

Original Research Article

Knowledge, attitude and perception towards Human Papillomavirus and its vaccination: A cross-sectional survey of female university students enrolled in health and non-health related programs

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ABSTRACT

Understanding the human papillomavirus (HPV) and its vaccination is critical due to the global HPV-related disease burden and related costs. This study was based on a cross-sectional design to survey female students enrolled at the Universiti Teknologi MARA Puncak Alam Campus, Selangor, Malaysia. Our study aimed to examine the knowledge, attitude, and perception towards HPV and its vaccine among groups of university students from health and non-health-related programs. Link to validated questionnaires in the form of Google Forms were distributed through course heads. Intentionally, an equal number of sample sizes were obtained from the two groups. Two hundred out of 240 questionnaires targeted were collected (response rate equal 83%). Healthcare providers were the most common source of information. Age, education level, faculty and year of study were significant contributing factors to knowledge. 29% had already completed their immunisation schedule of 3 shots, while 40% had not received the vaccine and had not scheduled an appointment either. A Mann-Whitney test was done on the level of knowledge, which was low and moderate, regarding health issues, mode of transmission, prevention of HPV, vaccine benefits and side effects, which favoured the health-related students (median = 6.50) over the non-health-related students (median = 1.50), (p-value = 0.0001). Significant differences were observed regarding answers on attitudes toward vaccine benefits, perception of vaccination behaviour and external influences. Public health initiatives in developing education policies to equip university students, particularly those in non-health-related programs, with the knowledge, right attitude and perception are imperative to increase their vaccination uptake.

Keywords: HPV and vaccination, knowledge, attitude and perceptions, students

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Received: 02 Aug 2024; accepted: 14 Oct 2024 Available online: 25 Oct 2024

<http://doi.org/10.24191/IJPNaCS.suppl1.01>



1.0 Introduction

There is a high disease burden globally for human papillomavirus (HPV)-related cancers, with a significant economic impact on the broader economy due to productivity losses and treatment-related costs (1). HPV is the most commonly transmitted disease through sexual intercourse than intimate contact (2). The cost of the HPV virus is substantial, with estimated costs of diagnosis and treatment of HPV-related cervical abnormalities and anogenital warts approximated at \$9.1 billion yearly in both males and females in the US (3). HPV vaccines are available in two types: the bivalent HPV vaccine (HPV 6 and 11) for females and the quadrivalent HPV vaccine (HPV 6,11,16, and 18) for both males and females aged from 9 to 25 years. They have the potential to prevent HPV-related disease burden. The World Health Organization's agenda was to eliminate HPV infection by 2030 (4). However, misconceptions, poor knowledge, and awareness drove the negative attitude toward vaccination (5). Implementing and reinforcing public health measures, such as improving HPV screening and increasing vaccination programs, could help reduce this burden by maintaining high HPV vaccination coverage (1,6). The prevalence of high-risk HPV infection in Malaysia was reported to be 4.53% among women screened (7). According to the World Health Organization, vaccination rates were even lower in Asia—about 4 per cent in WHO's Western Pacific Region (among countries like China, Vietnam, and the Philippines) and about 2 per cent in Southeast Asia, including Malaysia (8).

Socioeconomic status is associated with vaccination coverage. Low-income countries might not get the best HPV vaccine coverage compared to more advanced and high-income countries. The cost for the recommended 3-dose course of HPV vaccine

in Malaysia is approximately 360 USD or MYR 1200, which is not affordable for everyone. Hence, those with lower socioeconomic statuses who are not subsidised the HPV vaccines are the ones who are susceptible to cervical cancer (6). Parental or legal guardian consent is required for young women aged 18 years and below or those dependent on their parents for financial support (9).

The administration of the HPV vaccine is more effective in children between 9 and 25 years old, which involves primary school up to tertiary education students. However, the dissemination of HPV and vaccination information to these groups of youths, especially the non-health-related students, was quite limited due to the non-health curriculum of their courses. In addition, the cultural and religious context of Malaysian university educators were quite reserved to talk about sexual issues related to HPV to these groups, as was also observed in other low and middle-income countries (10). They tend to believe that the discussion of sexually transmitted diseases can be viewed as a taboo subject (5). Hence, the sexual issues of HPV were silent in the education of especially the non-health related students.

The influence of anti-vaccination propaganda, the experience of adverse events following immunisation (AEFI), perceived religious prohibition, a belief that traditional complementary and alternative medicine (TCAM) use is safer, pseudoscience beliefs and anti-vaccine conspiracy theories were identified as reasons for refusing to vaccinate in some Muslim communities in Malaysia (7). These factors hinder acquiring knowledge and attitudes toward the HPV vaccine, which can thus influence vaccination rates, as evidenced in studies by Chen *et al.* (2022) (6) and Sharma *et al.* (2022) (11). Hence, influencing vaccine uptake is vital to reduce the mortality and

morbidity resulting from life-threatening diseases due to HPV and to stamp the rise of vaccine-preventable diseases (12).

Hence, this study was conducted on our public university students, who are predominantly Muslim Malay ethnic, to address the knowledge gap and how socioeconomic, cultural, and religious factors above influence our students in terms of knowledge, attitude, and perceptions. We targeted students aged 18 years and above who formed the grown-up cohort that was previously eligible for HPV vaccination under the 2010 HPV vaccination program managed by the Ministry of Health (13). The target age group for the HPV immunisation program, a school-based approach, was 13-year-old schoolgirls. The programme aimed to progressively build herd immunity in young adults. Successive cohorts of immunised seroconverted 13-year-old girls would be protected when they became sexually active. Since this university has medical and non-medical related programs, we intended to compare both programs. We hope this study will spur discussion among university administrators and health authorities to benefit university students, mainly from health-related programs. The findings from this racial-religious centric study will highlight the need for future health efforts to increase vaccine uptake among this population.

2.0 Materials and Methods

2.1 Design of the Study

The study was based on a cross-sectional design to survey female students enrolled at the Puncak Alam Campus under the Selangor branch of Universiti Teknologi MARA (UiTM), the largest public university in Malaysia. Research Ethics Committee, UiTM, approved the study protocol, reference number REC/248/17.

2.2 Population Sampling

From March to July 2020, convenient online sampling was done for the two groups of students enrolled in a health-related or non-related program (Refer to 2.6 research conduct). The health-related programs available and chosen were pharmacy and health sciences courses. The non-health-related programs sampled were accountancy, hotel and tourism, and business and management out of the ten non-health faculties available. The inclusion requirements included undergraduates aged 18 years and above who were Malaysian citizens studying full-time.

2.3 Sample Size Calculation

A single proportion formula as below was used to calculate the sample size:

$$n = \left(\frac{Z}{\Delta}\right)^2 * P(1 - P)$$

where n is the sample size, Z is the Z score corresponding to the desired confidence level of 95%, which is 1.96. Delta (Δ) is the margin of error or precision of 5%, 0.05, and P is the estimated vaccination rate of HPV based on previous studies (5). We estimated that p was 18% (0.18), and by increasing the sample size by 10%, the final required number of respondents was estimated at 240.

2.4 Research Instrument

The questionnaire used in the study was adapted from a previous research questionnaire entitled Beliefs and Attitudes regarding HPV Vaccination among College-age Women: An Application of the Health Belief Model by Schaefer in 2010 (14) and knowledge and attitudes regarding the Human Papillomavirus and HPV vaccine among college students: A gender comparison study (15) (15). We adapted

these two questionnaires, acknowledging the theory of belief model, which was incorporated in the first questionnaire and has much influence on perceptions and attitudes. The second questionnaire we adapted was conducted among college students who were similar in age to our study sample.

The questionnaire's first part (Part A) included respondents' demographic data and HPV immunisation history. The demographic part included questions on age, race, program (faculty), year of study and respondent education level. HPV immunisation history included a question on the respondents' previous HPV vaccine uptake and the source of information for HPV and its vaccine. Next, the second part (Part B) of the questionnaire contained four subsections with eight questions. This part formed the HPV knowledge score based on the following scoring: for correct responses, a score of 1 was given, while "not sure" or "I do not know", and for incorrect responses were given scores of 1 and zero, respectively, yielding a range for HPV knowledge score of zero–18. This part, which consisted of multiple choice and true/false questions, assessed the respondent's knowledge regarding HPV and HPV vaccines. The four sub-sections with one mark for the correct answers for each question includes: awareness towards HPV and HPV vaccination (3 questions), about HPV and HPV vaccine: students' understanding of health issues related to HPV (1 question), mode of transmission of HPV (1 question), HPV prevention (1 question), HPV vaccine benefit (1 question) and main side-effect associated with the HPV vaccine (1 question). The total marks that can be achieved under domain knowledge was 18. The levels of knowledge were divided into three classes: low, medium, and high knowledge regarding HPV and the HPV vaccine. Low knowledge will be assigned for

a score of less than five marks, medium knowledge between 5-10 marks, and good knowledge for a score of ten or more. The criteria for assigning the levels depends on how many marks are scored from the total of correct answers, which commensurate with the levels of knowledge. The last part, which is Part C, includes the domain of attitude and perception: students' attitude regarding vaccine benefit (1 question), HPV severity (1 question), behaviour (1 question), external influences (6 questions), and barriers (2 questions). Questions on the perception of behaviour in this part followed the health belief model. The response options were yes-no and "don't know", with more than one correct answer for some questions. This third part, Part C of the questionnaire, assessed respondents' attitudes and perceptions towards HPV and HPV vaccines. The questions for this part of the questionnaire must be answered based on a scale of 'strongly disagree', 'disagree', 'neutral', 'agree' and 'strongly agree'. Only those answers of "strongly agree" or "agree" were taken as "yes" answers to be included in the percentages for comparison between the two groups. The last section of the questionnaire must be answered based on a 'yes-no' scale. Questions under demographics contained either numerical or nominal response options.

2.5 Face and Content Validation

Content validation was done regarding relevancy and clarity among four senior lecturers from the university as experts in the field. The results of content validity obtained showed an acceptable index of I-CVI of 0.83. Their comments were used to amend the items' wording. Pilot testing was done on ten pharmacy students to get feedback regarding their understanding and comprehension of the questionnaire. The face validity index (F-CVI) calculated was an acceptable value of

0.85. The feedback obtained from the pilot study was used to refine the questionnaire in terms of structure and wording before coming up with the final version for our field study. This includes modifying the sentences to tailor to our Malaysian students' local and cultural context.

2.6 Research Conduct

The survey tool, which was in English, was uploaded into Google Forms. The link to the questionnaire was posted to the telephone instant messaging service, i.e. the WhatsApp of the student heads of courses of the two program categories. Since the questionnaire is in Google form, which did not allow any section to be left unanswered before proceeding to the next section, the contact number of the authors to be contacted in case of difficulty in answering the questions was encrypted together with the questionnaire. The student heads of the courses were requested to distribute the link to their colleagues, irrespective of year of study, to fill out the questionnaire. After a week's lapse from the distribution date, student heads sent a reminder to fill out the questionnaire as a follow-up measure. The Google form link was set to allow responses of up to 120 for each program category within the duration of the study. An attempt by any respondent beyond that will receive a notification stating, "the maximum number of responses has been reached and hence no more accepting responses". Within the study period, a follow-up effort was made through WhatsApp to obtain an equal number of responses for each group to avoid bias.

All the participants were required to read and understand the preceding statement in the Google form regarding the research's nature and objectives. Participation in the study was entirely voluntary. In addition, students were assured by a statement in the Google form that their responses would be

kept strictly confidential in a digital folder accessible by password only by researchers. It was also stated in the Google Form for students' understanding that the responses were used for research purposes without affecting their academic performance. No incentives were offered to the potential participants. Participants provided their consent by signing the signed form for the questionnaire before being granted access. An appendix containing medical jargon or healthcare-related terminologies with definitions and explanations was also distributed with the questionnaires to assist respondents, especially those of non-health-related backgrounds.

2.7 Data Analysis

All the data obtained from the questionnaire responses was entered into the SPSS version 25 software package for analysis. Descriptive results were presented as frequencies and percentages. Chi-square tests were used to determine the association between the students' demographic profiles and the scores of items under the domains of knowledge. Chi-Square and Fischer Exact tests were used to determine the association between perception and attitude items with the two categories of students. Mann-Whitney test was used to compare the knowledge score between health-related and non-health-related female students. A correlation test determined the magnitude of association between factors contributing to vaccine uptake. A p-value of ≤ 0.05 was considered statistically significant.

3.0 Results

3.1. Demographics of Respondents (Part A)

The respondents completed and returned two hundred questionnaires successfully, giving a response rate of 83%. The respondents for the study were female students (n=200) with a

mean age of 22.8. Most of the respondents who participated in the survey were from the level of Degree (95.0%), followed by diploma (4.5%) and PhD (0.5%). The most significant proportion for the study was from Faculty of Health Science (n=99, 49.5%), Pharmacy (n=1, 0.5%), Hotel and Tourism (n=1, 0.5%), Business Management (n=50,

25%) and Art and Design (n=49, 24.5%). The respondent's current study year ranges from 2nd year (n=46, 23%), 3rd year (n=148, 74%), 4th year (n=5, 2.5%) and post-graduation (n=1, 0.5%). Most participants were Malays (n=196, 98%), followed by other races (n=4, 2%). Table 1 summarises students' demographics.

Table 1: Demographic of respondents

Age	No. of students	Percentage (%)
21	5	2.5
22	109	54.5
23	22	11.0
24	61	30.5
25	2	1.0
31	1	0.005
Total	200	100.0

Education level	No. of students	Percentage (%)
Diploma/STPM	9	4.5
Degree	190	95.0
PhD	1	0.5
Total	200	100.0

Faculty	No. of students	Percentage (%)
Health Science	99	49.5
Pharmacy	1	0.5
Hotel and Tourism	1	0.5
Business Management	50	25.0
Art and Design	49	24.5
Total	200	100.0

Study year	No. of students	Percentage (%)
2 nd year	46	23.0
3 rd year	148	74.0
4 th year	5	2.5
Postgraduate student	1	0.5
Total	200	100.0

Ethnic origin	No. of students	Percentage (%)
Malays	196	98.0
Others	4	2.0
Total	200	100.0

3.2 Source of Information (Part A)

Most of the respondents stated that most of the HPV and HPV vaccine information were from healthcare provider 47.48% (n=104) followed by internet 44.29% (n=97), television or radio 37.89% (n=83), school 37.44% (n=82), friend 28.31% (n=62), newspaper or magazine 23.28% (n=51), family 13.69% (n=30) and other sources 2.73% (n=6). Figure 1 depicts the number of respondents versus the types of sources of information about HPV and HPV vaccination sought by the respondents.

3.3 Vaccination Status between health-related and non-health-related female students (Part A)

The results showed that one-third (n=63, 29%) had already completed their immunisation schedule of 3 shots, while approximately 20% (n=43) had received only the first shot. Six students (2.7%) had not received any shot but had scheduled an appointment, while the remaining 40% (n=88) had not received the vaccine or scheduled an appointment. Figure 2 depicts the vaccination status between health-related and non-health-related female students.

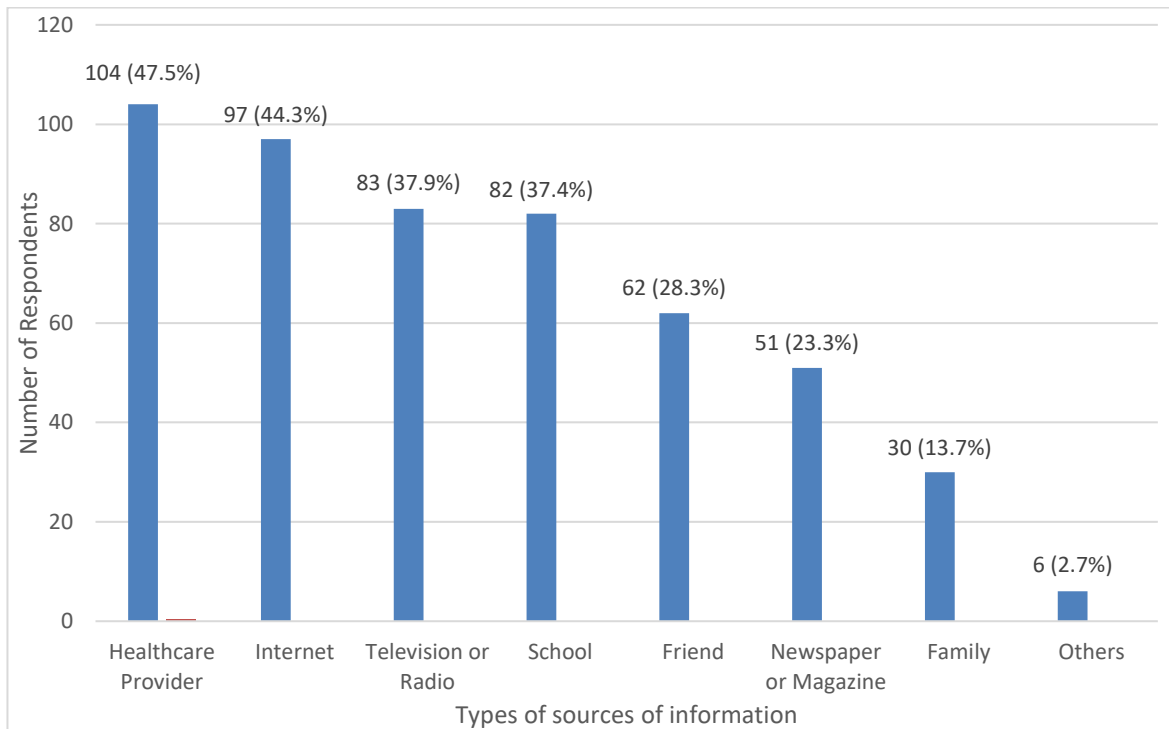


Figure 1: Number of respondents versus types of sources of information about HPV and HPV vaccine

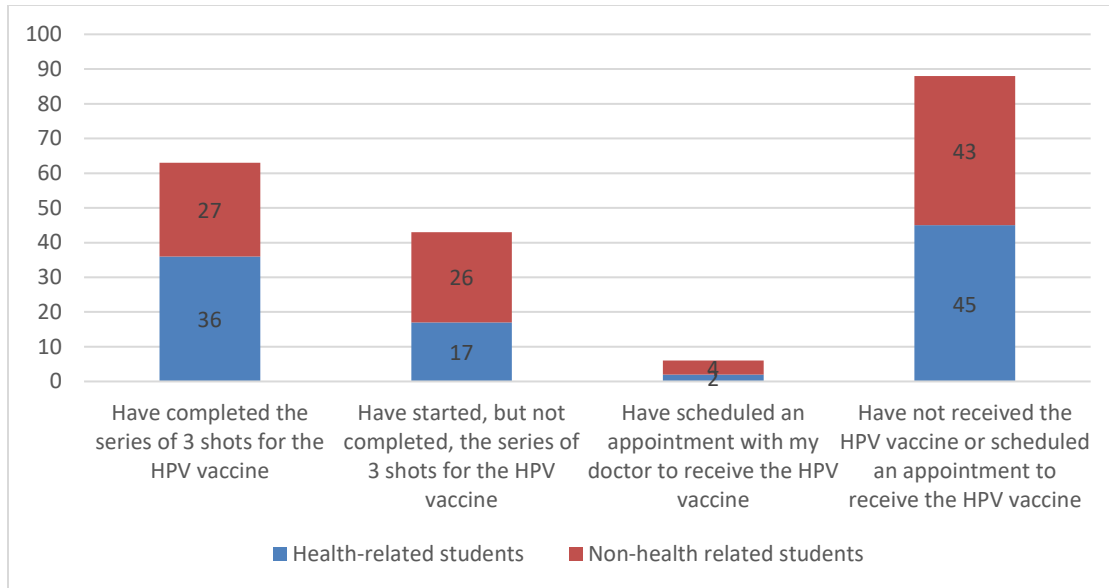


Figure 2: Vaccination status between health-related and non-health-related female students

Table 2: Domain Knowledge: Awareness Towards HPV and HPV Vaccine (n=200)

Questions	Yes	No	Not sure
Have you heard of HPV (human papillomavirus) before taking this survey	174 (87%)	14 (7%)	12 (6%)
Have you heard of HPV (human papillomavirus) vaccine (Gardasil®, Cervarix®) before taking this survey	142 (71%)	26 (13%)	32 (16%)
HPV vaccine is available for men	19 (9.5%)	101 (50.5%)	80 (40%)

3.3 Domain knowledge: Awareness towards HPV and HPV vaccine (Part B)

Most were aware of HPV (n=174, 87%) and the availability of the HPV vaccines. However, only 9.5% (n=19) were aware that HPV vaccines were also available for men. Table 2 shows the breakdown of the answers to questions on awareness regarding HPV and HPV vaccines for the knowledge domain.

3.4 Domain Knowledge: Understandings towards HPV and HPV vaccine (n=200) (Part B)

The level of knowledge in terms of health issues, mode of transmission, and prevention of HPV, as well as vaccine benefits and side-effects, favoured the health-related students with a median of 6.50 rather than the non-related ones with a median of 1.50 by Mann-Whitney test (U=2790, p=0.0001). In addition, positive correlations were found between knowledge scores and vaccination status of either complete or not complete (r=0.63, p<0.05). Tables 3 and 4 show the breakdown of the answers to questions on understanding HPV for the knowledge domain.

Table 3: Domain Knowledge: Understandings Towards HPV (Part B) (n=200)

Health issues related to HPV					
Type of student	Cervical cancer	HIV	Penile cancer	Genital warts	Don't know
Health-related	82 (41%)	10 (5%)	8 (4%)	48 (24%)	8 (4%)
Non-health related	70 (35%)	5 (2.5%)	3 (1.5%)	17 (8.5%)	25 (12.5%)
Total	152 (76%)	15 (7.5%)	11 (5.5%)	65(32.5%)	33 (16.5%)

Mode of transmission of HPV				
Type of student	Coughing and sneezing	Genital skin-to-skin contact	Contact with bodily fluids (blood)	Don't know
Health-related	0 (0%)	66 (33%)	21(10.5%)	13(6.5%)
Non-health related	9 (4.5%)	32 (16%)	28 (14%)	31(15.5%)
Total	9 (4.5%)	98 (49%)	49 (24.5%)	44 (22%)

HPV Prevention					
Type of student	Practising abstinence	Taking antibiotics	Using condoms	Being vaccinated	Don't know
Health-related	14 (7%)	5 (2.5%)	26 (13%)	83 (41.5%)	10 (5%)
Non-health related	11 (5.5%)	13 (6.5%)	14 (7%)	53 (26.5%)	24 (12%)
Total	25 (12.5%)	18 (9%)	40 (20%)	136 (68%)	34 (17%)

Table 4: Domain Knowledge: Understandings Towards HPV Vaccine (Part B) (n=200)

HPV Vaccine benefit (prevention)					
Type of student	Prevent genital warts	Prevent cervical cancer	Prevent herpes	Prevent oral cancer	Don't know
Health-related	57 (28.5%)	78 (39%)	35 (17.5%)	10 (5%)	6 (3%)
Non-health related	21 (10.5%)	60 (30%)	10 (5%)	7 (3.5%)	35 (17.5%)
Total	78 (39%)	138 (69%)	45 (22.5%)	17 (8.5%)	41(20.5%)

Side-effects					
Type of student	Vomiting	Soreness at the site where the shot is given	Headache	Joint pain	Don't know
Health-related	14(7%)	39(19.5%)	4(2%)	6(3%)	37(18.5%)
Non-health related	6 (3%)	39 (19.5%)	8 (4%)	9 (4.5%)	51(25.5%)
Total	20 (10%)	65 (32.5%)	12 (6%)	15 (7.5%)	88 (44%)

3.5 Attitude and perception regarding Vaccine benefit, vaccination behaviour, external influence and barrier

Table 5 shows significant differences ($p < 0.05$), favouring health-related students

into agreeing that the vaccine is effective in preventing oral cancer and the spread of HPV to partners; doctors influence them to get vaccinated and have the opinion that the HPV vaccine is expensive. However, on the other hand, significant differences arose more of

the non-health related students believing that getting the HPV vaccination was against their

belief and would feel embarrassed if others knew they were getting the vaccine.

Table 5: Part C: Domain attitude and perception

Attitude on HPV vaccine benefits						
Type of student	Prevent cervical cancer	Prevent some types of penile cancer	Prevent oral cancer	Prevent the spread of HPV to partners		
Health-related	71 (35.5%)	39 (19.5%)	14 (7%)	70 (35%)		
Non-health related	66 (33%)	43 (21.5%)	30 (15%)	50 (25%)		
p-value*	0.124	0.309	0.014*	0.006*		
Attitude on HPV severity						
	If contracted HPV, it could harm future health					
Health-related	49 (24.5%)					
Non-health related	44 (22%)					
p-value	0.274					
Perception of vaccination behaviour						
	Getting Gardasil would go against my beliefs.					
Health-related	13 (6.5%)					
Non-health related	29 (14.5%)					
p-value	0.002*					
Perception of external influences						
	If my friends knew about the HPV vaccine, they would approve of me getting vaccinated against HPV.	If my parents knew about the HPV vaccine, they would approve of me getting vaccinated against HPV.	If my partner knew about the HPV vaccine, they would approve of me getting vaccinated against HPV.	If my doctor knew about the HPV vaccine, they would approve of me getting vaccinated against HPV.	If they knew about the HPV vaccine, most people who are important to me would get themselves vaccinated against HPV if they were at risk.	If other people knew I received Gardasil, I would be embarrassed.
Health-related	40 (20%)	44 (22%)	41 (20.5%)	52 (26%)	58 (29%)	10 (5%)
Non-health related	33 (16.5%)	38 (19%)	38 (19%)	39 (19.5%)	45 (22.5%)	31 (15.5%)
p-value	0.513	0.386	0.114	0.025*	0.062	0.000*
Perception on Barrier						
	In your opinion, how expensive is Gardasil? (~RM900 for the entire series) (yes answer)			Getting Gardasil is painful (yes answer)		
Health-related	48 (24%)			46 (23%)		
Non-health related	32 (16%)			34 (17%)		
p-value	0.016*			0.887		

*Significant (p<0.05), Chi-Square test

3.6. Association between demographic and level of knowledge regarding HPV and HPV vaccine

Significant differences regarding knowledge of HPV and HPV vaccine were found with most demographic criteria such as age, education level, faculty and study year, except for the respondents' race. Half of the respondents (50%) had low knowledge (score less than five marks), another half (50%) had medium knowledge (score between 5-10

marks), and none had good knowledge (score ten marks or more). A higher percentage of students (34%) from the health-related programs scored medium expertise compared to only 16% from non-health-related programs. Age, education level, the faculty students were enrolled in, and year of study were significant factors influencing knowledge ($p < 0.05$). Table 6 summarises students' demographic and knowledge characteristics.

Table 6: Association between respondents' demographic with level of knowledge regarding HPV and HPV vaccine

Variable N= 200	Low Knowledge		Medium Knowledge		High Knowledge		Total		P value	
Age	21	3	1.5%	2	1%	0	0%	5	2.5%	0.001*
	22	68	34%	41	20.5%	0	0%	109	54.5%	
	23	8	4%	14	7%	0	0%	22	11%	
	24	18	9%	43	21.5%	0	0%	61	30.5%	
	25	2	1%	0	0%	0	0%	2	1%	
	31	1	0.5%	0	0%	0	0%	1	0.5%	
Education level	Diploma/STPM	0	0%	9	4.5%	0	0%	9	4.5%	0.006*
	Degree	99	49.5%	91	45.5%	0	0%	190	95%	
	PhD	1	0.5%	0	0%	0	0%	1	0.5%	
Faculty	Health Science	32	16%	67	33.5%	0	0%	99	49.5%	0.000*
	Pharmacy	0	0%	1	0.5%	0	0%	1	0.5%	
	Hotel and Tourism	1	0.5%	0	0%	0	0%	1	0.5%	
	Business Management	34	17%	16	8%	0	0%	50	25%	
	Art and Design	33	16.5%	16	8%	0	0%	49	24.5%	
Study year	2 nd year	46	23%	0	0%	0	0%	46	23%	0.000*
	3 rd year	50	25%	98	49%	0	0%	148	74%	
	4 th year	3	1.5%	2	1%	0	0%	5	2.5%	
	Postgraduate student	1	0.5%	0	0%	0	0%	1	0.5%	
Race	Malay	100	50%	96	48%	0	0%	196	98%	0.061
	Other	0	0%	4	2%	0	0%	4	2%	

*Significant ($p < 0.05$), Chi-Square test

4.0 Discussion

Even though, to our knowledge, this is the first study to sample public university students' knowledge, attitudes, and perceptions of HPV and HPV vaccination in Malaysia, this study contributes to the existing literature in informing that efforts to increase coverage of HPV vaccination remain a challenge for our public health. Critical results of low vaccine coverage (29%) potentially impact the success of the government's HPV prevention outreach program, which started in Malaysia in 2010. There is the possibility of refusal and non-reuptake of doses of the HPV vaccine by this grown-up cohort of students from the HPV immunisation program since the start of the program in 2010. Our study findings were not comparable with those of a study done in California and Italy, which showed higher percentages, 37.10% and 30.1%, respectively, of the respondents who had been vaccinated (16,17). This is due to the solid national vaccination policy instituted in these countries. However, we are better off than the Philippines, with coverage of only 23% of the target female population for the first dose and 5% for the final dose (4).

The fact that a large proportion of female respondents were not vaccinated despite awareness of HPV might indicate barriers beyond knowledge, such as cost, cultural and religious beliefs, and lack of access to healthcare and parental awareness. Our findings may provide insights into implementing targeted models for our local vaccination strategies in relation to our local context. These models' success largely depends on achieving high vaccination coverage, which is more effectively realised through various vaccination strategies (18). For example, these cultural and religious beliefs should be counter-explained to the girl's parents early in the lives of their children since the study found parents were

directly associated with the adherence to HPV vaccination (OR = 1.78, $p = 0.004$) (19). Engaging religious leaders in immunisation programs is crucial to enhancing the uptake of vaccines among Muslims (7). It is recommended that health professionals disseminate vaccination information as a trusted source, as evidenced by our findings. Our country's preventive strategy through an effective national HPV immunisation program, which started in 2010 to progressively build herd immunity in young adults, should be monitored closely for its effectiveness. Various other preventive models can be instituted to reduce HPV-related disease burden, as was done in Russia (18), where they examined various vaccination models, including school-based and health centre-based programs, to understand their effectiveness in achieving high vaccination coverage.

Further health promotion programs should focus on improving health literacy and perception of the HPV vaccine's benefits to achieve desirable vaccination coverage (19). To counter misinformation leading to vaccine hesitancy in Malaysia, adequate training of providers and culturally appropriate educational materials are needed to improve their knowledge of the HPV vaccine and to facilitate effective communication with their patients and the community, as suggested for Africans (20). Enhancing targeted education in terms of safe sexual practices, such as consistent and correct condom use and limiting the number of sexual partners, can also be advocated by practical, experienced trainers to reduce the risk of HPV transmission (20,21). Education and awareness about HPV and its prevention are crucial in promoting optimal sexual health (20).

We studied university students above 18 years old to determine the accumulated knowledge, attitudes and perceptions of the grown-up cohort from the 2010 vaccine

immunisation programs. Our study was different from two studies regarding HPV and HPV vaccines done previously in Malaysia: one on female respondents by Wong and Li Ping (2008) (9) to investigate the acceptability of the HPV vaccine among a multiethnic sample of young women aged between 13 and 27 years and another one by Shafie *et al.*, (2014) (22) which studied the knowledge and perception of HPV infection and vaccination among medical students at a university in Malaysia. Unlike these two studies, we have compared students in terms of health-related and non-health-related programs. However, there was a study done by Rashman *et al.* (2011) (23) in Malaysia. Still, it was not comparable with our study since it was done on secondary school students below 18 years old regarding HPV's association with cervical cancer. Other studies involved participants of different age groups: in Germany, they investigated vaccine uptake in females aged 9-45 years and HPV-related screening and prevalence in a cohort of females aged 9-70 (24). They studied women (25) and post-menopausal women (26) in China. In Slovenia, they studied the acceptability of HPV vaccination among 25-45-year-old women (25). However, our study results on awareness concurred with the study mentioned above by Wong and Li Ping (2008) (9), where most participants had heard about HPV. Same for the study done by Shafie *et al.* (2014) (22) among medical students regarding HPV in Malaysia also showed a high percentage (85.8%) of them had heard about HPV, and 80.0% of the respondents knew that a free HPV vaccination program was available in Malaysia.

Students from health-related programs were more knowledgeable than their counterparts (p -value= 0.001). This is probably due to the broader exposure of health-related students to matters of medicine and health. The higher knowledge

among health-related groups also coincides with the higher percentage of health-related students who have received a complete dose of 3 shots of the HPV vaccine. The positive correlation between knowledge scores and vaccination status proved this.

The sources for the HPV and HPV vaccine information among respondents ranged from healthcare providers followed by the internet television or radio, school friends' newspaper or magazine, family and other sources. Another study done on different ethnicities in America in 2011 showed that most of the respondents' sources of information for HPV and HPV vaccines came from television, healthcare providers, and friends in that sequence (26). Another study in Switzerland 2022 showed that most of the respondent's sources of information for HPV and HPV vaccines came from school health programs, followed by healthcare providers and participants' social networks (27). On top of that, pharmaceutical companies, the Ministry of Health, and non-governmental organisations also use multiple mediums such as mass media, media electronics, posters and pamphlets to disseminate information (28). The vaccination rate was also associated with information about the vaccine from other sources such as newspapers, family, friends or a brochure. Parental satisfaction with the quality of information given was also associated with the vaccination rate. Vaccine refusal was due to dissatisfaction with information (29).

Although the majority of the female respondents in our study knew that HPV could cause cervical cancer, as also discovered by Unger *et al.* (2015) (26), and also thought that the HPV vaccine could prevent cervical cancer and genital warts, as Kessel *et al.* (29) and Eche *et al.* (30) found that most females had higher knowledge regarding HPV vaccination and cervical cancer. However, some of our respondents

wrongly believed that HPV was associated with HIV, which gave rise to the need for educators to explain the different mechanisms of HIV infection, which involves the immunity system, as compared to HPV infection, which does not include immunity in the body. For the mode of transmission of the HPV, most of our respondents answered that HPV can be transmitted through genital skin-to-skin contact, hence knowing that HPV can be transmitted through sexual activity and intimate contact. Another study also showed that most of the respondents agreed that HPV can be transmitted sexually, and most people will not have visible signs or symptoms of the HPV infection (26).

Although almost half (44%) of the respondents did not know the main side effects of the HPV vaccine. Fortunately, the highest percentage (32.5%) of the respondents agreed that soreness at the injection site was the main side effect of the HPV vaccine, which is the correct answer to the question. The perceptions regarding the benefits of the HPV vaccine show that most of our female respondents believed that the HPV vaccine could prevent cervical cancer, the spreading of HPV to partners and penile cancer, but only a small proportion of female respondents agreed that HPV can cause oral cancer, which is true whereby the HPV can also cause oral cancer in the form of oropharyngeal cancer (31).

The attitude regarding HPV severity showed that almost half of both health-related and non-health-related female students agreed that HPV could affect their health in the future. As for the perceptions against vaccination behaviour, 6.5% of the female health-related respondents surprisingly believed that getting the HPV vaccine would go against their beliefs. A study showed that the lack of faith regarding the HPV vaccine was due to its effectiveness or safety (32). Another study stated that the

main reasons why parents did not intend to vaccinate their daughters were due to a lack of knowledge, a belief that the vaccine was not needed, and concerns about vaccine safety or side effects (2). Hence, it is necessary to address solutions and provide communication strategies to overcome the misconceptions and concerns about vaccine safety and efficacy.

Not more than half of the respondents agreed that external factors from friends, parent, partner, or doctors could affect their intention to be vaccinated with the HPV vaccine. However, almost half of the female respondents believed they would encourage essential people to be vaccinated if they were at risk. At the same time, a small proportion (5%) of female health-related respondents would be embarrassed if other people knew that they received the HPV vaccine. These factors should be considered in the promotional activities to increase the uptake of HPV vaccination, regarding the power of peer influence without compromising individuals' privacy. In another study, female respondents believed that significant others would influence them to be vaccinated and their healthcare providers would support them (16).

About one-quarter (24%) of female health-related respondents stated that the cost of HPV vaccination, which required three series of shots, was expensive even though the clinic of *Lembaga Penduduk Dan Pembangunan Keluarga Negara (LPPKN)* offered the free HPV vaccination for the female who met required criteria; the female must not be married, not pregnant, Malaysian and born from 1990 to 1996 to be eligible for the free HPV vaccine. Other studies stated that the barriers to the HPV vaccination were primarily focused on the newness of the vaccine, which did not have enough information regarding the vaccine's safety and efficacy. Also, their daughters were not ready for vaccination at a young age (33).

Mass media's emergence and rapid development changed how people perceive vaccination. Any adverse event or vaccine safety issue, regardless of actual or perceived, may lead to rumours in the community and widespread reports in mass media (34). This condition potentially impacts outreach programs in HPV-related disease prevention (35). Thus, the issue of HPV infection, cancer and the side effects associated with the vaccine need to be conveyed to the public in an effective way to reduce and avoid misunderstanding and misconception on those issues. The message should be modified according to local cultural context, and the information provided should cover various target audiences, not only the end-users who are targeted for vaccination but also parents, educators, public figures and healthcare providers.

The limitations of our study arose from our study population which consisted mostly of Malay students, possibly contributing to a potential racial bias in the study results. However, this data homogeneity mimics the reality where mainly Malay students comprise the majority of youths in Malaysia compared to other races. Limitation also existed in the follow-up process with the respondents, which was mostly done through WhatsApp. Due to COVID-19, telephone or face-to-face online interaction was not feasible due to high telephone line charges and limited connectivity since students stayed at home with their parents in various states of Malaysia, including rural areas with limited or no connectivity.

5.0 Conclusion

The score obtained by both groups, though favouring the health-related students, showed that the knowledge regarding HPV was low and moderate, favouring the health-related students, which might influence the low

uptake of the HPV vaccine. Significant differences were observed regarding attitudes toward vaccine benefits, perception of vaccination behaviour and external influences between the two groups. Knowledge gaps can lead to irrational thinking and subject to outside unjustified influence, which could affect the willingness to be vaccinated. This study's findings could inform the design of future educational programs, which should include coverage of vaccination topics in the curriculum. Public health initiatives in developing education policies to equip university students, particularly those in non-health-related programs, with the knowledge, right attitude and perception are imperative, hopefully, to increase their vaccination uptake.

Future research or initiatives should study the effectiveness of the different models of vaccination programs that target the broader spectrum of ages from as early as nine years old to see the vaccination impact at a later age beyond 25 years.

Authorship contribution statement

MZA: Carried out the data analysis and drafted the manuscript; **NFL:** participated in the design and helped to draft the manuscript **MLF & NI:** participated in coordination of the study, review and editing of the manuscript and draft corrections. **KMS:** involved in supervision, funding acquisition, writing, review and editing.

Acknowledgement

We express our deepest gratitude to the Faculty of Pharmacy, Universiti Teknologi MARA, for providing the facilities and support necessary to conduct this research. Their contributions have been invaluable to the success of our study. This research received no specific grant from any funding

agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest

The authors declared that they have no conflicts of interest to disclose.

References

1. Sabale U, Karamousouli E, Popovic L, Krasznai ZT, Harrop D, Meiwald A, *et al.* The indirect costs of human papillomavirus-related cancer in Central and Eastern Europe: years of life lost and productivity costs. *J Med Econ.* 2024;27(sup2):1–8.
2. Hirth J. Disparities in HPV vaccination rates and HPV prevalence in the United States: a literature review. *Hum Vaccines Immunother.* 2019;15(1):146–55.
3. Clay PA, Thompson TD, Markowitz LE, Ekwueme DU, Saraiya M, Chesson HW. Updated estimate of the annual direct medical cost of screening and treatment for human papillomavirus-associated disease in the United States. *Vaccine.* 2023;41(14):2376–81.
4. Lintao RCV, Cando LFT, Perias GAS, Tantengco OAG, Tabios IKB, Velayo CL, *et al.* Current Status of Human Papillomavirus Infection and Cervical Cancer in the Philippines. *Front Med.* 2022;9:1–15.
5. Alsanafi M, Salim NA, Sallam M. Willingness to get HPV vaccination among female university students in Kuwait and its relation to vaccine conspiracy beliefs. *Hum Vaccines Immunother.* 2023;19(1):2194772.
6. Chen G, Wu B, Dai X, Zhang M, Liu Y, Huang H, *et al.* Gender differences in knowledge and attitude towards HPV and HPV vaccine among college students in Wenzhou, China. *Vaccines.* 2022;10(1):6–17.
7. Alsuwaidi AR, Hammad HAAK, Elbarazi I, Sheek-Hussein M. Vaccine hesitancy within the Muslim community: Islamic faith and public health perspectives. *Hum Vaccines Immunother.* 2023;19(1):1–7.
8. Dorji T, Nopsopon T, Tamang ST, Pongpirul K. Human papillomavirus vaccination uptake in low-and middle-income countries: a meta-analysis. *EClinicalMedicine.* 2021;34:100836.
9. Wong LP. Young multiethnic women’s attitudes toward the HPV vaccine and HPV vaccination. *Int J Gynecol Obstet.* 2008;103(2):131–5.
10. Mackroth MS, Irwin K, Vandelaer J, Hombach J, Eckert LO. Immunising school-age children and adolescents: Experience from low- and middle-income countries. *Vaccine.* 2010;28(5):1138–47.
11. Sharma SJ, Schartinger VH, Wuerdemann N, Langer C, Möllenhoff K, Collin L, *et al.* Awareness of human papillomavirus (HPV) and HPV vaccination amongst the general population in Germany: Lack of awareness and need for action. *Oncol Res Treat.* 2022;45(10):561–6.
12. Wong LP, Wong PF, Abubakar S. Vaccine hesitancy and the resurgence of vaccine-preventable diseases: the way forward for Malaysia, a Southeast Asian country. *Hum Vaccines Immunother.* 2020;16(7):1511–20.
13. Muhamad NA, Buang SN, Jaafar S, Jais R, Tan PS, Mustapha N, *et al.* Achieving high uptake of human papillomavirus vaccination in Malaysia through school-based vaccination programme. *BMC Public Health.* 2018;18(1):1–9.
14. Ziemer KS, Hoffman MA. Beliefs and attitudes regarding human papillomavirus vaccination among college-age women. *J Health Psychol.* 2013;18(10):1360–70.
15. Flarity KO. Knowledge and attitudes regarding the human papillomavirus and HPV vaccine among college students: A gender comparison study. Mississippi: University of Southern Mississippi; 2012. Available from: Honors Theses. 50. https://aquila.usm.edu/honors_theses/50
16. Ratanasiripong NT, Cheng AL, Enriquez M. What college women know, think, and do about human papillomavirus (HPV) and HPV vaccine. *Vaccine.* 2013 Feb 27;31(10):1370–6.

17. Mennini FS, Silenzi A, Marcellus A, Conversano M, Siddu A, Rezza G. HPV vaccination during the COVID-19 pandemic in Italy: Opportunity loss or incremental cost. *Vaccines*. 2022;10(7).
18. Borowska M, Koczkodaj P, Mańczuk M. HPV vaccination coverage in the European region. *Nowotwory J Oncol*. 2024;74(3):191–6.
19. Fallucca A, Immordino P, Riggio L, Casuccio A, Vitale F, Restivo V. Acceptability of HPV vaccination in young students by exploring health belief model and health literacy. *Vaccines*. 2022;10(7).
20. Fokom Domgue J, Dille I, Kapambwe S, Yu R, Gnanon F, Chinula L, *et al.* HPV vaccination in Africa in the COVID-19 era: a cross-sectional survey of healthcare providers' knowledge, training, and recommendation practices. *Front Public Heal*. 2024;12:1343064.
21. Wang H, Liu F, Zhang H, Chen N, Wang C. Influential factors and willingness to advocate for HPV vaccination among male nursing interns in China. *BMC Nurs*. 2024;23:628.
22. Shafei MN, Zainon N, Zulkifli NF, Ibrahim MI. Knowledge and perception on human papilloma virus infection and vaccination among medical students of a university in Malaysia. *Procedia - Soc Behav Sci*. 2014;116:2707–10.
23. Rashwan H, Lubis SH, Ni KA. Knowledge of cervical cancer and acceptance of HPV vaccination among secondary school students in Sarawak, Malaysia. *Asian Pacific J Cancer Prev*. 2011;12(7):1837–41.
24. Taavela K, Eriksson T, Huhtala H, Bly A, Harjula K, Heikkilä K, *et al.* The quality of life of frequently vs infrequently screened HPV-vaccinated women. *Qual Life Res*. 2024;33(4):941–9.
25. Mlakar J, Oštrbenk Valenčak A, Kežar J, Beseničar-Pregelj L, Poljak M. Assessment of acceptability and determinants of uptake and schedule completion of human papillomavirus (HPV) vaccine by 25 to 45 years old women in Slovenia. *Vaccines*. 2023;11:423.
26. Unger Z, Maitra A, Kohn J, Devaskar S, Stern L, Patel A. Knowledge of HPV and HPV vaccine among women ages 19 to 26. *Women's Heal Issues*. 2015;25(5):458–62.
27. Schwendener CL, Kiener LM, Jafflin K, Rouached S, Juillerat A, Meier V, *et al.* HPV vaccine awareness, knowledge and information sources among youth in Switzerland: A mixed methods study. *BMJ Open*. 2022;12(1):1–11.
28. Domingo EJ, Noviani R, Noor MRM, Ngelangel CA, Limpaphayom KK, Van Thuan T, *et al.* Epidemiology and Prevention of Cervical Cancer in Indonesia, Malaysia, the Philippines, Thailand and Vietnam. *Vaccine*. 2008;26(SUPPL. 12).
29. Kessels SJM, Marshall HS, Watson M, Braunack-Mayer AJ, Reuzel R, Tooher RL. Factors associated with HPV vaccine uptake in teenage girls: A systematic review. *Vaccine*. 2012;30(24):3546–56.
30. Eche MT, Vermaak K. Knowledge, attitude and practice of female university students regarding human papillomavirus and self-sampling in KwaZulu-Natal, South Africa: A cross-sectional survey. *BMC Womens Health*. 2022;22(1):1–14.
31. Chivu C, Clarke A, Hundt G. Girls' knowledge about HPV vaccine and cervical cancer. *Eur J Surg Oncol*. 2016;42(11):S250.
32. Rosenthal SL, Rupp R, Zimet GD, Meza HM, Loza ML, Short MB, *et al.* Uptake of HPV vaccine: demographics, sexual history and values, parenting style, and vaccine attitudes. *J Adolesc Heal*. 2008;43(3):239–45.
33. de Martel C, Plummer M, Vignat J, Franceschi S. Worldwide burden of cancer attributable to HPV by site, country and HPV type. *Int J Cancer*. 2017;141(4):664–70.
34. Kim HW, Lee EJ, Lee YJ, Kim SY, Jin YJ, Kim Y, *et al.* Knowledge, attitudes, and perceptions associated with HPV vaccination among female Korean and Chinese university students. *BMC Womens Health*. 2022;22(1):1–9.