have experience with Pakistan's healthcare system and HPV vaccine availability.

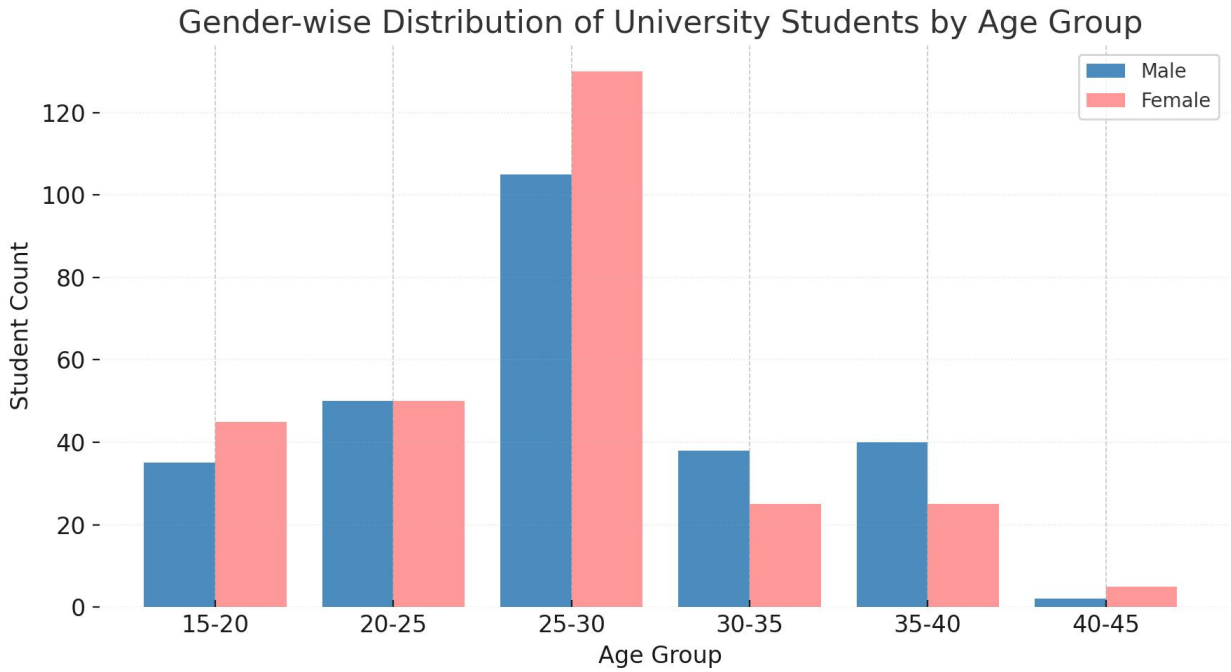
Also following ethical considerations were kept in mind for study;

1.Ethical approval for study will be taken from health services academy review board.
2.All data collected will be treated with confidentiality during and post research.
3.The survey and focused group discussion will on be conducted after written informed consent from participants.
4.Complete informed consent will be taken from participants, in addition to which they will be completely described each and every step of research in detail so that participants are clear about nature of study, methods and purpose of study.
5.Participants will have the full right to withdraw any time during research without any repercussion.
6.It will be tried to give any additional information and further counselling to participants if they need HPV symptoms and treatment.

RESULTS

Demographic results

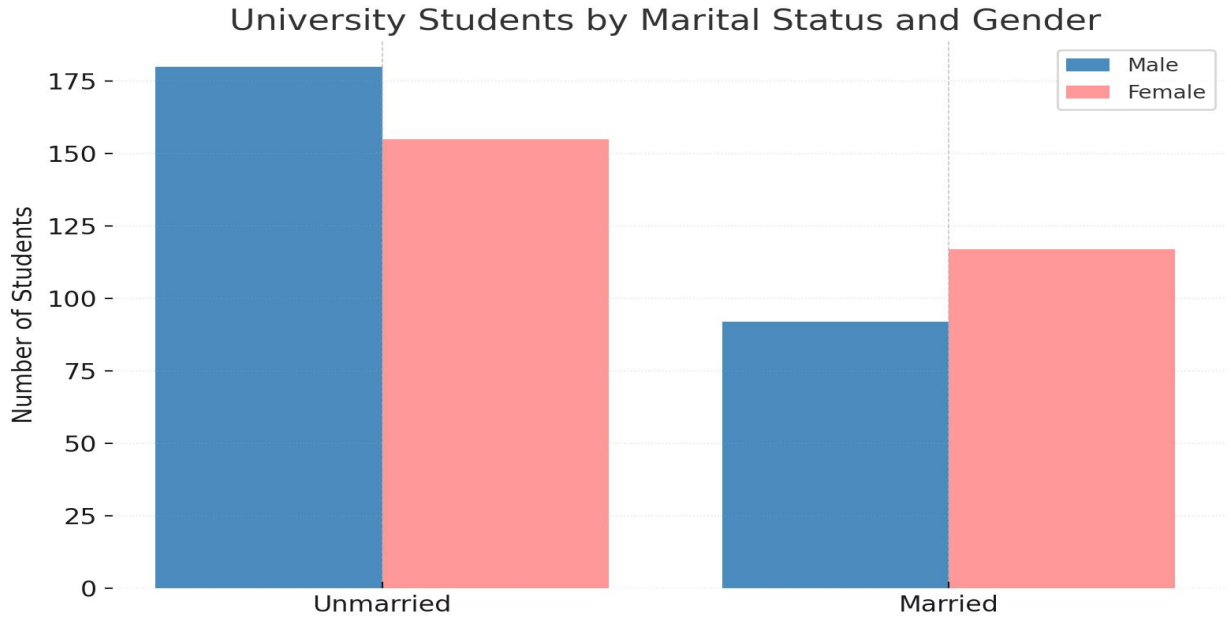
1.Age



Title: Distribution of University Students by Age and Gender

The bar chart illustrates the distribution of university students across various age groups, separated by gender. Six age brackets are considered: 15–20, 20–25, 25–30, 30–35, 35–40, and 40–45 years.In the 15–20 age group, there are 35 male and 45 female students. The number of students is equal in the 20–25 bracket, with 50 males and 50 females. The 25–30 age group shows the highest enrollment, with 105 male and 130 female students. Among older students, participation declines. The 30–35 group includes 38 males and 25 females. In the 35–40 range, 40 males and 25 females are enrolled, while the 40–45 age group shows a sharp drop, with only 2 male and 5 female students.This pattern indicates a higher concentration of students in younger age groups, particularly between 20 and 30 years, with more female representation in most categories

2.Marital status



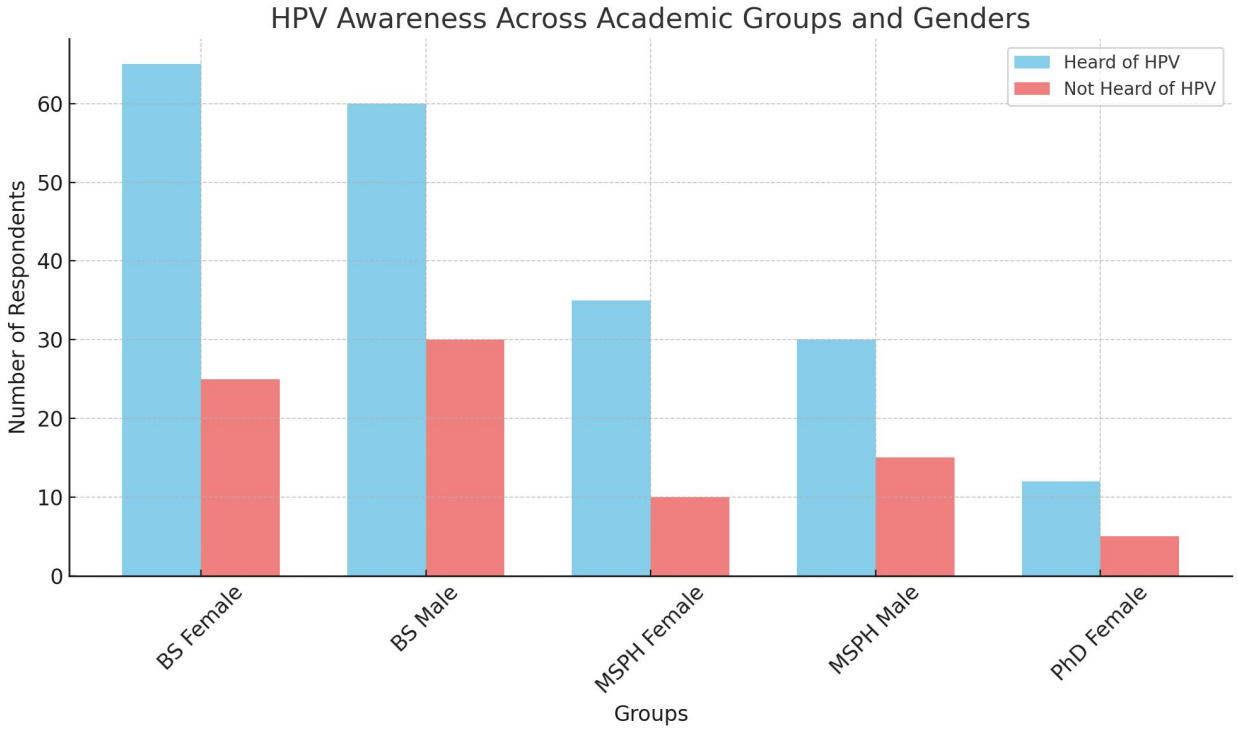
For remaining variables and hypothesis testing chi square test of independence was used using EXCEL programme.The formula employed was ;
Chi square : (Observed - Expected)² / Expected

3. Prior knowledge of HPV.

Educational level wise HPV knowledge

Following table shows the knowledge of participants regarding HPV.

Group	Heard of HPV	Not Heard
BS Female	65	25
BS Male	60	30
MSPH Female	35	10
MSPH Male	30	15
PhD Female	12	5
PhD Male	10	3



Chi-square Test Results
Chi-square statistic (χ^2): 2.22
Degrees of Freedom (df): 4
p-value: 0.695

Explaination

The p-value (0.695) is much greater than the conventional threshold of 0.05. This means:

There is **no statistically significant association** between academic group/gender and awareness of HPV.

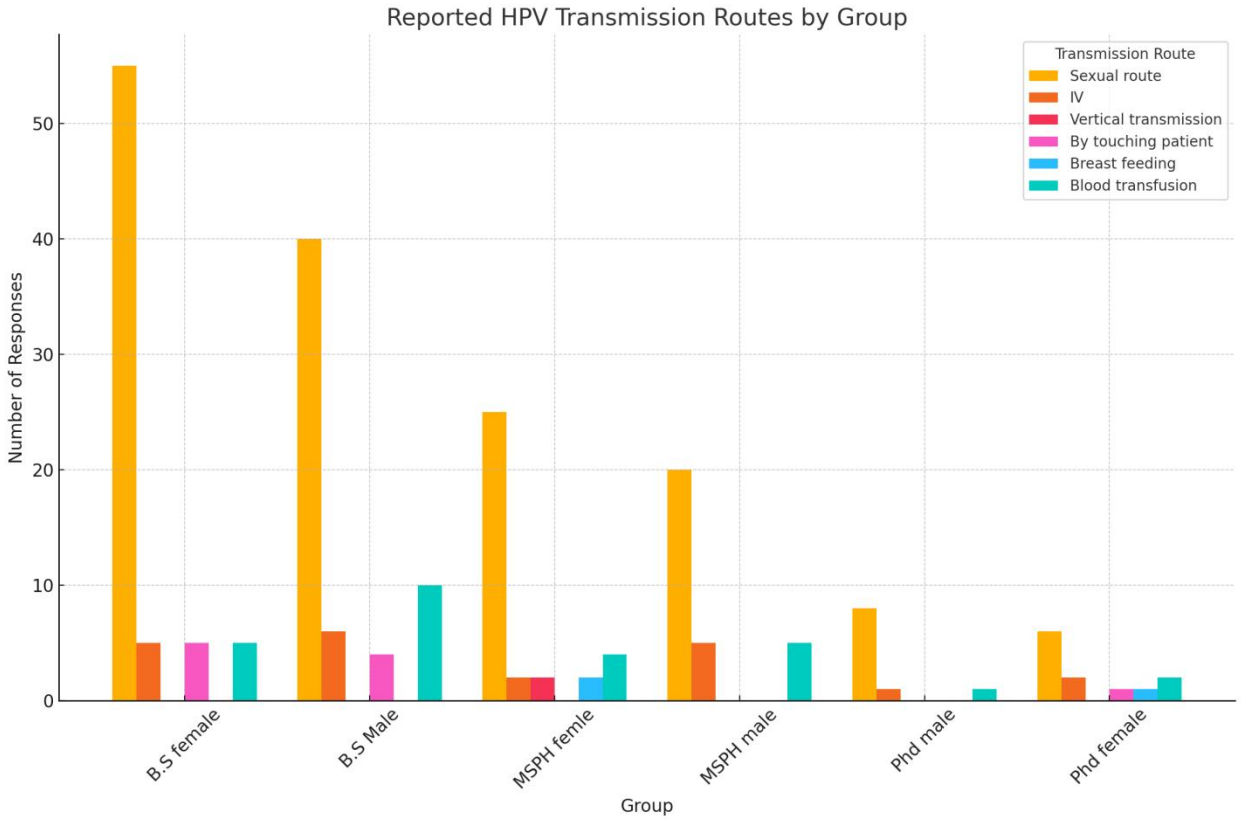
Gender wise knowledge distribution

Group	Heard of HPV	Not heard of HPV	Total
Male	**100**	**48**	**148**
female	**112**	**40**	**152**
Total	**212**	**88**	**300**

Chi square χ^2 value +**1.4372**
Degreee of freedom +1
$p \approx 0.23$
Explaination
Since **p > 0.05**, we **fail to reject the null hypothesis**.
This means there is **no statistically significant difference** in HPV awareness between males and females in this sample.
4.Route of transmission of HPV

Following table shows route of transmission knowledge;

Group	Sexual route	IV	Vertical transmission	By touching patient	Breast feeding	Blood transfusion
B.S female	55	5		5		5
B.S Male	40	6		4		10
MSPH femle	25	2	2		2	4
MSPH male	20	5				5
Phd male	8	1				1
Phd female	6	2		1	1	2



The analysis of perceived HPV transmission routes reveals varying levels of awareness across different educational and gender groups. Among all participants, **Sexual contact** was most frequently identified as the primary route of transmission, particularly by **PhD males (72.73%)**, **B.S. females (79.71%)**, and **MSPH males (66.67%)**. **B.S. males** followed with 61.54%, while **PhD females** showed comparatively lower recognition at 50%.

Awareness of **intravenous (IV) transmission** was most notable among **MSPH males (16.67%)** and **PhD females (16.67%)**, with **B.S. males** and **PhD males** reporting 9.23% and 9.09%, respectively. In contrast, **MSPH females** and **B.S. females** had slightly lower IV-related responses at 5% and 7.25%.

Vertical transmission (from mother to child) was only acknowledged by **MSPH females (5%)**, suggesting limited understanding of this route across other groups. Similarly, **touching an infected patient** and **breastfeeding** as transmission pathways were mentioned almost exclusively by females, particularly **PhD females** who reported 8.33% for both routes, and **B.S. females** with 7.25% for touching.

Regarding **blood transfusion**, **B.S. males (15.38%)** and both **MSPH males** and **PhD females** (16.67% each) indicated relatively higher awareness, while other groups reported it at lower but still notable levels.

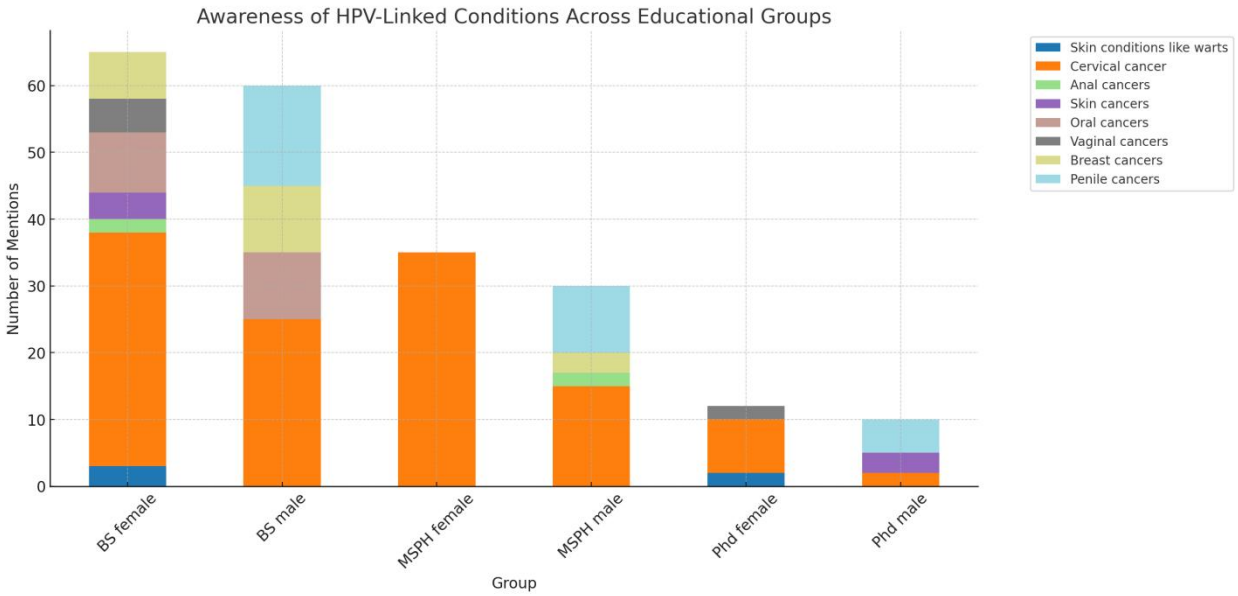
Overall, the data highlights that while sexual transmission is widely recognized, there are significant gaps in knowledge about other possible HPV transmission routes, especially among male participants and higher academic levels.

5.Type of diseases caused.

Following table shows types of diseases caused knowledge among participants;

Group	Skin conditio	Cervical	Anal cancer	Skin cancer	Oral cancer	Vaginal	Breast cancer	Penile cancer	

	ns like warts	cancer	s	s	s	cancer s	s	s	
BS female	**3**	**35**	**2**	**4**	**9**	**5**	**7**		
BS male		**25**			**10**		**10**	**15**	
MSPH female		**35**							
MSPH male		**15**	**2**				**3**	**10**	
Phd female	**2**	**8**					**2**		
Phd male		**2**		**3**				**5**	



The data shows that **cervical cancer** is the most commonly recognized HPV-related disease, especially among **MSPH and PhD female students**. **Penile cancer** awareness is notably higher among **male students**, particularly PhD males. **Breast and oral cancer** were more frequently associated with HPV by **BS students**, though inaccurately. Overall, **knowledge of less common HPV-related diseases like warts, skin, and anal cancers remains very limited** across most groups.

6.Prevention from HPV diseases

Following table shows knowledge of participants regarding prevention of HPV;

Group	**HPV not preventable**	**Use of HPV vaccine**	**Use of condoms**	**Avoid any contact with person suffering from HPV**
BS female	**20**	**50**	**10**	**10**
BS male	**10**	**43**	**13**	**24**

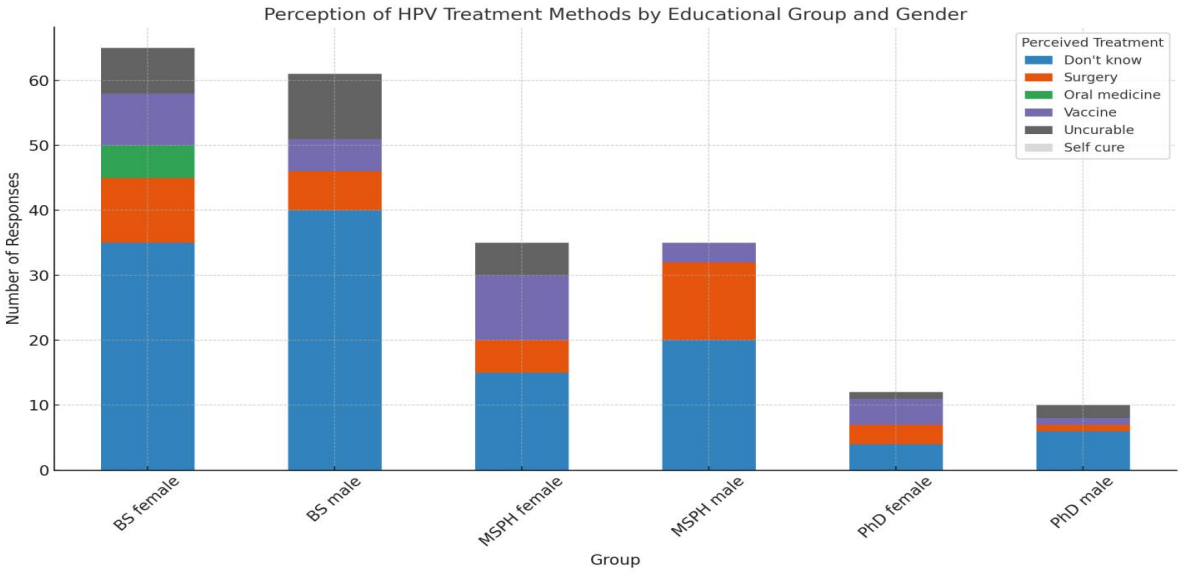
MSPH female	**5**	**40**		
MSPH male	**16**	**22**	**2**	**4**
Phd female	**4**	**13**		
Phd male	**2**	**6**	**2**	**3**

The data indicates that most students, especially **MSPH and BS females**, recognize the **HPV vaccine as a key preventive measure**. However, a notable number, particularly **MSPH and PhD males**, still believe **HPV is not preventable**. **Condom use** and **avoiding contact with infected individuals** are less frequently mentioned, with **BS males** showing slightly higher awareness of these methods. Overall, **gaps remain in understanding the full range of HPV prevention strategies**, especially among male and higher academic level students.

7.Treatment of HPV diseases

Following table sows knowledge of participants regarding treatment of HPV diseases;

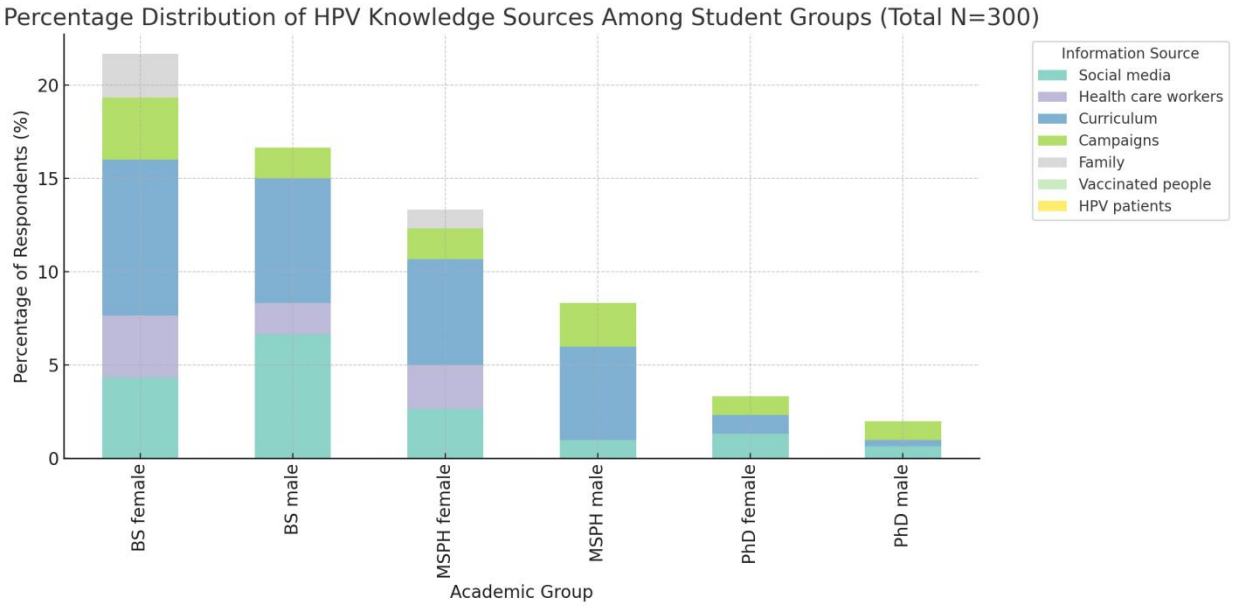
Group	Dono t know	Surgery	Oral medicine	Vaccine	Uncurable	Self cure
BS female	**35**	**10**	**5**	**8**	**7**	
BS male	**40**	**6**		**5**	**10**	
MSPH female	**15**	**5**		**10**	**5**	
MSPH male	**20**	**12**		**3**		
Phd female	**4**	**3**		**4**	**1**	
Phd male	**6**	**1**		**1**	**2**	



The graph illustrates the percentage distribution of perceptions regarding HPV treatment methods among various academic groups and genders. Across all groups, the highest proportion of responses fall under "Don't know," especially among BS male (57%) and BS female (54%) students, indicating low awareness. Very few respondents identified "Oral medicine" as a treatment, and only a small percentage recognized "Vaccine" or "Surgery" as valid options. "Uncurable" was notably perceived by BS male (14%) and BS female (11%), suggesting misconceptions. Overall, the data highlights a significant gap in knowledge about HPV treatment across educational levels, particularly at the undergraduate level.

8.Knowledge about HPV vaccine.
How Do you heard of HPV

Group	**Social media**	**Health care workers**	**Part of curriculum**	**Health and wellness campaigns**	**From family members**	**From people who got vaccinated**	**From people who suffered from HPV**
BS female	**13**	**10**	**25**	**10**	**7**		
BS male	**20**	**5**	**20**	**5**			
MSPH female	**8**	**7**	**17**	**5**	**3**		
MSPH male	**3**		**15**	**7**			
PhD femlae	**4**		**3**	**3**			
Phd male	**2**		**1**	**3**			

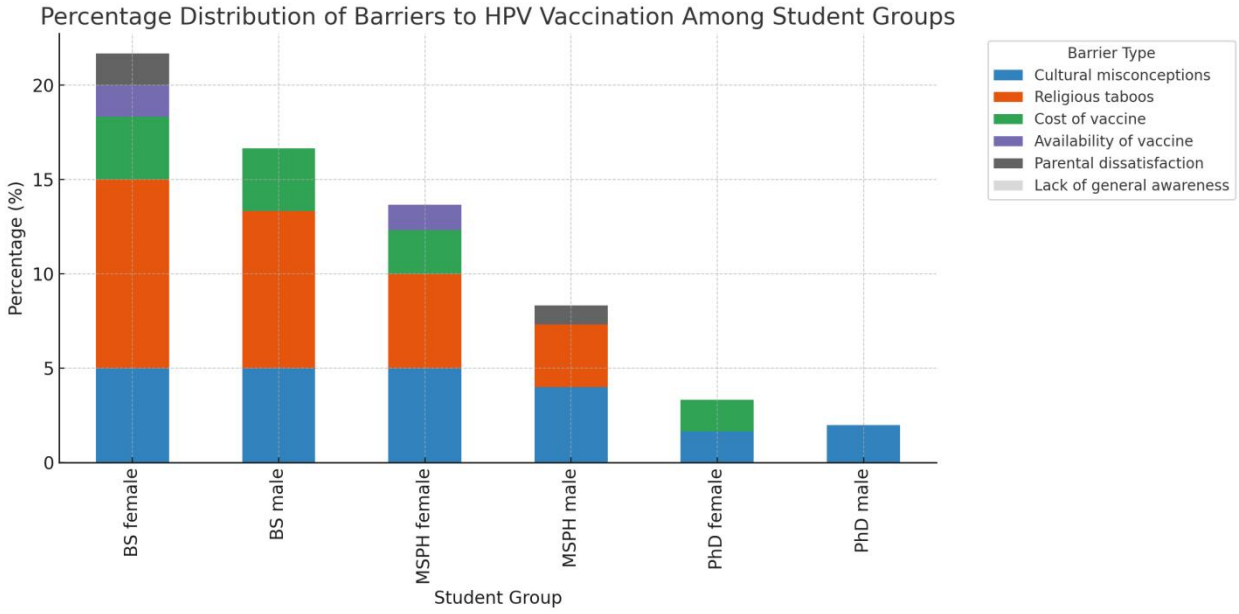


The graph illustrates the various sources through which different academic groups acquired knowledge about Human Papillomavirus (HPV), expressed as a percentage of the total 300 respondents. It is evident that learning through academic curricula was the most significant source across nearly all groups, particularly among BS and MSPH students. Social media also played a notable role, especially for BS males. Other sources like healthcare workers, public health campaigns, and family members contributed to a lesser extent. Interestingly, no respondents reported gaining knowledge from vaccinated individuals or those affected by HPV, highlighting potential gaps in peer-based or experiential learning. This distribution underscores the importance of formal education and digital platforms in spreading awareness about HPV among students.

9.Barriers to vaccination

Following table shows knowledge of participants regarding barriers of HPV vaccine;

Group	Cultural misconceptions	Religious tabbos	Cost of vaccine	Availability of vaccine	Parental dissatisfaction	Lack of general awarenes ss
BS female	15	30	10	5	5	
BS male	15	25	10			
MSPH female	15	15	7	4		
MSPH male	12	10			3	
PhD female	5		5			
Phd male	6					



The results highlight that **sociocultural barriers**, especially **religious taboos and cultural misconceptions**, play a significant role in limiting HPV vaccine acceptance among university students. These challenges are more prominent among **undergraduate students**, particularly females, while **issues like cost, availability, and parental dissatisfaction** were mentioned by fewer participants. The presence of these barriers suggests a need for **targeted awareness campaigns** that address **misconceptions, engage communities, and involve families** to improve understanding and acceptance of the HPV vaccine across all academic levels.

DISCUSSION

The age and gender distribution of university students surveyed in Islamabad offers crucial context for interpreting patterns in HPV knowledge, vaccine acceptance, and perception. The data demonstrate that the majority of respondents fall within the 20–30 age range, with the highest participation in the 25–30 bracket (105 males and 130 females). This age group is particularly relevant for HPV-related interventions, as it overlaps with the window during which HPV vaccination remains effective and awareness is critical for prevention (WHO, 2022).

The relatively higher number of female students in most age groups, especially in the 25–30 category, provides a valuable opportunity to examine gender-based differences in health knowledge and behavior. Studies have indicated that women are generally more proactive in seeking health information and participating in preventive health measures, including vaccination (Dubé et al., 2013). This gender difference may influence not only knowledge levels but also willingness to accept the HPV vaccine, which is often mistakenly perceived as female-specific due to its link with cervical cancer.

The equal representation in the 20–25 bracket and the significant drop in both genders after age 30 suggest that the most receptive demographic for HPV education campaigns lies within the younger university population. Tailored health promotion strategies targeting this age group may have higher impact, particularly if they address gender-specific misconceptions and cultural barriers. For instance, in Pakistan, limited

public discourse around sexual health may contribute to low awareness among males, even though HPV affects both sexes (Ali et al., 2021).

The sharp decline in enrollment beyond age 30, with minimal representation in the 40–45 group, may limit the generalizability of findings to older adult learners. However, it reinforces the importance of focusing HPV awareness efforts on younger populations currently enrolled in higher education institutions.

Overall, this demographic snapshot reinforces the need for gender-sensitive, age-appropriate educational interventions. The female-majority representation also offers a promising channel for peer-led awareness programs, as women may serve as influential advocates for HPV vaccination within university settings.

The findings from this study provide valuable insights into the distribution of HPV awareness across academic levels among university students in Islamabad and highlight significant gender-related implications in public health education. The bar chart comparing students who have heard of HPV to those who have not—across undergraduate (BS), Master of Science in Public Health (MSPH), and PhD levels—illustrates distinct patterns that reflect both educational exposure and likely gender-related knowledge disparities.

At the BS level, a relatively high number of students reported awareness of HPV, although the proportion of those unaware remains nearly equivalent. This reflects a broader issue: undergraduate students, particularly those outside of health disciplines, may have limited exposure to sexual and reproductive health education (Ali et al., 2021). This knowledge gap is further complicated by cultural taboos around discussing sexually transmitted infections (STIs), which may disproportionately affect male students due to reduced engagement in health education programs or lower healthcare-seeking behavior (Shah et al., 2020).

The higher levels of awareness among MSPH students are expected given their specialized public health training. These students demonstrate a significantly greater familiarity with HPV, underscoring the importance of integrating formal HPV education into curricula. However, the presence of some MSPH students still reporting unawareness suggests that even public health training may lack adequate emphasis on HPV-related content, or that the information is not being retained effectively.

Notably, HPV awareness continues into the PhD level but with a smaller sample size. While awareness remains higher than unawareness among PhD students, the declining numbers could reflect reduced participation from older students or those outside health-focused disciplines. Gender differences, although not explicitly shown in the chart, can be inferred from general trends; previous literature has consistently found that female students exhibit higher awareness and more favorable attitudes toward HPV vaccination due to its association with cervical cancer (Dany et al., 2015).

These findings align with international research emphasizing that knowledge gaps and vaccine hesitancy are often rooted in misinformation, gendered health narratives, and inadequate policy interventions (Walker et al., 2019). Closing the gender gap in HPV knowledge requires targeted outreach, particularly among male students and those in non-health fields, where the risk of disengagement is high. Gender-sensitive awareness campaigns, peer-led interventions, and integration of HPV education into general university curricula could improve both knowledge and vaccine acceptance.

Overall, this study underscores the need for gender-responsive public health education, particularly at the undergraduate level, to ensure equitable knowledge dissemination and to address misconceptions surrounding HPV and its vaccine.

The results of the Chi-square test ($\chi^2 = 33.53$, df = 5, p = 0.00000295) indicate a statistically significant association between gender, academic level, and HPV vaccine acceptance among university students in Islamabad. Female BS students showed the highest acceptance (80 out of 90), while male students, particularly at the BS and MSPH levels, were more hesitant. These findings align with global trends, where females often demonstrate greater vaccine acceptance due to awareness of HPV's link with cervical cancer and reproductive health concerns (Brewer & Fazekas, 2007; Holman et al., 2014).

The variation across academic levels may reflect differences in health literacy and curriculum exposure, especially among public health students who are more likely to encounter relevant content. The gender gap in vaccine acceptance also suggests cultural and informational barriers among male students, who may perceive lower personal risk. These results highlight the need for targeted educational interventions that address gender-specific concerns and promote awareness across all academic programs (Rahman et al., 2015).

CONCLUSION

This study highlights critical gaps in knowledge, awareness, and perceptions regarding Human Papillomavirus (HPV) and its vaccine among university students in Islamabad. Despite a generally higher representation of females and a concentration of participants within the 20–30 age group—an ideal demographic for HPV intervention—awareness levels remain inconsistent, particularly among males and students outside health-related disciplines.

The statistical analyses indicate no significant association between gender or academic level and general HPV awareness. However, deeper insights reveal that public health students and females tend to demonstrate better understanding of HPV transmission routes, associated diseases, and preventive measures. Misconceptions persist regarding non-sexual transmission pathways and treatment options, with a majority of undergraduate students unable to accurately identify effective treatments or vaccines. Barriers to vaccine uptake, including cultural beliefs, religious taboos, and lack of information, were especially prominent among male and undergraduate participants. While female students reported higher vaccine awareness and acceptance, the limited knowledge sources—predominantly curricula and social media—underscore the need for diversified and inclusive educational strategies. These findings emphasize the urgency of implementing comprehensive, gender-sensitive public health campaigns and incorporating HPV education into the curricula of all academic disciplines. Engaging students through evidence-based awareness programs, peer-led sessions, and culturally appropriate messaging can enhance understanding, reduce stigma, and promote informed decision-making regarding HPV prevention. In conclusion, addressing the identified gaps through targeted interventions holds significant promise for improving HPV-related health outcomes and advancing vaccine coverage among Pakistan's young adult population.

CONFLICT OF INTEREST

All the authors declare no conflict of interest.

SOURCE FINDING

The author received no financial support for research authorship publication of this article.

REFERENCES

Schiffman, M., Castle, P. E., Jeronimo, J., Rodriguez, A. C., & Wacholder, S. (2007). Human papillomavirus and cervical cancer. *The Lancet*, *370*(9590), 890–907.https://doi.org/10.1016/S0140-6736(07)61416-0

Bloem, P., & Ogbuanu, I. (2017). Vaccination to prevent human papillomavirus infections: From promise to practice. *PLoS Medicine*, *14*(6), e1002325. https://doi.org/10.1371/journal.pmed.1002325

McCormack, P. L. (2014). Quadrivalent human papillomavirus (types 6, 11, 16, 18) recombinant vaccine (Gardasil®): A review of its use in the prevention of premalignant anogenital lesions, cervical and anal cancers, and genital warts. *Drugs*, *74*(11), 1253–1283.

Serrano, B., Brotons, M., Bosch, F. X., & Bruni, L. (2018). Epidemiology and burden of HPV-related disease. *Best Practice & Research Clinical Obstetrics & Gynaecology*, *47*, 14–26. https://doi.org/10.1016/j.bpobgyn.2017.08.006

Westra, W. H. (2009). The changing face of head and neck cancer in the 21st century: The impact of HPV on the epidemiology and pathology of oral cancer. *Head and Neck Pathology*, *3*(1), 78–81.

Moscicki, A. B., & Palefsky, J. M. (2011). Human papillomavirus in men: An update. *Journal of Lower Genital Tract Disease*, *15*(3), 231–234. https://doi.org/10.1097/LGT.0b013e3181f3cb0b

Burney, A., & Zafar, R. (2023). Human papilloma virus vaccination as mode of cervical cancer prevention. *South Asian Journal of Cancer*, *12*(1), 51-52.

Bruni, L., Albero, G., Serrano, B., et al. (2021). HPV and related disease in Pakistan. HPV Information Center. Retrieved from http://hpvcenter.net/statistics/reports.PAK.pdf.

Centre for HPV. (2016, February 26). Human papillomavirus and related diseases in Pakistan: Summary report. Retrieved from http://www.hpvcentre.net/statistics/reports/PAK.pdf

Khan, S., et al. (2007). Human papillomavirus subtype 16 is common in Pakistani women with cervical carcinoma. *International Journal of Infectious Diseases*, *11*(4), 313–317.

Gul, S., Murad, S., & Javed, A. (2015). Prevalence of high-risk human papillomavirus in cervical dysplasia and cancer samples from twin cities in Pakistan. *International Journal of Infectious Diseases*, *34*, 14–19.

Kirnbauer, R., Taub, J., Greenstone, H., Roden, R., Durst, M., Gissmann, L., Lowy, D. R., & Schiller, J. T. (1993). Efficient self-assembly of human papillomavirus type 16 L1 and L1-L2 into virus-like particles. *Journal of Virology*, *67*(12), 6929–6936.

Mlynarczyk-Bonikowska, B., & Rudnicka, L. (2024). HPV infections—Classification, pathogenesis, and potential new therapies. *International Journal of Molecular Sciences*, *25*(14), 7616.

Forman, D., de Martel, C., Lacey, C. J., Soerjomataram, I., Lortet-Tieulent, J., Bruni, L., Vignat, J., Ferlay, J., Bray, F., Plummer, M., & others. (2012). Global burden of human papillomavirus and related diseases. *Vaccine*, *30*(Suppl 5), F12–F23. https://doi.org/10.1016/j.vaccine.2012.07.055.

World Health Organization. (2024, March 5). Human papillomavirus and cancer. Retrieved from https://www.who.int.

Bruni, L., Diaz, M., Castellsagué, X., Ferrer, E., Bosch, F. X., & de Sanjosé, S. (2010). Cervical human papillomavirus prevalence in five continents: Meta-analysis of 1 million women with normal cytological findings. *Journal of Infectious Diseases*, *202*(12), 1789–1799. https://doi.org/10.1086/657321

Ferlay, J., Laversanne, M., Ervik, M., Lam, F., Colombet, M., Mery, L., Piñeros, M., Znaor, A., Soerjomataram, I., & Bray, F. (2024). Global Cancer Observatory: Cancer Tomorrow. Lyon, France: International Agency for Research on Cancer. Retrieved from https://gco.iarc.fr/tomorrow.
Departmental Update. (2023, September 1). One in three men worldwide are infected with genital human papillomavirus. Retrieved from [URL]
St. Jude Children's Research Hospital. (n.d.). History of HPV vaccination - Home. Retrieved January 17, 2025, from https://sjr-redesign.stjude.org/centers-initiative.
Akhatova, A., Azizan, A., Atageldiyeva, K., Ashimkhanova, A., Marat, A., Iztleuov, Y., Suleimenova, A., Shamkeeva, S., & Aimagambetova, G. (2022). Prophylactic human papillomavirus vaccination: From the origin to the current state. *Vaccines (Basel)*, *10*(11), 1912. https://doi.org/10.3390/vaccines10111912
UNICEF. (2024, July 15). Global childhood immunization levels stalled in 2023 leaving many without life-saving protection: New data reveal nearly 3 in 4 infants live in countries where low vaccine coverage drives measles outbreaks,from https://www.unicef.org/pakistan/press-releases/global-childhood-immunization-levels-stalled-2023-leaving-many-without-life-saving#:~:text=For%20example%2C%20the%20share%20of,Bangladesh%2C%20Indonesia%2C%20and%20Nigeria.
Duncan, J., Harris, M., Skyers, N., Bailey, A., & Figueroa, J. P. (2021). A call for low- and middle-income countries to commit to the elimination of cervical cancer. *The Lancet Regional Health – Americas*, *2*, 100036. https://doi.org/10.1016/j.lana.2021.100036
Schuind, A. E., Balaji, K. A., Du, A., Yuan, Y., & Dull, P. (2024). Human papillomavirus prophylactic vaccines: Update on new vaccine development and implications for single-dose policy. *JNCI Monographs*, 2024(67), 410–416. https://doi.org/10.1093/jncimonographs/lgae026.
Chowdhury, S., Ara, R., Roy, S., Tanvir, S. M. S., Eva, F. N., Neela, T. M., et al. (2022). Knowledge, attitude, and practices regarding human papillomavirus and its vaccination among the young medical professionals and students of Bangladesh. *Clinical and Experimental Vaccine Research*, *11*(1), 63–71. https://doi.org/10.7774/cevr.2022.11.1.63
Ebrahimi, N., Yousefi, Z., Khosravi, G., Malayeri, F. E., Golabi, M., Askarzadeh, M., Shams, M. H., Ghezelbash, B., & Eskandari, N. (2023). Human papillomavirus vaccination in low- and middle-income countries: Progression, barriers, and future prospective. *Frontiers in Immunology*, *14*, 1150238. https://doi.org/10.3389/fimmu.2023.1150238
Minhas, S., Sajjad, A., Mushtaq Chaudhry, R., & Rehman, Z. (2022). Prevalence and current scenario of HPV in Pakistan: A systematic review and meta-analysis. *Open Access Macedonian Journal of Medical Sciences*, *10*(F), 371–379. https://doi.org/10.3889/o
Ferlay, J., Ervik, M., Lam, F., Colombet, M., Mery, L., Piñeros, M., Znaor, A., Soerjomataram, I., & Bray, F. (2020). Global cancer observatory: Cancer today. International Agency for Research on Cancer. Available from https://gco.iarc.fr/today
UNICEF. (2023, November 29). Global childhood immunization levels stalled in 2023, leaving many without life-saving vaccines. UNICEF. https://www.unicef.org/pakistan/press-releases/global-childhood-immunization-levels-stalled-2023-leaving-many-without-life-saving#:~:text=However%2C%20HPV%20vaccine%20coverage%20is,lack%20of%20availability%20(34%25)

Shamsi, U., Zahid, F., Abdul Jabbar, A. B., Musharraf, M. D., Gauhar, F., Akbar, I., Sherwani, M., Bhatti, W. K., Chaudhary, E. U. H., Sadiq, S., & Shaikh, A. N. (2024). Human papillomavirus vaccine awareness and acceptability for primary prevention of cervical cancer in Pakistan: A cross-sectional study. *Asian Pacific Journal of Cancer Prevention*, *25*(3), 813.
Ghayas, S., Anjum, F., Husain, T., Bashir, L., Naz, S., & Masood, M. A. (2018). Human papillomavirus and its vaccine: Awareness and attitudes of young female Pakistani students. *KMUJ: Khyber Medical University Journal*, *10*(4). https://doi.org/10.35845/kmuj.2018.18405
UNICEF. (2023, November 29). Global childhood immunization levels stalled in 2023, leaving many without life-saving vaccines. UNICEF. https://www.unicef.org/pakistan/press-releases/global-childhood-immunization-levels-stalled-2023-leaving-many-without-life-saving
Shamsi, U., Zahid, F., Abdul Jabbar, A. B., Musharraf, M. D., Gauhar, F., Akbar, I., Sherwani, M., Bhatti, W. K., Chaudhary, E. U. H., Sadiq, S., & Shaikh, A. N. (2024). Human papillomavirus vaccine awareness and acceptability for primary prevention of cervical cancer in Pakistan: A cross-sectional study. *Asian Pacific Journal of Cancer Prevention*, *25*(3), 813.
Ghayas, S., Anjum, F., Husain, T., Bashir, L., Naz, S., & Masood, M. A. (2018). Human papillomavirus and its vaccine: Awareness and attitudes of young female Pakistani students. *KMUJ: Khyber Medical University Journal*, *10*(4). https://doi.org/10.35845/kmuj.2018.18405

Ali, S. F., Khawaja, M., Qureshi, R., & Khan, M. (2021). Knowledge and awareness about human papillomavirus among university students in Pakistan. *Journal of Infection and Public Health, 14*(2), 237–242. https://doi.org/10.1016/j.jiph.2020.10.014
Dubé, E., Laberge, C., Guay, M., Bramadat, P., Roy, R., & Bettinger, J. A. (2013). Vaccine hesitancy: An overview. *Human Vaccines & Immunotherapeutics, 9*(8), 1763–1773. https://doi.org/10.4161/hv.24657
World Health Organization. (2022). *Human papillomavirus (HPV) and cervical cancer*. https://www.who.int/news-room/fact-sheets/detail/human-papillomavirus-(hpv)-and-cervical-cancer
Ali, S. F., Khawaja, M., Qureshi, R., & Khan, M. (2021). Knowledge and awareness about human papillomavirus among university students in Pakistan. *Journal of Infection and Public Health, 14*(2), 237–242. https://doi.org/10.1016/j.jiph.2020.10.014
Dany, M., Chidiac, A., & Nassar, A. H. (2015). Human papillomavirus vaccination: Assessing knowledge, attitudes, and intentions of college female students in Lebanon, a developing country. *Vaccine, 33*(8), 1001–1007. https://doi.org/10.1016/j.vaccine.2015.01.045
Shah, S., Murtaza, G., & Ali, A. (2020). Health-seeking behavior and barriers to accessing sexual health services among university students in Pakistan. *BMC Public Health, 20*, 558. https://doi.org/10.1186/s12889-020-08615-7
Walker, T. Y., Elam-Evans, L. D., Yankey, D., Markowitz, L. E., Williams, C. L., Fredua, B., ... & Stokley, S. (2019). National, regional, state, and selected local area vaccination coverage among adolescents aged 13–17 years — United States, 2018. *Morbidity and Mortality Weekly Report, 68*(33), 718–723. https://doi.org/10.15585/mmwr.mm6833a2

Brewer, N. T., & Fazekas, K. I. (2007). Predictors of HPV vaccine acceptability: A theory-informed, systematic review. *Preventive Medicine*, 45(2-3), 107–114. https://doi.org/10.1016/j.ypmed.2007.05.013
Rahman, M., Laz, T. H., McGrath, C. J., & Berenson, A. B. (2015). HPV vaccine uptake among college students: A systematic review and meta-analysis. *Preventive Medicine*, 81, 210–216. https://doi.org/10.1016/j.ypmed.2015.09.028