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Cervical Cancer prevention in Malaysia: Knowledge and attitude of undergraduate pharmacy students towards human papillomavirus infection, screening and vaccination in Malaysia

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Introduction

Cervical cancer is the second most common cancer among women worldwide [1]. Human papillomavirus (HPV) types 16 and 18 are aetiologically associated with cervical cancer and account for approximately 70% of cervical cancers [2]. In Malaysia, cervical cancer is the second most common cancer in women and 88.6% of invasive cervical cancers are attributed to HPVs 16 or 18 [3]. There is a general consensus that prophylactic HPV vaccination and early cytology screening using Pap smear test are effective in reducing the incidence of cervical cancer [4]. In Malaysia, Pap smear screening began in the late sixties and the Malaysian Ministry of Health introduced HPV immunisation on a voluntary basis as a nationwide programme in 2010. Despite the availability of Pap smear test and vaccines against the HPV, there has not been a decline in the incidence of cervical cancer in Malaysia and the incidence rates of cervical cancer per 100,000 populations and in a year is about 14.8 [5,6]. Epidemiological data further demonstrate that the number of women aged ≥ 15 years at risk of cervical cancer in Malaysia is 11.34 million and the mortality rate is two times higher than that in the Netherlands, the United Kingdom and in Finland [7].

The participation in Pap smear test and acceptance of HPV vaccine by the general population depends on a range of factors, including their knowledge and awareness of cervical cancer [8]. Health professionals play a vital role in cervical cancer prevention by community education in promoting Pap smear test and recommending HPV vaccination [9]. Therefore, it is important to understand the awareness of health professionals about HPV infection and vaccination. University students, currently studying health professional courses,

are the future practitioners and their knowledge and attitudes could influence the success of screening and vaccination programs in Malaysia. Also, it is important to assess their knowledge in order to develop educational and awareness programs to increase their knowledge and improve their attitude. An earlier report from Malaysia [10] suggested that the acceptance rates of HPV vaccines among medical and pharmacy students were very low despite their higher level of knowledge. This study attempted to measure the knowledge of undergraduate students and their attitude towards HPV vaccination, as many strategies have been implemented recently to promote HPV vaccination.

Pharmacists are one of the key stakeholders in the Malaysian healthcare system and possess complete control over the supply of medicines in the public health clinics [11]. People often visit pharmacies usually to purchase a particular prescription medication or over-the-counter products and pharmacists can contribute a lot in public awareness programs. It would be ideal to enhance the knowledge of current pharmacy students as they will start their practice in the public and private sectors within a few years. In order to evaluate the opportunity to design and implement educational strategies for the current pharmacy students, it is essential to investigate their knowledge and acceptance of HPV vaccine. This can then be followed by establishing educational policies on cervical cancer-related topics in the universities. Eventually, all these interventions can help to decrease the incidence of HPV infections and cervical cancer in Malaysia.

Method

Study design

The research protocol was approved by the Institutional Review Board (BP I-01/11(28) 2014). A cross-sectional survey was conducted on undergraduate pharmacy

1 students attending a private university in Kuala Lumpur, Malaysia during academic semesters
2 between June and August 2014.
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6 ***Sampling and sample size***

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1 A convenience sampling method was used in this study. Sample size was calculated
11 using the Raosoft calculator with the margin of error 5% and confidence level 95%. Based on
12 this, the minimum sample size required was 184 for this study. 356 undergraduate Pharmacy
13 students were approached, of whom 6 students were not interested in participation in the
14 study. Out of 350 students, 270 students completed this study. The response rate was 77.1%.
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23 ***Participants***

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27 The validated questionnaires were distributed to the participants after a lecture. The
28 only inclusion criterion was students studying the Bachelor of Pharmacy program (Hons) at
29 the university. The participants were given a study information sheet and an informed consent
30 form, along with a survey questionnaire. Participants were aware that they could withdraw
31 from the study at any time. Their anonymity and confidentiality were preserved.
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41 ***Study instruments***

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44 A self-administered questionnaire was adapted and modified from previous studies
45 [12, 13, 14,]. The questions were structured into three sections. The first section focused on
46 demographic data. The second section addressed the participants' level of knowledge of HPV
47 infection, cervical screening (i.e. Pap smears) and the HPV vaccine. The third part measured
48 the attitude of the participants towards HPV vaccination. All the items in the questionnaire
49 were evaluated by a panel of cancer physicians and oncology pharmacists with research
50 interests, expertise in HPV management and involved in education programs. The content
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1 validity ratio was 0.70. A pilot study was undertaken, during the first phase of which a
2 convenience sample of twenty pharmacy students were asked to comment on the
3 questionnaire, and subsequently the wording and order of some questions were revised.
4 During the second phase of the pilot study, another twenty pharmacy students were selected
5 to complete the questionnaire. A Cronbach-alpha reliability value was 0.84. Face validity to
6 ensure appropriateness and ease of completion was confirmed by the panel throughout the
7 development process.
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There were 17 knowledge questions (Table 3), which were summed to form an HPV knowledge score by assigning a score of “1” for every correct answer given and a score of “0” for every incorrect answer given and then calculating a total score for all of the questions. The composite score of the scale was calculated by summing correct answers to all questions. The cut off points for knowledge was stratified first by applying on a standardized population (oncology pharmacists) having a high level of knowledge and the scores were within 12-17. The same procedure again on a standardized population assumed to have a low level of knowledge (first year pharmacy students) and the scores were within 0-5. The average of both the two cut off points from the Sum [Mean of Individual Raw Score -2SEM) X (Correction Factor)] was then considered as the actual cut off points for the knowledge [15]. We defined three levels of knowledge: low score (0–5), medium score (6–11) and high score (12–17).

Responses to all attitudinal variables were assessed using 5-point Likert-type scales ranging from strongly agree to strongly disagree. The attitude score was calculated using the participants’ responses to the 12 statements with score from 1 for Strongly Agree to 5 Strongly Disagree. In the first step, the individual items in the Likert scale questionnaire were given equal weighting by at least three content experts. The overall cut off value for the

instrument was thus obtained by multiplying the ‘Correction Factor’ [with the median of individual raw Score –25th percentile of interquartile range (IQR)] of each item and finally summing them up together [16]. The cut off value for attitude was 35 and a lesser score ≤ 34 was considered ‘Negative Attitude’ and higher score ≤ 35 was considered ‘Positive Attitude’.

Statistical analysis

The results were summarized into tables, and the data were tested for statistical significance, where necessary. Descriptive statistics were used to summarize demographic details and source of information. Participants who responded ‘Yes’ for knowledge questions were tabulated as percentages of correct answers. Participants’ responses to attitude questions were presented as percentages of agreement. Statistical tests such as, t-test, one-way analysis of variance followed by post hoc Bonferroni test were applied ($p < 0.05$). A stepwise multiple linear regression analysis model was used to check the relation between independent (gender, ethnicity, religion, and relationship status) and dependent variables (knowledge and attitude). Confidence level and level of significance were fixed at 95% and 5% respectively.

Results

Of 350 undergraduate students approached, 270 (77.1% response rate) participated in the study. Table 1 summarizes the descriptive statistics of the respondents. There were almost three times as many females compared to males, a reflection of the gender mix of the students enrolled in the Bachelor of Pharmacy (Hons) program in the university. The majority of respondents were Chinese (83.7%), followed by Malay (7%) and Indian (7%). 41.1% were in a committed relationship, 36.6% were involved in dating, while 22.3% were not involved in any committed relationship or dating.

Many of the respondents who knew about HPV had acquired the knowledge through mass media, predominantly the television (28.9%) and through the internet (14.4%). Some (28.5%) learned through family and friends. Only 11.1% reported that they knew about HPV through a healthcare provider (Table: 2). Many male respondents mentioned the internet (40% vs. 22% females), as the source of information. Chinese female respondents mentioned their parents and family members (23%) as a source of information. However, some respondents did not remember from where they obtained information (less than 10%).

Table 3 comprises the questionnaire items regarding the respondents' knowledge on HPV infection, its prevention, and Pap smear testing. The majority of respondents knew that HPV infection is preventable (87.8%) and that HPV is a cause of cervical cancer (81.1%). HPV is a sexually transmitted disease (60%) was the next item answered correctly by most participants. Meanwhile, knowledge on facts such as 'Pap-smear can be performed after the age of 21' (36.3%) was very poor among the respondents. More than 70% did not know that Pap-smear test should be carried out every 3 years. Female respondents were more knowledgeable about cervical cancer risks than males. However, the statement 'HPV infections are preventable' was answered correctly by only 59% of female respondents, compared with 96% males.

The respondents' attitudes towards HPV infection, HPV prevention and HPV vaccine were analyzed and the details of the variables are shown in Table 4. The majority of respondents answered that cervical cancer is a severe disease (87.0%) which is preventable (74.4%). More than three quarters of the participants (78.9%) considered themselves at high risk for cervical cancer by concurring with the affirmation "I may be susceptible to HPV infection". 73.9% of the respondents felt that the amount of risk involved in vaccinating for HPV is less than being infected by HPV. However, only 26.3% of the respondents considered that HPV vaccine is helpful to prevent cervical cancer and only 59.6% felt that HPV vaccine

is safe. Nevertheless, 78.5% of the respondents said that they would have vaccinated themselves against HPV if vaccination were freely available.

Table 5 showed the mean knowledge and attitude scores of the respondents were evident as 9.08 ± 0.46 and 35.79 ± 4.01 respectively. Overall, more than half of the respondents had moderate knowledge while one third of the respondents had high knowledge. A slightly more than half of the respondents had a positive attitude about HPV infection, HPV prevention and HPV vaccine.

Table 6 showed that there was a significant difference in knowledge by gender (11 ± 5.23 for males vs 13 ± 3.23 for females; $p=0.001$). However, there was no significant difference in attitude by gender. Though there were no significant differences in respondents' knowledge vs relationship status, there were significant differences in attitude by the respondents' relationship status. When a post hoc Bonferroni test was applied, mean attitude score among those who were not dating (33.26 ± 3.18) was found to be significantly less than among those who were dating (35.56 ± 2.12 ; $p = 0.04$).

Table 7 showed the stepwise multiple linear regression analysis to estimate the linear relationship between the dependent variables (knowledge score) and independent variables (gender, ethnicity, religion, and relationship status). Gender was the predictor for knowledge score with the variance of 25.6%, $p=0.001$. Table 7 also showed the stepwise multiple linear regression analysis to estimate the linear relationship between the dependent variable (attitude score) and independent variables (gender, ethnicity, religion, and relationship status). Relationship status was the predictor for attitude score with the variance amount of 18.4%, $p=0.003$.

Discussion

This population is important not only because it comprises future pharmacists who can educate the general public, but also the students are a target for HPV vaccination. The goal of an ideal healthcare system is for patients to see their healthcare providers as a trusted and reliable source of information. Having healthcare providers educate patients on HPV would increase HPV prevention and decrease the incidence of cervical cancer.

The demographic data showed that the majority of the respondents were exposed to sexual life during their undergraduate studies. Considering the fact that none of the respondents were married, all these sexual activities are pre-marital sexual activities and the results also reflecting the increasing acceptance of premarital sex by young people. The widening bio-social gaps along with rapid urbanization and exposure to mass media [17] have led to an increase in pre-marital sexual activity, which exposes young population to the risk of sexually transmitted diseases.

Mass media is the main source of information about HPV infection and vaccination, followed by friends and family members. This is consistent with an earlier report [18]. In fact, the media serve as a major source of information, particularly when the topic is about new medical applications and prior knowledge is low. People will improve their knowledge about the vaccine and the link between HPV and cervical cancer if they are increasingly exposed to newspaper articles and television reports regarding HPV [19]. The media play an important role in informing and educating the public about health interventions even in international settings [20] Griffioen *et al.*, [21] noted that young women learned about HPV vaccination mainly through media such as magazines and television. In the technology savvy era, the media serve as a major source of information [22]. The result also indicated the influence of friends and family as the second largest source of information which is an

encouraging sign. Friends and family are still the most influential and considered as trustworthy. Word-of-mouth recommendations can help to spread the message about vaccination and help to reduce the incidence of cervical cancer. Vaccine promoters may need to have special strategies for information dissemination to reach the general population more effectively to encourage vaccination uptake. The limited role of healthcare providers in providing information to the public is an issue to be considered. Considering the complex multicultural society in Malaysia, women may feel uncomfortable or be unwilling to seek HPV-related vaccination from healthcare professionals [8]. In addition, young adults may have fewer opportunities to receive a healthcare professional's recommendation due to lower healthcare use than other age groups [23].

Knowledge about HPV among healthcare providers was highly associated with recommending the vaccine to the public [24]. HPV educational programs directed by healthcare providers increased either the knowledge of HPV or the intent to receive the HPV vaccine [25]. Wetzel *et al.*, identified the use of wellness maintenance suppliers in developing HPV educational protocol for adolescents and found an increase in HPV knowledge in adolescents of different ages, sex, and races [26]. Previous studies assessed the knowledge of HPV vaccines in various health professionals to produce more effective health strategies and training [27, 28]. An earlier report by Wong *et al.*, [12] showed a general lack of knowledge among university students' concerning HPV vaccine in Malaysia. Assessment of knowledge of Malaysian undergraduate pharmacy students about HPV infection and cervical cancer prevention will help to develop more effective strategies for health promotion and education. The current study revealed that the knowledge level of undergraduate pharmacy students was high and not significantly different among their ethnic groups. Of note, this study was conducted almost 4 years after the Malaysian ministry of health introduced the HPV vaccination program on a voluntary basis to school children aged 13.

The results revealed that the female students have more knowledge than their male counterparts. These data are in line with an earlier report [27] and suggest that the female population receives sufficient information and can retain and may act on the information about cervical cancer, Pap smear test and HPV. In the context of the prophylactic HPV vaccine for cervical cancer prevention, involvement of males may have important implications in female vaccination initiatives. HPV education and prevention efforts must also be focused on the male population, as males are equally responsible for spreading the HPV, which may lead to cervical cancer in their female partners [28]. As knowledge about HPV infections has increased considerably in the Malaysian undergraduate pharmacy student community, this might result in an increase in the future knowledge of the general population when these students are practising as professionals in community and hospital environments. Undergraduate pharmacy students, as an important element of future healthcare providers, can take advantage of each patient's visit as an opportunity to inform their patients about the importance of cervical cancer screening and the risk factors for HPV and cervical cancer.

The data indicated that the study population may be unclear about the role of Pap smear examination and its application in cervical cancer screening. An exploratory study found that young women did not make a connection between HPV, cervical cancer, and Pap smears [29]. The limited knowledge on Pap smear test among the study population reflected their misconceptions about Pap smears and may have negative influences on cervical cancer prevention. Education to improve undergraduate pharmacy students' understanding about the importance of Pap smear test may enhance regular health checks for cervical cancer. There is a critical need for education in this aspect to improve the use of this early screening for cervical cancer. Though both genders have equal responsibility in preventing HPV infection, comparatively fewer female respondents (59% female vs 91% male) mentioned that HPV infection is preventable; this needs special attention. Given the promising advances in the

1 prevention of early cervical cancer, disparities in the use of these resources is concerning and
2 is a reflection of a number of inadequacies in health education programs. Further studies are
3 warranted on how to improve knowledge of cervical cancer prevention in female
4 undergraduate pharmacy students.
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10 A few factors specific to this study population were particularly interesting when it
11 comes to their attitudes towards and uptake of HPV vaccination. Almost only one quarter of
12 the respondents agreed that HPV vaccine is helpful in preventing cancer. Though the
13 knowledge of majority of the respondents was at the high level, their attitude towards the role
14 of HPV vaccines in cervical cancer prevention is less when we consider the response to the
15 statement “HPV vaccine is helpful to prevent cervical cancer”. Factors associated with the
16 decision to vaccinate are complex and varied [30]. Compared with their higher level of
17 knowledge about the HPV infection and its prevention, the students might consider that the
18 currently licensed bivalent and quadrivalent HPV vaccines will act against HPV 16 and 18
19 subtypes. Hence, it may not completely prevent cervical cancer, although the majority of
20 cervical cancers in Malaysia are due to HPV 16/18 subtypes. Additionally, the increasing
21 incidence of new cervical cancer cases even after the introduction of HPV vaccine in
22 Malaysia should thus be considered by students’ in relation to the effectiveness of available
23 HPV vaccines. The respondents, having access to all the cervical cancer related information
24 from the internet, might be aware that HPV infection is only one of the causes of cervical
25 cancer. This might have created some doubts about the effectiveness of the vaccines. The
26 students’ attitude on the safety of HPV vaccine is another area of concern, as HPV vaccines
27 are generally well tolerated. Only around 60% agreed that the HPV vaccine is safe. This
28 result agrees with the earlier report [31] from Malaysia that mentioned safety as one of the
29 major concerns for many participants. With all the uncertainty surrounding the safety of HPV
30 vaccines among the future pharmacists, it is critical to comment on their role in
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recommending HPV vaccines to the public. Future educational campaigns must focus on this area and provide sufficient information to the students about the safety of HPV vaccines.

A significant difference between genders relating to the level of knowledge was identified. We recognised that because HPV vaccination and screening are applied only to females and HPV vaccines protect women from a high proportion of precursor lesions of cervical carcinoma, their knowledge level may be higher. This result supported the review study by Dinas et al. [32]. A significant difference between relationship status and the attitude towards HPV vaccination was identified. The respondents who were in a sexual relationship and involved in dating had a positive attitude while those who were not dating had a negative attitude. This difference may be because the respondents who were not in any sexual relationship may have felt that they were not at risk of getting HPV. Respondents also believed that the available vaccine is effective for primary prevention of HPV infection and cervical cancer. Consistent with previous studies [33, 34], a larger interest in the HPV vaccine was observed among students who are in committed relationships and students who are dating.

In contrast with previous studies [35, 36] there is a higher awareness and better attitude towards HPV and cervical cancer prevention among a young population in a university environment. Greater awareness, however, does not necessarily imply correct knowledge. Indeed, our data indicate that many scholars do not know that condom usage can prevent HPV infection that Pap-smears should be performed every 3 years, and that HPV infection can happen often.

In this study, the predictor of knowledge about HPV infection was consistent with earlier reports [22, 36]. Participants who were in committed relationships and those who are dating felt more vulnerable to HPV. Eaton *et al.*, found that a high proportion of women who

perceived that they were at risk for HPV infection tested positive for the virus [37]. However, the participants in our study were not subjected to any diagnostic test,

The cost of the vaccine was one of the most important barriers to HPV vaccination among participants with low willingness to be vaccinated against HPV [38]. An earlier report from Malaysia found that cost was regarded as the major determinant in recommendations to prescribe the vaccine [39]. In the present study, a higher number of participants expressed interest in the HPV vaccine uptake if it was freely available. Though the respondents at perceived risk are interested in vaccination, the remainder of the respondents would accept vaccination only if it was freely available. This was observed among respondents from different ethnic backgrounds. In Malaysia, the recommended 3-dose course costs approximately 210 USD (Ringgit Malaysia 900). This may also explain why a large percentage of our participants (86.3%) believed that the vaccine is not affordable even if it provides many benefits. In Malaysia, where out-of-pocket costs of healthcare can topple a household, if the vaccination is limited to those willing to pay higher costs, most women will not benefit. Therefore, the vaccine may need to be subsidized to ensure wide coverage in Malaysia [40].

HPV vaccination and early detection of cervical cancer by Pap smear testing could sharply reduce the number of cervical cancers caused by the human papilloma virus if HPV vaccine uptake increases dramatically. With the number of cervical cancers increasing in Malaysia, we cannot afford to wait to protect our young people from future HPV infections. Hence, the results of this study were important to identify strengths and areas of concern in the education of future pharmacists. Based on the results of this study an education leaflet could be developed to highlight facts about HPV and cervical cancer and fill the knowledge gaps identified in this study. This will help to implement HPV vaccination and promote Pap smear test among the target population in Malaysia.

Limitations

Foremost, as a cross-sectional study, it is hard to prove causal relationships between knowledge and intention to receive/suggest vaccination. We addressed this in part by placing some focus on the relationship between intention to be vaccinated and HPV knowledge. The study employed a self-reporting survey methodology. Self-report is a requisite component for full disclosure of the sensitive nature of sexual health knowledge and conduct. Although we recruited an ethnically diverse sample, the sample as a whole was relatively small. As it was a convenience sample, the non-random sampling bias can occur. A sampling frame was constructed to overcome the sampling bias. Thus the required sample size was met in this study. However, the findings may not generalize to all Malaysian undergraduate pharmacy students. Moreover, we do not know if knowledge and attitudes would be different in matched populations of non-healthcare students or in students of another healthcare profession. In this study we included all pharmacy students in a university as a single group but did not classify them according to their year of study in our data. Future studies on pharmacy students in Malaysia should take into account the stage of their study.

Conclusions

This study on a sample of undergraduate pharmacy students indicated that the overall knowledge about HPV infection, cervical cancer and HPV vaccination were moderately high. However, there is a gap in the knowledge of Pap smear testing and some concerns about the safety of HPV vaccines among the respondents. Similarly, overall attitude of the respondents towards HPV infection, prevention and HPV vaccination were positive though there was a disagreement about helpfulness of HPV vaccine to prevent cervical cancer.

This result will help to establish educational policies on cervical cancer related topics in universities in Malaysia. It will also help educators to plan and implement appropriate

education campaigns for undergraduate pharmacy students to reduce HPV infections and consequently the incidence of and mortality from cervical cancer in Malaysia.

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Table 1: Socio-demographic characteristics of the respondents

Demographic character	N	%
Gender		
Male	71	26.3
Female	199	73.7
Ethnicity		
Malay	19	7
Chinese	226	83.7
Indian	19	7
Others	6	2.3
Religion		
Islam	21	7.8
Buddhism	160	59.3
Hinduism	15	5.6
Christianity	51	18.9
Free thinker	15	5.6
Atheist	1	0.4
Others	7	2.4
Relationship status		
Committed	111	41.1
Dating	99	36.6
Not dating	60	22.3

Descriptive statistics was employed to summarize participants' demographic data

Table 2: Source of information about cervical cancer prevention, HPV infection and HPV vaccines

Source of information	N	%
Friends and Family	77	28.5
Media	78	28.9
Gynaecologist	8	3.0
General Practitioner	7	2.6
Health Centres/ Clinics	30	11.1
Pharmacist	5	1.9
Internet	39	14.4
Do not know/ remember	26	9.6

Descriptive statistics was employed to summarize source of information about cervical cancer prevention, HPV infection and HPV vaccines

Table 3: Knowledge about HPV infection, HPV prevention and HPV vaccine

Variables	% With correct answer	P value
HPV can cause cervical cancer.	219 (81.1%)	0.023
HPV infections are preventable	237 (87.8%)	0.296
Condom use can prevent HPV infection	140 (51.9%)	0.107
HPV is a sexually transmitted disease (STD)	162 (60.0%)	0.079
HPV infection is frequent.	118 (43.7)	0.889
HPV infection can last for years	145 (53.7%)	0.006
Cervical cancer is caused by persistent HPV infection	150 (55.6%)	0.027
HPV may infect both, men and women.	138 (51.1%)	0.007
Most HPV infection resolves spontaneously.	41 (15.2%)	0.003
HPV can infect you without symptoms.	163 (60.4%)	0.016
HPV can cause genital warts.	153 (56.7%)	0.001
HPV can cause other anogenital cancers	112 (41.5%)	0.002
HPV vaccine prevents around 70% of cervical cancer.	164 (60.7%)	0.318
Pap-smear can screen cervical cancer.	182 (67.4%)	0.091
Pap-smear is very or relatively effective in screening cervical cancer.	154 (57.0%)	0.006
Pap-smear should be done every 3 years.	78 (28.9%)	0.051
Pap-smear can be done after the age of 21.	98 (36.3%)	0.042

Descriptive statistics was employed to summarize participants' responses for the questions on knowledge about HPV infection, HPV prevention and HPV vaccine. Participants who responded 'Yes' for knowledge statements were tabulated as percentages of correct answers.

Table 4: Attitude on HPV infection, HPV prevention and HPV vaccine

Variables	Agree/Strongly agree	P value
Cervical cancer is a severe disease.	234 (87.0%)	0.093
Cervical cancer is preventable.	209 (74.4%)	0.310
I may be susceptible to HPV infection.	213 (78.9%)	0.388
HPV vaccine is helpful to prevent cervical cancer.	71 (26.3%)	0.227
HPV vaccine is safe.	161 (59.6%)	0.031
There is less risk involved in being vaccinated than in having HPV infection.	201 (73.9%)	0.225
HPV vaccination will not lead to complicated sexual activities.	119 (44.1%)	0.077
Vaccinating young people against HPV would not encourage them to become sexually active.	88 (32.6%)	0.068
I would not want myself to be infected with HPV.	233 (86.3%)	0.497
Information on HPV helps me to decide whether I should be vaccinated against HPV.	230 (85.2%)	0.446
If my doctor thinks HPV vaccination is a good idea, I would have myself vaccinated against HPV.	214 (79.3%)	0.001
I would have myself vaccinated against HPV if the vaccination is freely available.	212 (78.5%)	0.027

Descriptive statistics was employed to summarize participants' responses to the statements on HPV infection, HPV prevention and HPV vaccine. Participants' response to attitude statements were presented as percentages of agreement

Table: 5 Respondents total mean scores and cut off points of knowledge and attitude

Knowledge		N (%)	P value
Low	0-5	48 (17.8%)	0.621
Moderate	6-11	142 (52.6%)	0.453
High	12-17	80 (29.6%)	0.782
Attitude		N (%)	P value
Negative attitude		130 (48.2%)	0.635
Positive attitude		140 (51.8%)	0.471
		Mean (SD)	P value
Total Mean knowledge score (SD)		9.08 (0.46)	0.01
Total Mean attitude score (SD)		35.79 (4.01)	0.02

Descriptive statistics was employed to summarize respondents' total mean scores and cut off points of knowledge and attitude

Table: 6 Association of mean knowledge and attitude scores with socio-demographic characteristics.^a

Knowledge			Attitude	
Variables	Mean ± Standard Deviation	p-value	Mean ± Standard Deviation	p-value
Gender				
Male	9.50 ± 1.61	0.001*	34.80 ± 3.15	0.42
Female	11.24± 1.42		35.21± 2.20	
Ethnicity				
Malay	9.95 ± 1.84	0.18	34.05 ± 3.53	0.80
Chinese	11.26 ± 1.67		35.29 ± 3.25	
Indian	12.15 ± 1.68		34.98 ± 3.71	
Others	8.45± 1.92		35.11± 2.09	
Religion				
Islam	10.38 ± 1.47	0.24	34.08 ± 3.33	0.48
Buddhism	10.21 ± 1.43		35.29 ± 3.57	
Hinduism	11.55 ± 1.74		35.98 ± 3.18	
Christianity	11.64 ± 1.32		35.67 ± 3.07	
Free thinker	10.51 ± 1.78		34.58 ± 4.73	
Atheist	10.87 ± 1.83		35.56 ± 4.29	
Others	11.17 ± 1.95		34.92 ± 3.11	
Relationship status				
Committed	11.57 ± 1.62	0.30	34.84 ± 2.36	0.04*
Dating	12.95 ± 1.04		35.56 ± 2.12 ^b	
Not dating	11.78 ± 1.58		33.26 ± 3.18 ^b	

* Statistically significant difference at $p \leq 0.05$.

^a Statistical tests applied: t test, one-way analysis of variance.

^b Statistically significant difference; post hoc Bonferroni test.

Table: 7 Stepwise multiple linear regression analysis with knowledge, attitude scores as dependent variable among respondents.

Model	R	R²	F	P value
Gender ^a	0.372	0.256	9.654	0.001
Relationship status ^b	0.257	0.184	18.742	0.003

^a Predictor of knowledge
^b Predictor of attitude

Response to reviewers (2)

- Q 1) Although authors responded to the 1st reviewer, information about cut off point determination (starting in last paragraph of page 4) perhaps is too detail for general readers.

Answer:

Now, we revised the paragraph and provided a brief details about the cut off point determination as follows.

Responses to all attitudinal variables were assessed using 5-point Likert-type scales ranging from strongly agree to strongly disagree. The attitude score was calculated using the participants' responses to the 12 statements with score from 1 for Strongly Agree to 5 Strongly Disagree. In the first step, the individual items in the Likert scale questionnaire were given equal weighting by at least three content experts. The overall cut off value for the instrument was thus obtained by multiplying the 'Correction Factor' [with the median of individual raw Score –25th percentile of interquartile range (IQR)] of each item and finally summing them up together [16]. The cut off value for attitude was 35 and a lesser score ≤ 34 was considered 'Negative Attitude' and higher score ≤ 35 was considered 'Positive Attitude'.

The same has been included in the manuscript, which replaced the earlier one.

- Q 2) Second par in the Discussion: The demographic data showed that the majority of the respondents were exposed to sexual life during their undergraduate studies. Does 'sexual life' here refers pre-marital sexual activities? (As mentioned in the latter sentence). Does author have this information? (Table 1 only has information about relationship status - not directly reflect pre-marital sexual activities).

Answer:

The respondents marital status was not mentioned in the table as none of them have got married. This is based on the earlier comment received from Reviewer #1.

As the respondents were not in a married relationship, all their sexual activities are considered premarital sexual activities. The same has been included in the discussion as follows.

Considering the fact that none of the respondents were married, all these sexual activities are pre-marital sexual activities and the results also reflecting the increasing acceptance of premarital sex by young people.

- Q 3) There was still a typo on page 7 when referring to the table.

Answer:

The typo error was rectified in Page 7.